Coeur d'Alene Tribe
Energy Efficiency Feasibility Study

Coeur d'Alene Tribal Benewah Medical Center Front Entrance

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EEFS SECTION I – ENERGY EFFICIENCY FEASIBILITY STUDY – EXECUTIVE SUMMARY

The Coeur d'Alene Tribe's (Tribe) Energy Efficiency Feasibility Study (EEFS) is the culminating document that compiles the energy efficiency and building performance assessment and project prioritization process completed on 36 Tribally owned and operated facilities within Tribal lands. This project was funded by a grant from the Department of Energy (Grant ID Number DE-EE0005170) and the work was completed by a collaboration of Coeur d'Alene Tribal staff and OurEvolution Energy & Engineering. The purpose of this project was to evaluate the opportunities and feasibility of completing energy conservation measures within the subject buildings. Additionally, this project includes assessments of renewable energy opportunities and a baseline building energy performance database constructed within the Environmental Protection Agency's Portfolio Manager environment. The purpose of the database is to allow Tribal staff to compare energy performance of the subject buildings on a periodic basis in order to quantify and track energy performance, improvements due to energy efficiency and renewable energy projects, and anomalies across the Tribal building portfolio.

The EEFS study was completed in five distinct phases beginning with a review of previous energy assessment (renewable and energy efficiency) studies that the Tribe had previously undertaken. These studies include: the Wind and Biomass Energy Feasibility Assessment completed by McNeil Technologies, Inc. in June of 2008; the Coeur d'Alene Energy Efficiency Assessment Report, completed by McKinstry in June of 2012 and the Tribe's Energy Efficiency and Conservation Strategy completed in the fall of 2012 with funding from the Department of Energy's Energy Efficiency and Conservation Block Grant program and the Bonneville Power Administration (BPA). Additionally, energy studies of the Benewah Auto and Benewah Markets, completed with BPA funding were leveraged. Information gained during the background information including facility light counts (completed by McKinstry) were used throughout this report.

The second phase of this project began with initial field assessments of the 36 subject facilities which were completed between October 29 and November 9, 2012. These assessments included evaluation of building energy performance indicators including building envelope, heating, ventilation and air conditioning systems (HVAC), lighting, plug and process loads, and domestic water heating systems. In order to clarify issues that arose during the processing of the initial fieldwork and utility data, subsequent field efforts were completed in March and May of 2013. The Field Energy Assessment Initial Findings Report was issued in April of 2013 with addendums completed in the summer of 2013. This report, included as Section II of this study, details the methodology and facility specific findings of the field work and delineated potential energy conservation measures to be considered by Tribal decision makers for further study and prioritization as part of the larger EEFS.

The main findings of this report include issues and opportunities related to:

- Building Envelope
    - Unsealed envelope penetrations
    - Inadequate roof drainage conditions

    - Damage to envelope materials
- Heating, Ventilation and Air Conditioning
    - Thermostats set-points that do not reflect energy efficient settings and/or actual building occupancy patterns
    - Inadequate filter maintenance
    - Mismatched system components
    - Systems reaching the end of serviceable life span
    - Damaged system components
    - Lack of outside air ventilation
    - HVAC distribution system leakage, obstructions and imbalances
    - Door and window air leakage
- Lighting Systems
    - Low efficiency linear fluorescent lamps and fixtures
    - Halogen lighting
    - High intensity discharge (metal halide, high pressure sodium) lamps
    - Incandescent lamps
    - Lack of occupancy sensors
- Domestic Hot Water (DHW)
    - Inadequate draft pressure in combustion appliance exhaust systems
    - Lack of hot water pipe insulation
    - Units that appeared to be specified for natural gas using propane as combustion fuel source
- Plug and Process Loads
    - Excess refrigeration capacity
    - Energy intense "burner" style coffee service areas
    - Aging commercial refrigeration system components

The third phase of the energy assessment and feasibility study process was focused on analyzing two years of utility billing data for the subject buildings. The analyses included developing Energy Use Indexes (EUI), Benchmarking, Monthly Energy Consumption Profiles, Energy Consumption Base-load and Rate Assessment for each of the subject facilities. The main findings of this portion of the energy assessment process include:

- The facility with the highest energy use index (EUI) is Benewah Auto. At the time of the assessment, this facility was being billed for approximately 1894.5 kBTU/sf/yr of energy. This is approximately 801% of the Commercial Building Energy Consumption Survey (CBECS) benchmark value for this type of facility.
- Only seven of the 36 facilities evaluated had energy use indexes at or below the CBECS energy use benchmark indicating that there is substantial opportunity for energy efficiency improvements within the target facilities.

The fourth phase of this EEFS was to further evaluate the selected energy conservation measures (ECMs) delineated in the Field Energy Assessment Initial Findings Report and screened by Tribal staff. This evaluation included developing estimates of potential energy savings, implementation costs, potential rebates and funding sources and technical requirements for each proposed energy upgrade project as well as determining opportunities for the application of renewable energy technologies within Tribal lands. These analyses included developing energy performance models, utility rebate estimates (based on utility energy performance calculators), and prioritization selection criteria, weighting, scoring and matrices. The purpose of this process was to provide Tribal decision makers with a tangible roadmap for energy efficiency implementation by developing a prioritization of specific ECMs within target buildings as well as to provide a prioritization of buildings within the Tribal portfolio that have the greatest potential for: 1) annual energy savings, 2) greatest potential for energy savings as a percentage of building energy use and 3) greatest internal rate of return for project implementation. The results of these analyses were summarized in the Coeur d'Alene Tribe Energy Conservation Measure Prioritization Report (Coeur d'Alene Prioritization Report) which was issued in October of 2013. The Coeur d'Alene Prioritization Report is included as Section IV of this study. The highlight findings of this report include:

- The most common and highly ranked facility specific measures include:
    - Adjusting thermostats to reflect energy efficient set points and actual building occupancy
    - Replacing T12 linear fluorescent lamps and fixtures with high efficiency T8 lamps and fixtures
    - Replacing aging HVAC infrastructure
    - Eliminating unnecessary loads
    - Addressing significant building envelope issues
    - Installing hot water pipe insulation
- The facility with the highest potential for energy savings is the Tribal Resort and Casino with approximately $85,000 per year of energy cost savings associated with $325,000 of energy efficiency upgrades (internal rate of return of 27.3%).
- The Food Distribution Warehouse has the highest potential energy savings as a percentage of total facility energy use with a 70% energy reduction predicted with the recommended measures.

Table 1 summarizes the Building Ranking by Annual Energy Cost Savings Potential. It should be noted that, because of their recent construction, annual energy savings could not be calculated the Natural Resources and New Roads Maintenance Shop; therefore these buildings are not included in the economic ranking tables.

Table 1. Building Ranking by Annual Energy Cost Savings Potential

Rank	Facility	Estimated Net Incremental Cost of Implementation ($)	Projected Annual Energy Savings (kBtu/year)	Projected Annual Energy Savings (kWh/year)	Projected Annual Savings ($/year)	Annual Energy Savings (%)	Simple Payback (years)	Net Present Value of ECMs ($)	Internal Rate of Return (%)
1	CDA Casino Resort and Hotel	$325,608	3568401	1045839	$85,686	4.9%	3.8	$1,042,785	27.3%
2	Benewah Market	$597,440	1359435	398428	$16,215	31.1%	36.8	-$322,877	-4.3%
3	Food Distribution Warehouse	$32,853	281405	82475	$6,598	70.0%	5.0	$72,741	20.7%
4	Casino Conoco Gas Station	$19,205	309991	90853	$6,358	32.9%	3.0	$82,184	34.3%
5	Circling Raven Golf Course Pro Shop	$17,036	248388	72798	$5,671	16.5%	3.0	$73,398	34.5%
6	DeSmet Longhouse	$1,840	172666	50606	$5,349	36.2%	0.3	$83,048	294.5%
7	Rose Creek Longhouse	$742	154607	45313	$4,713	22.8%	0.2	$74,031	594.4%
8	Tribal Headquarters	$58,400	214975	63005	$4,457	66.9%	13.1	$13,978	5.4%
9	Early Childhood Learning Center	$31,425	182777	53569	$3,772	16.0%	8.3	$29,313	11.4%
10	Benewah Auto	$17,960	173674	50901	$3,240	16.8%	5.5	$33,945	18.4%
11	Tribal Wellness Center	$8,144	123448	36181	$2,894	2.4%	2.8	$37,983	36.8%
12	Fire Warehouse and Shop	$9,166	116807	34234	$2,738	38.8%	3.3	$34,522	31.0%
13	Tribal Court Services	$1,645	133232	39048	$2,366	32.9%	0.7	$35,920	146.2%
14	Senior Housing Complex	$6,083	93556	27420	$2,248	17.6%	2.7	$29,750	38.2%
15	New Tribal School	$6,000	85736	25128	$2,155	3.8%	2.8	$28,353	37.2%
16	Tribal Housing Authority	$3,989	79513	23304	$1,864	27.7%	2.1	$25,685	48.1%
17	Technology Center	$2,162	71016	20814	$1,665	4.3%	1.3	$24,300	78.7%
18	Tribal Facilities	$2,640	69779	20451	$1,637	30.3%	1.6	$23,391	63.6%
19	Felix Aripa Building	$2,475	67347	19738	$1,579	17.1%	1.6	$22,632	65.4%
20	Social Services	$2,580	66013	19347	$1,547	26.4%	1.7	$22,035	61.5%
21	Tribal Police HQ	$9,376	65390	19165	$1,438	28.6%	6.7	$17,580	14.8%
22	Department of Education	$3,963	69040	20234	$1,426	21.4%	2.8	$18,765	37.2%
23	Finance Department	$2,473	50590	14827	$1,320	32.6%	1.9	$18,539	54.9%
24	Veteran's Center	$279	46951	13761	$1,068	23.8%	0.3	$16,660	353.5%
25	Career Renewal & Child Services	$2,078	37937	11119	$889	30.2%	2.3	$12,085	44.1%
26	Casino Daycare	$1,949	35587	10430	$834	31.1%	2.3	$11,337	44.1%
27	Golf Course Pavilion	$10,335	25369	7435	$643	44.6%	16.1	$160	3.2%
28	Echelon Plummer	$1,250	26451	7752	$491	0.9%	2.5	$6,578	40.6%
29	Tribal School - New Bus Garage	$800	20562	6026	$482	21.9%	1.7	$6,867	61.8%
30	City Link	$3,618	21645	6344	$414	12.3%	8.7	$3,049	10.7%
31	Tribal Housing Authority Shop	$903	10498	3077	$246	17.2%	3.7	$3,026	28.3%
32	Old Roads Maintenance Shop	$855	8867	2599	$221	7.9%	3.9	$2,670	26.8%
33	BIA	$1,235	7250	2125	$208	28.9%	5.9	$2,101	17.1%
34	Youth Shelter	$12,855	-21874	-6411	-$551	-19.5%	-23.3	-$21,213	NA
Totals		***$1,199,361***	***7977028***	***2337933***	***$171,880***			***$1,565,318***	

The final phase of the EEFS process was to research potential funding sources and strategies for implementing the recommended energy conservation measures. These sources and strategies include:

- Utility Rebates and Incentives
- Non-Profit Grant Programs
- State Programs
- Federal Programs
- Internal Policies and Strategies for Energy Efficiency

These sources and strategies are discussed in Section V of this report.

Energy Efficiency Workgroup Meetings were held at critical points within this assessment process in order to bring Tribal staff, utilities and other stakeholders together to update them on the interim results, plan next steps, and address specific issues and conditions.

Report Format

This report contains six main sections. These sections include:

- Section I - Energy Efficiency Feasibility Study – Executive Summary and Report Format
- Section II - Coeur d'Alene Field Energy Assessment Initial Field Findings Report
- Section III - Coeur d'Alene Tribal Buildings – Utility Billing Analyses Report
- Section IV - Coeur d'Alene Energy Conservation Measure Prioritization Report
- Section V - Potential Funding Sources and Strategies for Energy Project Implementation
- Section VI - Appendices
  - Appendix A – Observed Equipment Inventory
  - Appendix B – Energy Efficiency Product Information
  - Appendix C – ECM Prioritization Report – Economic Analyses
  - Appendix D – Lighting Upgrade Recommendations
  - Appendix E – Bonneville Power Administration (BPA) Energy Efficiency Implementation Manual
  - Appendix F – Energy Efficiency Workgroup Meeting Agendas and Participants

Each of the sections, except for the Appendices contains a relevant table of contents, summary, description of the methodology, detailed facility specific evaluations and results and conclusions. The appendices contain summaries of the main findings, calculations and interim technical memorandum submittals. An electronic copy of all spreadsheets used for this EEFS was provided to the Tribe via DVD submitted with the hard copy submittals of this EEFS.

Glossary

AFUE	Annual Fuel Utilization Efficiency – A thermal efficiency measure of combustion devices including furnaces, boilers, and water heaters that is not steady-state but takes into account the actual, season long, average efficiency of a piece of equipment, taking into account operating transients.
BTU	British Thermal Unit – Considered the “universal unit” for energy calculations. The amount of energy it takes to raise one pound of water 1 degree Fahrenheit. Approximately 3412 BTU = 1 kWh of energy.
kWh	Kilowatt-hour – Unit of energy (typically electrical energy)
COP	Coefficient of Performance – A measure of efficiency that is the ratio of the amount of heating and cooling the unit produces to its required electrical energy input.
EER	Energy Efficiency Ratio – Used to rate air DX or direct expansion air conditioners, calculated as the ratio of output cooling (in BTU/hour) to input electrical power (in watts).
EUI	Energy Use Index – A measure of the energy use “density” of a given facility; described in kBTU/square foot/year.
Full light	A building entry door the majority of which is glass.
Half-light	A building entry door approximately half of which is glass.
HSPF	Heating Seasonal Performance Factor, used to measure the combined heating and cooling efficiency of heat pump HVAC systems.
IRR	Internal Rate of Return
OSA	Outside air, used to describe fresh ventilation air.
PTAC	Packaged Terminal Air Conditioner - Typically found in hotel and motel rooms for heating and cooling of a single zone, generally mounted on and penetrating an exterior wall. In most cases heating is by electric resistance and cooling is by DX or direct expansion.
PTHP	Packaged Terminal Heat Pump – similar to PTAC but uses heat pump technology for both heating and cooling, offering substantially better energy efficiency.
RTU	Roof Top Unit – typically a packaged HVAC unit that combines the all the components of a heating and cooling system including the supply fan into a single box mounted on the roof.

SEER	Seasonal Energy Efficiency Ratio – Similar to EER but rather than applying to a only cooling mode as in EER, represents the overall efficiency taking into account the energy required for both heating and cooling modes as in a heat pump system or DX air conditioner combined with a furnace/air handler.

EEFS SECTION II – COEUR D'ALENE TRIBE – FIELD ENERGY ASSESSMENT INITIAL FINDINGS REPORT

Field Assessment Initial Findings Report - Introduction and Purpose

As part of the Coeur d'Alene Tribe's 2012-2013 Energy Efficiency Feasibility Study, 36 tribally owned and operated facilities are being assessed for building performance and energy conservation opportunities. The fieldwork for these assessments was completed between October 29 and November 9, 2012. The purpose of this report is to provide Tribal staff, decision makers and stakeholders with the initial findings of the building assessments in terms of building performance, energy conservation opportunities and recommendations for further study. This information will be used to determine which recommendations will be carried forward into subsequent energy project prioritization analyses. Future work will include building energy modeling (where appropriate), cost analyses, prioritization and specifications for recommended energy performance improvement and energy conservation measure implementation.

Initial Findings, Recommendations and Summary Table

The following sections delineate the initial findings and recommendations associated with each of the buildings assessed as part of the larger Energy Efficiency Feasibility Study. Table 2 contains a summary of the recommended energy conservation measures based on the initial findings.

Table 2. Summary of Recommended Energy Conservation Measures (ECMs)

Facility	ECM Type	Recommendation
Tribal Facilities Department Maintained Buildings		
Tribal Headquarters	HVAC	• Complete EnergyPro model of building to assist in design of retrofit HVAC systems and cost analyses Provide air source heat pumps to all basement offices • Replace non-programmable thermostats with Honeywell TB822OU programmable thermostats • Program thermostats to reflect actual occupancy patterns • Replace aging HVAC systems with high efficiency heat pumps • Perform duct testing and air sealing as necessary

CDA Facilities	Envelope	• Provide interlocks on bay doors to prevent HVAC from operating when doors are open • Replace weather stripping around bay doors
	HVAC	• Program thermostats to reflect actual occupancy patterns
	Lighting	• Install lighting occupancy sensors in office and shop
	DHW	• Install hot water pipe insulation
Social Services	Envelope	• Replace weather stripping around all exterior doors
	HVAC	• Relocate white board in Career Renewal so it does not block HVAC return register • Conduct duct pressure testing and complete duct sealing as necessary • Assess thermostat locations and relocate to more "zone central" location where necessary • Undercut doors to improve air balance • Set programmable thermostats to better reflect actual occupancy patterns and appropriate energy efficient set points and setback temperatures
	Lighting	• Replace T-12s with T-8s • Replace exterior incandescent spots with CFL or LED equivalent • Replace wall mounted incandescent bulbs with CFLs
	Plug Loads	• Eliminate redundant separate refrigerators where feasible

Veterans' Center	Envelope	• Inspect and seal window weather seals as necessary • Replace weather stripping around all three exterior doors
	HVAC	• Relocate thermostat from mechanical room to conditioned space • Program thermostat to default to 55°F heating and 84°F cooling, 24/7; Allow occupants to reset manually only when building is occupied
	Lighting	• Replace 60W incandescent bulbs with 13W CFLs
	DHW	• Insulate all hot water pipes and cold water inlet pipe to 6' from water heater
	Plug loads	• Consider removing existing refrigerator or place on timer so it only operates a few hours a day during periods when most likely to be used
Bureau of Indian Affairs	HVAC	• Reprogram thermostats to better reflect occupancy patterns and set points • Undercut interior doors to improve building air balance
	Lighting	• Replace 60W incandescent in restrooms with 13W CFLs • Replace T-12 lighting with T-8 lighting
	DHW	• Insulate all hot water pipes and cold water inlet pipe to 6' from water heater
Department of Education	Envelope	• Repair damaged siding, replace insulation behind it • Water/air seal all compromised areas of wall system with outdoor rated caulk • Replace exterior door weather stripping

Department of Education	HVAC	• Reprogram thermostats to better reflect occupancy patterns and set points • Schedule maintenance call to assess Bard heat pump performance and clean/straighten condenser fins • Undercut interior doors to improve building air balance
	Lighting	• Replace 60W incandescent in restrooms with 13W CFLs • Install lighting occupancy sensors in restrooms, offices, and meeting areas • Replace T-12 lighting with T-8 lighting
	DHW	• Insulate all hot water pipes and cold water inlet pipe to 6’ from water heater
Finance Department	Envelope	• Repair damaged siding, replace insulation behind it • Water/air seal all compromised areas of wall system with outdoor rated caulk • Replace exterior door weather stripping
	HVAC	• Undercut doors to improve air balance • Set programmable thermostats to better reflect actual occupancy patterns and appropriate energy efficient set points and setback temperatures
	Lighting	• Replace 60W incandescent in restrooms with 13W CFLs • Install lighting occupancy sensors in restrooms, offices, and meeting areas • Replace T-12 lighting with T-8 lighting
	DHW	• Insulate all hot water pipes and cold water inlet pipe to 6’ from water heater

Finance Department	Plug loads	• Discontinue use of coffee maker burners; transfer hot coffee to thermally insulated carafe for storage
Food Distribution Warehouse	Envelope	• Adequately air seal all building penetrations • Insulate walls to a minimum of R-19 • Insulate ceiling to a minimum of R-38
	HVAC	• Upgrade HVAC system to heat pump technology Install programmable thermostats
	Lighting	• Upgrade warehouse lighting to high-bay T5 • Upgrade office area lighting to T-8 • Replace exterior lighting with LED on photocells or timer. • Install lighting occupancy sensors in restrooms, offices, meeting areas
	DHW	• Insulate all hot water pipes and cold water inlet pipe to 6’ from water heater
	Process Loads	• Evaluate operation of existing freezer condenser/evaporator pairs and replace as necessary • Replace all shaded pole evaporator fan motors with electronically commutated motors.
Camp Larson	DHW	• Install pipe insulation over heat tape on any pipes in danger of freezer; eliminate use of space heaters

<table>
<tr><td rowspan="4">Early Childhood Learning Center</td><td>HVAC</td><td>Provide OSA to Phase II by either
install energy recovery ventilators or
retrofit existing air handlers to take in OSA
Assess thermostat locations and relocate to more “zone central” location where necessary
Set programmable thermostats to better reflect actual occupancy patterns and appropriate energy efficient set points and setback temperatures
Ensure all air handler filters are regularly replaced with correct size filters and filter covers are properly installed
At end of life for Lennox air conditioner systems replace with Energy Star rated heat pumps</td></tr>
<tr><td>Lighting</td><td>Do NOT replace existing T-8 lighting with incandescent lighting</td></tr>
<tr><td>DHW</td><td>Insulate all hot water pipes and cold water inlet pipe to 6’ from water heater
Install timer on 80-gallon water heater pump so it does not circulate during unoccupied hours</td></tr>
<tr><td>Plug loads</td><td>Replace Signature2000 upright freezer with Energy Star rated equipment</td></tr>
<tr><td>Rose Creek Longhouse</td><td>Envelope</td><td>Replace weather stripping around all exterior doors</td></tr>
</table>

Rose Creek Longhouse	HVAC	• Assess whether Modine units were properly converted to use propane. If so, document accordingly; if not, ensure that they are and then document accordingly – Subsequent evaluation indicates that these units were converted to propane. • Program thermostats to maintain setback temperatures and have Facilities staff reset for heating or cooling two hours prior to scheduled events
	Lighting	• Replace 60W incandescent in wall sconces with 13W CFLs
	DHW	• Insulate all hot water pipes and cold water inlet pipe to 6' from water heater
	Process Loads	• Schedule immediate service call for kitchen range to diagnose and remediate conditions causing pilot lights to emit excessive CO and repair any gas leaks • Install at least one CO detector in kitchen
DeSmet Longhouse	HVAC	• Schedule service call to repair of damaged heat exchanger fins on York 20-ton heat pump • Verify existence of interlock between kitchen exhaust hood and direct duct furnace • Program thermostats to maintain setback temperatures and have Facilities staff reset for heating or cooling two hours prior to scheduled events

DeSmet Longhouse	Process Loads	• Install at least one CO detector in kitchen • Install signage indicating exhaust hood must be operating whenever range or oven is in use • Disable icemaker when building is not occupied; facilities staff must enable 24-hours prior to use • Disable commercial refrigerator when building is not occupied; facilities staff must enable 1 to 2 hours prior to use • Close propane valve to building when unoccupied; trained Facilities staff must open valve and light pilots prior to use
Fire Warehouse and Shop	Envelope	• Replace seals on bay doors • Replace weatherstripping on interior doors that connect the office space to storage areas. • Remove window mounted air conditioner units when they are not needed to decrease air leakage within the structure. Ensure adequate seals around window units when reinstalled each cooling season

Fire Warehouse and Shop	HVAC	• Replace existing nonprogrammable thermostats in office and kitchen with programmable units with appropriate setbacks for the building's standard occupancy patterns and energy efficient set points • Complete routine (quarterly) maintenance on all electric wall heaters • Replace electric resistance wall heaters and window air conditioning unit in first floor office area, kitchen and service area with a multi-zone ductless heat pump system
	Lighting	• Upgrade T12 fluorescent lighting in two story garage and shop structure to high bay T5 lighting
	DHW	• Insulate all accessible hot water pipes as well as the hot water heater cold water inlet pipe to a distance of 6 feet from the tank
	Process Loads	• Replace kitchen refrigerator with Energy Star rated equivalent • Have compressor and distribution system assessed for leakage and complete repairs as necessary. Raise compressor tank so that drain valve is accessible and operational
Roads Maintenance Shop	Envelope	• Determine whether new bay doors are interlocked to prevent unit heater operation when open; if not, install them • Secure source of waste oil so that Clean Burn unit can be utilized on regular basis in Old Shop

Roads Maintenance Shop	Lighting	• Repair or replace photocell on outdoor fixture above front bay door of Old Shop • Replace T-12s with T-5s in Old Shop • Replace all exterior 100W bulbs on New Shop with 23W CFL equivalents • Repair or replace photocell on incandescent flood lights on New Shop
Department of Natural Resources	Envelope	• Install insulated window coverings in main reception area • Complete duct leakage testing and repair/seal ducts as necessary with fiberglass tape and mastic • Install insulated window coverings on north facing windows in main reception area • Insulate and weather-strip attic and crawlspace access hatches
Felix Aripa Fish and Wildlife Building	HVAC	• Connect restroom exhaust fans to existing ducting and terminate through roof penetrations • Install return air grills in open office area suspended ceilings to improve HVAC air balance • Set programmable thermostats to better reflect actual occupancy patterns at energy efficient set points and setback temperatures • Provide OSA by installing energy recovery ventilators • Institute record keeping protocol for servicing electrostatic air filters • Insulate all exterior refrigerant lines on heat pumps

Felix Aripa Fish and Wildlife Building	DHW	• Insulate all hot accessible hot water pipes and cold water inlet pipe to 6' from tank
Tribal Police Headquarters	Envelope	• Replace weather stripping around all exterior doors
	HVAC	• Replace Bryant packaged RTU with split system heat pump; relocate condenser unit to ground level o If not replaced immediately, then verify that unit is correctly converted for use with propane fuel • Replace Bryant air conditioner and gas furnace air handler with split heat pump system; relocate condenser unit to ground location • Install mini-split ductless air conditioner to provide adequate cooling capacity for server room; air seal door to server room • Completing air sealing measures on attic duct system. • Complete EnergyPro model to evaluate heating and cooling loads in order to specify appropriate replacement HVAC equipment
	Lighting	• Replace remaining T-12s with T-8s

Tribal Police Headquarters	DHW	• Insulate all hot accessible hot water pipes and cold water inlet pipe to 6' from tank. • Repair/replace exterior hose bib that allows hot water to leak and/or re-plumb exterior hose bib so that it distributes cold water only.
Old Benewah Medical Center	Envelope	• Install new weather stripping around exterior doors
	HVAC	• Complete thorough design review before any modifications to building interior spaces that might affect HVAC performance • Ensure that programmable thermostats are set to accurately reflect new building occupancy patterns with appropriate temperature set points and setbacks • Install simple thermostat to control operation of attic exhaust fans
	DHW	• Replace 20-year old Ruud 80-gallon water heater with new high efficiency Energy Star hybrid heat pump water heater • Insulate all hot accessible hot water pipes and cold water inlet pipe to 6' from tank • Install digital timers on DHW circulation pumps to disable pump operation during unoccupied hours

Youth Shelter	Envelope	• Replace loose fitting metal framed windows with dual paned windows in non-metal frames with adequate air seals • Reconfigure existing gable vents to reduce size of vents and opportunity for moisture intrusion • Insulate and weather-strip attic access hatch
	HVAC	• Install separate new Energy Star rated split heat pump system with provisions for OSA to serve second floor • Replace existing air conditioner condenser with heat pump sized to meet heating and cooling loads for first floor only. • Install correct sized air filter on existing first floor air handler; provide new properly fitted cover for filter • Reconfigure all bathroom exhaust fans to discharge to outside the structure, not into attic • Ensure that programmable thermostats are set to accurately reflect new building occupancy patterns with appropriate temperature set points and setbacks.
	DHW	• Insulate all accessible hot water pipes and cold water inlet pipe to 6' from tank
Technology Center	Envelope	• Replace damaged weather stripping around exterior doors • Complete energy efficiency design review before plans for future expansion are finalized

Technology Center	HVAC	• Ensure that programmable thermostats are set to accurately reflect new building occupancy patterns with appropriate temperature set points and setbacks
	Lighting	• Replace metal halide exterior lighting with LED equivalent
	Process loads	• Research emerging heat recovery technology to determine if heat rejected from server process load could be utilized to provide space heating in common areas of building
Tribal Court Services	Envelope	• Remediate problems with roof and parcel runoff through crawlspace • Reinstall crawlspace vapor barrier with appropriate anchoring • Continue to monitor crawlspace humidity levels

Tribal Court Services	HVAC	• Relocate outside air intakes away from front walkway to location higher above grade • Complete pressure testing of entire building's duct system • Seal entire duct system with fiberglass tape and mastic then re-do pressure testing to measure and verify efficacy of repairs • Implement strict regimen of monthly air handler filter replacements • Install permanent continuous drainage for downstairs dehumidification system • Set programmable thermostats to better reflect actual occupancy patterns at energy efficient set points and setback temperatures • Install ceiling fans in atrium foyer to redistribute stratified air throughout building. •
	Lighting	• Replace all existing T-12s with T-8s • Replace incandescent lights in restrooms with CFLs Install occupancy sensors in offices, meeting rooms, and restrooms
	DHW	• Insulate all hot accessible hot water pipes and cold water inlet pipe to 6' from tank
Tribal Casino Resort Maintained Buildings		

Casino Daycare	Lighting	• Replace T-12s with T-8s • Augment existing emergency backup lighting with receptacle mounted rechargeable LED floodlight/flashlights
Circling Raven Golf Course Pro Shop	HVAC	• Consider “Catalyst” energy management system for packaged heat pumps
	Lighting	• Replace all incandescent flood lighting in lounge to equivalent CFL • Replace 50W MR16 spot lighting in retail space with LED spots in direct down lighting or direct/indirect (reflected) configuration
	DHW	• Have both water heaters inspected by qualified technician to ensure they are in fact specified and adapted for use with propane; if so then label accordingly; if not then replace with appropriate units certified for use with propane • Insulate all hot accessible hot water pipes and cold water inlet pipe to 6’ from tank
	Process Loads	• Provide minimum quarterly maintenance on all exterior refrigeration condenser units • Have walk-in cooler condenser serviced by trained technician to mitigate icing on coils and expansion valve • Complete refrigeration system upgrades per Energy Smart Grocer recommendations

Golf Course Pavilion	HVAC	• Replace existing nonprogrammable thermostats with programmable thermostats that default to setback temperatures to be overridden manually when building is scheduled for occupancy • Consider retrofit of mini-split heat pump systems to address lack of cooling capacity and provide more efficient 1st stage of heating • Complete EnergyPro model of building before any HVAC retrofits commence
	Process Loads	• Unplug commercial refrigerator when not in use; allow 1-2 hours for startup when building is scheduled for occupancy
	DHW	• Insulate all hot accessible hot water pipes and cold water inlet pipe to 6' from tank • Install a timer on water heater that restricts its operation during periods of non-use
Tribal Casino Conoco Service Station	Envelope	•
	HVAC	• Consider adding "Catalyst" energy management system to all packaged heat pumps
	Lighting	• Replace 150W metal halide wall packs with LED equivalent • Replace 400W parking lot metal halides with LED equivalent • Install lighting occupancy sensors in restrooms, office, and service areas

Tribal Casino Conoco Service Station	Process Loads	• Schedule service call for cooler condenser to remediate icing of expansion valve. • Complete refrigeration system upgrades as recommended by Energy Smart Grocer assessment.
City Link Bus Garage	Envelope	• Install insulated window coverings on office windows
	HVAC	• Undercut office doors to provide better air balance within zone served by heat pump system
	Lighting	• Replace exterior metal halide lighting with LED equivalent • Install lighting occupancy sensors in offices, restrooms, and service areas
	DHW	• Insulate all hot accessible hot water pipes and cold water inlet pipe to 6’ from tank •
	Plug Loads	• Replace three burner coffee maker and urn with thermal carafe style coffee maker/storage
Tribal Casino Resort Hotel	HVAC	• Require maintenance and cleaning staff to turn off PTHPs upon exiting empty rooms Require periodic inspection and cleaning of PTHP filters

<table>
<tr><td rowspan="3">Tribal Casino Resort Hotel</td><td>Lighting</td><td>Upgrade parking lot lighting by:
Maintain all photocells on existing lighting
Replace 400W halide lamps with LED equivalent
Install dual-level ballasts and occupancy sensors
Institute parking management controls
Upgrade interior lighting from incandescent to CFL or LED as appropriate</td></tr>
<tr><td rowspan="2">Process Loads</td><td>Consider reducing frequency and duration of propane fireplaces and aesthetic fire features
Complete refrigeration system upgrades as recommended in Energy Smart Grocer assessment.</td></tr>
<tr><td>Consider reducing frequency and duration of propane fireplaces and aesthetic fire features
Complete refrigeration system upgrades as recommended in Energy Smart Grocer assessment.</td></tr>
<tr><td colspan="3">Tribal Housing Authority Maintained Buildings</td></tr>
</table>

Tribal Housing Authority Office and Shop	HVAC	• Complete duct leak testing and repair seams with fiberglass tape and mastic • At end of serviceable life replace Rheem air conditioner with Energy Star rated air source heat pump • Perform regular quarterly HVAC filter changes on all systems • Set programmable thermostats to better reflect actual occupancy patterns at appropriate energy efficient temperature set points and setbacks • Evaluate Rheem condenser coils for signs of freezing or other deterioration due to air handler mismatch • Install timer switch on electric resistance heater in Shop Area.
	Lighting	• Upgrade T12 linear fluorescent lighting to T8 lighting • Replace incandescent flood lighting with CFL equivalent • Install lighting occupancy sensors in restrooms and offices.
	DHW	• Insulate hot water pipes and cold water inlet pipe to 6' from tank
	Plug loads	• Replace refrigerator with Energy Star rated equivalent • Install Vending Miser on vending machine •

Senior Housing Complex	HVAC	• Provide some form of non-electric dependent backup heat for common area during extended power outages • Install filter cover on common room air handler in mechanical room next to kitchen • Assess potential for retrofitting existing apartment ductless heat and cooling systems with auxiliary heat strips that will allow them to perform at local climatic conditions
	Lighting	• Replace incandescent with 23W CFLs (common spaces) or 13W CFLs (restrooms) • Determine why exterior HID lights are operating during daylight hours and make appropriate repairs to either photocells or timers; Institute inspection and maintenance program to ensure normal scheduling is uninterrupted; replace mechanical timers with digital timers with battery backup
	DHW	• Replace 75-gallon kitchen propane water heater with new high efficiency condensing water heater with provision for combustion air from outside • Insulate all hot water pipes and cold water inlet pipe to 6' from tank
	Plug Loads	• Install Vending Miser on vending machine

<table>
<tr><th colspan="3">Tribal School Maintained Buildings</th></tr>
<tr><td rowspan="3">New Tribal School</td><td>Lighting</td><td>• Install occupancy sensors in all classrooms, restrooms, and office areas</td></tr>
<tr><td>DHW</td><td>• Replace existing propane boiler with system more appropriately sized for actual DHW loads; Further analysis required to determine optimal sizing and configuration</td></tr>
<tr><td>Process Loads</td><td>• Perform required repairs to remediate humidity problems in walk-in cooler and freezer
• Perform regular maintenance on walk-in cooler and freezer evaporator coils; ensure that fins are cleaned to allow adequate air flow</td></tr>
<tr><td rowspan="2">New Tribal School Bus Garage</td><td>HVAC</td><td>• Install timers on both electric resistance heating systems to ensure they are not operating when building is unoccupied
• Repair exhaust fan screen; maintain louvers to ensure they close when fan is not operating</td></tr>
<tr><td>Lighting</td><td>• Install lighting occupancy sensors</td></tr>
<tr><th colspan="3">Tribal Farm Maintained Building</th></tr>
<tr><td>Tribal Farm Shop</td><td>Lighting</td><td>• Remediate performance issues with recent upgrade to T8 lighting (likely due to improper grounding of fixtures)</td></tr>
</table>

Tribal Development Corporation Maintained Buildings		
Benewah Auto	Envelope	• Add R-30 rigid insulation during roof rehabilitation
	HVAC	• Replace roof top packaged AC/heating units with Energy Star ground mounted split system heat pumps; relocate all ducts to building interior • Set programmable thermostats to better reflect actual occupancy patterns and energy efficient temperature set points and setbacks
	Lighting	• Replace T-12s in storage area with T-8s • Replace T-12s in exterior canopy with T-8s
	DHW	• Insulate all hot water pipes and cold water inlet pipe to 6’ from tank
Echelon Plummer	Lighting	• Install occupancy sensors in restrooms, offices, break room, and meeting areas
	DHW	• Insulate all hot water pipes and cold water inlet pipe to 6’ from tank
	Plug & Process Loads	• Complete leak testing of compressed air distribution system • Install Vending Miser on vending machine
Benewah Market and Offices	Envelope	• Repair damaged siding
	HVAC	• Remove old “swamp cooler” from above deli and install appropriate register and filter for deli makeup air duct
	Lighting	• Replace any remaining T-12s with T-8s
	DHW	• Insulate all accessible hot water pipes and cold water inlet pipe to 6’ from tank

Benewah Market and Offices	Process Loads	• Upgrade walk-in cooler cabinets to fully insulated mounted on moveable framework • Replace door seals on any walk-ins not replaced • Install automatic door closers on walk in cooler and freezer doors. • Clean all walk-in evaporator coils and fins, collection trays, and condensate drip lines • Replace condensate drip dray in domestic meat cooler • Replace remainder of open display cases with new reach-in cases or open cases with night covers • Replace all shaded pole evaporator fan motors with ECM • Ensure all refrigerant lines are insulated throughout facility with no gaps • Install Vending Misers on vending machines • Complete refrigeration system upgrades as described in Section IV
Benewah Medical Maintained Buildings		
Tribal Wellness Center	HVAC	• Schedule comprehensive assessment of Dectron pool area dehumidification systems by qualified technician • Recondition all exterior elements of Dectron duct system using fiberglass tape and mastic; remove any debris or materials currently stored on top of ducting

Tribal Wellness Center	Lighting	• Train staff to turn off basketball court lights when not in use • Replace all incandescent lighting in recessed cans with CFL or LED equivalent • Replace all metal halide exterior lighting with LED equivalent Replace metal halide fixtures in rotunda with LED spots
	DHW	• Insulate all hot water pipes and cold water inlet pipe to 6’ from tank
	Plug & Process Loads	• Develop energy management protocol for both high power audio systems • Install new door latches and seals on saunas • Install new seals around steam room doors • Ensure dryer vent outlet at rooftop is cleaned regularly; consider moving dryer to location near exterior wall

Tribal Facilities Department Maintained Buildings

Tribal Headquarters Preliminary Findings

Tribal Headquarters Facility Description

The approximately 13,500 square feet Tribal Headquarters (THQ) building is largely a two-story structure consisting of a main floor constructed over a ground floor daylight basement. The center section of the structure also includes a third floor. This building was originally built in 1990 for use as a hotel, but since the Tribe acquired the structure in 1996, it has been converted in multiple office spaces that house the following Tribal departments:

Figure 1. Tribal Headquarters Building

- Basement Level
  - Attorneys' Offices
  - Veteran's Services
  - Culture and Language Department
  - Tribal Enrollment
- Ground Level (2nd Floor)
  - Tribal Chairman's Office
  - Council Chambers
  - Tribal Reception
  - Tribal Council Offices
  - Council Fires (Tribal Newspaper)
  - Public Works
- Third Floor
  - Tribal Administrator's Office and Human Resources

THQ is operated mainly Monday through Friday 7:00 am to 5:00 pm.

Tribal Headquarters Building Envelope

The THQ is constructed on a slab-on-grade foundation. The walls and roof systems are constructed using conventional wood framing. The exterior of the building is clad in vinyl siding that appeared to be in good condition at the time of the assessment. The roof of the structure is covered in a standing-seam metal roofing system, which was in good condition at the time of the assessment. However, obvious signs of moisture intrusion were visible in the Council Fires storage area which indicates that a significant leak exists in the wall system and/or roof system near this location. The ground floor of the structure has mainly fixed sheetrock ceilings with the exception of the Council Chambers and reception area which has suspended acoustic ceilings. The third floor and basement offices have suspended acoustic ceilings. 10-12" of loose-fill cellulose insulation was observed in the attic spaces above the ground floor offices. This insulation has an approximate R-value of R-38. Fiberglass batt insulation was observed in the wall system. The approximate R-value of this insulation is R-13. It is unknown whether this slab was insulated at the time of construction. The windows observed in the structure were dual paned with metal frames. These windows were operable and in fair condition at the time of the assessment. Weather stripping and door sweeps around many of the exterior doors were in extremely deteriorated condition allowing large amounts of leakage to/from the conditioned space.

Tribal Headquarter Heating Ventilation and Air Conditioning (HVAC) and Domestic Hot Water (DHW)

Each of the departments in the THQ building is served by separate HVAC and DHW systems. It should be noted that all equipment pairings specified herein were developed from field observation of the make, model and locations of these systems and the assumption that identified equipment served zones in direct proximity. See the attached Observed Equipment Inventory for more information. A description of the observed systems follows:

Attorneys' Office HVAC and DHW

The Attorneys' Office has no central heating and cooling system, therefore there is no provision for outside ventilation air (OSA) for this space. Each of the individual offices within the Attorney's Office is equipped with a 1,800 watt electric Cadet wall heater controlled by a non-programmable, mechanical thermostat. Additionally, four, approximately 1,500-watt personal space heaters were observed in the office. The personal space heater at the reception desk appeared to be the only heat provided at this location and building occupants indicated that it was insufficient to maintain an adequate level of comfort. A 1,800-watt Cadet wall heater was observed in the restroom. The only source of cooling observed was a through wall personal terminal air-conditioner (PTAC) located in one of the offices. Though this unit did not have an accessible nameplate, OE estimates that it has capacity of 7,000 BTU/hour cooling, 11,000 BTU/hour heating and an estimated efficiency (EER) of 7. This is far below Energy Star standards for air-conditioning.

DHW is provided by a 50-gallon, electric resistance water heater with a rated capacity of 3,375-watts. This unit was manufactured by the U.S. Water Heater Group in 1994. Though this unit appeared in fair condition at the time of the assessment, at 19 years old, it has likely surpassed its serviceable life span.

Veteran's Services HVAC and DHW

The Veteran's Services office has no central heating and cooling system, therefore there is no provision for outside ventilation air (OSA) for this space. Building occupants are new to the office, but indicate that comfort has been an issue. This space contains a combination of heating and cooling systems including a Carrier PTAC unit manufactured in 1994. This unit is legacy from when the structure was operated as a hotel and has a rated capacity of 7,000 BTU/hour cooling and 11,600 BTU/hour heating with a stated EER of 11. Though this rating does meet the minimum standards for Energy Star, at 19 years old, this unit is not likely performing at its rated efficiency. This unit is controlled by an internal non-programmable, mechanical thermostat. Supplemental heat is provided to this space by two, 800-watt wall heaters controlled by non-programmable, mechanical thermostats.

DHW is provided by a 50-gallon, electric resistance water heater with a rated capacity of 3,375-watts. This unit was manufactured by the U.S. Water Heater Group in 1994. Though this unit appeared in fair condition at the time of the assessment, at 19 years old, it has likely surpassed its serviceable life span.

Culture and Language Department HVAC and DHW

The Culture and Language Department office has no central heating and cooling system, therefore there is no provision for outside ventilation air (OSA) for this space. Office occupants indicate that comfort is an issue in this office. This space contains a combination of heating and cooling systems including two, window-mounted air conditioning units with capacities estimated at 1-ton each. These units are controlled by integral, non-programmable thermostats and were in poor condition at the time of the assessment. One PTAC unit remains in the language (center) portion of the office. This unit is likely legacy from when the structure was operated as a hotel and has a rated capacity of 7,000 BTU/hour cooling and 11,600 BTU/hour heating with a stated EER of 11. Though this rating does meet the minimum standards for Energy Star, at 19 years old, this unit is not likely performing at its rated efficiency. This unit is controlled by an internal non-programmable, mechanical thermostat. Supplemental heating is provided by approximately eight, 800-watt Cadet wall heaters located throughout the office. These units are controlled by individual, non-programmable thermostats located in various locations throughout the office. Building occupants indicate that these thermostats do not necessarily control the zones they are located in, that some of the units are non-functional and that personal space heaters are used to attempt to regulate comfort.

No DHW was observed in the Culture and Language Department office; therefore it is unknown where this office obtains its hot water.

Tribal Enrollment Office HVAC and DHW

The Tribal Enrollment Office contains a combination of heating and cooling systems including a central, forced air system with no provision for fresh ventilation air (OSA). This central system includes a Ruud, direct-expansion (DX) air conditioner manufactured in 1999 with a rated capacity of 2-tons and efficiency of 10 (SEER). This does not meet Energy Star standards of 14.5 SEER for this type of system. This air-conditioner is paired with a Ruud electric furnace/air handler manufactured in 1999 with a heating capacity of 9.8 kW. The air handler for this unit is located in a mechanical closet that can only be accessed by removing a portion of the interior wall system. The filter on this air handler was noted be in poor condition and no filter door was present on this unit. This condition is a significant source of leakage within the air system which allows unfiltered air into the system and can dramatically reduce its overall delivered heating/cooling efficiency. This system is controlled by a programmable thermostat is centrally located within the main office. OE engineers observed that the occupied heating set point for this unit (76°F) was very high compared to industry standards (68°F). Air distribution in the Tribal Enrollment Office is supplied by flexible ducting with integral R-5 insulation. This ducting was in good condition at the time of the assessment.

Supplemental heating and cooling is provided in the reception area by a Carrier PTAC unit manufactured in 1994. This unit is legacy from when the structure was operated as a hotel and has a rated capacity of 7,000 BTU/hour cooling and 11,600 BTU/hour heating with a stated EER of 11. Though this rating does meet the minimum standards for Energy Star, at 19 years old, this unit is not likely performing at its rated efficiency. This unit is controlled by an internal non-programmable, mechanical thermostat.

Additional cooling is provided to the server room located in the Tribal Enrollment office by a Fujitsu ductless air conditioner. The serial number for this unit indicates that it was manufactured in 2002. This system was in good condition at the time of the assessment and has a rated capacity of 2-tons and rated SEER of 18. This unit meets the minimum standards for Energy Star rating (14.5 SEER). This unit is controlled by a programmable thermostat located in the server room and is set to provide 24-hour cooling to 70°F. This temperature falls within industry standards for server rooms.

DHW is provided to the Tribal Enrollment Office by a 50-gallon, electric resistance water heater with a rated capacity of 3,375-watts. This unit was manufactured by the U.S. Water Heater Group in 1994. Though this unit appeared in fair condition at the time of the assessment, at 19 years old, it has likely surpassed its serviceable life span.

Tribal Chairman's Office HVAC and DHW

The Chairman's Office is equipped with a central heating and cooling system, however, no provision for fresh ventilation air (OSA) was observed during the field assessment. Cooling is provided in this central system by a 3-ton, Trane, split-system air conditioner. This unit was manufactured in 1993 and has a rated efficiency of 10 (SEER). This does not meet the minimum standards for Energy Star rating. This unit was in fair condition at the time of the assessment, but at 20 years old, it has likely surpassed its serviceable life span. This unit is paired with a Trane, electric resistance furnace/air handler manufactured in 1993. The nameplate on this unit indicates that the heater element was "field installed"; however no heater model was selected from the given options. The estimated capacity of this unit is 20 kW. As with the air conditioner unit, this unit is at an advanced age and has likely surpassed its serviceable life span. Air distribution within the Tribal Chairman's office is provided by a combination of rigid ducting with an applied R-5 insulation and flexible ducting with integral R-5 insulation. These ducts are partially submerged in ceiling cellulose insulation which adds to the effective R-value. This ducting appeared in fair condition at the time of the assessment. One "whole office" return was observed in the HVAC distribution system indicating that there may be inadequate circulation of air within the space.

No DHW was observed in the Chairman's office; therefore it is unknown where this office obtains its hot water.

Council Chambers HVAC and DHW

The Council Chambers is heated and cooled by a combination of systems. These systems include a central system that appears to have provisions for fresh ventilation air (OSA). Fresh air is controlled by a manually operated baffle within the fresh air intake ducting. The central system is composed of a Carrier air-conditioner with a capacity of 3.5-tons (10 SEER) paired with a Carrier air handler/electric furnace with a capacity of 20 kW. The serial number on these systems indicates that they were manufactured in 1996. This system is controlled by a programmable thermostat located in the Council Chambers. This thermostat was programmed to provide 68°F heating during typical working hours with a setback to 64°F. Typically unoccupied periods (weekends) were programmed to higher heating temperatures (71°F) for longer periods (7 am to 10 pm) than the occupied settings. Air distribution in the Council Chambers central HVAC system is provided by flexible ducting with integral R-5 insulation. This material was in good condition at the time of the assessment. Additional heating and cooling capacity is provided by a pair of Carrier PTAC units manufactured in 1994. These units are legacy from when the structure was operated as a hotel and have a rated capacity of 7,000 BTU/hour cooling and 11,600 BTU/hour heating with a stated EER of 11. Though this rating does meet the minimum standards for Energy Star, at 19 years old, this unit is not likely performing at its rated efficiency. This unit is controlled by an internal non-programmable, mechanical thermostat. According to building occupants, these units are not routinely utilized.

No DHW was observed in the Council Chambers; therefore it is unknown where this office obtains its hot water.

Tribal Reception HVAC and DHW

The Tribal Reception area and supporting break room is equipped with a central heating and cooling system composed of a 2.5-ton, Trane air conditioner paired with a Trane air handler/electric furnace. The air conditioner was manufactured in 1993 and has a rated efficiency of 10. This does not meet the minimum standard for Energy Star rating (14.5 SEER). The electric furnace was manufactured in 1993, and though no heating unit was selected from the options on the nameplate, we estimate the capacity of this unit at 20 kW. At 20 years old, this system has likely surpassed its serviceable life. No provision for fresh ventilation air (OSA) was observed during the field assessment. Air distribution in the reception area is provided by flexible ducting with integral R-5 insulation. This material was in good condition at the time of the assessment. One “whole office” return was identified within the HVAC distribution system. This return was located adjacent to the mechanical room. Due to the open nature of this space, this likely provides adequate circulation of conditioned air. The central HVAC system is controlled by a programmable thermostat located behind the main reception desk. The set points on this unit were within industry standards.

No DHW was observed in the Tribal Reception; therefore it is unknown where this office obtains its hot water.

Tribal Council Office HVAC and DHW

The Tribal Council Office is equipped with a central heating and cooling system composed of a 5-ton, Trane air conditioner paired with an electric furnace/air handler. No provision for fresh ventilation air (OSA) was observed during the field assessment. The Trane condenser was manufactured in 1996 and has a rated SEER of 10. This does not meet the minimum standard for Energy Star rating (14.5 SEER). There was no accessible nameplate on the air handler and its age and capacity are unknown. At 17 years old, this system is likely reaching the end of its serviceable life. Air distribution within the Tribal Council Office is provided by a combination of rigid ducting with an applied R-5 insulation and flexible ducting with integral R-5 insulation. These ducts are partially submerged in ceiling cellulose insulation which adds to the effective R-value. This ducting appeared in poor condition at the time of the assessment with deteriorating fabric duct tape observed at seams. This is likely a source of air leakage within the system. One "whole office" return was identified in the HVAC distribution system. This return is located in the hallway. With the office doors closed most of the time, the location of this return is likely inadequate to provide pressure balance and even distribution of air within the office space. This HVAC system is controlled by a programmable thermostat that is set to provide heating to 73°F (76°F cooling) from 7 am to 5 pm daily with a night setback of 62°F (78°F cooling). Weekend set points were similar to the weekday set points with the exception that that heating and cooling was provided for longer periods (6:00 am to 10:00 pm). It is unclear whether the extended period of weekend space conditioning is required during these periods. The occupied setting of 73°F exceeds recommended heating set points (68°F).

No DHW was observed in the Tribal Council office; therefore it is unknown where this office obtains its hot water.

Council Fires HVAC and DHW

The Council Fires office is equipped with a central heating and cooling system composed of a 2.5-ton, Trane air conditioner paired with a Trane electric furnace/air handler. These units were manufactured in 1993. The air conditioner has a rated efficiency of 10 (SEER). This does not meet the minimum standard for Energy Star rating (14.5 SEER). The nameplate on the air handler indicates that the heater element was "field installed" however, no heater model was selected from the given options. The estimated capacity of this unit is 20 kW. At 20 years old, these systems have likely reached the end of their serviceable life. No provision for fresh ventilation air (OSA) was observed during the field assessment. Air distribution within the Council Fires office is provided by a combination of rigid ducting with an applied R-5 insulation and flexible ducting with integral R-5 insulation. These ducts are partially submerged in ceiling cellulose insulation which adds to the effective R-value. This ducting appeared in poor condition at the time of the assessment with deteriorating fabric duct tape at seams and damaged ducting observed. This is likely a source of air leakage within the system. One "whole office" return was identified in the HVAC distribution system. With the small size of this office, this return configuration likely provides adequate circulation and pressure balance. This HVAC system is controlled by a programmable thermostat that is set to provide heating to 73°F (76°F cooling) from 7 am to 5 pm daily with a night setback of 62°F (78°F cooling). Weekend set points were similar to the weekday set points with the exception that that heating and cooling was provided for longer periods (6:00 am to 10:00 pm). It is unclear whether the extended period of weekend space conditioning is required during these periods. The occupied setting of 73°F exceeds recommended the heating set point (68°F).

No DHW was observed in the Council Fires office; therefore it is unknown where this office obtains its hot water.

Public Works HVAC and DHW

The Public Works office is served by two heating, ventilation and air-conditioning systems. According to office occupants, the main Public Works reception area is served by the Tribal Reception system, but no thermostatic control is available in the Public Works office. In addition to the Tribal Reception system, the reception area is served by a retrofitted duct that provides heat from the main Public Works HVAC system. Occupants indicate that this retrofit is not effective at delivering conditioned air to the Public

Works reception area. The main system that serves the Public Works office is a central heating and cooling system composed of a 3-ton, Trane air conditioner paired with a Trane electric furnace/air handler. These units were manufactured in 1993. The air conditioner has a rated efficiency of 10 (SEER). This does not meet the minimum standard for Energy Star rating (14.5 SEER). The electric furnace nameplate indicated that the heating element was "field installed" however, no heating unit was selected from the given options. We estimate the capacity of this unit to be 20 kW. At 20 years old, these systems have likely reached the end of their serviceable life. In addition to the main HVAC system, one office is equipped with a Carrier PTAC unit. This unit is likely legacy from when the structure was operated as a hotel and has a rated capacity of 7,000 BTU/hour cooling and 11,600 BTU/hour heating with a stated EER of 11. Though this rating does meet the minimum standards for Energy Star, at 19 years old, this unit is not likely performing at its rated efficiency. This unit is controlled by an internal non-programmable, mechanical thermostat. No provision for fresh ventilation air (OSA) was observed during the field assessment. Air distribution within the Public Works office is provided by a combination of rigid ducting with an applied R-5 insulation and flexible ducting with integral R-5 insulation. These ducts are partially submerged in ceiling cellulose insulation which adds to the effective R-value. This ducting appeared in poor condition at the time of the assessment with deteriorating fabric duct tape at seams and damaged ducting observed. Specifically, the trunk line that serves the bathroom was observed to be extremely damaged, likely due to being stepped on or otherwise impacted by service personnel. These conditions likely are sources of leakage and negatively affect the delivered heating efficiency of this distribution system. One "whole office" return, located in the hallway was identified in the HVAC distribution system. With the office doors closed most of the time, the location of this return is likely inadequate to provide pressure balance and even distribution of air within the office spaces. This HVAC system is controlled by a programmable thermostat that is set to provide heating to 73°F (76°F cooling) from 7 am to 5 pm daily with a night setback of 61°F (78°F cooling). The occupied setting of 73°F exceeds recommended the heating set point (68°F).

Figure 2. Public Works attic space showing crushed ducting, impacted duct insulation and loose-fill cellulose attic insulation.

No DHW was observed in the Public Works office; therefore it is unknown where this office obtains its hot water.

Tribal Administrator's Office and Human Resources HVAC and DHW

The Tribal Administrator's Office and Human Resources Department is served by a central heating and cooling system composed of 3.5-ton Carrier air conditioner paired with a Carrier electric furnace/air handler with a rated capacity of 20 kW. These units were manufactured in 1996. The air conditioner has a rated efficiency of 10 (SEER). This does not meet the minimum standard for Energy Star rating (14.5 SEER). At 17 years old, this system is likely reaching the end of its serviceable life. No provision for fresh ventilation air (OSA) was observed during the field assessment. Air distribution in these offices is provided by flexible ducting with integral R-5 insulation. This material was in good condition at the time of the assessment. This HVAC system is controlled by a programmable thermostat that is set to provide heating to 70°F (74°F cooling) from 7 am to 5 pm daily (Monday through Friday) with a night setback of 62°F (78°F cooling). Weekend set points were similar to the weekday set points with the exception that that heating and cooling was provided for longer periods (6:00 am to 10:00 pm). It is unclear whether the extended period of weekend space conditioning is required during these periods. The occupied setting of 70°F exceeds recommended the heating set point (68°F).

Tribal Headquarters Lighting

Lighting in the Tribal Headquarters is provided mainly by a combination of energy efficient T8 linear fluorescent lamps, T12 linear fluorescent and incandescent bulbs in various fixtures. Occupancy sensors were observed in only one location, the restrooms located in the Tribal Reception area restrooms.

Tribal Headquarters Plug and Process Loads

Plug and process loads in the Tribal Headquarters are primarily standard office equipment including computers, printers, and copiers, along with standard kitchen equipment in the break rooms and common areas. This equipment includes refrigerators, vending machines and coffee makers. Many of the refrigerators noted during the field assessment were not used to capacity and therefore have the potential to be abandoned. Additionally, the two vending machines located in Tribal Reception are not on “Vending Misers”. Vending Misers function as occupancy sensors and allow these units to power down when the building is not in use. Vending Misers can save up to $200 per year on soda coolers and up to $150 per year on dry snack vending machines. One of the major “elective” plug loads of note is the two-burner Bunn coffee maker/warmers located in the Public Works and Council Offices. These units have rated capacity of 1800-watts. Though not always running at full power, the burners on this unit use approximately 1200-watts continuously during the 40-hour scheduled work week. Therefore this unit is a significant electrical load.

Tribal Headquarters Initial Recommendations

OurEvolution has identified the following energy conservation measures and recommendations for the Tribal Headquarters Building:

- Provide heating, ventilation (including OSA) and cooling systems (air source heat pumps) in “basement” offices. This will not only save energy by reducing the number of personal space heaters, but will also make these spaces healthier and more comfortable to occupants which has been shown to improve productivity.
- Add additional OSA infrastructure to offices that do not provide fresh ventilation air (energy recovery ventilators).
- The existing nonprogrammable thermostats should be replaced with programmable units with appropriate setbacks for the building’s standard occupancy patterns. OE recommends occupied thermostat set points to be no greater than 68°F heating and 78°F cooling with setbacks in unoccupied periods to 55°F cooling and 84°F cooling. In order to be consistent with the thermostat upgrades observed in other Tribal facilities, OE recommends the Honeywell TB822OU Commercial Programmable Thermostat.

- Set programmable thermostats to better reflect occupancy patterns and energy efficiency set points. OE recommends occupied thermostat set points to be no greater than 68°F heating and no less than 78°F cooling with setbacks in unoccupied periods to 55°F heating and 84°F cooling.
- Replace aging HVAC infrastructure with high efficiency heat pump units.
- Perform duct testing and air sealing as necessary on all existing HVAC distribution systems.

Tribal Headquarters Next Steps

OE recommends modeling specific zones of the Tribal Headquarters in order to assist in the design of retrofit HVAC systems. OE will then provide specifications and cost analyses for target energy conservation measure recommendations.

Tribal Facilities Initial Findings

Tribal Facilities Facility Description

The Tribal Facilities building was constructed in 2004 and is a 6,250 square foot structure housing offices and a large workshop. Three-quarters of the footprint is a 3,750 square foot open single-story workshop area. The remainder is two-story with storage and a restroom downstairs and a 1,250 square foot finished office area upstairs. The building is typically occupied from 8am to 4pm weekdays.

Figure 3. CDA Facilities Building

Tribal Facilities Building Envelope

The Facilities building is a conventional wood framed building with a concrete slab on grade foundation. Exterior walls have cementatious composite siding and drywall interior with insulation levels estimated to be R-19. The exterior portion of the building envelope was in good condition at the time of the assessment with no obvious signs of damage. The Facilities building has no roof drainage system, therefore water is shed around the entire perimeter of the structure. Surplus construction materials were observed stacked against the siding on the west side of the structure. These combined conditions tend to allow moisture to remain against the siding which can lead to early deterioration of the construction materials. Ceiling insulation is blown cellulose approximately 12" deep for an estimated R-value of approximately R-40. The entire building is under a wood framed pitched attic roof with metal roof decking. The windows are double paned and in nonmetal frames. Large bay doors in the workshop are insulated but were observed to be poorly sealed allowing for high levels of infiltration.

Tribal Facilities Heating Ventilation and Air Conditioning (HVAC)

The Facilities building has three main HVAC systems. A pair of matched York packaged heat pumps, with nominal capacities of 5 tons each, serve to heat and cool the entire first floor including the workshop, restrooms, and storage areas. Based on refrigerant type, model number and serial number these units are believed to have been manufactured in 2006 and have estimated energy efficiency ratings of 10.0 SEER. This does meet the minimum standards for Energy Star rating (>=14.5 SEER). A single 2-ton Ducane split heat pump serves to heat and cool the second floor office area. Based on refrigerant type, model number and serial number this unit is believed to have been manufactured in 2000 and had an estimated energy efficiency rating of 10 SEER. This does not meet the minimum standards for Energy Star rating (>=14.5 SEER). The air handler serving the office area appears generic in nature and had no observable nameplate data.

Thermostats throughout the building are programmed to provide conditioning during normal business hours 7 days per week despite being normally unoccupied on weekends. The current programmed setback is from 66°F to 65°F at night. There are no interlocks on the bay doors such that the heating systems can operate at any time including when bay doors are open, which they often are.

Tribal Facilities Domestic Hot Water (DHW)

Hot water for the Facilities building is provided by a single US/Craftmaster electric, 19-gallon tank water heater manufactured in 2005. No circulation pump, timer, pipe insulation, or any other enhancements were observed on this unit.

Tribal Facilities Lighting

Lighting in the second floor office area is provided by linear T8 fluorescents. Lighting in the shop and storage areas throughout the first floor is provided by energy efficiency high output T5 fluorescents. Only one of the two storage rooms is equipped with occupancy sensors. Fixtures in the main shop area are in three rows of three with each row on an independent switch. The occupants report that shop lighting is often left off since open bay doors generally provide sufficient light for most activities.

Tribal Facilities Plug and Process Loads

The main plug and process loads are in the second floor office area. These loads include mostly office equipment, computers, printers, copiers, and kitchen equipment in its small break area. The air compressor system and other tooling in the workshop represent significant loads when operating but they are actually in use a low number of hours so their net energy impacts are likely negligible.

Tribal Facilities Initial Recommendations

OurEvolution has identified the following energy conservation measures and recommendations for the Facilities building:

- Set programmable thermostats to better reflect occupancy patterns and energy efficiency set points. OE recommends occupied thermostat set points to be no greater than 68°F heating and no less than 78°F cooling with setbacks in unoccupied periods to 55°F heating and 84°F cooling.
- Interlock workshop heat pumps for operation only when large bay doors are closed. Currently the heat pumps can, and in cold weather likely do, operate whenever the bay doors are open. Installation of interlocks to prevent operation when bay doors are open will result in significant energy savings.
- Weather stripping around large bay doors. Cold outside air infiltrating into the building greatly increases the heating load on the building. Better door seals will both greatly reduce heating energy and increase occupant comfort levels.
- Install lighting occupancy sensors in the main shop area and the one storage room that does not already have one.
- Insulate all accessible hot water pipes as well as the hot water heater cold water inlet pipe to a distance of 6 foot from the tank.

Tribal Facilities Next Steps

Modeling this structure is not necessary to quantify the savings associated with the suggested measures. Therefore, subsequent work for this structure will include providing specifications and cost evaluations of the recommended measures.

Social Services Initial Findings

Social Services Facility Description

The Social Services facility consists of three separate, double-wide, modular buildings. These structures are oriented along a north-south axis, which may limit the viability of applying solar technologies to this facility. Two of the facilities are connected by a common breezeway and one is freestanding. Together these structures create approximately 3,400 square feet of conditioned area. Though no nameplate was observed on these units, they appear to be of the same vintage as other structures assessed during this fieldwork, and are assumed to have been constructed in 1999. These structures contain the offices of the following Tribal Departments:

Figure 4. Social Services Facilities

- Social Services
- Child Services
- Career Renewal

The Social Services facilities are typically occupied from 7:30 am to 4:30 pm, Monday through Friday.

Social Services Building Envelope

Each of the buildings that comprise the Social Services facility is of conventional wood-framed modular construction. These buildings are constructed on post and pier foundations. A continuous wooden skirt encloses the crawlspace. We observed that crawlspace venting on the east side of the structure had been blocked by Styrofoam. Therefore adequate crawlspace ventilation was only provided on the west side of the structures. Though no obvious damage was observed, this condition has the potential to increase humidity levels in the crawlspace which often leads to adverse moisture conditions. The walls are clad in a T-111-type sheet siding. The roofs are made of corrugated metal roofing material. These materials were in fair condition at the time of the assessment with visible deterioration noted, likely due to age of the structure. Additionally, staining on the suspended ceiling tiles at the north end of the Career Renewal office indicates that roof leakage has been an issue at this location; however, no active moisture intrusion was noted during the assessment. The east side of the structure is equipped with a roof drainage system which discharges roof runoff to the base of the structure. Moisture damage was noted at the base of the wall system in discharge locations. The west side of the structure has no roof drainage system, so runoff is uncontrolled. A small awning retrofitted above the entrance to the Child Services office and an alcove on the front entry way to the Social Services office protect clients and staff from rooftop runoff. The windows observed in the Social Services facility are dual paned with nonmetal frames. Weather stripping around all exterior doors was observed to be in poor condition. Fiberglass batt insulation with an integrated moisture barrier is present in the ceiling and floor, and fiberglass batt insulation was observed in the wall systems. The estimated R-values of this insulation are R-19 in the floors and R-30 in the roof and R-13 in the walls. All of the insulation observed was in good condition.

Social Services Heating Ventilation and Air Conditioning (HVAC)

Each of the departments in the Social Services facility is served by a pair of Bard wall-mounted, packaged heat pumps. Nameplate information was not available for these units, but, based on experience with similar systems, they are estimated to have 3-ton cooling capacities and 35,600 BTU/hour heating capacities at 47°F (19,000 BTU/hour at 17°F). These units have a rated efficiency of 9 EER and a COP of 2.9. This does not meet the minimum standards for Energy Star Rating (11 EER). These units likely original to the construction of the building (estimated 1999) and were in fair condition at the time of the assessment. The ducting for these systems is composed of flexible ducting with integral R-5 insulation. A dominant duct leakage test indicated that there is supply side duct leakage within the social services wing. Additionally, the main return for the heat pump located on the south side of the Career Renewal office was nearly completely blocked by a white board which had been mounted over the return duct. This dramatically reduces the airflow capacity of this system, which has obvious energy efficiency impacts and the ability of this system to provide adequate comfort in the zone that it serves. All of the heat pumps observed at the Social Services facility are controlled by individual programmable thermostats. The programming for these thermostats was inconsistent and in all cases was set to provide heating and cooling from 6:00 am to 10:00 pm on weekend days when the facility is not occupied. Additionally, due to reconfiguration of walls within the office spaces, many of the thermostats were in locations that were isolated or far removed from the zones they were designed to control space conditioning in. This condition results in energy inefficiency and the related discomfort issues caused by over serving some zones and underserving others.

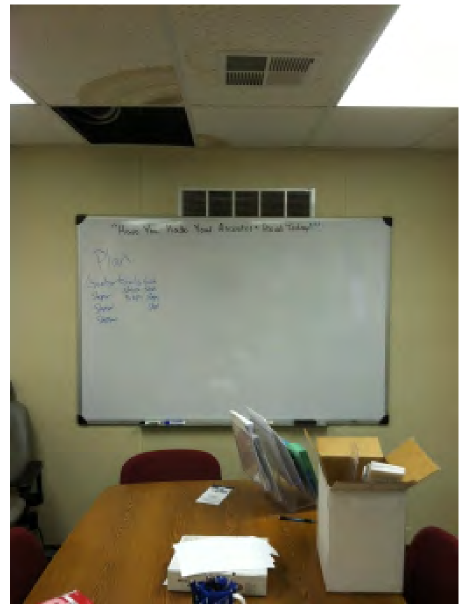

Figure 5. Whiteboard shown blocking the return air register in the Career Renewal office conference room. Also note staining in acoustic tile ceiling from previous moisture intrusion.

See the attached Observed Equipment Inventory for more information on these systems.

Social Services Domestic Hot Water (DHW)

Domestic hot water is provided to restrooms and break rooms located in each of the Tribal departments by 10-gallon electric resistance water heaters. Nameplate information was not obtained from these units but they are likely original to the building construction. Further research will be conducted on these units in a future site visit.

Social Services Lighting

Lighting in the Child Services office is provided by high efficiency T-8 linear fluorescent lamps in recessed fixtures. Both the Social Services and Career Renewal offices were equipped with T-12 linear fluorescent lamps in recessed fixtures. No lighting occupancy sensors were noted during the field assessment. Exterior lighting consisted of incandescent spot lights in photocell controlled fixtures and incandescent bulbs in wall mounted fixtures. Two of these wall mounted fixtures were on during the day at the time of the assessment.

Social Services Plug and Process Loads

Plug and process loads in the Social Services facility are primarily standard office equipment including computers (approximately 22 work stations), printers, and copiers. In addition to the office equipment, each of the offices has standard kitchen equipment in the break rooms including refrigerators, microwaves and coffee makers. The refrigerators noted during the field assessment were not used to capacity and with adjoining facilities combining refrigeration capacity may be an option.

Social Services Initial Recommendations

OurEvolution has identified the following energy conservation measures and recommendations for the Social Services facilities:

- Replace T-12 linear fluorescent lamps and fixtures in the Social Services and Career Renewal offices with high efficiency T-8 linear fluorescent lamps with electronic ballasts.
- Replace incandescent spots on exterior lighting with equivalent CFL.
- Replace incandescent bulbs in exterior wall mounted fixtures with CFL.
- Relocate white board in Career Renewal office so that it does not restrict return air flow to the HVAC system.
- Provide crawlspace ventilation on the east side of the structure.
- Conduct duct pressure testing and complete duct sealing as necessary.
- Set programmable thermostats to better reflect occupancy patterns and energy efficiency set points. OE recommends occupied thermostat set points to be no greater than 68°F heating and no less than 78°F cooling with setbacks in unoccupied periods to 55°F heating and 84°F cooling.
- Ensure that roof drainage systems discharge a minimum of 3' from the building.
- Assess the location of existing thermostats and relocate to more "zone central" location where necessary.
- Undercut doors or provide other means of airflow between sections of the interior of the structure in order to increase air flow to all portions of the building. This will tend to alleviate pressure imbalances and service imbalances noted in the structure.
- Replace weather stripping around all exterior doors.
- Install lighting occupancy sensors in restrooms, offices and conference rooms.
- Evaluate the need for separate refrigerators in each office and combine provide "common" refrigerator for the Social Services facilities.

Social Services Next Steps

Modeling this structure is not necessary to quantify the savings associated with the suggested measures. Therefore, subsequent work for this structure will include providing specifications and cost evaluations of the recommended measures.

Veterans’ Center Initial Findings

Veteran’s Center Facility Description

The Veterans’ Center building is a 2,230 square foot, single-story structure with an open meeting area, one office space, two restrooms, and a small kitchen. According to tribal staff it is rarely used and will likely be repurposed at some point in the near future.

Figure 6. Veteran's Center

Veteran’s Center Building Envelope

The Veterans’ building exterior is of concrete masonry construction with a slab on grade foundation. Interior walls have drywall and are assumed to be insulated to a level of R-11. Fiberglass batt insulation was observed in the attic and is estimated to have an R-value of approximately R-19 after accounting for gaps and areas where it has been displaced. All entry doors are insulated metal and the few small windows are double paned and in metal frames. Weather stripping around doors and windows is in generally poor condition and one window frame is poorly fitted with a gap between its members allowing for substantial infiltration of outside air into the building.

Figure 7. Large gap in poorly fitted window frame.

Veteran’s Center Heating Ventilation and Air Conditioning (HVAC)

The Veteran’s Center is heated and cooled by a central York split heat pump system manufactured in 2002 with a cooling capacity of 5 tons and rated heating capacity of 59,000 BTU/hour at 47°F (30,000 BTU/hour at 17°F). This unit has a rated efficiency of 12 SEER with an HSPF of 7.7. This does not meet the minimum standards for Energy Star (>=14.5 SEER, >=8.2 HSPF). This heat pump is paired with a York air handler manufactured in 2002. Though no auxiliary heat was selected on the nameplate, this unit has an estimated 15 kW auxiliary heating strip. This system provides outside air, but no economizers were noted during the field assessment. The system thermostat is located inside a locked mechanical room with a remote sensor located on an interior wall of the open meeting space. The thermostat is set to condition the building to 68°F winter and 78°F summer during normal operating hours despite the fact that the building is rarely used. Due to the location of the thermostat it cannot be overridden by building users.

Each of the restrooms has a small 1.5 kW wall mounted electric heater with manual mechanical thermostats that provide no timer or setback capabilities.

See the attached Observed Equipment Inventory for more information on these systems.

Veteran's Center Domestic Hot Water (DHW)
Hot water for the Veterans' building is provided by a single Whirlpool, electric, 50-gallon tank water heater. This unit has a rated capacity of 4,500 watts and was manufactured in 2002. This unit appeared in good condition at the time of the assessment. No circulation pump, timer, pipe insulation, or any other enhancements were observed on this unit.

Veteran's Center Lighting
The existing lighting in the Veterans' building is energy efficient T8 fluorescent throughout the interior, with two 60-watt incandescent fixtures providing outdoor lighting.

Veteran's Center Plug and Process Loads
The main plug and process loads in the Veterans' building are made up of kitchen equipment including and electric stove and refrigerator. The refrigerator was plugged in and operating though nearly completely empty and rarely used.

Veteran's Center Initial Recommendations
OurEvolution has identified the following energy conservation measures and recommendations for the Veteran's Center:

- Given the rare use of this building, the main recommendation is to program the heating and cooling system so that it is only providing a baseline level of conditioning when the building is unoccupied and brought to normal operating temperatures only when it is actually being used. The main thermostat control should be set to run at 55°F heating and 84°F cooling, 24 hours per day, 7 days per week. Occupants should then have the ability to manually set temperatures to desired levels upon entering the building and the thermostat will automatically reset to the baseline levels at the beginning of the next preprogrammed period. This will require moving the thermostat from the mechanical room into the area normally accessible to building users.
- Consider removing existing refrigerator or placing it on a timer so that it only runs a few hours per day during periods when it is most likely to be used.
- Insulate all accessible hot water pipes as well as the hot water heater cold water inlet pipe to a distance of 6 feet from the tank.
- Install lighting occupancy sensors in two restrooms.
- Replace weather stripping around three exterior doors.
- Inspect and seal window weather seals as necessary.
- Replace 60-watt incandescent exterior lighting with 13-watt CFL equivalent

Veteran's Center Next Steps
Modeling this structure is not necessary to quantify the savings associated with the suggested measures. Therefore, subsequent work for this structure will include providing specifications and cost evaluations of the recommended measures.

Bureau of Indian Affairs (BIA) Initial Findings

BIA Facility Description

The Bureau of Indian Affairs (BIA) building is a 1,046 square foot, single-story, modular structure used principally as office space. This structure was constructed in 2002 and is utilized approximately 50 to 75% of the year during normal business hours Monday through Friday.

Figure 8. Bureau of Indian Affairs Office

BIA Building Envelope

The BIA structure is of modular construction with wood (T-111) type sheet siding and low-slope impermeable membrane roofing over conventional modular wood framing. The siding and roof appeared to be in good condition at the time of the assessment, though, due to the lack of any roof drainage system, it appeared that roof runoff is likely to cause moisture damage to the siding at some point as evidenced by such damage to neighboring buildings of the same type and age. Rigid foam insulation with an integral radiant barrier is present in the ceiling and floor, with fiberglass batt insulation observed in the wall systems. The estimated R-values of this insulation are R-11 in the walls, R-19 in the floors, and R-30 in the roof. The insulation was in good condition at the time of the assessment. The windows in this facility are vinyl framed dual paned type and were in working order at the time of the assessment.

BIA Heating Ventilation and Air Conditioning (HVAC)

All heating and cooling for the BIA is provided by a pair of external wall mounted Bard heat pumps commonly used in modular construction. These units were manufactured in 2002 and each has a 3-ton cooling capacity and 34,400 BTU/hour heating capacity at 47°F (19,000 BTU/hour at 17°F). These units have a rated efficiency of 9 EER and a COP of 2.9. This does not meet the minimum standards for Energy Star Rating (11 EER). Both units appeared to be in good condition at the time of the assessment. Flexible insulation with integral (R-5) insulation is used for the HVAC distribution system. The HVAC systems are controlled by two, newer Honeywell programmable thermostats located in the main area of the facility. The thermostats were set to heat to 70°F with setback temp set to 62°F. Cooling set points were 74°F with a setback of 78°F. It was observed that space conditioning was programmed to be provided for many more hours than the building is actually in use.

Figure 9. BIA attic detailing rigid insulation and flexible ducting

See the attached Observed Equipment Inventory for more information on these systems.

BIA Domestic Hot Water (DHW)

Hot water heating for the BIA is provided by a single, Rheem, 6-gallon electric tank heater with 2,000-watt heating elements manufactured in 2002. No timers or circulation pumps were observed, nor pipe insulation or any other enhancements.

BIA Lighting

Lighting in the BIA is provided mainly by linear T12 fluorescents in recessed ceiling mounted fixtures with four 60-watt incandescent bulbs observed in the restroom.

BIA Plug and Process Loads

Plug and process loads in the BIA are primarily standard office equipment including computers, printers, and copiers, along with standard kitchen equipment in the break room.

BIA Initial Recommendations

OurEvolution has identified the following energy conservation measures and recommendations for the Bureau of Indian Affairs office:

- Install roof drainage system on the eve sides of the structure to prevent runoff from damaging the building envelope.
- Set programmable thermostats to better reflect occupancy patterns and energy efficiency set points. OE recommends occupied thermostat set points to be no greater than 68°F heating and no less than 78°F cooling with setbacks in unoccupied periods to 55°F heating and 84°F cooling.
- Upgrade existing T12 florescent lighting to energy efficient T8 lighting with electronic ballasts throughout the building.
- Replace 60-watt incandescent bulbs in restrooms with 13-watt CFLs.
- Add lighting occupancy sensors should be installed in bathrooms, meeting areas and offices.
- Insulate all accessible hot water pipes as well as the hot water heater cold water inlet pipe to a distance of 6 feet from the tank.
- Undercut doors or provide other means of airflow between sections of the interior of the structure in order to increase air flow to all portions of the building. This will tend to alleviate pressure imbalances and service imbalances noted in the structure.

BIA Next Steps

Modeling this structure is not necessary to quantify the savings associated with the suggested measures. Therefore, subsequent work for this structure will include providing specifications and cost evaluations of the recommended measures.

Department of Education Initial Findings

Department of Education Facility Description

The Department of Education building is a 2,850 square foot, single-story modular building used principally as office space but also is equipped with a central classroom and computer laboratory. This structure was constructed in 2001 and is occupied approximately 50 hours per week with regular Monday through Friday, 7:00 am to 5:00 pm hours, supplemented with evening and weekend classroom hours.

Figure 11. Department of Education Office

Department of Education Building Envelope

The Department of Education structure is of modular construction with wood (T-111) type sheet siding and low slope metal roofing over conventional modular wood framing. The roof of this structure appeared to be in fair condition at the time of the assessment. The building siding is seriously impacted by water runoff due to the fact that there is no effective continuous roof drainage system, which would channel water away from the building siding and foundation. Instead, this structure has a small (~1/2") aluminum channel that directs roof runoff to the corners of the structure where is runs down the wood cornice. The capacity of this system is seriously deficient and actually causes damage by directing water into the corners of the structure. In general, the building siding was observed to be holding moisture and many joints and connections had completely compromised seals. These were in good condition at the time of the assessment. Weather stripping around the exterior doors was observed to be in poor condition. Rigid foam insulation with an integrated radiant barrier is present in the ceiling and floor, with fiberglass batt insulation observed in the wall systems. The estimated R-values of this insulation are R-19 in the floors, and R-30 in the roof. Due to the existing moisture conditions observed in the wall system, the insulation is likely impacted, reducing its estimated effective R-value to R-9. The insulation was in good condition at the time of the assessment. The windows in this facility are vinyl framed dual paned type and were in working order at the time of the assessment.


Figure 10. Education building aluminum channel and water impacted cornice.

Department of Education Heating Ventilation and Air Conditioning (HVAC)

Heating and cooling for the main portion of the structure is provided by four external, wall-mounted heat pumps commonly used in modular construction. These units were manufactured in 2001 and each has a 3-ton cooling capacity and 34,400 BTU/hour heating capacity at 47°F (19,000 BTU/hour at 17°F). These units have a rated efficiency of 9 EER and a COP of 2.9. This does not meet the minimum standards for Energy Star Rating (11 EER). These units appeared to be in fair condition at the time of the assessment, with signs or weathering and visible damage to condenser fins. Flexible ducts with integral (R-5) insulation are used for the HVAC distribution system. The HVAC systems are controlled by three older White-Rodgers programmable thermostats and one upgraded Honeywell programmable thermostat. The Honeywell thermostat was programmed to setback heating from 72°F to 62°F Monday through Friday at 5:00 pm (74°F to 82°F cooling), but not setback until 10:00 pm on the weekends. The White-Rodgers thermostats are located in offices which were not accessible at the time of the assessment.

See the attached Observed Equipment Inventory for more information on these systems.

Department of Education Domestic Hot Water (DHW)

Hot water heating for Department of Education is provided by a GSW, 6-gallon electric tank heater with a 1500-watt heating element, manufactured in 2003. No timers or circulation pumps were observed, nor pipe insulation or any other enhancements.

Department of Education Lighting

Lighting in the Department of Education is provided mainly by linear T12 fluorescents in recessed ceiling mounted fixtures with approximately four, 60-watt incandescent bulbs observed in the restrooms. No occupancy sensors were noted in the restrooms.

Department of Education Plug and Process Loads

Plug and process loads in the Department of Education are primarily standard office equipment including computers, printers, and copiers, with a much higher concentration of computers in the centrally located classroom/computer lab. The break area includes a non-Energy Star rated full size kitchen refrigerator and a carafe-style coffee system.

Department of Education Initial Recommendations

OurEvolution has identified the following energy conservation measures and recommendations for the Department of Education:

- Install roof drainage system on the eve sides of the structure to prevent runoff from further damaging the building envelope.
- Repair damaged sections of siding and replace wall insulation as possible during renovations.
- Water/air seal all compromised areas of the wall system that may allow entrance of bulk water into the building envelope systems with an outdoor rated caulk.
- Replace damaged weather stripping at exterior doors.
- Set programmable thermostats to better reflect occupancy patterns and energy efficiency set points. OE recommends occupied thermostat set points to be no greater than 68°F heating and no less than 78°F cooling with setbacks in unoccupied periods to 55°F heating and 84°F cooling.
- Upgrade existing T12 florescent lighting to energy efficient T8 lighting with electronic ballasts throughout the building.
- Replace 60-watt incandescent bulbs in restrooms with 13-watt CFLs.
- Lighting occupancy sensors should be installed in bathrooms, meeting areas and offices.

- Insulate all accessible hot water pipes as well as the hot water heater cold water inlet pipe to a distance of 6 feet from the tank.
- Schedule maintenance call for Bard heat pumps to perform assessment of performance, maintenance and fin straightening.
- Undercut doors or provide other means of airflow between sections of the interior of the structure in order to increase air flow to all portions of the building. This will tend to alleviate pressure imbalances and service imbalances noted in the structure.

Department of Education Next Steps

Modeling this structure is not necessary to quantify the savings associated with the suggested measures. Therefore, subsequent work for this structure will include providing specifications and cost evaluations of the recommended measures.

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Finance Department Initial Findings

Finance Department Facility Description

The Finance Department building is a 3,600 square foot, single-story modular building used principally as office space. This structure was constructed in 1997 and is occupied Monday through Friday, 7:00 am to 5:00 pm.

Figure 13. Finance Department Office

Finance Department Building Envelope

The Finance Department structure is of modular construction with wood (T-111) type sheet siding and low slope metal roofing over conventional modular wood framing. The roof of this structure appeared to be in fair condition at the time of the assessment. The building siding is seriously impacted by water runoff due to the fact that there is no continuous roof drainage system, which would channel water away from the building siding and foundation. The siding was observed to be holding moisture and many joints and connections had completely compromised seals. Gutters had been retrofitted over the three main entrances to the facility; however, these gutters only protect a limited amount of area in the direct vicinity of the doorways. Standing water in direct contact with the building siding was noted in an alcove located at the rear of the building. With no significant precipitation at the time of the assessment, this negative drainage condition appears to be long term. Weather stripping around the exterior doors was observed to be in poor condition. Rigid foam insulation with an integrated radiant barrier is present in the ceiling and floor, with fiberglass batt insulation observed in the wall systems. The estimated R-values of this insulation are R-19 in the floors, and R-30 in the roof. Due to the existing moisture conditions observed in the wall system, the insulation is likely impacted, reducing its estimated effective R-value to R-9. The insulation was in good condition at the time of the assessment. The windows in this facility are vinyl framed dual paned type and were in working order at the time of the assessment.

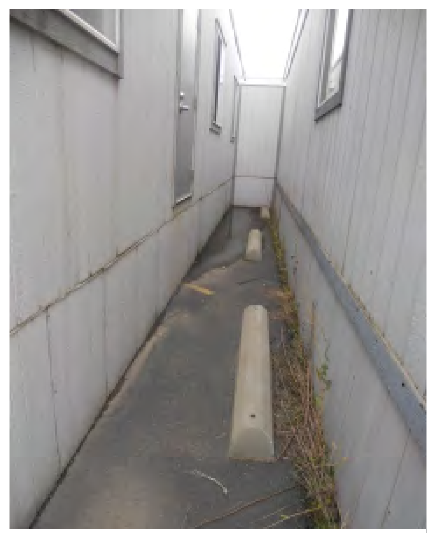


Figure 12. Standing water in contact with building siding in rear alcove.

Finance Department Heating Ventilation and Air Conditioning (HVAC)

Heating and cooling for the main portion of the structure is provided by five external wall mounted packaged heat pumps commonly used in modular construction. These units were manufactured in 1997 and each has a 3-ton cooling capacity and 34,400 BTU/hour heating capacity at 47°F (19,000 BTU/hour at 17°F). These units have a rated efficiency of 9 EER and a COP of 2.9. This does not meet the minimum standards for Energy Star Rating (11 EER). These units appeared to be in fair condition at the time of the assessment, with signs or weathering and visible damage to condenser fins. In addition to the Bard heat pumps, supplemental air conditioning is provided by a Mitsubishi, Mr. Slim ductless air conditioner that appeared to be in fair condition at the time of the assessment. This unit was manufactured in 2001, has a cooling capacity of 1-ton and a rated efficiency of 26 SEER which exceeds Energy Star standards for air conditioners (>=14.5 SEER). Flexible ducting with integral (R-5) insulation is used for the HVAC distribution system. The HVAC systems are controlled by five older White-Rodgers programmable thermostats. The thermostats were set to heat to 72°F with a 6:00 pm setback temperature of 65°F, however, the weekend set points indicated that the building was conditioned at 72°F with a 10:00 pm setback temperature of 65°. Cooling set points were 74°F with a setback of 78°F. Additionally, according to building occupants, the existing thermostats are located such that they control zones far away from the thermostat location (i.e. thermostat adjacent to the reception area controls heating and cooling on the other side of the structure). This condition makes it nearly impossible to control comfort levels within the building.

See the attached Observed Equipment Inventory for more information on these systems.

Finance Department Domestic Hot Water (DHW)

Hot water heating for Finance Department is provided by a single State, 6-gallon electric tank heater with a1500-watt heating element manufactured in 1997. No timers or circulation pumps were observed, pipe insulation or any other enhancements.

Finance Department Lighting

Lighting in the Finance Department is provided mainly by linear T12 fluorescents in recessed ceiling mounted fixtures with approximately four, 60-watt incandescent bulbs observed in the restrooms. No occupancy sensors were noted in the restrooms.

Finance Department Plug and Process Loads

Plug and process loads in the Finance Department are primarily standard office equipment including computers, printers, and copiers, along with standard kitchen equipment in the break room. The kitchen equipment appeared to fairly new and in good condition. The major plug load of note is the two-burner Bunn coffee maker/warmer located in the kitchen. This unit has a rated capacity of 1800-watts. Though not always running at full power, the burners on this unit use approximately 1200-watts continuously during the 40-hour scheduled work week. Therefore this unit is a significant electrical load.

Figure 14. 1,800-watt, Bunn coffee maker in break room

Finance Department Initial Recommendations

OurEvolution has identified the following energy conservation measures and recommendations for the Finance Department:

- Install roof drainage system on the eve sides of the structure to prevent runoff from further damaging the building envelope.

- Repair damaged sections of siding and replace wall insulation as possible during renovations
- Water/air seal all compromised areas of the wall system that may allow entrance of bulk water into the building envelope systems with an outdoor rated caulk.
- Replace damaged weather stripping at three exterior doors.
- Assess the location of building thermostats in order to determine the zones that they are controlling. Replace/relocate thermostats as necessary to more effectively control heating and cooling zones.
- Set programmable thermostats to better reflect occupancy patterns and energy efficiency set points. OE recommends occupied thermostat set points to be no greater than 68°F heating and no less than 78°F cooling with setbacks in unoccupied periods to 55°F heating and 84°F cooling.
- Upgrade existing T12 florescent lighting to energy efficient T8 lighting with electronic ballasts throughout the building.
- Replace 60-watt incandescent bulbs in restrooms with 13-watt CFLs.
- Install lighting occupancy sensors in bathrooms, meeting areas and offices.
- Insulate all accessible hot water pipes as well as the hot water heater cold water inlet pipe to a distance of 6 feet from the tank.
- Discontinue use of coffee maker burners and instead transfer coffee into thermally insulated containers for storage of fresh coffee.
- Schedule maintenance call for Bard heat pumps to perform assessment of performance, maintenance and fin straightening.
- Undercut doors or provide other means of air flow between sections of the interior of the structure in order to increase air flow to all portions of the building. This will tend to alleviate pressure imbalances and service imbalances noted in the structure.

Finance Department Next Steps

Modeling this structure is not necessary to quantify the savings associated with the suggested measures. Therefore, subsequent work for this structure will include providing specifications and cost evaluations of the recommended measures.

Food Distribution Warehouse Initial Findings

Food Distribution Warehouse Facility Description


Figure 15. Food Distribution Warehouse

The Food Distribution Warehouse is a 4,800 square foot, high bay building that was repurposed in the 1970s from its original use as an equipment building. This facility provides food assistance to Tribal members and contains a dry food warehouse, two large refrigeration areas (one cooler, one freezer) and a small office area.

Food Distribution Building Envelope

The warehouse structure was initially constructed as a wood pole building with a corrugated metal roof. In the conversion process wood wall framing was added and finished with drywall on the inside. The exterior of the structure is clad in a combination of metal, corrugated siding and wood (T-111) sheeting. Significant defects to the metal siding and walls were noted during the field assessment with visible penetrations through the entire wall system observed at the base of the structure in several locations. These conditions allow for significant air leakage within the structure, and also allows for the entry of vermin. The rear (north facing) wall of the building was noted to have severe structural impairments such that is not well connected to the roof system or slab and occupants indicated that it regularly moves substantially when affected by the wind. Due to the generally poor structural condition of the building, occupants indicated that it was likely to be significantly rehabilitated or replaced in the near future.

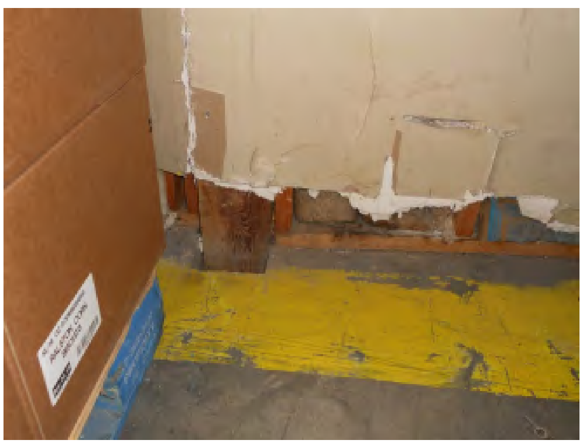


Figure 16. Impacted wall system with visible penetrations to the outside

The entire building sits on an un-insulated above grade concrete slab. The walls of the structure are insulated with fiberglass batt insulation, however due to the compromised condition of the exterior siding, the insulation observed was in generally poor condition. The effective R-value of the wall system is estimated at R-3. The interior of the structure has a suspended ceiling with an average height of 16 feet. Though fiberglass batt insulation was observed on the deck of the ceiling, approximately 15% of the insulation was displaced during attic maintenance and never replaced to its appropriate locations. The effective R-


Figure 17. Displaced insulation above suspended ceiling

value of this insulation in its existing condition is R-9. In addition to the insulation located on the suspended ceiling, supplemental insulation is provided by a combination fiberglass batt/vapor barrier insulation installed between the roof rafters. The R-value of this material is approximately R-11; therefore, the composite ceiling R-value for this facility is R-20.

No roof drainage systems (gutters, downspouts) were observed during the field assessment. This condition likely allows bulk water flow into the structure.

Food Distribution Warehouse Heating, Ventilation and Air Conditioning

Two, 1,500-watt, Cadet electric resistance wall heaters condition the office area, as well as a window mounted, 1-ton air-conditioning unit. Two, electric, unit-heaters were noted suspended from the ceiling but site staff indicated that these were not used and that the warehouse is primarily heated with two electric resistance furnaces mounted in the attic space above a suspended ceiling. The filters for these units were observed to be too large for the application and were thus taped to the air handler. This likely leads to the inadequate filtration of return air. Additionally, the location of these units makes them extremely difficult to access for servicing. OurEvolution engineers were unable access them to obtain nameplate information. The HVAC distribution system is insulated to a level of R-5 and appeared to be in fair condition at the time of the assessment with duct tape seam seals. Fiberglass tape and mastic are recommended for all HVAC distribution seam sealing. There is no cooling provided in the warehouse area and heat control of the offices and warehouse floor areas are controlled with mechanical (non-programmable) thermostats.

Figure 18. Electric resistance heater unit suspended from roof truss. Note edge of excessively large media filter.

See the attached Observed Equipment Inventory for more information on these systems.

Food Distribution Warehouse DHW

A 1000-watt, 19-gallon US/Craftmaster electric tank water heater provides domestic hot water for the restroom. This unit was manufactured in 1998 and appeared to be in fair condition at the time of the assessment. However, at 15-years old, it is likely nearing the end of its serviceable life.

Food Distribution Warehouse Lighting

Both office and warehouse interior lighting is provided by suspended 8' and 4' T12 linear fluorescent lighting. A large, 1000-watt metal halide is used to provide exterior lighting over the main entry bay door. No photo-cell or timer control was observed for this fixture.

Figure 19. Food Distribution Warehouse freezer and cooler units

Food Distribution Warehouse Plug and Process Loads

The office area of the building had a normal distribution of office equipment including 2 computer workstations and at least one printer.

The warehouse is equipped with two, large walk-in refrigeration units including a 10ft by 24ft cooler and a smaller 8ft by 16ft walk-in freezer. A third unit was identified adjacent to the main entry door to the facility but was not in operation at the time of the assessment. The freezer walk-in was installed on its own insulated curb and is equipped with three evaporator/condenser pairings that appeared to be original to the freezer cabinet. No nameplate information was available on these units therefore their age is unknown. Based on the vintage of the cabinet, we estimate that these units are in excess of 20 years old. These units were observed to be in fair condition with debris noted on condenser coils and some icing visible on the interior evaporator coils. The walk-in cooler cabinet is built directly on the warehouse slab floor such that its interior space is in direct thermal communication with the floor outside the enclosure; this likely leads to excess heat gain within the cooler cabinet. The cooler compressor/condenser unit was recently replaced with a Copeland unit manufactured in 2012. The paired freezer evaporator coil had also been recently replaced with a MasterBilt. Both of these units were in good condition at the time of the assessment.

Food Distribution Warehouse Recommendations

The existing impacted structural conditions of the Food Distribution Warehouse are significant and should be paramount in evaluating any potential upgrades to the facility prior to considering specific energy conservation measures. The costs of such measures should be closely compared to constructing a new facility. If a wholesale rehabilitation of the structure is undertaken, the following energy conservation measures should be included. The costs of these measures in comparison to the total cost of the overall building restoration project would be nominal.

- Adequately air-seal all building penetrations.
- Insulate walls to a minimum of R-19.
- Insulate ceiling to a minimum of R-38.
- Upgrade lighting in warehouse to high-bay linear fluorescent T5 lighting.
- Upgrade lighting in offices to linear fluorescent T8 lighting.
- Replace exterior lighting with equivalent LED lighting equipped with timers and/or photocell controls.
- Install programmable thermostats
- Upgrade heating and cooling systems to high efficiency heat pump technology.
- Mount walk-in cooler on a freestanding, insulated curb.
- Evaluate the operation of the existing freezer condenser/evaporator pairs and replace as necessary.
- Replace all shaded pole evaporator fan motors with electronically commutated motors (ECM)
- Replace all T12 linear fluorescent lighting with T8 equivalent in office
- Replace all T12 linear fluorescent lighting with high bay T5 equivalent in warehouse
- Install lighting occupancy sensors in restrooms, offices and meeting areas.

Food Distribution Warehouse Next Steps

Due to the existing conditions of this structure, modeling would not yield reliable results and is therefore not recommended. Input from the Tribe is needed to determine the planned use of the Food

Distribution Warehouse in its current location. This information will determine how best to proceed with the recommendations, analyses and final mitigations for this facility. Since the initial assessment of this facility, significant progress has been made on core elements of the building.

Camp Larson Initial Findings

Camp Larson Facility Description

Camp Larson, located on the shore of Lake Coeur d'Alene, is a recreational facility available to Tribal members and functions as the base of the Tribe's Lake Management Department during the summer season. Facilities at Camp Larson consist of:

Figure 20. Camp Larson Picnic Pavilion

- a maintenance shop
- a boat house
- an open picnic pavilion
- a small restroom building
- a pump house
- former cabins for overnight stays were recently removed

Camp Larson Building Envelope

The maintenance shop and boat house are both conventional wood frame buildings with metal siding and slab on grade foundations. The picnic pavilion is a simple pole frame structure with a metal roof. The restroom has precast concrete construction with a metal roof. The pump house is wood framed with T-111 type sheet siding and a metal roof. None of the buildings is insulated.

Camp Larson Heating Ventilation and Air Conditioning (HVAC)

None of the structures at Camp Larson have any permanent HVAC systems. Most have no heating at any time, the one exception being a small 1500-watt electric resistance heater in the pump house. This heater is used to prevent pipes from freezing during the few weeks in late fall before the entire camp is winterized and effectively shut down for the season. After this period it is left operating at its lowest setting until the water system is brought back online in the spring.

Camp Larson Domestic Hot Water (DHW)

There is no hot water service in any structures at Camp Larson.

Camp Larson Lighting

All interior lighting in the shop, boat house, and under the picnic pavilion is energy efficient T8 fixtures with electronic ballasts. Exterior lighting around the shop, boat house, and restroom is small (250W) metal halides. Restroom lights are on a pressure-sensitive occupancy sensor. Lights in the remainder of the buildings have no occupancy sensors. These facilities have very periodic occupancy, generally limited to staff that ensure lights are off when not in use.

Camp Larson Plug and Process Loads

Plug and process loads at Camp Larson consist of rarely used tooling in the maintenance shop and a single submersible water pump that onsite records indicate produces approximately 150,000 gallons per year from a shallow well.

Camp Larson Initial Recommendations

OurEvolution has identified the following energy conservation measures and recommendations for the Camp Larson:

- Install pipe insulation over thermostatically controlled heat tape on any pipes in danger of freezing so that use of the electric resistance space heater is no longer necessary. Such heaters are an inefficient means of serving that purpose since most of the heat they generate is not applied directly to the pipes they are supposed to be warming but rather the space around them. 70 feet of heat tape consumes only 350 watts as opposed to 1500 watts so energy use for freeze protection should be reduced by as much as 80% if correctly applied.

Camp Larson Next Steps

Modeling this structure is not necessary to quantify the savings associated with the suggested measures. Therefore, subsequent work for this structure will include providing specifications and cost evaluations of the recommended measures.

Early Childhood Learning Center (ECLC) Initial Findings

ECLC Facility Description

The Early Childhood Learning Center building is an approximately 19,000 square foot L-shaped structure constructed in two phases. The original building, designated Phase I and constructed in 2003, is a long, narrow, single-story structure built along an east-west axis. Phase II, added in 2006, is an adjacent 2-story structure built along a north-south axis.

ECLC Building Envelope

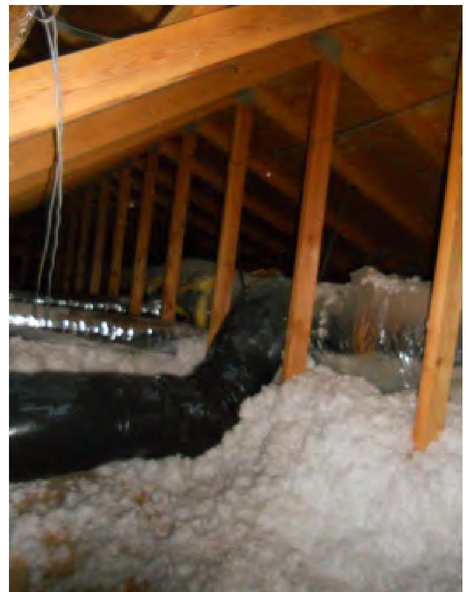


Figure 21. Phase I roof insulation unevenly distributed.

The ECLC structure is of conventional wood frame construction with a raised floor foundation. It has cementatious siding and a pitched attic roof with asphalt composition shingles. The roof of this structure appeared to be in good condition at the time of the assessment. The entire roof system is equipped with continuous gutters that discharge to a subsurface collection system at some but not all points. Several gutter downspouts were observed to either be disconnected from the subsurface collection ports or never to have been hooked up at all, allowing runoff to discharge directly onto the ground right next to the building with no diversion whatsoever. In at least one location at the east side near the junction between Phase 1 and Phase 2, this discharge was located immediately beside a pair of heat pump condensers. This condition creates significant risk of moisture damage to the building envelope and any nearby mechanical equipment over time and should be remediated. In addition, gutters across the front of the building span over 100 feet with no discharge other than at the ends. This run of gutter was noted to sag at several points with signs of significant corrosion at most of the low spots. This entire part of the gutter system is compromised and should be cleaned and re-leveled with at least two new downspouts installed, with subsequent monitoring to ensure adequate performance to prevent moisture damage to the building. Steps should be taken at downspouts throughout the rest of the building to ensure that they are either properly hooked up to the subsurface collection system or else diverted a minimum of three feet away from the building foundation.

All the windows are double paned and in nonmetal frames and appeared to be in good operating condition. Exterior walls are estimated to have R-19 insulation. Floors over the crawlspace were observed to have fiberglass batt insulation with a rated R-value of R-19. This material was in good condition at the time of the assessment. Roof insulation in Phase I was observed to have loose fill fiberglass insulation blown over batt insulation installed between ceiling joists for an estimated composite R-value of R-24. Insulation quality was observed to have been significantly compacted and disturbed by workers at various points in the attics throughout the building. Roof insulation in Phase II was observed to be 8” to 10” of blown cellulose in generally good condition for an estimated net R-value of R-38.

ECLC Heating Ventilation and Air Conditioning (HVAC)

Heating and cooling for Phase I of the ECLC is provided by a collection of six, Lennox 4-ton split DX air conditioning systems manufactured in 2003 with EER of 9.8. These units do not meet the cooling efficiency requirements for Energy Star (EER >= 12 for central split systems), therefore these systems are not Energy Star rated. Each of these systems is coupled to one of six Lennox electric furnace/air handlers also manufactured in 2003 and each having primary electric resistance heating capacity of 20 kW. Each of these units is equipped with a timer which, at the time of the assessment was programmed to turn the unit off from 10:00 pm to 11:00 nightly. It is unclear what benefits these timers provide. Venting slats on the clerestory of Phase I indicate that outside air is provided to this section of the building. It is not known how the fresh air mix is controlled and there were no apparent energy recovery or economizers observed for this fresh air intake. A Reznor swamp cooler/ventilator provides make up air for the kitchen exhaust hood.

Heating and cooling for Phase II is provided by a collection of four, York split system heat pumps each with cooling capacity of 5-tons and heating capacity of 59,000 BTU/hour at 47°F (19,300 BTU/hour at -3°F). These units were manufactured in 2006 and have a rated SEER of 12 and HSPF of 7.7. These units do not meet the cooling efficiency requirements for Energy Star (HSPF >=8.0) for air source heat pumps, therefore these systems are not Energy Star rated. Each of these systems is coupled to one of four York air handlers also manufactured in 2006 and each having backup electric resistance heating capacity of 20 kW. No provisions for fresh outside ventilation air (OSA) were observed on these systems during the field assessment.

One Phase II downstairs classroom has a supplemental Fujitsu mini-split ductless cooling system with a SEER of 18.0. This system meets Energy Star requirements and is Energy Star rated.

Flexible ducting with integral (R-5) insulation is used for the HVAC distribution system in both phases. Ducting was observed to be in generally good condition. Two air handlers serving the entire second floor of Phase II are located in the attic. These units utilize the space between the rafters and suspended drop ceiling as a return air plenum, with several constrictions between various zones. Some zones such as the conference room had no measurable return air flow. Though this was a common technique in the past, currently this not thought of as a “best practice” for return air distribution as it tends to lead to pressure and air flow imbalances within the system. Building staff indicated there is often a level of dissatisfaction with heating and cooling levels throughout the second floor and it appears likely that poor air balance in the distribution system is a contributing factor.

Figure 22. Phase I downstairs AHU with poorly fitted filter and missing filter cover.

Figure 23. Phase II upstairs AHU with poorly fitted filter and missing filter cover

Filter systems on at least two of the Phase II air handlers were observed to be very poorly fitted with covers missing, a condition which can contribute to both poor air quality and poor air distribution balance.

The HVAC systems are controlled by Honeywell programmable thermostats. All thermostats throughout Phase 1 are located inside individual classrooms so were inaccessible during the assessment due to security constraints. Thermostat programming throughout Phase II was inconsistent from one system to the next. Heating set points ranged from 65°F to 72°F and cooling set points anywhere from 70°F to 78°F, with further variances between weekend and evening setbacks.

OurEvolution recommends set points for all systems during normally occupied hours of 68°F heating and 78°F cooling, with setbacks of 55°F heating and 82°F cooling for evening and weekend hours.

See the attached Observed Equipment Inventory for more information on these systems.

ECLC Domestic Hot Water (DHW)

Hot water heating for ECLC is provided by two separate water heaters. The kitchen is served by a 50-gallon, Bradford-White electric tank water heater with 4500 watt heating elements. This unit was manufactured in 2012. No timer or circulation pump was observed, nor pipe insulation or any other enhancements. The remainder of the building is served by an 80-gallon Bradford-White electric tank water heater with 4500 watt heating elements manufactured in 2003. This larger unit is equipped with a circulation pump but no timers, pipe insulation, nor any other enhancements.

ECLC Lighting

Lighting in the ECLC is provided mainly by energy efficient linear T8 fluorescents in ceiling mounted fixtures. Some areas have additional compact fluorescent fixtures and a there are just a few incandescent lights in various classrooms. No occupancy sensors were noted in any locations throughout the building.

During the assessment OurEvolution engineers were informed that there are plans to remove existing energy efficient T8 lighting fixtures and replace them with inefficient incandescent fixtures due to building occupant health concerns regarding electromagnetic field (EMF) radiation from fluorescent lighting. While it is true that some percentage of the population suffers sensitivity to the flicker and hum associated with poor quality magnetic ballasts in older T-12 type linear fluorescent lighting, the conditions that lead to this sensitivity are completely eliminated in modern T-8 systems with electronic ballasts. Meanwhile "electromagnetic sensitivity" from EMF associated with fluorescent lighting has never been recognized by the medical and scientific communities. In virtually all cases where ill effects are blamed on these lighting systems, there is some significant factor being overlooked, often poor air quality. OurEvolution highly recommends that any plans to replace energy efficient T-8 lighting with incandescent lighting should be suspended and reconsidered.

ECLC Plug and Process Loads

Plug and process loads in the ECLC consist of standard office equipment including computers, printers, and copiers, along with commercial kitchen equipment and three sets of laundry washers and dryers.

Kitchen equipment includes a single commercial True T-49 double-door reach in cooler, a True T-19 single reach-in, two Hotpoint residential grade refrigerator/freezers, two Frigidaire upright chest freezers, and one Signature2000 upright chest freezer. The Signature2000 freezer was observed to have a severely compromised door gasket. The True reach-ins and the two Frigidaire freezers are Energy Star rated; the Hotpoint refrigerators and Signature2000 freezer are not. The large commercial stove in the ECLC kitchen is a 10-burner Wolf electric range with electric oven.

Figure 24. Compromised door gasket on Signature2000 freezer unit

The dryer located on the first floor of Phase II has its vent constricted from its standard 4 inch diameter down to just 3 inches where it goes into the wall, where it is routed all the way to the roof, which is a vertical distance of more than 20 feet. This condition greatly reduces the efficacy of the dryer cycle and inevitably leads to excess build-up of material from the dryer such that the exhaust eventually becomes completely plugged. For fire prevention and best operating efficiency, clothes dryers should always have the shortest (preferable horizontal) exhaust path to the outside with as few restrictions as possible. If the exhaust system must be routed to the roof, a supplementary, in-line fan can be installed on the exhaust that allows the material to be completed exhausted.

ECLC Initial Recommendations

OurEvolution has identified the following energy conservation measures and recommendations for the ECLC:

- Provide fresh air ventilation (OSA) to Phase II in accordance with the latest version of the International Mechanical Code.
    - Option 1: Install energy recovery ventilator to meet ventilation requirements
    - Option 2: Retrofit existing Phase II air handlers with OSA intake infrastructure
- Assess the location of Phase II thermostats in order to determine the zones that they are controlling. Replace/relocate thermostats as necessary to more effectively control heating and cooling zones.
- Set programmable thermostats to better reflect occupancy patterns and energy efficiency set points. OE recommends occupied thermostat set points to be no greater than 68°F heating and no less than 78°F cooling with setbacks in unoccupied periods to 55°F heating and 84°F cooling.
- Ensure that all air handler filters are replaced with properly fitted filters and that filter covers are correctly installed.
- Install occupancy sensors for lighting systems in all restrooms, meeting areas and offices.
- Do NOT replace existing energy efficient T-8 fixtures with incandescent lighting.
- Insulate all accessible hot water pipes as well as the hot water heater cold water inlet pipe to a distance of 6 feet from the tank.
- Install a timer on the 80-gallon water tank so that it is not circulating hot water throughout the entire building during unoccupied hours.
- At the end of the serviceable life of the Lennox air-conditioners, these units should be replaced with Energy Star rated heat pumps.
- Replace Signature2000 upright freezer with an Energy Star rated equivalent.
- Evaluate and repair damaged gutter systems and discharge points.

ECLC Next Steps

Modeling this structure is not necessary to quantify the savings associated with the suggested measures. Therefore, subsequent work for this structure will include providing specifications and cost evaluations of the recommended measures.

Rose Creek Longhouse Initial Findings

Rose Creek Longhouse Facility Description

The Rose Creek Longhouse is an 8,410 square foot, single-story building used for Tribal community and family gatherings. Building occupancy is sporadic and inconsistent in terms of both time of use and occupant density. Tribal staff indicated use patterns average approximately one day per week and usually all day when in use.

Figure 25. Rose Creek Longhouse

Rose Creek Longhouse Building Envelope

The Rose Creek Longhouse is of conventional wood frame construction with a slab on grade foundation. It has wood siding with a 3' high brick façade splash guard and a pitched attic roof with asphalt composition shingles. Windows are dual paned in vinyl frames and were in good condition at the time of the assessment. Front and rear entry doors are insulated metal. The weather stripping on these doors are significantly deteriorated to the point that light was visible through gaps. This deteriorated weather stripping on doors likely leads to significant air leakage to/from the structure.

Rose Creek Longhouse Heating Ventilation and Air Conditioning (HVAC)

The Rose Creek Longhouse is heated and cooled principally by two, York heat pumps, each with a rated cooling capacity of 15-tons and heating capacity of 185,000 BTU/hour at 47°F (121,000 BTU/hour at 17°F). These units have an EER of 8.7 and COP of 3.0. Though fairly efficient, these systems do not meet Energy Star guidelines for heat pumps (>12 EER). These units and their indoor air handlers with electric backup were manufactured in 2002 and 2001, respectively. The air handlers are equipped with outside air economizers that were observed to be set to "auto" mode. In addition, there are two 80% efficient Modine duct furnaces with 240,000 BTU/hour output capacities that provide further backup heating capacity when the heat pump systems are unable provide adequate heating capacity. These units were manufactured in 2010 and were in good condition at the time of the assessment; however the nameplates for these units indicated that they were specified for natural gas, with no indication that a retrofit had been completed to make them compatible with propane which is their current fuel source. Natural gas to propane conversion kits are available for this unit, so it is possible that this unit has been converted. Using propane in units specified for use with natural gas can dramatically decrease the efficiency and output and of heating systems.

The building is equipped with programmable setback thermostats however due to the sporadic use patterns described above there is no attempt to operate the building at idle temperatures during normal hours when unoccupied. It appears likely that the vast majority of the building's energy footprint is expended on space conditioning during periods when it is completely unoccupied.

See the attached Observed Equipment Inventory for more information on these systems.

Rose Creek Longhouse Domestic Hot Water (DHW)

Hot water heating for the Rose Creek Longhouse is provided by a naturally drafted, 97-gallon, and 80% efficient commercial Rheem Ruud propane water heater manufactured in 2004. No timers or circulation pumps, nor pipe insulation was observed during the assessment.

Rose Creek Longhouse Lighting

Lighting in the Rose Creek Longhouse is provided mainly by energy efficient T8 linear fluorescent lamps in indirect fixtures with supplemental lighting provided by dimmable 60-watt incandescent fixtures in wall sconces.

Plug and process loads in the Rose Creek Longhouse are made up entirely of kitchen equipment. A pair of large True T-49 reach-in coolers, manufactured in 2001 and 2007, are plugged in and operating at all times but were observed to be empty at the time of this audit. Additionally, large commercial vent hoods are present.

In addition to electrical loads, the kitchen contains propane deep fryers and two commercial Wolf propane ovens, one with an 8-burner stove top and one with a large flat griddle.

Figure 26. Wolf commercial ovens in kitchen at longhouse.

Rose Creek Longhouse Initial Recommendations

OurEvolution has identified the following energy conservation measures and recommendations for the Rose Creek Longhouse:

- An immediate service call to the longhouse by a qualified commercial kitchen technician should be scheduled to diagnose and remediate the conditions which are causing the pilot lights to burn excessively and produce CO at elevated levels and identify and repair any gas leaks observed in the range. Addressing this condition will likely reduce propane usage within the building and therefore result in improved energy efficiency.
- Install at least one CO detector in all areas where combustion appliances are located and that signage is placed in the commercial kitchen indicating that the exhaust hood must be in operation during any use of the range and oven.
- Assess whether existing Modine duct furnaces have been converted to operate on propane. If not, install conversion kit on each furnace and label properly. If so, indicate on nameplate.
- Program thermostats to maintain the building at minimum levels (55°F during heating season, 84°F during cooling season) and have Facilities staff arrive two to three hours early to set temperatures for appropriate levels for scheduled events.
- Insulate all accessible hot water pipes as well as the hot water heater cold water inlet pipe to a distance of 6 feet from the tank.
- Replace all 60-watt incandescent bulbs with equivalent 13-watt CFLs in wall sconces.
- Replace weather stripping around exterior doors.

Rose Creek Longhouse Next Steps

Modeling this structure is not necessary to quantify the savings associated with the suggested measures. Therefore, subsequent work for this structure will include providing specifications and cost evaluations of the recommended measures.

DeSmet Longhouse Initial Findings

DeSmet Longhouse Facility Description

The DeSmet Longhouse is an approximately 8,250 square foot single-story building constructed in 2009. This facility is used for Tribal community and family gatherings and other events. Building occupancy is sporadic and inconsistent in terms of both time of use and occupant density.

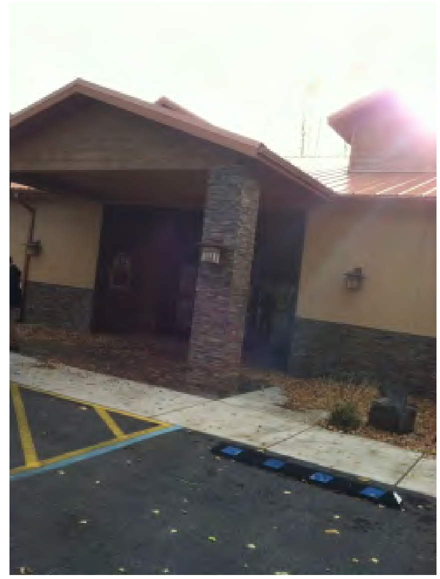


Figure 27. DeSmet Longhouse entry way

DeSmet Longhouse Building Envelope

The DeSmet Longhouse is of conventional wood frame construction with approximately ¾ of the structure on a slab-on-grade foundation. It has stucco siding with a 3' high stacked rock façade splash guard. This facility has a pitched attic roof with raised seam metal roofing. The roof system is equipped with full eave side gutter systems. These systems were clogged with debris at the time of the assessment. Windows in this facility are dual paned in aluminum frames equipped with a thermal break. Front and rear entry doors are full light dual paned glass with aluminum frames. Service man doors in the kitchen loading area are insulated metal. Weather stripping on all exterior doors was in excellent condition at the time of the assessment as were the rest of the building envelope systems.

The small crawlspace and ceiling at this facility is insulated with R-30 fiberglass batt insulation. The walls are estimated to be insulated to a level of R-19 and the roof to a level of R-38.

DeSmet Longhouse Heating Ventilation and Air Conditioning (HVAC)

The DeSmet Longhouse is equipped with two central heating and cooling systems, supplemented by a propane fired, "direct" heater that services the kitchen area. The central systems include a York Latitude air source heat pump, manufactured in 2009 with a rated cooling capacity of 5-tons and heating capacity of 58,000 BTU/hour at 47°F outside temperature (39,000 BTU/hour at 17°F). This heat pump has a rated efficiency of 7.7 HSPF and 13 SEER which does not meet the Energy Star minimum standards for this type of equipment (>=8.2 HSPF and >=14.5 SEER); however this unit is still considered energy efficient. This unit was in good condition at the time of the assessment. This 5-ton York heat pump is paired with a York air handler/electric furnace manufactured in 2009. The nameplate on this unit indicates that the heating element was "field installed," however; no element was selected from the alternates provided. We estimate that this furnace/air handler has a capacity of 20 kW. A MicroMetl economizer was noted on the fresh air intake of this system.

The second central system consists of a York air source heat pump, manufactured in 2009 with a rated cooling capacity of 20-tons and heating capacity of 220,000 BTU/hour at 47°F outside temperature (138,000 BTU/hour at 17°F). This heat pump has a rated efficiency of 8.6 EER and a COP of 2.9, which does not meet the Energy Star minimum standards for this type of equipment (>=12 EER). This unit was in poor condition at the time of the assessment with significant damage to the heat exchanger fins observed. This damage is likely from vandalism as evidenced from the type of impacts observed and the uncontrolled access to this unit. This 20-ton York heat pump is paired with a York air handler/electric furnace manufactured in 2009. The nameplate on this unit indicates that the heating element was "field installed," however no element was selected from the alternates provided. We estimate that this furnace/air handler has a capacity of 30 kW.


Figure 28. York, 2-ton heat pump detailing extensive damage to the heat exchanger fins.

Neither of the heat pumps described above are rated to provide heat below 17°F. Below this temperature the system relies on its electric resistance heating element in the air handler to provide heating. Additionally, both of the exterior units are located in an area that is not secured and, as evidenced by the damage to one of the units, are prone to further damage from vandalism.

Supplemental heating is provided to the commercial kitchen in the longhouse by a propane-fired, direct industrial air heater manufactured in 2009 by Captive-Aire Systems. This unit has a rated capacity of 144,480 BTU/hour and is designed to deliver tempered make-up air for installations requiring frequent air changes, such as the commercial kitchen equipped with a large vent hood at the longhouse. There is likely an interlock that restricts the use of this furnace to times when the exhaust hood is operational. The existence of this interlock was not confirmed at the time of the assessment.

The building is equipped with three programmable thermostats and associated remote sensors throughout the structure. These systems were programmed to provide moderate heating and cooling 24 hours per day, seven days per week even though the building is unoccupied a majority of the year. However, at the time of the assessment, the programming had been overridden and the facility was heated to 72°F. The large exhaust fans in the commercial kitchen were also running during this field assessment, therefore much of the heat was being exhausted.

See the attached Observed Equipment Inventory for more information on these systems.

DeSmet Longhouse Domestic Hot Water (DHW)
Access to the mechanical room containing the DHW was not accessible during the initial field effort. A previous study indicates that there are two water heaters serving the DeSmet Longhouse, "an electric resistant (sic) tank serving the rest rooms and set at 115°, and a larger tank for the kitchen area set at 135°." OE eventually determined the DeSmet Longhouse is actually equipped with a Takagi T-H2-DV-D tank-less condensing water heater with a rated efficiency of 92% manufactured in 2009. It remains unknown whether this unit is equipped with a circulation pump or any other enhancements.

DeSmet Longhouse Lighting
The interior lighting in the DeSmet Longhouse is extremely energy efficient including compact fluorescents in suspended fixtures, T-8 linear fluorescent lamps, and LED flood lamps in recessed fixtures. Exterior lighting is also an example of energy efficient design and includes LED spots in

recessed fixtures. It should be noted that not only do these efficient lighting components produce light efficiently, they also do not produce excessive amounts of heat, thus reducing cooling loads on the building dramatically.

DeSmet Longhouse Plug and Process Loads

The main plug loads observed in the longhouse are associated with the commercial kitchen equipment. The more significant loads include a True T72G, three-door, reach in refrigerator. This unit is considered energy efficient for a commercial kitchen, but is not Energy Star rated (likely due to the glass doors). This unit was empty at the time of the assessment. In addition to the reach in refrigerator, the kitchen is also equipped with a commercial propane fired oven and range. As is common with these types of units, the pilot lights for this unit were observed to be excessive in size and create an inordinate amount of heat. The oven temperature in the "off" position was measured at 150°F. The kitchen also contains a Manitowoc commercial ice machine. At the time of the assessment, this unit was full of ice and operating.

Figure 29. "Lazy" pilot flame observed on commercial range.

DeSmet Longhouse Initial Recommendations

OurEvolution has identified the following energy conservation measures and recommendations for the DeSmet Longhouse:

- An immediate service call to the longhouse by a qualified commercial kitchen technician should be scheduled to assess the condition of pilot orifices and adjust or repair as necessary.
- Schedule a service call to attempt to repair damaged heat exchanger fins noted on 20-ton York heat pump.
- Install at least one CO detector in all areas where combustion appliances are located and see that signage is placed in the commercial kitchen indicating that the exhaust hood must be in operation during any use of the range and oven.
- Install a lockable perimeter fence around outdoor HVAC components to prevent unauthorized access to these units.
- Verify the existence of interlock between commercial exhaust fan and direct furnace.
- Program thermostats to maintain the building at minimum levels (55°F during heating season, 84°F during cooling season) and have Facilities staff arrive two to three hours early to set temperatures for appropriate levels for scheduled events.
- Disable commercial ice maker when the building is not occupied. This will require a staff person to enable the device 24-hours prior to use.
- Unplug (or power-strip) commercial refrigerator when not in use. The shutdown process must include blocking open doors, removing all contents, and emptying condensate tray. 1-2 hours must be given at start up in order to allow the unit to reach a temperature that is safe for food storage.

- Close propane valve to structure when not in use. This would require a trained staff person to light pilot lights when the building is scheduled to be in use.

DeSmet Longhouse Next Steps

Modeling this structure is not necessary to quantify the savings associated with the suggested measures. Therefore, subsequent work for this structure will include providing specifications and cost evaluations of the recommended measures.

Fire Warehouse and Shop Initial Findings

Fire Warehouse and Shop Facility Description

The Fire Warehouse facility includes the main firehouse, offices, kitchen and garage in addition to a separate shop building. The main facility is an approximately 8,150 square foot structure that includes a large two-high-bay garage, first and second floor office and storage areas and large first floor kitchen. The garage area is also connected to smaller, single story, two bay garage. The shop building is approximately 2,700 square feet that contains the main first floor shop area and an approximately 750 square foot storage loft.

Figure 30. Fire Warehouse front entrance

Fire Warehouse and Shop Building Envelope

Both the main facility and shop buildings are constructed with conventional wood framing on slab-on-grade foundations. These structures are clad in corrugated metal siding with standing seam metal roofs. These materials were in fair condition at the time of the assessment with obvious damage observed at the bay door on the shop. Neither the Fire Warehouse nor the shop structure have roof drainage systems, therefore water is shed around the entire perimeter of the structures. This can lead to excess moisture buildup at the base of the buildings. Care should be taken to ensure that vegetation and materials are not placed against the side of the building which could lead to moisture being held against building elements eventually leading to damage. Windows in the main facility are dual paned with non-metal frames. These windows were in good, operable condition at the time of the assessment. There are no windows in the shop structure. The doors (including large bay doors) are insulated metal. These too were in good condition with the exception of the bay door located on the west side of the high bay garage which has a noticeably poor seal. The interior doors that connect the first floor office space to the warehouse floor had significantly damaged weather stripping. The interior of the main structure is finished in drywall and was likely insulated to R-19 during construction. The interior of the single story garage and shop building are finished in plywood. No insulation was observed in these wall systems. Loose fill fiberglass was noted in the ceiling of the loft portion of the shop structure. The estimated R-value of this insulation is R-11. It should be noted that recessed lights were observed in the shop loft which were installed by cutting through the ceiling plywood and mounting the lights to attic structural members. These penetrations are completely

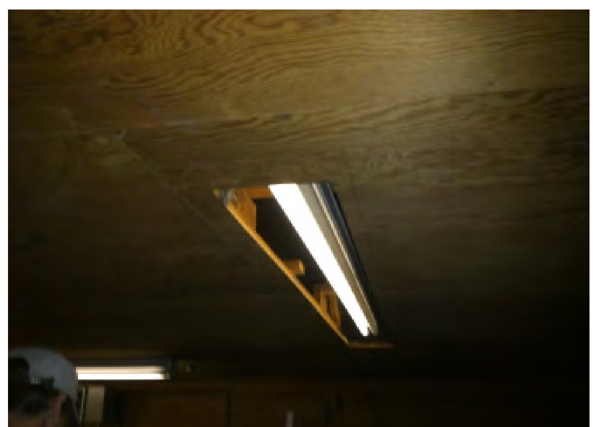


Figure 31. Shop ceiling showing recessed lighting in unsealed ceiling penetration.

unsealed and provide a direct pathway for air leakage to/from the structure. Ceiling insulation in the main facility area is estimated to be R-30.

Fire Warehouse and Shop Heating, Ventilation and Air Conditioning (HVAC)

Neither the main facility nor shop structure is equipped with central HVAC systems. The main facility is heated by six, 1,500-watt, electric resistance wall heaters. Two of these systems are located in the main garage area, one in the kitchen, one in a maintenance area, one in the first floor office area and one in the second floor office area. In general, the units were in very poor condition with dust, dirt and debris observed. When the units in the main garage were operated, a large amount of dust was seen and a burning smell was noted. These conditions represent a potential fire hazard. These units are individually controlled by non-programmable, mechanical thermostats with no timers or setback capability. According to building occupants, these units are rarely used with the exception of the two heaters located in the garage which operate 24-hours per day during the cold season in order to dry fire trucks. Three, approximately 1,500-watt personal space heaters were noted in the first floor office area and one was observed in the second floor office. Cooling is provided to the main facility by two through-window air conditioning units. The first floor office is equipped with a Gold Star air conditioner with a rated capacity of 5,000 BTU/hour cooling capacity. No efficiency rating could be obtained for this unit. The seals around this unit were observed to be in poor condition which likely results in air leakage at this location. The second floor office is equipped with a Kenmore air conditioner with a rated cooling capacity of 5,000 BTU/hour and efficiency of 9.7 EER. This does not meet the Energy Star minimum standard for this type of air conditioner (>=11 EER). The seals around this unit were in good condition at the time of the assessment. One small (~18") manually controlled exhaust fan was observed in the main garage.


Figure 32. Example electric wall heater with dust and debris noted.

The shop structure is heated by two electric resistance approximately 4,000-watt, ceiling mounted unit heaters. No nameplate information was available on these heaters. These units are controlled by individual, non-programmable, mechanical thermostats.

See the attached Observed Equipment Inventory for more information on these systems.

Fire Warehouse and Shop Domestic Hot Water (DHW)

The Fire Warehouse is equipped with a 50-gallon, electric resistance water heater, which provides hot water to the restrooms and kitchen facilities. This unit was manufactured by the U.S. Water Heater Group in 1994 and has a rated capacity of 4,500 watts. At 19 years old, this unit is likely nearing the end of its serviceable life. No timers, pumps, pipe insulation or other energy efficiency enhancements were noted on this unit.

The shop is equipped with a 10-gallon, electric resistance water heater which provides hot water for hand washing in a small restroom. No nameplate information was available on this unit, but has an estimated capacity of 1,200 watts. Based on the condition of this unit and the vintage of the structure, we estimate that it is approximately 15 to 20 years old and likely in need of replacement due to age. No timers, pumps, pipe insulation or other energy efficiency enhancements were noted on this unit.

Fire Warehouse and Shop Lighting

Lighting in the main Fire Warehouse high bay shop and garage is provided by T-12, linear fluorescent lamps in 8' fixtures. This type of lighting in high bay applications rarely provides adequate light and only one of the two fixtures in the single story garage was operable at the time of the assessment. The first floor offices, break room, and kitchen and second story office were equipped with energy efficient T-8, linear fluorescent lamps in 4' fixtures. Exterior lighting is provided by a 400-watt mercury vapor lamp that building occupants indicated operates 24-hours per day. No lighting occupancy sensors were noted.

The shop is lit by T-12, linear fluorescent lamps in 8' and 4' fixtures that provide an inadequate amount of light for performing detailed tasks such as maintenance on vehicles and equipment. Exterior lighting is provided by a 400-watt metal halide lamp. This fixture was inoperable at the time of the assessment.

Fire Warehouse Plug and Process Loads

Plug and process loads in the Fire Warehouse and Shop are primarily standard office equipment including computers, printers, and copiers, along with standard kitchen and laundry equipment in the break room. Two large refrigerators (18 and 20 cubic foot) and one small apartment refrigerator were noted during the field work. With the exception of the kitchen unit, these refrigerators were not being used to capacity with very little food stored in them. The kitchen refrigerator nameplate indicated that it was manufactured in 1988. No nameplate information was available on the other units. At 25 years old, this refrigerator has surpassed its serviceable life. None of the refrigeration units observed have Energy Star ratings. The main process load of note is a 6 hp air compressor paired with an 80 gallon storage tank. This tank provides compressed air to the shop through a galvanized piping distribution system. Significant corrosion was noted around the fittings of this distribution system and this is likely a source of leakage which causes the compressor to run more than necessary. Additionally, a water build up in the tank was obvious from condensation pooled at its bottom, however, the drain valve was not operational at the time of the assessment.

Figure 33. Compressed air distribution system showing significant corrosion around fitting.

Fire Warehouse Initial Recommendations

OurEvolution has identified the following energy conservation measures and recommendations for the Fire Warehouse and Shop:

- Repair/replace seals on large bay doors as necessary
- Replace weather stripping on interior doors that connect the first floor office space to the warehouse floor.
- Upgrade T-12 linear fluorescent lamps in the main facility two story garage and shop structure with high output T-5 linear fluorescent lamps in fixtures with electronic ballasts.
- Upgrade T-12 linear fluorescent lamps in single story garage with T-8 linear fluorescent lamps and fixtures with electronic ballasts and seal all ceiling penetrations.
- Install lighting occupancy sensors in offices, restroom and service areas.
- Replace mercury vapor lamp and fixture with equivalent LED or CFL lamp and fixture equipped with a photocell.
- Evaluate the need for all of the refrigerators in the Fire Warehouse and eliminate unnecessary units.
- Replace kitchen refrigerator with Energy Star rated equivalent.
- Complete routine (quarterly) maintenance on all electric wall heaters.
- Insulate all accessible hot water pipes as well as the hot water heater cold water inlet pipe to a distance of 6 feet from the tank.
- Have compressor and distribution system assessed for leakage and complete repairs as necessary. Raise compressor tank so that drain valve is accessible and operational.
- Remove window mounted air conditioner units when they are not needed to decrease air leakage within the structure. Ensure adequate seals around window units when reinstalled each cooling season.
- Replace electric resistance wall heaters and window air conditioning unit in first floor office area, kitchen and service area with a multi-zone ductless heat pump system. This will provide greater heating and cooling capacity with less energy investment.
- Replace existing nonprogrammable thermostats in office and kitchen with programmable units with appropriate setbacks for the building’s standard occupancy patterns. OE recommends occupied thermostat set points to be no greater than 68°F heating and no less than 78°F cooling with setbacks in unoccupied periods to 55°F heating and 84°F cooling. In order to be consistent with the thermostat upgrades observed in other Tribal facilities, OE recommends the Honeywell TB822OU Commercial Programmable Thermostat.

Fire Warehouse Next Steps

Modeling this structure is not necessary to quantify the savings associated with the suggested measures. If replacement of heating and cooling systems on the first floor with ductless air source heat pump is considered, a model may be required to quantify savings and accurately size the system. Therefore, subsequent work for this structure will include providing specifications and cost evaluations of the recommended measures.

Roads Maintenance Shop Initial Findings

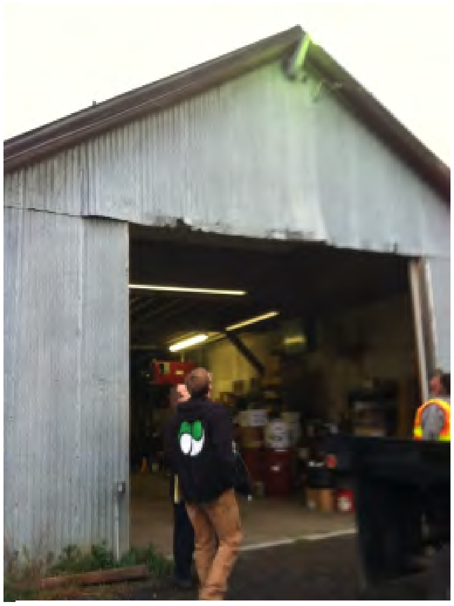


Figure 35. "Old" Roads Maintenance Shop showing metal halide lamp operational during daylight hours

Figure 34. "New" Roads Maintenance Shop

Roads Maintenance Shop Facility Description

The Roads Maintenance Facility is made up of two separate structures, one older (Old Shop) 2,200 square foot structure that has been in use for some time, and one new (New Shop) approximately 5,400 square foot structure that was only recently completed and thus not yet being utilized at the time of this assessment. The facility is normally is occupied Monday through Friday, 7:00 am to 5:00 pm with some activity during snow events since the Tribe's road clearing activities are staged from this location.

Roads Maintenance Shop Building Envelope

The Old Shop is a mostly an uninsulated, open air, wood structure with large bay doors at either end. It sits on a slab-on-grade foundation and has corrugated metal siding and roofing and plywood lining the insides of exterior walls. The building's few windows are single paned in metal frames and the large bay doors are uninsulated metal with poor seals.

The New Shop is a wood frame building with drywall interior, metal siding and a standing seam metal roof. It sits on a slab-on-grade foundation and is estimated to have R-19 insulation in the walls and R-30 in the roof. All windows are double-paned in nonmetal frames. Exterior entry doors are insulated metal, as are the large overhead bay doors. The New Shop has a completely equipped kitchen in the break area and two offices in a small upstairs corner.

Roads Maintenance Shop Heating Ventilation and Air Conditioning (HVAC)

The Old Shop is heated by a pair of older Modine electric unit heaters. No nameplates were visible on these units, so their capacities are unknown. The Old Shop also has a Clean Burn oil furnace manufactured in 2010 that is capable of utilizing reclaimed motor oil. This unit has a nominal input capacity of 170,000 BTU/hour. The manufacturer does not publish efficiency ratings for this product. Shop staff indicated that they were able to heat the shop for about 1.5 months last winter on a 250 gallon supply of used motor oil, after which they were unable to obtain enough fuel to continue using it. The old shop has a single, older, 1-ton window mount air conditioner in a small office space that actually vents its rejected heat into the shop rather than outside. Building occupants shared that they will often run heat in the Old Shop all night long during inclement weather in order to dry trucks used for roads service.


Figure 36. New Shop interior showing Modine unit heater and high output T-5 linear fluorescent lighting.

The New Shop is heated by a pair of new Modine Hot Dawg propane unit heaters. These units were mounted too high to be accessible during the assessment, but they are assumed to be the largest such units available, which have 125,000 Btu/hour heating capacities and a rated 80% efficiency. Both unit heaters are controlled by manually operated, wall mounted mechanical thermostats with no timers or setback capability. It is unknown whether there are interlocks installed on the large bay doors to prevent unit heater operation when bay doors are open.

The restroom, kitchen and break area, and offices are heated by 1500 watt electric resistance wall heaters with manually operated thermostats with no timers or setback capability.

See the attached Observed Equipment Inventory for more information on these systems.

Roads Maintenance Shop Domestic Hot Water (DHW)
Hot water heating for the Old Shop is provided by Rheem, 10-gallon electric tank heater with 1,000-watt heating elements manufactured in 2012. No timers or circulation pumps were observed, pipe insulation or any other enhancements.

Hot water heating for the New Shop is provided by a Ruud Pacemaker electric tank heater with 2,000-watt heating elements manufactured in 2012. No timers, circulation pumps, or pipe insulation were observed, though the unit was noted to be sitting atop a 1” thick pad of Styrofoam insulation.

Roads Maintenance Shop Lighting
Lighting in the Old Shop is provided mainly by 8 foot, T12 linear fluorescent fixtures with magnetic ballasts. These were observed to be in generally poor condition and provided poor quality light. Outdoor lighting is high intensity discharge metal halide. The exterior light at the front of the shop was observed to be on during daylight hours, likely due to a dirty or otherwise malfunctioning photocell.

Interior lighting in the New Shop is provided by very high efficiency high output T5 lighting, except the break area and offices which have energy efficient T8 fixtures. Exterior lighting consists of incandescent flood lamps and 100-watt incandescent bulbs. One set of exterior flood lights over the main bay door at the front of the structure were noted to be on during the daylight hours, therefore they may be an issue with the photocell on this unit.

Roads Maintenance Shop Plug and Process Loads

Plug and process loads in the Roads Maintenance Shop are primarily standard office equipment including computers, printers, and copiers, along with standard kitchen and laundry equipment in the break room. Like the building itself, all equipment within it appeared to be new and in good condition.

Roads Maintenance Shop Initial Recommendations

OurEvolution has identified the following energy conservation measures and recommendations for the Roads Maintenance Shop:

- Determine whether there are interlocks on the large bay doors to prevent unit heater operation when bay doors are open; if not, install them.
- Secure a reliable source of waste oil so that the Clean Burn oil furnace can be utilized on a regular basis in the old shop.
- Repair or replace the photocell on the outdoor light fixture above the front bay door of the old shop so that it does not operate during daylight hours.
- Replace existing T-12 linear fluorescent fixtures in the Old Shop with high output T-5 linear fluorescent fixtures.
- Replace all exterior, 100-watt incandescent bulbs on the New Shop to 23-watt CFL equivalent.
- Replace all exterior, incandescent flood lamps on the New Shop with CFL equivalent.
- Repair/replace photocell on incandescent flood lights on New Shop.

Roads Maintenance Shop Next Steps

Modeling this structure is not necessary to quantify the savings associated with the suggested measures. Therefore, subsequent work for this structure will include providing specifications and cost evaluations of the recommended measures.

Natural Resource Department (NR) Initial Findings

Natural Resource Department Facility Description

The NR building is an approximately 9,600 square foot single story building constructed in 2012. The building has a rectangular footprint oriented along a north-south axis, which greatly limits potential for either passive or photovoltaic solar retrofits to the roof system. This facility contains approximately 24 individual offices, in addition to common areas with cubicle works stations, conference room, break room kitchen, mechanical room, file storage and restrooms. This building is typically occupied 7:00 am to 5:00 pm Monday through Friday.

Figure 37. Department of Natural Resources north entry

Natural Resource Department Building Envelope

The NR building is composed of conventional wood frame construction built on a concrete perimeter foundation. This building has vinyl lap siding and has a pitched attic roof with raised seam metal roofing. The roofing materials were in good condition however water intrusion in the attic space was noted under ventilation air intakes. This indicates that the roof penetration seals may be compromised in these locations. The roof system is equipped with full eave side gutter systems with subsurface discharge. Windows in this facility are dual paned with nonmetal frames. All of the office windows are operable and were in excellent condition at the time of the assessment. The main entry to the facility is on the north side of the structure and features a large insulated glass façade and full light entry doors. No insulated window coverings were noted in the reception area, which is subjected to unusually high heating loads attributable to all the north facing glass. All of the service doors are also “full light” with large sections of insulated glass in nonmetal frames. Weather stripping on all exterior doors was in excellent condition at the time of the assessment as were the rest of the building envelope systems with the exception noted above. All of the interior ceilings are suspended with the exception of the cathedral ceilings located in the north reception area.

The crawlspace of the NR building has a complete vapor barrier installed and is insulated with fiberglass batt insulation. This material was in excellent condition and has an estimated R-value of R-30. The access hatch is to the crawlspace is insulated but was not air sealed, so it is likely a source of air leakage to/from the building. The walls have fiberglass insulation with an estimated R-value of R-19. The ceiling is insulated with loose-fill fiberglass insulation. This material has an estimated R-value of R-38. For the majority of the attic area, this material was in good condition with the exception of moisture impacted material found at locations where roof penetrations appeared to be leakingThere may also be additional rigid insulation on the roof deck below the metal roofing as is common in this type of construction; however, this could not be verified during the field work. Three attic hatches were noted during the field work. Though these hatch doors were insulated, they were not adequately air sealed, so are likely sources of air leakage to/from the building.

Natural Resource Department Heating Ventilation and Air Conditioning (HVAC)

The NR building is served by a combination of 7, Carrier Performance™/Comfort Series air source heat pumps manufactured in 2011. These systems vary in cooling capacity from 2-tons to 5-tons and have heating capacities that range from 24,000 BTU/hour to 60,000 BTU/hour. All of these units are Energy Star rated and were in excellent condition at the time of the assessment. See the attached Observed Equipment Inventory for more information regarding these systems.

The air handlers for these heat pumps were manufactured by Carrier in 2010 and 2011 and have auxiliary electric resistance heating capacities that range from 5kW to 15 kW. Five of these units are installed in a central attic mechanical area and have a common ducting system to provide fresh ventilation air (OSA) to the building. This OSA ducting configuration may limit fresh air to air handlers furthest away from the intake location (AHU 1 and AHU 7). No economizers were noted on this system. The remaining two air handlers are located in separate, individual attic mechanical areas located at the north and south sides of the building. Fresh ventilation air (OSA) is provided to each of these systems. No economizers were noted on these systems. During the assessment, moisture intrusion was noted at the roof penetrations associated with these fresh air intakes.

Though served by the central HVAC system, the reception desk area heating is supplemented by a Cadet baseboard electric resistance heater with a rated capacity of 1000 watts. This unit is controlled by its own non-programmable thermostat.

The HVAC distribution system is mainly composed of flexible ducting with integral R-5 insulation. Some portions of the distribution system were fabricated with rigid metal ducting with added R-5 insulation blankets. With the exception of the materials that were impacted by moisture intrusion as described above, the supply ducting was in good condition. The return HVAC distribution system uses the area above the suspended ceiling as a return plenum. Holes have been cut in walls that separate offices and conference rooms to allow return air from these locations to flow into this suspended ceiling plenum.

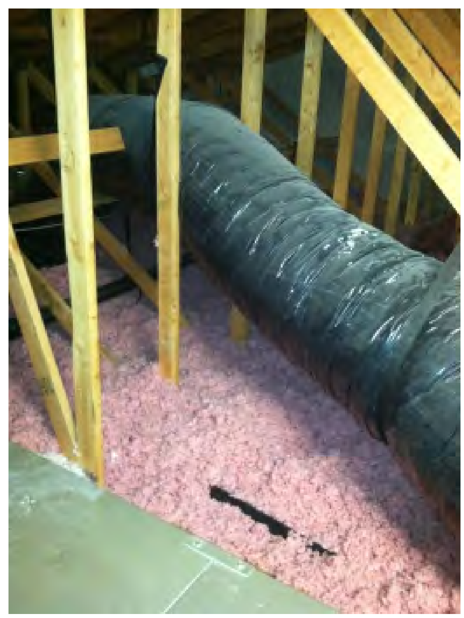


Figure 38. Insulated flexible ducting and loose fill fiberglass insulation observed in the central attic mechanical room.

The seven zones within the NR building are controlled by programmable thermostats located in the zones they serve. These units were observed to be programmed to reasonable levels and occupancy hours at the time of the assessment. Though the building is new and had not seen winter occupancy, occupants indicate a general satisfaction with comfort levels.

See the attached Observed Equipment Inventory for more information on these systems.

Natural Resource Department Domestic Hot Water (DHW)

Hot water is provided to the NR restrooms and kitchen by a 50-gallon, Bradford White, electric resistance water heater. This unit was manufactured in 2011 and has a rated capacity of 4,500 watts. This unit is equipped with a circulation pump on a timer that restricts pumping during non-occupied periods. No pipe insulation, water heater timers or other enhancements were noted.

Natural Resource Department Lighting

The interior lighting in the NR facility is provided by energy efficient 4', T-8 linear fluorescent lamps in recessed fixtures and approximately 4 wall sconces with CFLs. Lighting occupancy sensors were noted in the restrooms. Exterior lighting is provided by energy efficient CFL wall packs controlled by a central timer.

Natural Resource Department Plug and Process Loads

Plug and process loads in the NR building are primarily standard office equipment including computers (~29 workstations), printers, and copiers, along with kitchen equipment in the break room which includes a small refrigerator.

Natural Resource Department Initial Recommendations

OurEvolution has identified the following energy conservation measures and recommendations for the Department of Natural Resources:

- Address roof moisture intrusion issues.
- Maintain occupied thermostat set points to be no greater than 68°F heating and no less than 78°F cooling with setbacks in unoccupied periods to 55°F heating and 84°F cooling.
- Install weather stripping on three attic hatches and one crawlspace hatch to reduce air leakage.
- Insulate all accessible hot water pipes as well as the hot water heater cold water inlet pipe to a distance of 6 feet from the tank.
- Install insulated window coverings in the main reception area.

Natural Resource Department Next Steps

Modeling this structure is not necessary to quantify the savings associated with the suggested measures. Therefore, subsequent work for this structure will include providing specifications and cost evaluations of the recommended measures.

Felix Aripa Fish and Wildlife Building (Felix Aripa) Initial Findings

Felix Aripa Facility Description

The Felix Aripa Fish and Wildlife Building is an approximately 7,480 square foot single story building constructed in 2004. This facility contains approximately 25 individual offices, in addition to common areas with cubicle works stations, conference room, break room kitchen, mechanical room, supply storage and restrooms. This building is typically occupied 7:00 am to 5:00 pm Monday through Friday.

Figure 39. Felix Aripa Building north entrance.

Felix Aripa Building Envelope

The Felix Aripa Building is of conventional wood frame construction built on a concrete perimeter foundation. This building has vinyl lap siding and has a pitched attic roof with asphalt composite roofing materials. The roofing materials were in fair condition at the time of the assessment. Though the attic space is vented with soffit vents, inspection of the attic space indicated that loose fill insulation had been installed over the soffit vents. This tends to dramatically decrease the attic air flow at these locations which can lead to adverse moisture conditions within the attic space. The roof system is equipped with full eave side gutter systems with subsurface discharge. Windows in this facility are dual paned with nonmetal frames. All of the office windows are operable and were in good condition at the time of the assessment. The main entry foyer is on the north side of the structure and features a large insulated glass façade and full light entry doors. No insulated window coverings were noted in the entrance foyer. All of the service doors are also “half-light” with approximately half of the door area comprised of sections of insulated glass in nonmetal frames. Weather stripping on exterior doors was in poor condition at the time of the assessment with significant air leakage noted at the south entry doors. All of the interior ceilings are suspended with the exception of the cathedral ceilings located in the north reception area.

The crawlspace of the Felix Aripa Building has a partial vapor barrier installed on the floor. This vapor barrier had large gaps at building footings and a significant amount of bulk moisture and staining was observed on structural elements. The floor is insulated with fiberglass batt insulation. This material was in fair condition with significant sagging and gaps noted. The estimated effective R-value of this material is R-12. The access hatch is to the crawlspace is neither insulated nor air sealed, so it is likely a source of air leakage to/from the building. The walls have fiberglass insulation with an estimated R-value of R-19. The ceiling is insulated with loose-fill cellulose insulation with an estimated R-value of R-30. This material was in fair condition at the time of the assessment. One attic hatch was noted during the field work. Though this hatch doors was insulated, it was not adequately air sealed, so it is likely sources of air leakage to/from the building.

Felix Aripa Heating Ventilation and Air Conditioning (HVAC)

The Felix Aripa Building is served by a combination of 5, York HP Series air source heat pumps manufactured in 2002. These systems have a rated cooling capacity of 5-tons and rated heating capacity of 59,000 BTU/hour at 47°F (19,300 BTU/hour at -7°F). These units have a rated efficiency of 12 SEER and an HSPF of 7.7. These efficiencies do not meet the minimum standards for Energy Star rating (>= 14.5 SEER and >=8.2 HSPF). The exterior units were in fair to poor condition at the time of the assessment, with significant amounts of corrosion noted in the casing, fans and compressors. Additionally, the refrigerant lines that connect the exterior unit to the interior unit appeared to have been insulated at the time of construction, but had subsequently degraded and been entirely removed, which likely leads to significant degradation of the performance of these systems.

Figure 41. Moisture staining observed on mechanical catwalk adjacent to air handler.

The air handlers for these heat pumps were manufactured by York in 2002. Though these units have auxiliary electric resistance heaters installed, no model was field selected on the nameplate. We estimate the heating capacity of the auxiliary heaters is 15 kW. These units are installed in a central attic catwalk that extends the length of the building. Moisture staining was noted at the base of many of these units indicating that condensate pans had not been properly sealed or drained. Additional drain piping noted during the field assessment may indicate that these conditions were addressed subsequent to the water damage noted. No provisions for fresh ventilation air (OSA) are included in the HVAC systems and no economizers were noted. One building occupant indicated that poor air quality had been an issue within this structure and that the HVAC systems had been retrofitted to attempt to address this issue. The likely attempted mitigation for poor air quality in the building are the White-Rodgers Comfort Plus (Model SST) electrostatic air filters observed on all five of the HVAC air handlers. According the product literature, these electrostatic filters are equipped with a pre-filter that removes large particulates (hair, dust, etc.) and an ionizing process designed to remove irritants (pollen, spores, mold, etc.) and "black soiling contaminants (dirt and smoke particles). An optional activated carbon filter section can be added to these systems to remove odors and other gas particles, however no carbon filter was observed on the installed units. Filter maintenance requires the elements to be removed and washed with warm water as they become soiled. Many extra filter elements were observed in the attic space stored on top of the air handlers. These filters are likely effective at removing the materials specified

Figure 40. Crushed ducting, impacted duct insulation and foil take on HVAC distribution system.

above, if properly maintained, though it is not clear what the added benefit of these filters are over traditional media filters for this application. Furthermore, these filters do not address the lack of fresh ventilation air (OSA) to the building, which is a greater issue in terms of air quality.

Figure 43. Felix Aripa roof detailing differences in snow melt over connected sections of the roof. Note color of roof deck on north side of structure.

The HVAC distribution system is mainly composed of a combination of flexible ducting with integral R-5 insulation and rigid ducting wrapped in R-5 fiberglass blankets. Many areas of the distribution system had damaged and/or missing duct insulation. Duct leakage is likely significant based on the observed conditions of the HVAC distribution system. These conditions include damaged (crushed) ducting and improperly sealed air handler cabinets and connection points within the system. Foil tape was noted throughout the HVAC distribution system. This material tends to have a short serviceable lifespan and is prone to failure. Further evidence of systemic duct leakage was provided after a short snowfall event. Specifically, a section of the roof over the north attic area was observed to thaw recent snowfall faster than the rest of the structure. This indicates that the attic area in this area is warmer than the rest of the building likely due to supply duct leakage.

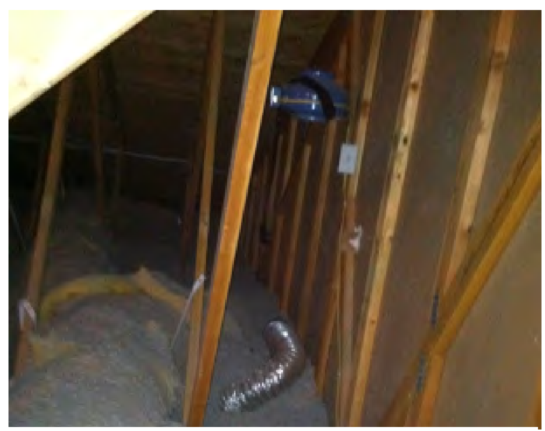


Figure 42. Disconnected bathroom exhaust fans noted in attic.

The return HVAC distribution system uses the area above the suspended ceiling as a return plenum. Holes have been cut in walls that separate offices from the common areas to allow return air from these locations to flow into this suspended ceiling plenum. Though this was a common practice in the past, it is no longer considered a best design practice. Return air grills were observed in the offices which allow air to pass into the suspended ceiling plenum, however, no return air grills were observed in the main common area. Therefore, return air from this section of the building relies on leakage through the suspended sealing seams and penetrations as a flow pathway. This likely contributes to dust and particulate load in the building.

Two bathroom exhaust fans were noted in the attic area. One of these units was disconnected from the roof penetration ducting and was thus exhausting air into the attic space. This can lead to moisture buildup in the attic. The second exhaust fan was disconnected from both the bathroom vent and attic penetration therefore, instead of exhausting air from the bathroom it is circulating air within the attic space and allows uncontrolled air leakage from the conditioned space. Though this does not likely cause damage to the building, it is not serving the zone it is designed to serve.

The five zones within the Felix Aripa building are controlled by programmable thermostats located in the zones they serve. These units were not programmed consistently and commonly were set to provide "occupied" heating and cooling temperatures (70°F heating/78°F cooling) from 6:00 am to 10:00 pm on the weekends.

See the attached Observed Equipment Inventory for more information on these systems.

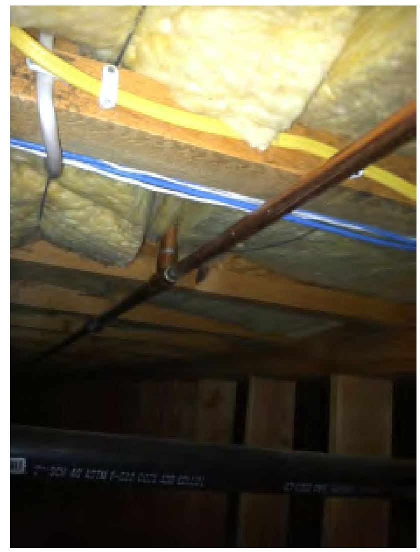


Figure 44. Uninsulated, copper hot water piping in crawlspace

Felix Aripa Domestic Hot Water (DHW)

Hot water is provided to the Felix Aripa restrooms and kitchen by a 50-gallon, US/Craftmaster, electric resistance water heater. This unit was manufactured in 2008, has a rated capacity of 4,500 watts and is equipped with a timer. No pipe insulation, pumps or other enhancements were noted.

Felix Aripa Lighting

The interior lighting in the Felix Aripa facility is provided by energy efficient 4', T-8 linear fluorescent lamps in recessed fixtures and approximately 4-5 fixtures equipped with CFLs. No lighting occupancy sensors were noted. Exterior lighting is provided by energy efficient CFL wall packs controlled by a central timer.

Felix Aripa Plug and Process Loads

Plug and process loads in the Felix Aripa Building are primarily standard office equipment including computers (~30 workstations), printers, and copiers, along with kitchen equipment in the break room which includes a small refrigerator.

Felix Aripa Initial Recommendations

OurEvolution has identified the following energy conservation measures and recommendations for the Felix Aripa Building:

- Insulate all exterior refrigerant lines on heat pumps.
- Complete duct leakage testing and repair/seal ducts and air handlers as necessary. Seal ducts with fiberglass tape and mastic approved for use with ducting.
- Install insulated window coverings on north facing windows in the reception area.
- Connect restroom exhaust fans to existing ducting and penetration points.
- Install return air grills in the suspended ceiling in the main common office area to allow for more balanced HVAC distribution.

- Set programmable thermostats to better reflect occupancy patterns and energy efficiency set points. OE recommends occupied thermostat set points to be no greater than 68°F heating and no less than 78°F cooling with setbacks in unoccupied periods to 55°F heating and 84°F cooling.
- Insulate and weather strip one attic hatch and one crawlspace hatch.
- Insulate all accessible hot water pipes as well as the hot water heater cold water inlet pipe to a distance of 6 feet from the tank.
- Install lighting occupancy sensors in restrooms, offices and meeting rooms.
- Consider installing economizer controls on new OSA intakes.
    - Alternate 1: Install energy recovery ventilator system to provide fresh ventilation air.
- Institute record keeping protocol for servicing of electrostatic air filters. Maintain records at the point of installation.

Felix Aripa Next Steps

Modeling this structure is recommended if economizer controls are considered to be an option the Tribe wishes to pursue. Additional work for this structure will include providing specifications and cost evaluations of the recommended measures.

Tribal Police Headquarters (Tribal Police) Initial Findings

Tribal Police Facility Description

The Tribal Police facility is an approximately 1,800 square foot structure constructed in the 1990s. The northern portion (~1/3) of this facility houses a front office reception area which is occupied Monday through Friday, 8:00 am to 4:30 pm. The southern portion of the facility contains officer work stations, evidence room, server room, holding area, restrooms and small break room. This facility is equipped with a large diesel generator for backup power. OE engineers could not access this unit during the field assessment.

Figure 45. Tribal Police Headquarters entry.

Tribal Police Building Envelope

The Tribal Police facility is of conventional wood framing construction sided in cementatious, lap siding. This facility was constructed on a concrete, slab-on-grade foundation. The truss-framed roof has asphalt composite roofing materials. The roof was in fair to poor condition at the time of the assessment with visible signs of deterioration. The front entry door is “full light” with a large dual paned glazing section in an insulated metal frame. All other exterior doors are insulated metal. The weather stripping on exterior doors was in poor condition at the time of the assessment. The windows in this facility are dual paned with nonmetal frames. These were in good, operable condition at the time of the assessment.

The walls of the structure are insulated with fiberglass batt insulation to a level of R-19. Cellulose insulation was observed in the attic of this structure. The estimated R-value of these materials is R-30. It is unknown whether the slab floor was insulated at the time of construction.

Figure 46. Corrosion noted in propane supply piping.

Tribal Police Heating, Ventilation and Air Conditioning

Heating and cooling at the Tribal Police facility is provided by a combination of three central heating and cooling systems. The main system that serves the rear office area is composed of a Bryant, packaged RTU air-conditioner and natural gas furnace. This unit was manufactured in 1995. Though this unit can be safely retrofitted for use with propane (as it is used currently), no indication of the conversion was provided on the nameplate. This unit has a rated cooling capacity of 5-tons and (natural gas) heating capacity of 115,000 BTU/hour. This unit has a rated cooling efficiency of 10 SEER and rated combustion efficiency (AFUE) of 80%. This unit does not meet the minimum standards for Energy Star rating (>=95% AFUE, >=14 SEER). This unit is not equipped to provide fresh ventilation air (OSA) to the structure. This packaged unit was in poor condition at the time of the assessment with obvious signs of corrosion to condenser fins and compressors. At 18 years old, with the conditions observed, this unit has likely surpassed its serviceable life. Additionally, the propane line that serves this system was severely corroded at the time of the assessment. The HVAC distribution system consists of rigid metal ducting with integral R-5 insulation on the roof with flexible ducting with R-5 insulation located in the attic area. This material was in fair condition at the time of the assessment.

The secondary central heating and cooling system serves the northern portion of the facility. This system includes a split system, roof mounted air conditioner manufactured by Bryant in 1992. This system has a rated cooling capacity of 1.5-tons and has a rated efficiency of 12 SEER. This does not meet the minimum requirements for Energy Star rating. This unit was in poor condition at the time of the assessment. At 21 years old, with the conditions observed, this unit has likely surpassed its serviceable life. This roof top air conditioning unit is paired with a Bryant, Plus 80, natural gas furnace/air handler located in the attic of the facility. Though this unit can be safely retrofitted for use with propane (as it is used currently), no indication of the conversion was provided on the nameplate. This unit was manufactured in 1994 and has a heating capacity of 37,000 BTU/hour with a rated efficiency of 80.2 AFUE. This unit does not meet the minimum standards for Energy Star rating (>=95% AFUE). This unit is not equipped to provide fresh ventilation air (OSA) to the structure. This unit was in fair condition at the time of the assessment. At 19 years old, this unit is likely approaching the end of its serviceable life. The HVAC distribution for this system is comprised of flexible ducting with R-5 integral insulation. This material was in fair condition at the time of the assessment.

Figure 47. Bryant air conditioner condenser with obvious signs of corrosion and deterioration.

Police station occupants indicated during interviews that there are significant deficiencies with the HVAC systems' capability of delivering conditioned air to all spaces within the building, particularly the Chief's office at the northeast corner furthest from the air handlers. Subsequent inspection of the attic duct system revealed major deficiencies, with numerous holes at duct junctions and at least one location where a duct was completely disconnected. This condition not only contributes to uncontrolled loss of a major portion of the conditioned supply air into the attic, but it also creates an air pressure imbalance in the conditioned space which leads to dramatically increased rates of infiltration of outside air through openings in the building envelope and can lead to substantial issues with interior air quality as well.

The two central heating and cooling systems are controlled by two programmable thermostats, each located in the zone that they serve. These units were not accessible during the field work. Due to the 24-hour per day nature of the southern portion of the facility, setbacks are not likely to be possible. However, the northern portion occupancy is limited to a typical work day, therefore programming setbacks for this area is recommended. The server room is served by the larger of the two central systems. This area was excessively hot during the field assessment and indicates that the controls and configuration of the current system do not provide adequate cooling for these critical network systems.

See the attached Observed Equipment Inventory for more information on the mechanical systems identified during this field effort.

Tribal Police Domestic Hot Water

Domestic hot water is provided by a 12-gallon, electric resistance water heater manufactured by US

Craftmaster in 2004. This unit has a rated capacity of 1,500 watts. This unit was in good condition at the time of the assessment. Along with providing hot water to the station bathrooms and break rooms, according to staff and verified by OE, the water heater was inadvertently or intentionally plumbed to an outside hose bib which provides water for washing of cars, etc. However, this hose bib is not plumbed with cold water and has been a leak issue for a long period. This condition creates an inordinate load on the hot water heater which is likely running continuously due to the significant leakage.

Tribal Police Lighting

Interior lighting at the Tribal Police facility is provided mostly by energy efficiency T-8 linear fluorescent lamps in recessed fixtures. Approximately 4, T-12 linear fluorescent lamp/fixture combinations were observed in service areas including utility closet, evidence room and entry way. No occupancy sensors were noted during the field work. Exterior lighting is provided by approximately 4, 150-watt, metal halide wall packs.

Tribal Police Plug and Process Loads

In addition to a normal distribution of office equipment including 12 computer workstations and at least three printers, the Tribal Police facility has a significant amount of plug loads associated with communication equipment, computer network servers and security cameras. This facility also contains a 25-cubic foot Estate side-by-side refrigerator/freezer manufacture in 2006. This unit is not Energy Star rated was not used to capacity at the time of the assessment.

Tribal Police Initial Recommendations

OurEvolution has identified the following energy conservation measures and recommendations for the Tribal Police Headquarters:

- Replace weather stripping on all exterior doors.
- Replace remaining T-12 linear fluorescent lamps and fixtures with high efficiency T-8 linear fluorescent lamps with electronic ballasts.
- Install lighting occupancy sensors in restrooms and storage areas.
- Replace Bryant packaged air conditioner/gas furnace with equivalent packaged or spilt system heat pump. Relocate RTU to ground mounted location.
    - If immediate replacement of this unit is not undertaken, verify that the existing gas furnace has been retrofitted for use with propane and replace corroded propane distribution.
- Repair leakage in hot water plumbed exterior hose bib and/or re-plumb hose bib to distribute only cold water.
- Replace Bryant air conditioner and gas furnace air handler with equivalent split system heat pump. Relocate RTU to ground mounted location.
- Perform major service to restore the integrity of the entire attic duct system, sealing all joints with approved fiberglass tape and mastic.
- Install ductless mini-split air conditioner to provide adequate server room cooling capacity. Air seal doors to server room.
- Replace 150-watt metal halide wall packs to LED equivalent.

- Set programmable thermostats to better reflect occupancy patterns and energy efficiency set points. OE recommends occupied thermostat set points to be no greater than 68°F heating and no less than 78°F cooling with setbacks in unoccupied periods (reception area) to 55°F heating and 84°F cooling.

Tribal Police Next Steps

Modeling this structure is necessary to complete evaluation of proposed heating and cooling system upgrades. Additional work for this facility will include providing specifications and cost analyses for the recommended energy conservation measures.

Old Benewah Medical Center Preliminary Findings

Old Benewah Medical Center Facility Description

The Old Benewah Medical Center (Old BMC) building is a two-story structure developed in several phases comprising approximately 13,800 square feet of total conditioned floor area. The building formerly served as a medical clinic for the entire Tribe and surrounding geographical area. It has recently been vacated as its function has been replaced by the New Benewah Medical Center. At the time of this assessment the building was unoccupied, but there are plans to repurpose it for occupancy as office space by a number of other Tribal departments.

Figure 48. Old Benewah Medical Center front entrance with hydronic ice melt system embedded in sidewalk and steps

Old BMC Building Envelope

The Old BMC structure is of conventional wood frame construction. The central section, Phase I, is single story structure with a slab-on-grade foundation and a low-slope impermeable membrane roof. The west end, Phase II, is two-stories with a perimeter foundation over mostly crawlspace with some finished basement serving as mechanical space and storage. Phase II has a pitched wood frame roof covered by asphalt composition shingles. A double-wide modular structure with wood construction, asphalt composition shingled roof, and steel floor framing over a well-insulated, raised perimeter foundation was attached to the east end of Phase I. The entire roof system has integrated gutters that discharge to the subsurface. This drainage system appeared to be in good working order. Exterior wall insulation is estimated to be R-19 throughout. The low-slope roof over Phase I is estimated to have R-30 roof insulation. The attic over Phase II was observed to have 12 to 14 inches of loose fill fiberglass insulation in excellent condition for estimated R-value of R-44. The roof over the modular wing at the east end is estimated to have R-30 insulation installed. The part of Phase II over a crawlspace is estimated to have R-19 floor insulation. It is unknown whether the below grade slab supporting the basement area was insulated at the time of construction.

Windows throughout the Old BMC are dual-paned with metal frames. The front entry is clad in store-front glass, also dual paned in metal frames. Windows throughout the building appeared to be in generally good condition. Weather stripping around the front entry doors was observed to be in poor condition. Weather stripping around several other insulated metal entry doors on other sides of the building was also observed to be compromised.

Old BMC Heating Ventilation and Air Conditioning (HVAC)

Phase I and Phase II of the Old BMC underwent a major mechanical renovation in 2010, resulting in wholesale replacement of all heating and cooling equipment. The majority of heating and cooling loads are now met by an array of mostly high efficiency heat pumps manufactured in 2010. These include:

- 9 Carrier split heat pump systems ranging in capacities from 3 to 5 tons and SEER of 16

- 1 Carrier split heat pump with capacity of 3 tons and SEER of 13
- 2 Carrier packaged AC/electric roof top units with capacities of 2 and 2.5 tons and SEER of 10
- 2 Fujitsu mini-split ductless heat pumps with capacities of 1.5 tons and SEERs of 10 and 12
- 2 Liebert packaged wall mount air conditioners with capacities of 3-tons (non-AHRI rated units, provide cooling for the server room process loads)

Air handlers coupled to the Carrier split heat pump systems have auxiliary electric resistance heating strips ranging from 3 to 25 kW depending on relative heating loads for the zones they serve. With one exception, each of the Carrier split heat pump systems meet Energy Star requirements and are Energy Star rated. None of the rest of the listed heat pumps or air conditioners meets Energy Star minimum standards.


Figure 49. Energy Star rated Carrier Puron Heat Pumps.

The modular structure attached to the east end of the Old BMC is heated and cooled by a pair of the 3-ton Bard wall mounted packaged heat pumps commonly used one these types of buildings. These units were manufactured in 2008 and have SEER of 10. They do not meet Energy Star requirements.

Additional mechanical heating equipment includes a small ceiling mounted electric unit heater with estimated capacity of 2 kW located in a basement storage area; and an exterior, subsurface hydronic system used for melting ice on the building entry sidewalks, served by a Thermolec hot water boiler with 27 kW heating elements.

There are several exhaust fans throughout the building that are set to run continuously. One exhaust fan is manually operated and said to be switched on daily and off each evening by building operators. Two separate exhaust fans ventilate the attic space over Phase II except during very cold weather when they are switched off manually.

The systems serving the modular addition are controlled by Honeywell programmable thermostats with set points ranging from 70 to 72°F heating and 73 to 76°F cooling, with setbacks to 70°F heating and 80 to 82°F cooling. Set point temperatures are programmed for operation seven days per week from 5am to 6pm.

Systems in Phase I and Phase II are controlled by a Johnson Controls DDC system. OE engineers did not have an opportunity to evaluate this system's programming during the assessment. McKinstry previously noted that it was programmed to operate the building in occupied mode 24 hours per day, 7 days per week. It is assumed that all HVAC system programming will be updated to reflect new occupancy patterns as the building becomes repopulated after repurposing.

See the attached Observed Equipment Inventory for more information on these systems.

Old BMC Domestic Hot Water (DHW)

DHW for Phase I is met by a single American Water Heater Company electric tank water heater manufactured in 2009. This unit has a capacity of 50 gallons with 4500 watt heating elements. DHW for phase II is met by a single Ruud electric tank water heater with a capacity of 80 gallons and 4500 watt heating elements, manufactured in 1993. At 20 years of age this Ruud unit is likely at or approaching the end of its serviceable life. A Tiny Titan electric tank water heater with capacity of 2.5 gallons and a 1500 watt heating element, manufactured in 2010, was observed in a small infectious materials handling room adjacent to the front reception/waiting room restrooms. No water heater was observed in the modular addition but it is assumed that it likely houses a 50 gallon electric tank water heater with 4500 watts.

The 50-gallon American and the 80-gallon Ruud were both noted to have installed recirculation pumps. No timers, pipe insulation, or other enhancements were observed.

Old BMC Lighting

Lighting throughout the vast majority of the Old BMC is provided by energy efficient T8 fluorescent lighting. Occupancy sensors were noted in hallways, restrooms, and other areas where occupancy is likely to be transitory. The waiting area is lit by dimmable CFLs in recessed cans. Exterior lighting is provided by an array of 400-watt and 150-watt metal halide fixtures. No exterior lighting was observed to be operating during the assessment so it is assumed they are controlled by photocells in good working condition.

Old BMC Plug and Process Loads

The main plug and process loads observed in the Old BMC consisted largely of the standard types of medical equipment associated with outpatient medical clinics. Most or all of this equipment is expected to be removed before the building is re-occupied. Most existing computer equipment had already been removed by the time of this assessment, but it is assumed that upon re-occupation there will be a normal distribution of new office equipment. It is unknown whether the new occupancy will include server process loads such that all the cooling capacity available in the existing Liebert cooling systems will be necessary.

Other process loads likely to remain in the building include a complete kitchen in the break room on the second floor of Phase II; several small refrigerators in other areas of the building; several reverse osmosis water coolers throughout the building.

Initial Recommendations

OurEvolution has identified the following energy conservation measures and recommendations for the Old BMC:

- HVAC zoning in the Old BMC is carefully engineered to work with the existing spaces. Modification to existing spaces that involves moving existing walls, doors, or other interior features should be avoided since it will result in substantial impacts on overall HVAC system effectiveness and efficiency. Should the interior be changed, such that it significantly modifies the existing zoning, OE recommends that the mechanical systems and their respective control and distribution systems be modeled and re-engineered for the new occupancy.

- OE recommends occupied thermostat set points to be no greater than 68°F heating and no less than 78°F cooling with setbacks in unoccupied periods to 55°F heating and 84°F cooling.
- Replace the 20-year old Ruud 80-gallon electric tank water heater with a new high efficiency, Energy Star rated unit such as the GE GeoSpring Hybrid Heat Pump water heater.
- Insulate all accessible hot water pipes and all hot water heater cold water inlet pipes to a distance of 6 feet from the tank with 3/4" foam pipe insulation.
- Install digital timers on DHW recirculation pumps programmed to disable pumps during periods when building is unoccupied.
- Install a simple thermostat to control the attic ventilation exhaust fans to only come on when attic temperatures reach 75°F or greater.
- Replace weather stripping around exterior doors.

Next Steps

Unless significant remodeling is planned for repurposing the Old BMC, envelope and HVAC modeling of this structure is not necessary to quantify the savings associated with the suggested measures. Simple modeling may be required to verify the cost effectiveness of a replacement hybrid heat pump water heater as opposed to a conventional electric resistance model. Therefore, subsequent work for this structure may include computer modeling in EnergyPro before providing specifications and cost evaluations of the recommended measures.

Youth Shelter Initial Findings

Youth Shelter Facility Description

The approximately 5,000 square feet Youth Shelter is a two-story structure constructed in the early 1980s, which contains residential housing and children's services. The first floor (daylight basement) of this facility contains two offices, central meeting room, mechanical room and storage. The second floor contains four bedrooms, a central living and dining area, a kitchen, counseling office, server room and four bathrooms. The second floor residential portion of this facility is occupied 24 hours per day, seven days per week while the first floor office areas are occupied Monday through Friday 8:00 am to 4:00 pm.

Figure 50. Youth Shelter entry.

Youth Shelter Building Envelope

The Youth Shelter facility is of conventional wood frame construction, built on a combination of concrete, slab-on-grade foundation with concrete stem walls on the south, east, west and ½ of the north side of the structure. This building is clad in T-111-type sheet siding and has a pitched attic roof with asphalt composite roofing materials. The roofing materials were in fair condition at the time of the assessment. The siding was in fair condition with the exception of the chimney siding and gable siding which had observable moisture damage. The attic space is vented with a combination of soffit vents and very large gable vents. The roof system is equipped with full eave side gutter systems with subsurface discharge. Though these gutters were clogged with debris at the time of the assessment, they appeared to be in good structural condition. Though some of the windows in this facility have been upgraded to dual paned, vinyl framed units, most of the windows are dual paned with aluminum frames. These aluminum framed windows were observed to be very poorly fitting with damaged or completely missing seals. Weather stripping around exterior doors was observed to be missing or damaged. These conditions allow a significant amount of air leakage to/from the structure.

The attic is insulated with loose fill cellulose insulation applied to inconsistent depths (8" to 16") across the attic area. With an average depth of 12" this material would have an estimated R-value of R-30, however this material appeared to be negatively impacted by moisture which significantly reduces the effective R-value of insulation. Though the cause of the moisture is unknown, one factor could be the oversized gable venting whose slat openings appeared large enough to allow precipitation to enter the attic space. Additionally, three of the four bathroom exhaust fan ducts observed

Figure 51. Improperly terminated bathroom exhaust fans.

in the attic area were not properly terminated to the outside of the structure and instead discharge potentially moist air from the bathrooms (showers, baths, etc.) directly into the attic. From the dimension of the walls and the vintage of the structure, we can assume that the walls are insulated with fiberglass batt insulation to a level of R-19. It is unknown whether the slab-on-grade floor was insulated at the time of construction. The access hatch to the attic is neither insulated nor air sealed, so it is likely a source of air leakage to/from the building.

Youth Shelter Heating Ventilation and Air Conditioning (HVAC)

The Youth Shelter HVAC system is a single York central split system air conditioner manufactured in 1990. This unit has a rated cooling capacity of 5-tons with a rated efficiency of 9 SEER. This does not meet the minimum standards for Energy Star rating (>=14.5 SEER). This unit was in poor condition at the time of the assessment with obvious corrosion on fins, fan and compressor components. At 23 years old this unit has surpassed its serviceable lifespan. This air conditioner condenser is paired with a retrofitted electric resistance furnace/air handler manufactured by the Goodman Company in 2011. Though this unit has a heater package installed, no unit was selected on the nameplate so the actual capacity is unknown. Based on the available options and the size of the Youth Shelter, it is estimated the heater unit in this air handler has a capacity of 15 kW. This central system has no provisions for bringing in fresh ventilation air (OSA). The filter on this unit was noted to be the wrong size and had been cut down to fit. Additionally, there was no air filter door on the unit at the time of the assessment. This represents an air leak in the system which can cause pressure imbalances and allow unfiltered air to be entrained in the HVAC distribution system. Many electric personal space heaters and a humidifier were noted during the field assessment, which indicates that the central system may not providing adequate service to the building.

Figure 53. York air conditioner condenser with obvious signs of deterioration.

Figure 52. Improperly sized furnace filter with no filter access door in place.

The HVAC distribution system is composed of a combination of rigid metal ducting located in the space between the floors of the building therefore no duct inspection was possible. The floor registers in the second floor were observed to be very impacted by dust and debris. Three of the four bathroom exhaust fans were noted to be inoperable. In addition, as previously stated, three of the four bathroom exhaust fans were improperly terminated in the attic which can lead to excessive moisture building in the attic space.

The central HVAC system is controlled by a single programmable thermostat located in the first floor hallway. With very little thermal communication between the first and second floors due to the fact that the stairwell door remains locked, this thermostat cannot effectively control temperatures on the second floor. This was evidenced by the fact that, during the assessment, a second story window was observed to be wide open in an attempt to provide cooling while the thermostat was set at 72°F and the furnace was running. This has obvious impacts to the energy expenditures of this heating and cooling system. Additionally, due to the very different occupancy pattern between the first and second floor, programming this thermostat to reflect actual occupancy is impossible.

See the attached Observed Equipment Inventory for more information on these systems.

Youth Shelter Domestic Hot Water (DHW)

Hot water is provided to the Youth Shelter by an electric resistance water heater manufactured by U.S. Craftmaster in 2011. This 50-gallon unit has a rated power of 4,500 watts and was in good condition at the time of the assessment. No pipe insulation, pumps or other enhancements were noted.

Youth Shelter Lighting

The interior lighting in the Youth Shelter facility is provided by a combination of T-8 and T-12 linear fluorescent lamps in offices and a scattering of incandescent bulbs in the residential portions of the structure. No occupancy sensors were noted during the field work. Exterior lighting is provided by spot lighting equipped with a combination of incandescent bulbs and CFLs. This exterior lighting is not controlled by photocells, as evidenced by the fact that they were on during the day of the assessment.

Youth Shelter Plug and Process Loads

Plug and process loads in the Youth Shelter are primarily standard office equipment including computers (~5 workstations), and printers along with kitchen equipment. This equipment includes an Energy Star rated Frigidaire refrigerator and 18.5 cubic foot, Montgomery Ward chest freezer. This freezer is in excess of 20 years old and its seals were noted to be in poor condition. In addition to this equipment, many personal space heaters and one humidifier were noted during the field assessment.

Youth Shelter Initial Recommendations

OurEvolution has identified the following energy conservation measures and recommendations for the Youth Shelter:

- Replace loose fitting metal framed windows with dual paned windows with nonmetal frames and adequate air seals.
- Replace existing weather stripping on exterior doors.
- Reconfigure bathroom exhaust fans to discharge to the outside of the structure, not into the attic.
- Reconfigure existing gable venting system to reduce net size of vents and reduce opportunity for moisture infiltration into attic space.
- Insulate and weather strip attic hatch.
- Insulate all accessible hot water pipes as well as the hot water heater cold water inlet pipe to a distance of 6 feet from the tank.

- Install central HVAC system for the second floor. This system should include an Energy Star rated split system air source heat pump with an air handler and distribution system located in the attic. This system should be equipped to provide OSA or OSA should be provided with an energy recovery ventilator and should be controlled by a programmable thermostat located in a central area on the second floor.
- Replace existing air conditioner condenser with an appropriately sized Energy Star rated air source heat pump sized to meet the heating and cooling demands of the first floor only. Provide outside air with a wall mounted energy recovery ventilator or ducted into the existing air handler.
- Install correct size air filter on existing air handler and provide a filter cover for this unit.
- Replace chest freezer with Energy Star rated equivalent.
- Install lighting occupancy sensors in bathrooms, office, meeting and service areas.
- OE recommends occupied thermostat set points to be no greater than 68°F heating and no less than 78°F cooling with setbacks in unoccupied periods to 55°F heating and 84°F cooling.

Youth Shelter Next Steps

Modeling this structure is recommended if installing new HVAC equipment is to be considered for this study. Building models will allow OE to accurately size any new or replacement system(s). Additional work for this structure will include providing specifications and cost evaluations of the recommended measures.

Technology Center Initial Findings

Technology Center Facility Description

The Technology Center is an approximately 7,500 square foot two-story building constructed in 2004. This facility contains approximately 5 individual offices, in addition to common areas with cubicle work stations, conference room, break room kitchen, server "farm", radio station, artifacts storage area and restrooms. This building is typically occupied 8:00 am to 5:00 pm Monday through Friday. This building is served by a propane backup generator manufactured by Cummins.

Figure 54. Technology Center front entry.

Technology Center Building Envelope

The Technology Center is of conventional wood frame construction built on a slab-on-grade foundation. This building has vinyl lap siding and has a pitched attic roof with asphalt composite roofing materials. The roofing materials were in good condition at the time of the assessment. The roof system is equipped with full eave side gutter systems with subsurface discharge. Windows in this facility are dual paned with nonmetal frames. All of the office windows are operable and were in good condition at the time of the assessment. The main entry is on the west side contains a pair of "full light" doors with dual paned windows and metal frames. Service doors were noted to be insulated metal. Weather stripping on exterior doors was in fair to poor condition at the time of the assessment with significant air leakage noted at the north entrance. All of the interior ceilings are made of suspended acoustic tiles.

The attic of is insulated with 8 inches of blown cellulose insulation that is displaced in many locations with an estimated effective R-value of R-21. The walls are assumed to be insulated with fiberglass batts to a level of R-19. It is unknown whether the concrete slab floor was insulated at the time of construction.

Technology Center Heating Ventilation and Air Conditioning (HVAC)

The Technology Center is served by a combination of central and ductless heating and cooling systems. These systems include:

- 5, York HP Series air source heat pumps manufactured in 2004. These systems have a rated cooling capacity of 5-tons and rated heating capacity of 59,000 BTU/hour at 47°F (19,300 BTU/hour at -7°F). These units have a rated efficiency of 12 SEER and an HSPF of 7.7. These efficiencies do not meet the minimum standards for Energy Star rating (>= 14.5 SEER and >=8.2 HSPF). The exterior units were in good condition at the time of the assessment. The air handler units for these systems are Carrier AHP Series units manufactured in 2004 with rated auxiliary heating capacities of 20 kW each. These systems are not currently configured to provide fresh ventilation air (OSA) to the structure but are equipped with electrostatic air filtration systems.

- 2, Fujitsu, ductless air conditioners which serve the server farm. According to their serial numbers, these units were manufactured in 2007. These units have rated cooling capacity of 33,100 BTU/hour each at a rated efficiency of 15 SEER. Though this meets Energy Star minimum standards for split system air conditioners, this system is not Energy Star rated.

These systems are controlled by individual programmable thermostats set to provide heating and cooling (72°F and 74°F) respectively 7 days per week with no setback.

Ducting throughout the attic was observed to be joined with aluminum duct tape that may be compromised in several locations. Duct insulation was observed to be poorly fitted and falling off in many locations.

See the attached Observed Equipment Inventory for more information on these systems.

Technology Center Domestic Hot Water (DHW)

No domestic hot water systems were identified during this field work.

Technology Center Lighting

The interior lighting in the Technology Center is provided by energy efficient 4', T-8 linear fluorescent lamps in recessed fixtures. No lighting occupancy sensors were noted. Exterior lighting is provided by approximately eight 250-watt metal halide lamps in wall mounted fixtures.

Technology Center Plug and Process Loads

Plug loads in the Technology Center are primarily standard office equipment including computers (~15 workstations), printers, and copiers, along with kitchen equipment. The main process load in this facility is the server "farm" which forms the backbone of the Tribe's internal computer network as well as its commercial internet service provider business. According to building managers, these servers run at approximately 17 kW, 24-hours per day, 7 days per week. Additional process loads including audio and broadcast equipment are associated with the Tribe's FM radio station housed on the second floor of the Technology Center building.

Technology Center Initial Recommendations

OurEvolution has identified the following energy conservation measures and recommendations for the Technology Center:

- Install energy recovery ventilators to provide fresh ventilation air (OSA) to the building.
- Replace damaged weather stripping around exterior doors.
- Maintain programmable thermostats at 68°F heating and 78°F cooling in occupied mode with setbacks to a maximum of 55°F heating and minimum 84°F cooling.
- Install lighting occupancy sensors in restrooms, offices and service areas.
- Replace metal halide exterior lighting with LED equivalent.
- Research emerging heat recovery technology to determine if heat rejected from the server process load could be used to provide heating capacity in the common areas of the building.

Technology Center Next Steps

Modeling this structure is not necessary to quantify the savings associated with the suggested measures. Therefore, subsequent work for this structure will include providing specifications and cost evaluations of the recommended measures. Additionally, OE was informed that this structure was going to be expanded in the near future. We strongly recommend completing stringent energy efficiency and building performance design review early enough in the planning process to ensure that cost effective measures identified have maximum probability of implementation.

Tribal Court Services Initial Findings

Tribal Court Services Facility Description

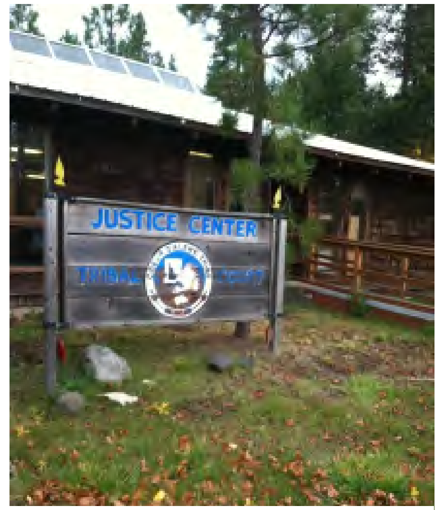


Figure 55. Tribal Court Services Building

The Tribal court services building, constructed in early 1980s, sits atop of a sloped wooded parcel at the bottom of which is a stocked trout pond. The building is an approximately 8,000 square foot structure that houses the Tribal court room, administrative offices, and legal staff. The building is split into two wings with a central reception area set back from the front of the wings, creating a U-shaped space in front. The lot slopes down toward this central area and the south facing front entry is accessed from the parking area by crossing a wooden walkway suspended several feet above grade level. The west wing housing the courtroom and administrative offices is two-story. The east wing housing legal staff is single story over crawlspace.

This building has serious ventilation and drainage defects that have deleterious impacts on both building condition and ultimately affect energy use since the resultant extreme humidity levels require constant mechanical dehumidification.

Tribal Court Services Building Envelope

The Tribal Court Services structure is of conventional wood frame construction. Roughly half the structure is built over a crawlspace with a permanent concrete perimeter foundation, with the remainder sitting atop a slab-on-grade foundation that is not likely insulated. It was not possible to observe insulation levels above the hard ceiling. Given the age of the building it is difficult to accurately estimate roof insulation levels but there is likely at least R-19 above the ceiling. Exterior walls are estimated to have R-13 insulation. Floors over the crawlspace have drywall nailed to the bottom of the joists so insulation could not be observed, however it is estimated to have R-19 fiberglass. There is vapor barrier installed in much of the crawlspace however it was not securely anchored and much of it has become displaced from its intended location, leaving the majority of the area with no vapor barrier. Exterior siding is mostly cedar shake shingles. The building has a mix of dual paned windows in different frame types including some each of metal, vinyl, and wood. The roof is corrugated metal over open beam wood framing with a large opaque skylight feature dominating the open foyer landing at the center of the building. Occupants informed that particularly in this area the roof has a history of leaks with many recent repairs, evidenced by the presence of many water stains in the ceiling in the foyer area.


Figure 56. Standing water observed in crawlspace

Substantial moisture was observed near the central portion of the crawlspace, with water flowing both under and over the poorly arranged vapor barrier in various places. It appeared the source of the moisture was water flow from beneath the foundation wall at the front of the building near the front entryway. It was observed that the grade at that location from the roadway to the front of the building is not such that water is diverted away from the building but rather straight at it. In addition, the roof has no integrated gutter system so runoff from most of the front facing slope of the roof is also directed straight at the point of entry into the crawlspace. Such uncontrolled moisture within crawlspaces contributes to a host of serious problems with building performance including unacceptable humidity levels, poor indoor air quality, risk of mold infestation, accelerated wear and tear on mechanical systems, and deterioration and decreased life span of wood framing and other construction materials.

Court Services Heating Ventilation and Air Conditioning (HVAC)

Four independent HVAC systems provide heating and cooling for the Tribal Court Services building including two split system heat pumps that may be original equipment, and two split DX air conditioner systems that were installed in or about 2005. Building occupants expressed a general level of dissatisfaction with overall building HVAC performance, with consistent complaints that some zones are overheated while others never get warm enough, along with reports of very poor ventilation leading to high humidity levels, very poor air quality, and evidence of mold growth within the building envelope.

The largest heat pump, serving the courtroom and administrative offices in the west wing of the building, is a Trane with capacity of 7.5 tons and EER of 10, coupled with a Rheem air handler with no auxiliary heating. According to manufacturer's literature the Trane heat pump is capable of delivering up to 40,000 BTU/hour of heating capacity down to -3°F but it is not clear whether that is sufficient to satisfactorily heat the building during the coldest weather. This unit has a filtration system made up of four individual filters mounted in a 2x2 array. The existing filters were noted to be very dirty and in need of changing, with a date from August 2012 written on one of them (just over three months prior to the date of the assessment). While quarterly filter changes are sufficient in many commercial buildings, considering the air quality issues in this building, monthly filter changes are recommended.

A smaller Lennox heat pump paired with a Raywall air handler serves the lower floor beneath the court room and administrative offices. The nameplate data from the Lennox unit were illegible due to weathering and the Raypack unit was installed with its nameplate against an interior wall, so no information about capacity or age could be collected for either component of this system. Based on the appearance and physical size of the units and the square footage of the zone served it is estimated to have capacity of approximately 3 tons and to be at least 15 years old with SEER no greater than 10. This air handler delivers conditioned air through floor registers via a duct system embedded in the concrete slab. This has the benefit of reducing potential for duct leakage, however if the slab is uninsulated can contribute to condensation issues that can lead to conditions conducive to the growth of mold that is then easily picked up in the air flow and delivered to conditioned spaces. Liberal use of both fabric backed and aluminum duct tape were observed on this system's air handler, some of which appeared to be affixing to the bottom of the unit a filter cover that was site fabricated out of cardboard. Given the precarious nature of this assembly it was not opened up to observe the condition of any filter that might have been found within it. Given the location of this unit in a mechanical room open to the crawlspace, any leaks on the return side will entrain crawlspace air into the supply air stream. This unit's condition is by all appearances unacceptable.

Two newer split systems manufactured by Ruud in 2005 serve the east wing of the building. The heat pump condensers have capacities of 3 tons each with SEER of 10. The air handlers are horizontal flow units installed in the crawlspace and each have 14 kW auxiliary heating strips. These air handlers were also observed to have liberal application of aluminum duct tape sealing both the supply and return sides of the ducting to the unit itself. Much of this tape was observed to be severely compromised. Further observation made it clear that there is substantial leakage on the return side, such that the entire crawlspace is at negative pressure with respect to the outside. This leads to a condition where the building spaces served by the air handler become positively pressurized, resulting in high levels of air exfiltration from the building, and worse, rather than return air coming from the within the building with some percentage made up of fresh outside air from an controlled source, it is instead being drawn into the supply air stream directly from the crawlspace itself. This observation, coupled with the extreme moisture conditions and possible mold contamination noted in the building envelope discussion above, amounts to an indoor air quality standards concern. Both Ruud air handlers were also noted to have very dirty filters installed.

Figure 58. Aluminum duct tape holding together return side of Ruud air handler ducts

The systems in the Tribal Court Services building do have provision for outside air (OSA), however it was observed that the two older systems serving the west wing had their OSA intakes located very close to grade level next to or beneath the front entry walkway, in an area previously noted to be subject to adverse moisture conditions due to the gradient of the slope and lack of provision for drainage around that area of the building. This further contributes to the poor air quality noted within the building.

Figure 57. Outside air intake beneath front entry walkway too close to grade level in very dark and moist location

A portable dehumidifier was observed plugged and set to run in an open area between individual offices at the center of the downstairs portion of the building. It was further observed that the unit was not operational as the tank was full but building staff were unaware that it required human intervention in order to keep running. Several of the offices in this area were observed to have significant mold growth in lower corner areas associated with exterior walls. There was also evidence of either moisture intrusion or heavy condensation on several wood window frames. A general condition of extremely high humidity appeared to be the norm at least during colder weather throughout the entire downstairs part of the building. It is likely that both the uninsulated slab construction and poorly performing HVAC systems contribute to this condition.

Building thermostat settings varied from system to system, anywhere between 68 and 70°F heating and between 72 and 78°F cooling, with setback levels also varying from between 62 and 68°F heating between 78 and 85°F cooling. Likewise, temp setting and setback periods varied, from between starting anywhere between 5:00 am to 8:00 am from zone to zone, going into setback mode anywhere from 5pm to 8pm. Weekend settings were even more varied, and in some cases it appeared that higher heat settings and lower cooling temperatures were called for during weekend hours when the building is likely unoccupied. By all appearances the general level of dissatisfaction with overall HVAC performance has resulted in untrained staff tampering with thermostat settings.

See the attached Observed Equipment Inventory for more information on these systems.

Court Services Domestic Hot Water (DHW)

DHW for the Tribal Court Services building is provided by a single Craftmaster electric tank water heater with capacity of 40 gallons and 3380 watt heating elements and manufactured in 1997. No pumps, timers, pipe insulation, or any other enhancements were observed.

Court Services Lighting

Lighting throughout most of the Court Services is provided a mix of older linear T-12 fluorescents in the courtroom, and newer energy efficient linear T-8 fluorescents in most of the office areas. No occupancy sensors were observed, and lighting throughout much of the facility was noted to be operational during the assessment regardless of whether or not zones were occupied or otherwise being used. The administrative office area in particular appeared to be substantially over lit, having an estimated lighting power density of 1.9 watts/square foot, which is twice the lighting power recommended for office areas utilizing T-8 fluorescents.

Exterior lighting was observed to be by metal halide fixtures with remote ballasts located in mechanical rooms within the building, including ten 1000-watt and seven 250-watt units. No exterior lighting was observed to be operating during daylight hours so it is assumed they are on either photocells or timers in good working condition.

Court Services Plug and Process Loads

Plug loads in the Tribal Court Services building are made up principally of a normal distribution of computers, printers, photocopiers, and other standard office equipment throughout the courtroom and office areas.

Process loads are characterized by standard items found in most office break rooms including a refrigerator, microwave oven, and 3-burner Bunn coffee maker. There is also a soft drink vending machine that was observed to be out of order so that building staff had to open it in order to get cold drinks for those who wish to purchase them. This vending machine did not have a Vending Miser.

One other process load associated with the building is a 2.5 amp, ½ horsepower air compressor pump used to aerate the stocked trout pond located on the property. This unit appeared to run continuously and draws approximately 2628 kWh per year at a cost of approximately $282.

Court Services Initial Recommendations

OurEvolution has identified the following energy conservation measures and recommendations for the Court Services:

- All elements of the entire building's duct system should be thoroughly pressure tested and sealed with particular attention paid to the return air ducts noted to be compromised and drawing crawlspace air into the building's conditioned spaces. Use of any fabric, vinyl, or aluminum backed tape should be avoided. All seals should be formed using fiberglass tape and approved duct mastic.
- Outside air intakes located near the front walkway should be moved to another location a greater distance from grade level and away from other obstructions that create a moist or potentially moldy atmosphere.
- Remediate problems with migration of roof and parcel runoff through crawlspace. This may require any or all of the following:
    - Installation of integrated roof drainage gutter system
    - Adjustments to parcel grade in front of building
    - Installation of French drain system around foundation exterior
    - Construction of runoff catchment system with sump pump
    - Excavation of foundation wall to below footing and application of exterior water seal treatment
    - Reinstallation of crawlspace vapor barrier with appropriate anchoring to ensure it remains in place
    - Periodic inspection and monitoring of crawlspace humidity levels to ensure that remediation has been successful
- Implement a strict regimen of air handler filter replacements at no less than monthly intervals. These intervals may be decreased to quarterly depending on the results of duct cleaning and sealing and relocation of OSA intakes.
- Install downstairs dehumidification system such that it can be run continuously by draining its contents to a suitable location so that the reservoir does not need to be emptied daily in order for it to function.
- Replace all existing T-12 fluorescent lights with energy efficient T-8 fluorescents with electronic ballasts.
- Replace incandescent lights in restrooms with CFL lamps.
- Install occupancy sensors in all areas of the building to turn off lights when no people are present.
- Replace the 2-burner Bunn coffee maker with a smaller single pot unit that dispenses hot coffee into a carafe to keep it warm. Coffee burners consume up to 1500 watts each. A 2-burner coffee maker, if left on continuously during business hours, can cost up to $612 per year to operate. A carafe system can cut this cost by more than 95%.
- Program thermostats to better reflect the occupancy of the offices. OE recommends 68°F heating and 78°F cooling set points during occupied periods with setbacks to 55°F heating and 84°F cooling during unoccupied periods.

- Install ceiling fans in foyer atrium to redistribute stratified air throughout the building, which should help mitigate poor air temperature balance between zones.
- Air seal doors and windows

Court Services Next Steps

Modeling this structure is not necessary to quantify the savings associated with the suggested measures. Therefore, subsequent work for this structure will include providing specifications and cost evaluations of the recommended measures.

Tribal Casino Resort Maintained Buildings

Casino Daycare Initial Findings

Casino Daycare Facility Description

The Casino Daycare is an approximately 1,800 square foot, single-story, double wide modular building with a retrofitted frame built roof system on independent posts and piers. The modular portions of the structure were built in 1999 and, according to occupants, the addition of the roof structure occurred in 2005. This building provides daycare services to Casino employees; therefore it is in operation and in use 24 hours per day, 7 days per week.

Figure 59. Tribal Casino Daycare Facility

Casino Daycare Building Envelope

The Casino Daycare structure is of modular construction with wood (T-111) type sheet siding. The roof addition consists of wood framing and truss members clad in a metal, raised seam siding in the gables and roof deck. The siding and roofing appeared in good condition at the time of the assessment. Fiberglass batt insulation/moisture barrier assemblies typically seen in modular construction were observed in the floor and between modular ceiling rafters. Fiberglass batt insulation was also observed in limited evaluation of wall cavities. This material appeared to be in good condition at the time of the assessment. Insulation levels are estimated to be R-11 in the walls, R-11 in the floors, and R-19 in the roof. All roof drainage features appeared to be in good condition. The windows in this facility are vinyl framed dual paned type and were in working order at the time of the assessment.

Casino Daycare Heating, Ventilation, and Air Conditioning (HVAC)

All heating and cooling for the Daycare is provided by a pair of Bard heat pumps commonly used in modular construction. These units each have rated cooling capacities of 3-tons and heating capacities of 34,400 BTU/hour at 47°F (19,000 BTU/hour at 17°F). These units were manufactured in 1999, have a rated coefficient of performance (COP) of 3 which declines to 1.9 at 17°F and cooling efficiencies of 9 EER. These efficiencies do not meet the minimum standards for Energy Star rating. Both units appeared to be in good condition at the time of the assessment. These systems are controlled by older White-Rodgers programmable thermostats located in the main area of the facility and in a side room. The programming features of these thermostats did not appear to be in use. Building occupants complained of poor heat distribution throughout the building such that in order

Figure 60. Existing ceiling insulation and duct work penetrating structural roof member.

for some areas to get sufficient heat, other areas become overheated to the point where they have to open windows.

As part of the inspection of the attic area above the suspended ceiling, OE engineers observed a major laminated framing member running down the center of the roofline was penetrated with a large hole to allow a flexible heating duct to pass directly through it. This may have negative effects on the structural integrity of the roof at this location.

Casino Daycare Domestic Hot Water

Hot water for the Daycare is provided by a single, Ruudglas, Pacemaker, 50-gallon electric tank water heater with 4,500 watt heating elements. This unit was manufactured in 2012 and appeared to be in good condition at the time of the assessment. No circulating pump, timer, or other controls were observed, nor any pipe insulation.

Casino Daycare Lighting

Interior lighting throughout the Daycare is principally provided by 4-foot, 2-lamp, T12 recessed fixtures with no occupancy sensors. Exterior lighting consists of halogen spot lights, high-pressure sodium wall packs and several 60-watt incandescent bulbs. There is a battery operated backup lighting system for frequent power outages but building occupants complained that it only lasts about a half hour, which is insufficient time for parents to arrive and get their children when the power does go out, resulting in periods when they are left in the dark.

Casino Daycare Plug and Process Loads

The main plug loads observed in the daycare include a large (24 cubic foot), Kitchen Aid refrigerator and Samsung stackable washer and dryer. All of these units were less than five years old and appeared to be in good condition at the time of the assessment.

Casino Daycare Initial Recommendations

OurEvolution has identified the following energy conservation measures and recommendations for the Casino Daycare Facility:

- The existing nonprogrammable thermostats should be replaced with programmable units with appropriate setbacks for the building's standard occupancy patterns. OE recommends occupied thermostat set points to be no greater than 68°F heating and 78°F cooling with setbacks in unoccupied periods to 55°F cooling and 84°F cooling. In order to be consistent with the thermostat upgrades observed in other Tribal facilities, OE recommends the Honeywell TB822OU Commercial Programmable Thermostat.
- Undercut doors or provide other means of airflow between sections of the interior of the structure in order to increase air flow to all portions of the building. This will tend to alleviate pressure imbalances and service imbalances noted in the structure.
- Existing T12 fluorescent lighting should be replaced with energy efficient T8 lighting with electronic ballasts, exterior lighting should be replaced with LED equivalent and any incandescent bulbs should be replaced with equivalent compact fluorescent lamps.

- Existing backup lighting system should be supplemented with receptacle mounted rechargeable LED flood lights that also function as handheld flashlights. These units are very energy efficient and provide many hours of reliable service on a single charge, and have recently become at a reasonable cost.

Casino Daycare Next Steps

Modeling this structure is not necessary to quantify the savings associated with the suggested measures. Therefore, subsequent work for this structure will include providing specifications and cost evaluations of the recommended measures.

Circling Raven Golf Course Pro Shop (Pro Shop) Initial Findings

Pro Shop Facility Description

The Tribal casino golf course pro shop is a single story, 13,500 square foot building constructed in 2005. This facility is used as retail space, lounge and small deli. The Facility is operated 8:00 am to 4:00 pm, Monday to Friday between November and February, and 7 days per week from March until the end of October.

Figure 61. Circling Raven Golf Course Pro Shop

Pro Shop Building Envelope

The pro shop was constructed using a combination of timber-framed and conventional building methods. This structure has a slab on grade foundation and is sided with wood board and batten siding with a brick façade as a splash guard. The pro shop has a raised seam metal roof with integrated roof drainage systems that discharge to the subsurface. The exterior of the structure was in good condition at the time of the assessment with no apparent damages to exterior elements. The structure has a significant amount of glazing on the east and west sides with nearly a complete glass face at the northeast and southwest entry doors. All windows observed during the field assessment were double paned with metal frames, and in good condition. The main floor of the pro shop has vaulted ceilings while the kitchen and client and office areas have suspended ceilings. Fiberglass batt insulation was noted in the attic and is assumed above the vaulted ceilings. The estimated R-value of the ceiling insulation is R-30. From the vintage of the structure and dimensions of the wall systems, the R-value of the wall insulation is R-19. It is unknown whether the slab-on-grade foundation was insulated at the time of construction.

Pro Shop Heating, Ventilation and Air Conditioning (HVAC)

The pro shop retail area, office areas, and bar/deli are served by a pair of Carrier, Weathermaster series, standard efficiency rooftop packaged heat pump units with cooling capacities of 8.5 tons and heating capacities of 98,000 BTU/hour at 47°F (52,000 BTU/hour at 17°F). These units were manufactured in 2002 and have auxiliary 25 kW heating strips. Both packaged units were equipped with outside air economizers and have rated efficiencies of 8.9 EER and 7.5 HSPF. This does not meet the minimum standard for Energy Star rating (>=11 EER, >-8.0 HSPF). A smaller, Carrier, Weathermaster series, split system heat pump serves the locker rooms. This unit has a rated cooling capacity of 4-tons and heating capacity of 47,000 BTU/hour at 47°F (30,800 BTU/hour at 17°F) with rated efficiencies of 10 SEER and 7.5 HSPF. This does not meet the minimum standard for Energy Star rating (>=14.5 SEER, >-8.2 HSPF) This heat pump is coupled to a Radco air handler located in the attic above the locker rooms. This unit is equipped with a 10 kW auxiliary heat strip. Both of these components were manufactured in 2002. All of the HVAC equipment observed during this assessment was in good condition, however, none of these units are Energy Star rated, therefore at the end of their useful life, we recommend installing Energy Star rated equipment. These systems are controlled by three programmable thermostats. The existing controls are set to be conditioning the building for many more hours than when people are actually present.

Supplemental cooling is provided to the deli kitchen by a pair of 2-ton, Fujitsu, ductless split system air conditioners with rated SEERs of 17.5. This far exceeds Energy Star's minimum standards, therefore are considered energy efficient. The serial numbers on these units indicate that they were manufactured in 2004. These units were in fair condition at the time of the audit, however the exterior units were installed in a location that could restrict proper air flow if vegetation is allowed to continue to grow and storage materials are placed near the units (as seen during the field assessment). Air flow pathways to these units must be maintained in order to ensure proper operations. Additionally, the ground mounted location of these units allows water from the adjacent walk in cooler roof to drain directly onto them. Due to these conditions, maintenance personnel should inspect these systems monthly. Finally, we observed that one of the split system indoor (evaporator) units was located so close to the large kitchen exhaust hood that any cooling it provides is likely immediately entrained in the exhaust stream. This likely dramatically reduces the effective output of this unit.

Figure 62. Kitchen air conditioning condenser units detailing potential impacts due to location

See the attached Observed Equipment Inventory for more information on these systems.

Pro Shop Domestic Hot Water (DHW)

Two, large, commercial Rheem/Ruud natural gas water heaters were observed in the golf course pro shop. One of the heaters serves the kitchen and lounge areas while the other, located in a separate mechanical room, serves the locker room and public restrooms. According to the original manufacturer's nameplate, both of these units are model HE119-199N manufactured in 2002. Both units had evidence that secondary nameplates had been applied and subsequently removed. This brings into question whether these units are actually the 199N units designed for natural gas or the 199LP units designed for propane or Liquid Petroleum. According to the manufacturer's manual for these units:

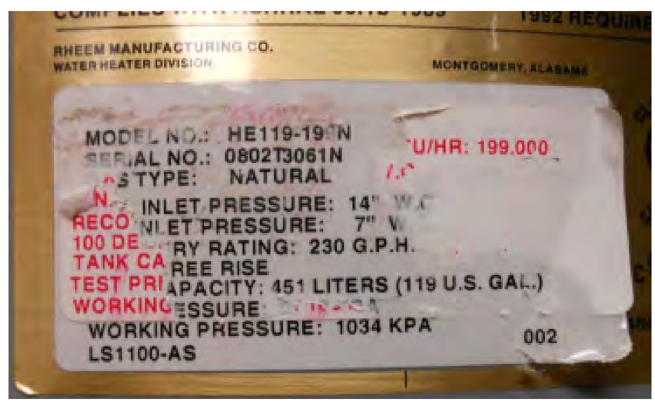


Figure 63. Water heater nameplates showing multiple labels

"Water heaters utilizing Liquefied Petroleum gas (LP) are different from natural gas models. A natural gas heater will not function safely on LP gas and vice versa. No attempt should ever be made to convert a heater from natural gas to LP gas. To avoid possible equipment dam age, personal injury or fire: **DO NOT connect this water heater to a fuel type not in accordance with unit rating plate**. Propane gas is for propane units and natural gas is for natural gas units. These units are not certified for any other type fuel."

Source:http://www.rheem.com/documents/advantageplus-advantageplus-use-and-care-manual-after

Since propane and natural gas are delivered at substantially different line pressures, the combustion air requirements for appliances using one or the other are also substantially different. With older naturally drafting water heaters this did not preclude conversion from one to the other and it was often as simple as changing a small orifice. But particularly with modern super-high efficiency condensing units such as these, the air flow requirements must be very exact in order for the units to function safely and at their rated efficiency. Given the partially removed labels that were applied over the original nameplate stickers, it is frankly unclear exactly which model these particular units are, but it is certain that they are running on propane and not natural gas. It is highly recommended to confirm that these units are the correct appliances for the fuel available.

Both hot water systems were observed to have circulating pumps but no timers and no pipe insulation was observed on either system.

Pro Shop Lighting

There is a mix of fluorescent, halogen, and other incandescent lighting throughout the Pro Shop, office areas, locker rooms, and bar/deli. There is significant glazing area so natural light (day lighting) is fairly effective around the perimeter. Much of the lighting is on dimmer controls and with one exception lighting levels were reported to be generally satisfactory by building staff. However the large central retail area is lit solely by can flood lamps directed up at the dark wood paneled ceiling with no direct down lighting. Despite its relatively high lighting power density this area is very under lit particularly given the retail application of the space. The exterior lighting is provided by energy efficient LED wall sconces.

Pro Shop Plug and Process Loads

The Pro Shop retail area, office areas, locker rooms, and deli all have a normal distribution of standard receptacle loads for their respective occupancy types. The deli kitchen is equipped with a True T-49F reach-in freezer, commercial ice maker and dishwashing equipment. Additionally, a vendor supplied drink cooler was observed. This unit was empty at the time of the assessment, likely due to the suspension of the summer season. When not in use for long periods, this cooler should be unplugged and the door left open. The kitchen's walk-in cooler is located in a site built structure on the exterior of the building. The walk-in cooler condenser unit is located on the ground on the east side of this

Figure 65. Walk-in cooler condenser with frozen expansion valve

Figure 64. Walk-in cooler condenser fins impacted by debris.

structure. As with the kitchen air conditioner condensers described above, this unit is exposed to weather and drainage from the building roof as well as from vegetation and debris from site landscaping. At the time of the assessment, the condenser fins were observed to be extremely dirty and icing on the coils was noted at the expansion valve. This likely indicates issues with the valve. The stovetops, griddle, ovens, and fryer are all propane. This equipment was all observed to be in generally good operating condition with no obvious deficiencies.

Pro Shop Initial Recommendations

OurEvolution has identified the following energy conservation measures and recommendations for the Golf Course Pro Shop:

- Replace all incandescent flood lighting in lounge area to equivalent CFL
- Replace incandescent flood lighting in retail space to LED spots. All fixtures should be installed either in either direct down lighting or direct/indirect (reflected) configurations rather than just pointing up at the ceiling as is currently configured.
- Consider adding “Catalyst” energy management equipment on all packaged heat pumps. This technology controls fan speeds and adds fine economizer tuning which may decrease energy consumption in these units by 30 to 40% (See attached product literature).
- Set programmable thermostats to better reflect occupancy patterns and energy efficiency set points. OE recommends occupied thermostat set points to be no greater than 68°F heating and no less than 78°F cooling with setbacks in unoccupied periods to 55°F heating and 84°F cooling.
- Unplug vendor supplied cooler in the deli kitchen and leave refrigerator doors open when this refrigeration capacity is not necessary.
- Insulate all accessible hot water pipes and insulate cold water inlet pipe to a distance 6’ from the tank
- Have water heaters inspected by qualified technician to ensure that the installed Ruud HE119-199N water heaters are in fact specified for use with the propane fuel with which they are

currently being operated. Should these units be confirmed to be designed for natural gas, they should be replaced with equivalent LP units.

- Provide a minimum of quarterly maintenance on all exterior condenser units.
- Have walk in cooler condenser serviced by trained technician to mitigate icing on coils.

Pro Shop Next Steps

Modeling this structure is not necessary to quantify the savings associated with the suggested measures. Therefore, subsequent work for this structure will include providing specifications and cost evaluations of the recommended measures.

Golf Course Pavilion Initial Findings

Golf Course Pavilion Facility Description

The Golf Course Pavilion is a 4,396 square foot building with a large central meeting area supported by a small catering kitchen, public restrooms, and support areas at its rear. This structure was completed in June of 2008. It has a low slope ceiling that follows the roof line with average ceiling height of approximately 13 feet. The Pavilion's occupancy is sporadic and is mostly used during the summer months for golf related events, weddings or other private or Tribal functions.

Figure 66. Golf Course Pavilion

Golf Course Pavilion Building Envelope

The Pavilion structure is timber framed with a combination of wood-sided and glass walls. The ceiling of this structure is vaulted, so no attic insulation inspection was possible. However, from the vintage of the building and the dimension of the vaulted cavity, we estimate ceiling insulation is R-30. The main meeting area is surrounded by window walls on its north, east, and west sides. Large storefront glazing in these walls has operable transoms above each individual pane for natural ventilation. With the significant amount of glazing on the east and west sides of this structure, and no apparent window coverings, overheating is likely to occur during the summer months. Insulation in exterior walls was inaccessible but, based on vintage and wall dimension, estimated to be R-19. The most distinctive feature of the building envelope is the "green roof," which is made up of a layer of soil approximately 1 foot deep in which is growing a variety of native grasses. It is difficult to express the insulation effectiveness of such a roof system in terms of composite R-value since in addition to thermal resistance it is highly dependent on other factors such as evaporation, reflection, convection, and thermal mass. It likely provides significant insulation value.

Golf Course Pavilion Heating, Ventilation and Air Conditioning (HVAC)

Heating for the Pavilion building meeting area is provided by a series of ten Thermazone Black Body electric resistance radiant heaters suspended from the ceiling over the meeting area. These units have a rated capacity of 2,400-watts each. Heating is controlled by a manually operated non-programmable thermostat. There is no air conditioning system so the only available cooling is provided by an exhaust fan on a manual timer at the rear of the building, in addition to natural ventilation from the transom windows. Building occupants report a general level of dissatisfaction with climate control conditions especially at events during the warmer months when the building sees its greatest use.

See the attached Observed Equipment Inventory for more information on these systems.

Golf Course Pavilion Domestic Hot Water (DHW)

Hot water for the Pavilion is provided by a single A.O. Smith, ProMax, 80-gallon electric water heater with a rated capacity of 4,500 watts. There were no pumps or timers, nor any pipe insulation observed during the field assessment.

Figure 67. Pavillion interior showing suspended lighting and operable transom windows

Golf Course Pavilion Lighting

Interior lighting at the Pavilion is provided by 42-watt, 4-pin, 2-lamp compact fluorescents lamps (CFLs) in suspended parabolic fixtures. These fixtures have dimmable ballasts and are considered high efficiency, however users report that they are unreliable and have been a constant source of trouble ever since their installation. Diagnosis of existing reliability issues with the installed dimmable CFL light fixtures is beyond the scope of this study.

Golf Course Pavilion Plug and Process Loads

The Pavilion kitchen is not designed for food preparation but rather catering support. The main plug loads observed at the Pavilion structure include a True T-49 reach-in cooler and a steam table for food warming. This reach-in cooler is Energy Star rated, however, given the periodic use of the structure, and minimal use of this refrigeration capacity, this unit could be unplugged during periods of non-occupancy.

Golf Course Pavilion Initial Recommendations

OurEvolution has identified the following energy conservation measures and recommendations for the Golf Course Pavilion:

- The existing nonprogrammable thermostats should be replaced with programmable units with appropriate setbacks for the building's standard occupancy patterns. OE recommends occupied thermostat set points to be no greater than 68°F heating and no less than 78°F cooling with setbacks in unoccupied periods to 55°F heating and 84°F cooling. In order to be consistent with the thermostat upgrades observed in other Tribal facilities, OE recommends the Honeywell TB822OU Commercial Programmable Thermostat.
- Unplug (or power-strip) commercial refrigerator when not in use. The shutdown process must include blocking open doors, removing all contents, and emptying condensate tray. 1-2 hours must be given at start up in order to allow the unit to reach a temperature that is safe for food storage.
- Insulate all accessible hot water pipes and insulate cold water inlet pipe to a distance 6' from the tank.
- Install a timer on the water heater that restricts operations during periods of non-use.
- Though not an energy conservation measure, comfort issues associated with lack of cooling capacity appear to be significant. Retrofitting energy efficient cooling capacity should be considered.

Golf Course Pavilion Next Steps

Modeling this structure is not necessary to quantify the savings associated with many of the suggested measures. However, if upgrading the Pavilion to include cooling capacity is considered, a building envelope and systems model will need to be completed. Additional work for this structure will include providing specifications and cost evaluations of the recommended measures.

Tribal Casino Conoco Service Station (Conoco) Initial Findings

Conoco Facility Description

The Conoco facility is an approximately 3,600 square foot structure constructed in 2010. This facility houses a gas station, small retail store and gaming area. This facility is operated 24 hours per day, 7 days per week. This facility is equipped with a large diesel generator for backup power. OE engineers were not provided access this unit during the field assessment.

Figure 68. Tribal Conoco Service Station

Conoco Building Envelope

The Conoco facility is of conventional wood framing construction with a combination of stucco and wood cladding the exterior. This facility was constructed on a concrete, slab-on-grade foundation. This material was in excellent condition at the time of the assessment. The roof of this structure is covered in a membrane roofing system. Though this material was in overall good condition at the time of the assessment, there were several deficiencies observed that will adversely affect the long term condition of roofing materials. A small section of the roof that covers the entrance awning was observed to be holding standing water with no apparent provisions for drainage. Over time, this ponding will deteriorate the roofing material and damage underlayment. Secondly, the rubber pathways used for roof maintenance activities were not properly sealed to the roofing membrane. These pathways were seen to be holding significant bulk water against roofing materials. Over time, this ponding will deteriorate the roofing material and damage underlayment.

Figure 69. Rubber pathway holding water against membrane roofing seams.

Figure 70. Standing water on roof above entry way.

Entry doors and large storefront windows are dual paned with metal frames. Exterior service doors are insulated metal. These doors and windows were observed to be in good condition at the time of the assessment.

The interior walls of the retail and storage and storage areas are finished in drywall and the suspended ceilings are finished with acoustic tiles. The walls of the structure are insulated with fiberglass batt insulation to a level of R-19. Fiberglass batt insulation was above the suspended ceiling between roof rafters. The estimated R-value of this material is R-30. It is unknown whether the slab floor was insulated at the time of construction.

Conoco Heating, Ventilation and Air Conditioning

Heating and cooling at the Conoco facility is provided by a pair of packaged Carrier, Weathermaker™ Series, and roof-top heat pump units. The system serving the main retail and gaming areas was manufactured in 2009 and has a rated cooling capacity of 7.5 tons and heating capacity of 85,000 BTU/hour at 47°F (48,000 BTU/hour at 17°F). Though no auxiliary heating assembly was specified on the nameplate for this unit, it is estimated to have a 25-kW electric resistance heater backup. This unit has rated efficiencies of 11.2 EER and COP at 3.3. This heat pump does meet the minimum requirements for cooling (>=11.0 EER), but does not meet the heating efficiency minimum standard, therefore this unit is not Energy Star rated. This system is equipped with a two-stage compressor. The second system, serving the service areas of the Conoco facility, was manufactured in 2010 has a rated cooling capacity of 3-tons and heating capacity of 35,600 BTU/hour at 47°F (18,200 BTU/hour at 17°F). Though no auxiliary heating assembly was specified on the nameplate for this unit, it is estimated to have a 15-kW electric resistance heater backup. This unit has rated efficiencies of 13.4 SEER and an HSPF of 7.7. These do not meet the minimum standards for Energy Star rating (>= 8.0 HSPF and >=14 SEER). The ducting for these systems is comprised of flexible ducting with integral R-5 insulation located above the suspended ceiling. These materials were in good condition at the time of the assessment. Both of these units are equipped with fresh ventilation air intakes (OSA) and economizer controls and both were in excellent condition at the time of the assessment. These systems are controlled by two programmable thermostats located in the main area of the facility and in the service area. These thermostats were programmed appropriately for the type of occupancy at the facility.

Figure 71. Packaged roof top heat pumps (RTUs).

See the attached Observed Equipment Inventory for more information on the mechanical systems identified during this field effort.

Conoco Domestic Hot Water

Hot water is provided to the Conoco by an 47-gallon, Bradford White, electric resistance water heater. This unit was manufactured in 2010, has a rated capacity of 4,500 watts and is equipped with a circulation pump. Hot water distribution lines located in the rear utility area were observed to be well insulated with recirculation pumps installed. No timers were installed on the recirculation pumps, however since the facility is operated 24 hours per day these are not necessary in this application.

Conoco Lighting

Interior lighting at the Conoco is comprised of energy efficient T-8 linear fluorescent lamps in recessed fixtures. Refrigeration lighting is also T-8. No lighting occupancy sensors were noted during the field assessment. The exterior lighting includes 150-watt metal halide wall packs and 400-watt metal halide parking lot lights. A previous study indicates that “Exterior lighting is very efficient LED (light emitting diode) and controlled by a photocell”. The only place where LED technology appeared to possibly be in operation is under the fuel pump canopy, but due to the location of this lighting, OE engineers were not able to verify that this lighting was in fact LED.

Conoco Plug and Process Loads

The office and retail desk has a normal distribution of office equipment including 4 computer workstations and at least one printer.

In addition to the office equipment, the Conoco is equipped with large, retail fronted, walk-in coolers and freezers. These units are equipped with Bohn, Heatcraft series evaporators coupled to roof-top condensers. The evaporator fins were noted to be in need of maintenance with heavy amounts of dust and debris observed. The freezer condenser was in good condition at the time of the assessment. The cooler condenser was noted to have ice building up on coils near the expansion valve.

See the attached Observed Equipment Inventory for more information on these systems.


Figure 72. Icing noted at expansion valve on cooler condenser.

Conoco Initial Recommendations

OurEvolution has identified the following energy conservation measures and recommendations for the Conoco facility:

- Repair/reconfigure roof drainage above entrance awning.
- Repair walkway path connections to roof top membrane.
- Schedule a service call for the cooler condenser to assess and repair icing observed near expansion valve.
- Replace 150-watt metal halide wall packs to LED equivalent.
- Replace 400-watt metal halide parking lot lighting to LED equivalent.
- Install lighting occupancy sensors in restroom, office and service areas.
- Consider adding “Catalyst” energy management equipment on all packaged heat pumps. This technology controls fan speeds and adds fine economizer tuning which may decrease energy consumption in these units by 30 to 40% (See attached product literature).

Conoco Next Steps

Modeling this structure is not necessary to quantify the savings associated with the suggested measures. Therefore, subsequent work for this structure will include providing specifications and cost evaluations of the recommended measures.

City Link Bus Garage (City Link) Initial Findings

City Link Facility Description

The City Link facility is an approximately 8,000 square foot building constructed in 2012. This facility contains a reception and office area that includes 3 individual offices, a common area with cubicle work stations (~2 workstations), break room kitchen, mechanical room, supply storage and restrooms. In addition to the office area this facility contains two high bay garage areas used to service the City Link bus fleet. This building is typically occupied 7:00 am to 5:00 pm Monday through Friday.

Figure 73. City Link Bus Garage

City Link Building Envelope

The City Link facility is constructed of concrete masonry unit (CMU) walls with a steel trussed roof. This structure was built on a slab-on-grade foundation. The building exterior walls are a combination of stained CMU, and corrugated metal siding. The roof at the City Link facility has a variety of pitches and orientations sections with standing seam metal roofing. The envelope of this structure was in excellent condition at the time of the assessment. The roof system is equipped with full gutter roof drainage systems with subsurface discharge. Windows in this facility are dual paned with metal frames. All of the office windows are operable and were in good condition at the time of the assessment. The main entry foyer is on the south side of the structure and features a large insulated glass façade and full light entry doors. In addition to the business entrance, the south side of this facility contains five large, insulated metal bay doors (~16’x16’). The air seals on the bay doors and on exterior entrance doors were in excellent condition at the time of the assessment. Interior ceilings in the office area are suspended acoustic tiles and the ceilings in the garage areas are vaulted with exposed roof decking.

Fiberglass batt insulation was noted in the ceiling of the office area. This material has an R-value of R-30. This material was in fair condition with significant sagging and gaps noted. The walls in the office have fiberglass insulation with and estimated R-value of R-19. There is a significant amount of south and west facing glass in the offices which can have dramatic effects on the overall insulation value of this space. The exterior walls in the garage area are CMU with no apparent insulation. No ceiling insulation was observable in the garage area but it is likely that there is rigid insulation between the roof deck and standing seam metal roof covering; if so, said rigid insulation likely has a value of R-30.

City Link Heating Ventilation and Air Conditioning (HVAC)

The City Link facility is served by a combination of central and unit heating and cooling systems. The office is heated and cooled by a Carrier, Performance Series™ split system air source heat pump manufactured in 2011. This unit has a rated cooling capacity of 3-tons and heating capacity of 35,400

BTU/hour at 47°F (13,200 BTU/hour at -3°F). This unit has a rated efficiency of 13 SEER and HSPF of 7.7. This does not meet the minimum standards for Energy Star rating (>=14.5 SEER,>=8.2 HSPF). This system is paired with a Carrier condensing gas furnace/air handler that provides auxiliary heating when the heat pump cannot produce adequate heat. This unit was manufactured in 2011, has a rated heating capacity of 80,000 BTU/hour, and a rated efficiency of 95% AFUE which meets Energy Star requirements. Though this unit is specified for use with natural gas, two labels on the air handler cabinet indicates that it was converted from natural gas to propane by Tyco Mechanical at the time of installation. This system appeared to have provisions for fresh air ventilation (OSA) and was in good condition at the time of the assessment. The distribution for this system consists of a combination of rigid metal ducting and flexible ducting with integral R-5 insulation. This material was in good condition at the time of the assessment. This central HVAC system is controlled by a programmable thermostat located in the office area. At the time of the assessment, this thermostat was programmed to provide heating to 69° and cooling to 74°F 24 hours per day, 7 days per week. Office occupants indicated that the office furthest from the air handler (#106) tends to overheat before a comfortable temperature is reached in the common area. This may be due to inadequate return in this office space. A small electric wall heater was noted in the entry foyer of the office. This unit has an estimated power consumption of 1,500 watts. This unit is controlled by an integral, non-programmable thermostat.

Figure 74. Natural gas to propane conversion label.

Work areas in the garage are heated by a combination of heat sources. No cooling is provided in the garage. These systems include a series of four, approximately 30-foot, MP Series, Re-Verber-Ray brand propane, tubular, infrared heaters manufactured in 2011. These units are controlled by individual, nonprogrammable thermostats. Though the nameplates for these units were not accessible due to the installation location, it is estimated that these units have heating capacities of 100,000 BTU/hour each. Additional heating is provided by a Modine Hot Dawg propane unit heater. This unit was manufactured in 2011 and has a rated heating capacity of 100,000 BTU/hour. This unit is controlled by an individual nonprogrammable thermostat. Heat is provided to the eastern portion of the garage by a propane furnace and air handler. Due to the location of this system, no nameplate information could be identified during the field assessment. The estimated heating capacity of this unit is 80,000 BTU/hour. The distribution for this system consists of rigid metal ducting. This unit is controlled by a programmable thermostat located in the east garage. Building occupants indicate that this heater is usually operated manually when needed, as this portion of the garage does not need regular space conditioning.

Four large exhaust fans with automatic louvers control air flow within the garage space. According to building occupants, these fans are operated manually when needed. Additionally, no interlock between the garage doors and any of the heating systems was noted. These interlocks serve to turn off heating when bay doors are open, thus reducing heat loss.

See the attached Observed Equipment Inventory for more information on these systems.

City Link Domestic Hot Water (DHW)

Hot water is provided to the City Link facilities by an 80-gallon, Bradford White, electric resistance water heater. This unit was manufactured in 2011, has a rated capacity of 4,500 watts and is equipped with a circulation pump that is controlled by a timer. No pipe insulation or water heater timers were noted.

City Link Lighting

The interior lighting in the office portion of the City Link facility is provided by energy efficient 4', T-8 linear fluorescent lamps in recessed fixtures. Lighting occupancy sensors were noted in the office restrooms. Shop lighting is provided by high output energy efficient T-5 linear fluorescent lamps in suspended fixtures. Service areas are lit by T-8 linear fluorescent lamps. Exterior lighting is provided by a total of eight, 175-wall, metal halide lamps in wall mounted fixtures. These lights are controlled by a timer.

City Link Plug and Process Loads

Plug and process loads in the City Link facility are primarily standard office equipment including computers (~5 workstations), printers, and copiers, along with kitchen equipment in the break room which includes a small refrigerator, three burner coffee maker and a Hamilton Beach 42-cup, urn-style coffee maker. The three burner coffee maker has an estimated power requirement of 3,600 watts (with all burners operating). The coffee urn has an estimated power requirement of 1000-watts. A Quincy, air compressor serves the garage's pneumatic systems. This unit has a 5 HP, "Watt Saver" electric motor manufactured in 2011 by Leeson Electric. This motor has the capability of providing "soft starts" which reduces the peak power demand for this unit. The pneumatic distribution system is constructed of galvanized metal piping. This material was in excellent condition at the time of the assessment, with no significant leak potential noted. Approximately 5 personal space heaters were observed in the office area. This indicates that the central system serving this area is not providing adequate heating.

Figure 75. Break room coffee makers.

City Link Initial Recommendations

OurEvolution has identified the following energy conservation measures and recommendations for the City Link facility:

- Insulate all accessible hot water pipes as well as the hot water heater cold water inlet pipe to a distance of 6 feet from the tank.
- Undercut doors or provide other means of airflow between sections of the interior offices in order to increase air flow to all portions of the building. This will tend to alleviate pressure imbalances and service imbalances noted in the structure.
- Install insulated window coverings on windows in the office areas.
- Maintain programmable thermostats at 68°F heating and 78°F cooling in occupied mode with setbacks to a maximum of 55°F heating and minimum 84°F cooling.
- Replace exterior metal halide lighting with LED equivalent
- Install lighting occupancy sensors in offices and service areas.
- Replace three burner coffee maker and urn with thermal carafe style coffee maker/storage.
- Install bay door/thermostat interlocks to prevent operation of heating systems when bay doors are open.

City Link Next Steps

Modeling this structure is not necessary to quantify the savings associated with the suggested measures. Therefore, subsequent work for this structure will include providing specifications and cost evaluations of the recommended measures.

Tribal Casino Resort Hotel (Casino) Initial Findings

Figure 76. Coeur d'Alene Casino Resort Hotel Campus. Note: Image does not show the Spa Towers wing or the extensive parking lot now located on the south side of the Casino.

Casino Facility Description

The Casino is an approximately 410,000 multi-story building which includes hotel lodging, a swimming pool, gaming floors, restaurants, an event center, laundry facilities, administrative offices and meeting rooms. The public facilities are open 7 days per week, 24 hours per day while administrative support offices (accounting, human resources, etc.) are occupied Monday through Friday, 7:00 am to 6:00 pm. The original Casino structure (bingo hall [event center] and main casino floor) was constructed in 1997. Subsequent construction includes the addition of the Lottery space in 1999, hotel (75 rooms), pool and offices in 2001, a four-story hotel wing (120 rooms) in 2002 and the recent 2011 opening of the Spa Towers which includes a new hotel wing (33 rooms), restaurant and health spa. In addition to the major construction, the Casino has undergone major remodels to the main entrance foyers and public areas. The hotel facilities have typical occupancies of 87% with spikes to 100% occupancy commonly seen on weekends. The Casino facility employs a staff of highly trained building maintenance and operations engineers that closely monitor and maintain the building systems. Interviews with this staff indicate that they have an ongoing energy management program that strives to optimize the new and existing systems within the facility.

Casino Building Envelope

The several phases of the Casino development utilize varying styles of construction including conventional wood framing, steel framing and roofing, and concrete masonry. The structures are clad with a combination of wood siding, metal siding, wooden shakes, stone facades, and large glass atriums. As with siding, a multitude of roofing types were observed. The central portion of the facility which includes the original gaming floor, restaurant, conference room, event center, employee cafeteria, mechanical rooms, laundry facilities, administrative and support offices has an impermeable membrane roofing system. This roof was in good condition at the time of the assessment. The original hotel structure has a combination of asphalt composite shingles and standing seam metal roofing. These materials were also in good condition. The roof over the recently completed Spa Towers wing is an impermeable membrane roofing system. This roof was in "new" condition. The entire facility is constructed on a slab-on-grade foundation. Though a thorough investigation of all of the attic spaces in the building was not possible, the attic insulation observed was loose fill fiberglass applied to an average depth of 12 inches. This material has an estimated R-value of R-30. Based on interviews with building maintenance and management staff, insulation in the wall systems includes R-19 fiberglass batts.

Casino Heating Ventilation and Air Conditioning (HVAC)

The several phases of development at the Casino facility include a multitude of heating and cooling systems. Due to the sheer quantity of systems, a complete mechanical inventory was not completed and not all equipment was accessible for assessment. The following sections characterize the general nature of the types of systems observed. Specific equipment configuration and zones served are based on initial visual observations of the systems and their relative locations and therefore may not accurately reflect the actual systems configuration.

Figure 77. Large, ground mounted, Aaon packaged chillers and propane furnaces.

The original HVAC systems for the main casino floor and event center include two, 50-ton and one 110-ton AAON ground mounted, packaged chiller/propane furnaces. These units date to the original construction of the main facility. The return air system that serves the 110-ton AAON utilizes an attic space as the return plenum. This space is physically connected to various portions of the Casino floor and event center through penetrations cut in the attic wall systems, which leads to largely uncontrolled return air distribution. Additionally, the attic space is extremely impacted by dust, debris and smoke residue which can be entrained in the return air. Though this air is filtered at the 110-ton AAON unit, this likely puts an undue burden on the filters. Finally, the attic plenum has a large (~6' diameter) exhaust fan that runs continuously with no heat recovery. As part of overall systems optimization, facility engineers have reconfigured the ventilation system that serves the Casino floor to include heat recovery and smoke filtration. According to staff, these systems now provide the majority of the heating load for the Casino floor, however, at the time of the assessment, the large AAON units were operating.

The administrative and support offices, employee cafeteria, mechanical areas and non-public common areas are served by a number of packaged heat pump roof top units (RTUs) manufactured primarily by Carrier. These units range in capacity from 5 to 50 tons. Most of these units are equipped to provide fresh ventilation air and economizer controls.

The original hotel structure common areas and non-smoking facilities are primarily served by three, packaged AAON chiller/propane furnace RTUs. Two of these units have capacities of 26-tons and one has a capacity of 9-tons. These units area equipped to bring in OSA and have economizer controls. No heat recovery systems were observed for these systems. Conference and community rooms are served by a combination of Lennox and Trane packaged RTUs that date from 1995. Heating for the presidential suites common areas in the original hotel structure is provided by a Lennox packaged propane furnace with a capacity of 180,000 BTU/hour manufactured in 2000. The ducting for this unit was noted be compromised with poor air seals and standing water noted. Cooling in these suites is provided by approximately 12, individual split system 1.5-ton air conditioners manufactured by Frigidaire in 2000. These units have a rated efficiency of 10 SEER which does not meet the minimum standard for Energy Star rating (>=14.5 SEER). The air handlers for these units were not accessible during the field assessment, but it is assumed that they are paired with propane furnace/air handlers. All of the equipment detailed in this paragraph was in fair to poor condition with obvious deterioration noted, likely due to age and exposure to the elements in the current uncovered rooftop location.

Figure 78. Impacted duct seals on Lennox that serves Presidential Suites.

In addition to the units described above, three more HVAC systems were noted on the roof adjacent to the 4-story hotel structure. According to staff, these systems serve the common areas of this portion of 4-story hotel. These systems include two split system heat pumps manufactured by Carrier in 2003 and have 1.5-ton cooling capacities 17,500 BTU/hour heating at 47F° (11,500 BTU/hour heating at 47F°). These units are paired with Carrier air handlers with 7 kW auxiliary electric resistance heating element. These units have a rated SEER of 10 and HSPF of 7.0. This does not meet the minimum standards for Energy Star rating (>=14.5 SEER, >=8.2 HSPF). Additional cooling capacity in this area is provided by a Carrier, Gemini Series spilt system air conditioner. This unit has a capacity of 104,000 BTU/hour cooling and a rated efficiency of 10 SEER, which does not meet the minimum standard for Energy Star rating (>=14.5 SEER). The air handler for this unit was not observed during the field assessment.

The indoor pool and spa area have a dedicated central HVAC system that provides 100% OSA. This system includes a Dectron dehumidification unit equipped with heat recovery. The temperature in the spa/pool area was noted to be set at 82°F and it felt excessively warm in this space.

The individual rooms in the "old" hotels facilities (195 rooms) are served by personal terminal air heat pumps (PTHP). Both Amana and Carrier PTHPs were observed in these rooms. The Amana units have capacities of 14,200 BTU/hour cooling and 17,100 BTU/hour heating and are equipped with 5 kW auxiliary heating strips. One of the units was operating when the room was unoccupied during the site assessment. Additionally, the filter on this unit was observed to be heavily soiled and in need of maintenance.

Heating and cooling in the Spa Towers facility is served by a state of the art, built-up central system consisting of a series of 1,000,000 BTU/hour staged Lochinvar propane boilers, paired with variable frequency drive (VFD) chillers equipped with variable frequency drive pumps and Modine air handlers also equipped with VFD fan motors. These systems serve both the common areas and individual rooms through hydronic distribution and variable air volume controls and equipment.

Figure 79. Soiled room PTHP filter in need of maintenance

Casino Domestic and Process Water Heating

Hot water in the original hotel structures is provided by a variety of water heating equipment. This equipment includes a pair of Thermal Solutions, Evolution series propane fired boilers with rated capacities of 1.5 million BTU's per hour each. Additional domestic water heating equipment observed consisted of a series of four 500,000 BTU/hour Lochinvar boilers paired with a large pressure tank. Pool and spa heating are provided by a Jandy boiler and Laars Light2 boilers. The capacities of these units are unknown. As previously noted, the flue pipe for the spa heater was observed to be in a compromised state. Domestic water heating for the Spa Towers facilities are provided by a series of Lochinvar boilers with rated capacities of 800,000 BTU/hour each.

Casino Lighting

Due to the nature of the occupancy and principal uses of the Casino, there is a variety of lighting throughout the facility. Much of this lighting has been selected to produce specific desired effects within the gaming areas and are thus not likely to be replaced for energy efficiency purposes. In addition to the aesthetic lighting, OE observed other types of upgradeable lighting throughout the facility including: T-12 linear fluorescent lamps, incandescent spots, and incandescent bulbs. No occupancy sensors were noted during the field assessment in offices, service areas or other non-public locations.

The largest single opportunity noted with respect to lighting is the parking lot lighting. This lighting includes approximately 400 individual 250-watt metal halide lamps in pole mounted fixture pairs. These lights are controlled by photocells, however, a number of them were observed to be on during the daylight. In addition to the 400 main parking lot lights, there are approximately 80 other pole mounted metal halides in the parking area that serve to light walkways and key portions of the facility.

Casino Plug and Process Loads

The main casino process loads are the approximately 1,800 video gaming machines. According to building staff these machines are equipped with occupancy sensor/timers that allow the machines to move to a "stand-by" mode when they are unused for long periods of time.

The Redtail Bar and Grill contains a pair of 150,000 BTU/hour propane fireplaces. These units are mostly aesthetic in nature as this area is served by a central HVAC system. According to building staff, these units are operated 12 hours per day year round. In addition to the fireplaces, an ornamental glass fire box was noted in the exterior wall of the entry foyer. This unit has a rated capacity of 400,000 BTU/hour. According to staff, this unit is operated approximately 12 hours per day year round. If the use assumptions stated above are correct, at $3 per gallon propane pricing, the combined cost of operating these units is approximately $92,000 per year.

Casino Initial Recommendations

OurEvolution has identified the following energy conservation measures and recommendations for the Casino Resort Hotel facility:

- Reconfigure the 110-ton AAON return air distribution system to cease using the attic plenum and instead install a rigid metal ducting system with return grills at desired locations. Install controlled exhaust and energy recovery on this return system.
- Consider adding "Catalyst" energy management equipment on all packaged heat pumps and air conditioners. This technology controls fan speeds and adds fine economizer tuning which may decrease energy consumption in these units by 30- to 40% (See attached information on the Catalyst system).
- Upgrade parking lot lighting
    - Maintain all photocell controls on existing lighting.
    - Replace 250-watt metal halide lamps with LED equivalent or
        - Install dual level ballasts and occupancy sensors – Dual level ballasts allow the lighting to be reduced during unoccupied periods without actually turning off power to the unit, so when activated by motion, the metal halide will power on immediately.
    - Institute parking lot management controls that would place certain sections of the lot in unoccupied mode where lighting could be controlled by motion sensors or manually.
- Institute management controls that require maintenance and cleaning staff to turn off all PTHPs upon exiting a vacant room.
- Institute management controls that require periodic inspection and cleaning of all PTHP filters.
- Consider reducing the frequency and duration of operating propane fireplaces and aesthetic fire features.
- Complete a separate, in-depth study assessing the viability and options associated with replacing the existing AAON packaged units with one or more built up systems.

Casino Next Steps

Modeling portions of this structure may be necessary in order to quantify and specify energy recovery systems if this recommendation is to be fully considered by the Tribe. Subsequent work for this structure will also include providing specifications and cost evaluations of the recommended measures.

Tribal Housing Authority Maintained Buildings

Tribal Housing Authority (Housing Authority) Initial Findings

Housing Authority Facility Description

The approximately 4,000 square foot Tribal Housing Authority office is a single-story structure built in two phases. The north side of the structure (Phase I) was constructed in 2006 and contains the main entry way, conference room, kitchen, offices and business reception. The south side of the office (Phase II) was constructed in 2009 and added clerestory windows to the main office entryway. This portion of the building contains offices and a large conference room. This facility is occupied Monday through Friday 7:00 am to 6:00 pm. The Tribal Housing Authority Shop was evaluated during a subsequent field visit during March of 2013. The shop is a detached 864 square foot single story building serving as workspace and storage.

Figure 80. Tribal Housing Authority entry.

Housing Authority Building Envelope

Phase I and Phase II of the facility are of conventional wood frame construction, built on a concrete, slab-on-grade foundation. This building is clad in cementitious lap siding and has a pitched attic roof with corrugated metal roofing. The roofing and siding materials were in good condition at the time of the assessment. This facility has a combination of vaulted and suspended acoustic tile ceilings. The Housing Authority building has no roof drainage system therefore water is shed around the entire perimeter of the structure. Though this can lead to moisture impacts in building envelope systems, no damage was observed during the assessment. The windows observed are dual paned in nonmetal frames. These windows were in good working order at the time of the assessment. Entry doors at the north side of the structure are dual paned glass in metal frames. Additional dual paned, metal framed window sidelights are included as part of the entry way door package. Service doors are insulated metal. Weather stripping around exterior doors was observed to be in poor condition.

Figure 81. Displaced attic insulation and damaged HVAC distribution system.

The attic area is insulated with fiberglass insulation which was significantly displaced. The effective R-value in this area is estimated at R-20. The vaulted ceilings are assumed to have fiberglass insulation to a level of R-30. From the dimension of the walls and the vintage of the structure, it is estimated that the walls are insulated with fiberglass batt insulation to a level of R-19. It is unknown whether the slab-on-grade floor was insulated at the time of construction.

The Housing Authority Shop is a separate free standing 864 square foot building with mostly corrugated metal siding and roofing. The shop has R-19 fiberglass batt insulation through much of its interior but with significant gaps in many areas. A one-foot high strip of uninsulated translucent corrugated fiberglass siding runs along the top of the exterior walls and all the way around the Housing Authority shop.

Housing Authority Heating Ventilation and Air Conditioning (HVAC)

The Housing Authority office is equipped with a combination of three central HVAC systems. These systems appear to have provisions to bring in fresh outside air (OSA). Phase I is served by two Carrier Comfort Series split system, air source heat pumps. The first of these units (FC#1) was manufactured in 2006 and has a rated cooling capacity of 3-tons and heating capacity of 34,600 BTU/hour at 47°F (21,000 BTU/hour at 17°F). This unit has a rated efficiency of 13 SEER and an HSPF of 8.1. This does not meet the minimum standards for Energy Star rating (>=14.5 SEER, 8.2 HSPF). This unit is paired with a Carrier air handler with installed auxiliary heating capacity of 10 kW.

The second Phase I system consists of a heat pump (FC#2) also manufactured by Carrier in 2006, and has a rated cooling capacity of 4-tons and rated heating capacity of 41,000 BTU/hour at 47°F (26,600 BTU/hour at 17°F). This unit has a rated efficiency of 13.2 SEER and an HSPF of 8.2. This does not meet the minimum standards for Energy Star rating (>=14.5 SEER, 8.2 HSPF). This unit is paired with a Carrier air handler with installed auxiliary heating capacity of 20 kW.

Both of the Phase I central HVAC systems were in good condition at the time of the assessment, however the filters on both units were extremely dirty and did not appear to have been changed for a long period of time. Additionally, a refrigeration line obstructs the filter access for FC#2, such that there is no way of replacing filters without deforming the new filter.

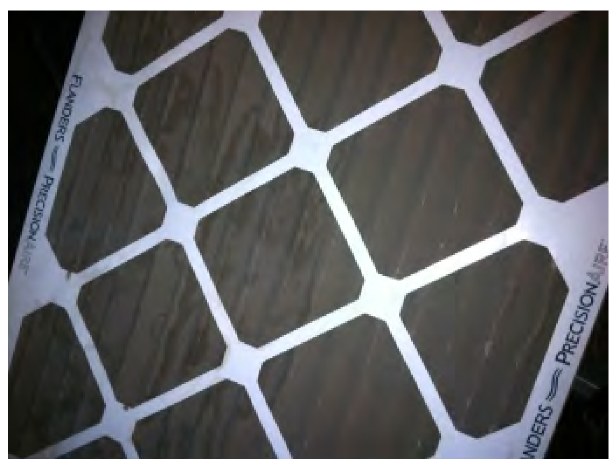


Figure 82. Extremely soiled HVAC air filter.

Phase II cooling is provided by a Rheem, split system air conditioner manufactured in 2009. This unit has a rated cooling capacity of 3-tons and rated efficiency of 13 SEER. This does not meet the minimum standard for Energy Star rating (>=14.5 SEER). This unit is paired with a Rheem air handler/electric furnace designed to service up to 2-tons of cooling. According to a Rheem distributor in Seattle, this mismatch (3-ton condenser with a 2-ton air handler) can lead to freezing in the condenser coils because the air handler does not have adequate capacity. This also has efficiency implications in that not all of the cooling capacity of the air conditioner can be delivered to the conditioned space and is therefore being wasted to the atmosphere. Though no heater package was selected on the nameplate, we estimated that this unit has an electric heating capacity of 15 kW.

In addition to the central systems two other units were observed. One small G.E. packaged (through wall) heat pump was noted in an office. This unit has an estimated cooling capacity of 9,000 BTU/hour and 9,000 BTU/hour heating capacity. A small electric resistance wall heater was noted in the entrance foyer. This unit has an estimated capacity of 2,000 watts. Both of these units are controlled by unit mounted thermostats with no setback controls.

The HVAC distribution system is composed of a combination of rigid metal ducting and flexible ducting with integral R-5 insulation. These materials were in poor condition at the time of the assessment with observations of damaged ducting, deteriorating cloth duct tape noted at connections, and damaged foil tape used at air handler connections (See Figure 91).

The central HVAC systems are controlled by programmable thermostats located in the zones that they serve. These systems were programmed to heat and cool the building to 69°F and 72°F (setbacks to 65°F and 75°F) respectively during the work day Monday through Friday. Saturday and Sunday programming included heating and cooling the building to 65°F and 75°F from 6:00 am to 10:00 pm.

The Housing Authority Shop is heated by a single TPI 5 kW electric unit heater with an unknown date of manufacture.

Housing Authority Domestic Hot Water (DHW)

Domestic hot water in the Housing Authority office is provided by a G.E. electric resistance water heater manufactured in 2005. This unit has a rated capacity of 30 gallons with 4,500 watt heating elements and was in good condition at the time of the assessment. No pipe insulation, pumps or other enhancements were noted.

The Housing Authority Shop has no domestic hot water.

Housing Authority Lighting

Phase I lighting is provided by T-12 linear fluorescent lamps in recessed and surface mounted fixtures. The lighting in Phase II consists mainly of T-8 linear fluorescent lamps in recessed fixtures. Incandescent flood lamps in recessed fixtures and wall mounted fixtures with incandescent bulbs provide exterior lighting. No occupancy sensors were noted during the field assessment.

The Housing Authority Shop has only two 2-lamp, 4-foot T-12 fluorescent light fixtures supplemented by several temporary CFLs in moveable fixtures. The translucent fiberglass siding allows significant daylight into the building.

Housing Authority Plug and Process Loads

Plug and process loads in the Housing Authority office are primarily standard office equipment including computers (~18 workstations), and printers along with kitchen equipment located in the small break room. This equipment includes a 14.4 cubic foot Whirlpool refrigerator. This unit is likely in excess of

15 years old and has likely exceeded its serviceable life. In addition to the refrigerator a cold drink vending machine was observed. This unit had no Vending Miser controls.

Housing Authority Initial Recommendations

OurEvolution has identified the following energy conservation measures and recommendations for the Housing Authority office:

- Replace weather stripping on exterior doors.
- Repair and re-install fiberglass batt insulation in attic area.
- Complete duct leakage testing and repair seams and attachment points with fiberglass tape and mastic approved for use in ducting.
- Upgrade T12 linear fluorescent lighting to T8 lighting
- Replace incandescent flood lighting with CFL equivalent
- Insulate all accessible hot water pipes as well as the hot water heater cold water inlet pipe to a distance of 6 feet from the tank.
- At the end of its serviceable life, replace the existing Rheem air conditioner with an air source heat pump.
- Perform routine HVAC filter changes quarterly.
- Replace refrigerator with Energy Star rated equivalent.
- Install lighting occupancy sensors in restrooms, office, meeting and service areas.
- Set programmable thermostats to better reflect occupancy patterns and energy efficiency set points. OE recommends occupied thermostat set points to be no greater than 68°F heating and no less than 78°F cooling with setbacks in unoccupied periods to 55°F heating and 84°F cooling.
- Evaluate Rheem condenser coils for signs of freezing or other deterioration due to air handler mismatch. See discussion above.
- Install Vending Miser on vending machine (See attached product literature).
- Install timer switch on Shop electric resistance heater

Tribal Housing Authority Next Steps

Modeling this structure is not necessary to quantify the savings associated with the suggested measures. Therefore, subsequent work for this structure will include providing specifications and cost evaluations of the recommended measures.

Senior Housing Complex Initial Findings

Senior Housing Complex Facility Description

The Senior Housing Complex, built in the late 1990s, is an approximately 20,000 square foot single-story structure with 4,200 square feet central common area winged on either side by a total of 20 individual apartments. The common area is open to complex occupants 24 hours per day, 7 days per week.

Figure 83. Senior Housing Complex

Senior Housing Building Envelope

The Senior Housing structure is of conventional wood frame construction with a slab on grade foundation, wood siding with a 3’ -8’ high brick façade, and a standing seam metal roof. Insulation levels are estimated to be R-19 in the walls and R-30 in the roof. It is unknown whether the slab foundation is insulated. Windows throughout are all double paned glass in nonmetal frames. Most exterior doors are insulated metal with large double paned glass areas, with the exception of a few insulated metal security doors to storage or mechanical rooms. The roof includes continuous gutters with a subsurface drainage system that appeared to be in good working order. Interior spaces throughout the complex have cathedral ceilings with heights averaging 15 feet in the common area and corridors and 12 feet in the apartment units. Most elements of the building envelope were observed to be in generally good condition.

Senior Housing Heating Ventilation and Air Conditioning (HVAC)

Heating and cooling for the common area of the Senior Housing complex is provided by a pair of York split heat pump systems each with rated cooling capacity of 4-tons and heating capacity of 47,000 BTU/hour at 47°F (17,700 BTU/hour at -3°F). These units were manufactured in 2005 with and HSPF of 8.0 and EER of 10.5. These units do not meet the cooling efficiency requirements for Energy Star (HSPF>=8.2, EER >= 14.5 for central split heat pumps), therefore these systems are not Energy Star rated. Each of these systems is coupled to one of two York air handlers also manufactured in 2005 and each having primary electric resistance heating capacity estimated to be 20 kW. Neither air handler is equipped with economizers but both do provide for mixing of outside air for ventilation in accordance with the international mechanical code. The air handler located in the mechanical room adjacent to the kitchen

Figure 84. HVAC air handler with missing filter door

had a missing filter access door. This can lead to pressure losses within the system and can entrain unfiltered air in the conditioned air stream. These HVAC systems are controlled by Honeywell programmable thermostats with slightly different settings. The thermostat closest to the kitchen is set to provide heating to 69°F (75°F cooling) from 6 am to 10 pm daily with a night setback of 65°F (78°F cooling). The thermostat behind the television is set to provide heating to 68°F (74°F cooling) from 6 am to 11 pm daily with a night setback of 62°F (78°F cooling).

Building users reported normally having a general level of satisfaction with common area comfort levels. They informed however that during frequent power outages experienced in the winter months, there is no backup heating in either the apartments or the common area; therefore they find themselves quite uncomfortably cold for often extended periods of time. The Senior Housing Complex has propane available for the kitchen but there is no backup generator to run the existing electric heating systems nor any form of propane heat. There is a large gas fireplace one corner of the common area but it reportedly has never been functional despite repeated requests to put it into service.

Each of the individual apartments is equipped with a ComfortStar mini-split ductless heat pump system with a rated cooling capacity of 2-tons and rated heating capacity of 24,000 BTU/hour and estimated heating capacity of 20,000 BTU/hour. Building occupants informed that these systems were never capable of delivering heat during the coldest months and had continuous problems with valves freezing, hence each apartment was later retrofitted with baseboard electric resistance heaters (1,500-watt) with manually operated mechanical thermostats with no timers or setback capabilities.

According to ComfortStar's specifications for the product that was installed, they are only rated to produce useful heat down to outside air temperatures of 19°F, hence it appears that the problem is simply that the selection of this product for the specified application was incorrect for the local climate. There is a good possibility, worth investigating, that these units are simply not fully equipped and that retrofitting the outdoor condenser units with auxiliary 5kW heat strips will bring them up to full functionality down to winter temperatures commonly encountered in Plummer's climate. Alternatively, Mitsubishi offers a similarly sized mini-split heat pumps that are well reviewed and their literature indicates is capable of delivering useful heat down to outside air temperatures as low as -13°F.

Several apartments were observed to have small (presumably 1-ton) window air conditioners. With properly functioning heat pump systems neither these nor the energy inefficient electric baseboard heating units would be necessary except under the most severe weather conditions.

See the attached Observed Equipment Inventory for more information on these systems.

Senior Housing Domestic Hot Water (DHW)

Hot water heating for the restrooms in the Senior Housing common area is provided by a 50-gallon electric tank water heater with 4500-watt heating elements manufactured by A.O. Smith in 2005. No circulation pumps, timers, pipe insulation, or other enhancements were observed. This unit appeared to be in good working order at the time of the assessment.

Hot water for the Senior Housing kitchen is provided by a single 75-gallon propane combustion tank water heater with 80,000 BTU/hour input capacity manufactured by Bradford-White in 1995. No circulation pumps, timers, pipe insulation, or other enhancements were observed. This unit was observed to be in very poor operating condition and due to the fact that it shares a mechanical room with the air handler serving the east end of the common area there is a significant risk of that space being contaminated with carbon monoxide (CO) gas. Each individual apartment has hot water needs met by its own water heater. The one apartment surveyed during this assessment had a 50-gallon electric tank unit by A.O. Smith identical to the one described for the common area restrooms above.

Senior Housing Lighting

Lighting in most of the common area including the restrooms and corridors is provided by recessed incandescent lamps. Due to the high ceilings not all of them were accessible for characterization but many were observed to be either 65 watt or 100 watt "soft-white" lamps. There is substantial south-facing glass for provision of day lighting, therefore much of this lighting is unnecessary during daylight hours. The common area kitchen is lit by 4 foot T8 linear fluorescents. No occupancy sensors, timers, or other controls were observed associated with any lighting systems within the Senior Housing complex.

Exterior lighting around the Senior Housing Complex is high intensity discharge metal halide with estimated 250 watt lamps. Many of these lights were observed to be on during daylight hours at 10am during the assessment. If they are on mechanical timers it is possible that their programming was skewed by the reported frequent power outages.

Senior Housing Plug and Process Loads

The principal plug and process loads in the Senior Housing complex common area are standard commercial kitchen equipment, including upright freezers, a commercial reach-in freezer, and a walk-in cooler with its condenser located on the roof. The entire zone is ventilated by a commercial kitchen exhaust hood over the stove. Supplemental cooling is provided by an evaporative "swamp" cooler, also located on the roof. In addition to the kitchen loads, the common area is equipped with a large chest freezer and vending machine. The chest freezer was locked at the time of the assessment, but from its exterior conditions, we estimate that this unit is in excess of 15 years old. The vending machine provides both cold drinks and dry snack foods. No Vending Miser was observed on this unit.

Senior Housing Initial Recommendations

OurEvolution has identified the following energy conservation measures and recommendations for the Senior Housing Complex:

- Replace all incandescent bulbs in common areas with 23-watt CFLs and in restrooms with 13-watt CFLs.
- Install lighting occupancy sensors in restrooms and hallways.
- Replace the very poor condition propane water heater serving the kitchen with a new, high efficiency, propane water heater. Since these units have sealed combustion chambers with both combustion supply air and flue gases plumbed directly to the outside through PVC pipes, there is no need to provide additional ventilation to the mechanical room and the potential for CO contamination of occupied spaces is eliminated.

- Insulate all accessible hot water pipes as well as the hot water heater cold water inlet pipes to a distance of 6 feet from the tanks.
- Take measures to provide some form of non-electric dependent backup heat for the common area during extended power outages.
- Determine why exterior HID lights are operating during daylight hours and perform necessary repairs to either timers or photocells to ensure that they only operate between sundown and sunrise. If controlled by mechanical timers either institute normal inspection and maintenance after power outages or replace with digital timers with backup batteries to ensure that normal scheduling is uninterrupted.
- Install Vending Miser on vending machine (See attached product literature).
- Assess the potential for retrofitting the existing ductless heating and cooling systems in apartments to perform at local climatic conditions. This may entail nothing more than retrofitting 5 kW heat strips in the condenser units.
- Install filter cover on air handler in mechanical room adjacent to kitchen.

Next Steps

Modeling this structure is not necessary to quantify the savings associated with the suggested measures. Therefore, subsequent work for this structure will include providing specifications and cost evaluations of the recommended measures.

Tribal School Maintained Buildings

New Tribal School Initial Findings

New Tribal School Facility Description

The New Tribal School (School) building, constructed in 1998, is an approximately 42,000 square foot, L-shaped, single-story structure. The ”north” wing, oriented along a northeast/southeast axis, houses primarily classrooms along with the library and administrative offices. The “east” wing, oriented along a northeast/southwest axis, houses the cafeteria kitchen, multipurpose room, gymnasium, and locker rooms. In addition there are two temporary modular structures, of approximately 1,000 square feet each used as classrooms.

Figure 85. Tribal School entry

School Building Envelope

The School structure is of concrete masonry construction with a slab on grade foundation and a pitched standing seam metal roof over truss framing. The roof of this structure appeared to be in good condition at the time of the assessment. All windows are double-paned in nonmetal frames and appeared to be in good operating condition.

Interior walls are finished with drywall and are estimated to have R-13 insulation. It is unknown whether the slab was insulated at the time of construction but no detail calling for it was noted in the construction plans provided. Fiberglass batt insulation with estimated R-value of R-30 was observed in some attic locations however there were significant areas, particularly around retrofitted mechanical components, where insulation had been disturbed or removed. Construction plans provided by school staff indicate R-30 rigid insulation installed between the plywood roof deck and standing seam metal roof throughout the entire building. The attic is vented at the eaves, reducing the net insulating value of the roof insulation, so the net composite R-value for the entire roof system is estimated to be no better than R-30, with some areas likely insulated to far lower values.

The two temporary structures are of conventional modular construction, with wood framed walls and roofs over steel floor framing on raised pier foundations, metal siding, and standing seam metal roofing. Estimated insulation levels are R-13 in the walls, R-19 in the floors, and R-30 in the roofs. Windows are double paned glass in nonmetal frames. Classes were in session so the interior of these portions of the facility were unavailable for observation during this assessment.

School Heating Ventilation and Air Conditioning (HVAC)

Heating for the school is provided by a variety of heat pumps and propane furnace air handlers located either in the attic area above the north wing over the classrooms and office area or the mechanical room above the locker rooms, adjacent to the gymnasium in the east wing. Cooling is provided by a variety of heat pumps and mini-split system condensers located at grade level along the northeast and southwest sides of the north wing. These systems are further characterized below.

There are a total of 15 heating systems located in the attic above the north wing, all Trane high efficiency condensing furnaces. These provide auxiliary heating when outside temperatures are too low for their paired heat pumps (described below) to provide adequate amounts of space conditioning. Ten of these are XR90 models with 56,000 BTU/hour output capacities and annualized fuel utilization efficiency (AFUE) of 92.1; the other five are Trane XR95 models with 57,000 BTU/hour output capacity and AFUE of 93.3. All of these units were manufactured between 2008 and 2010. All of these units furthermore meet Energy Star requirements and are thus Energy Star rated. All of the Trane air handlers appeared to have filters in properly installed and maintained on a regular basis.

Figure 86. Trane propane furnace/air handlers serving classrooms.

The main ducts associated with these systems are predominantly uninsulated rigid metal, except for flexible ducting with integrated R-5 insulation the last few feet where branches are connected to individual ceiling registers. As mentioned previously, though the roof deck is insulated, the eaves are vented so the attic space is not part of the conditioned space. Since the weather was mild during this assessment it is unclear the extent to which temperatures in the attic space fluctuate with outdoor temperatures, hence it is more study would be required in order to estimate the magnitude of energy losses associated with uninsulated ducting.

Figure 87. Furnace #F15 combustion air intake line disconnected

During the initial site assessment in November 2012 OE engineers questioned whether these Trane furnaces, designed for use with natural gas, were properly converted for use with propane fuel as no stamps, decals, or other evidence of such conversion were observed. During a subsequent site assessment in March of 2013 it was discovered that each of the heating units had an opened propane conversion kit containing the original natural gas orifices. These kits contained decals that were supposed to have been dated, initialed, and affixed to the units by the technician after conversion was performed however none of them were applied. It is unknown whether these conversion kits were present during the initial assessment in November however none of them are visible in photographs of the units taken at that time.

The air handlers have large shared outside air (OSA) intakes with economizer controls, however with only a couple of exceptions all the individual air handlers had dampers closed on their OA intakes downstream from the economizers, effectively preventing either fresh air ventilation or the essentially “free” cooling that is provided by installing economizers.

One of the Trane furnace units (F15) was noted to have its PVC combustion air intake line disconnected; it appeared at the time of installation the pipe was primed but never glued. Another unit (F11) was noted to have a duct disconnected from a supply register and appeared to be delivering conditioned supply air directly into the attic space. This not only wastes the output of that duct but also disrupts the balance between supply and return air. This condition creates a negative pressure imbalance in the conditioned space that results in greatly increased rates of infiltration of outside air into the conditioned space wherever leaks in the building envelope exist, such as around poor door and window seals.

Figure 88. Furnace #F11 disconnected duct blowing into attic

Thermostat settings in the classrooms were not evaluated since this assessment was carried out during school hours when students were present.

The mechanical room in the east wing houses two 68,000 BTU/hour propane furnaces, one a Trane XR95 (AFUE=93.3) manufactured in 2009 and the other a Concord 90 Plus which was inaccessible for collection of nameplate data but estimated to have AFUE of 90 or better and to have been manufactured no earlier than 2008. These units both meet Energy Star Requirements and are Energy Star rated.

The east wing mechanical room also houses four large Sterling propane heating systems which serve the larger areas comprising the east wing. These units appear to be original equipment manufactured between 1996 and 1998. Two of these furnaces have 320,000 BTU/hour output capacities for heating and ventilating the gymnasium. A similar unit serves the lunchroom. A single 440,000 BTU/hour output unit provides both heating and makeup air for the kitchen, which also has a 3000 CFM exhaust fan. These units from Sterling are engineered products designed to deliver high rates of ventilation with variable heat output. Combustion efficiency for all these units is estimated to be 80%. These units were originally manufactured for use with propane fuel. None of these older units meet Energy Star requirements nor hold Energy Star ratings.

Figure 89. East wing mechanical room.

Supplemental heating and cooling for the school is provided by a series of 15 Carrier heat pumps all having cooling capacities of 2.5 tons (30,000 BTU/hour heating), SEER of 13, and manufacture dates between 2008 and 2010. Additionally there are several smaller mini-split air conditioning condenser units including: one Carrier 2-ton unit (SEER of 12) manufactured in 1997; one Fujitsu Halcyon 1-ton unit (SEER=13.5) manufactured in 2007, and three Sanyo 1-ton units (SEER=17) manufactured in 2009. Of these systems, only the Carrier heat pumps and the Sanyo mini-split air conditioners meet Energy Star requirements and are thus Energy Star rated. Presumably the 15 Carrier heat pumps are tied to the 15

Trane propane furnaces. It appears that two of the Sanyo mini-split systems have refrigerant lines tied to the two smaller furnaces serving the locker rooms, with the remaining Sanyo and Fujitsu mini-split systems providing supplementary cooling to the office areas through wall mounted ductless evaporators.

The two temporary structures were heated and cooled by one each of the 3-ton Bard wall mounted packaged heat pumps commonly used one these types of buildings. These units were manufactured in 2008 and have SEER of 10.2. They do not meet Energy Star requirements and are not Energy Star rated.

See the attached Observed Equipment Inventory for more information on these systems.

School Domestic Hot Water (DHW)

Hot water heating for the school is provided by a 700,000 BTU/hour passively drafting natural gas boiler manufactured by Weber-Jarco in 1996. That company has since gone out of business and specifications are unavailable but combustion efficiency is presumed to be no greater than 80%. The unit's stated capacity is 636 gallons per hour at 100°F temperature rise. The nameplate states that it is rated for natural gas, with that specification crossed out and "L.P." written in by hand. It is unknown whether necessary conversion of both the burner orifices was implemented in order to ensure that the unit operates at its optimal efficiency but it was verified during a follow-up assessment that the fuel line regulator is rated for propane fuel. It was observed during the assessment that there is significant flame roll-out from the burner area during boiler operation despite what appears to be sufficient provision for makeup combustion air into the mechanical room. Given that the boiler has been in continuous service for 17 years, it is presumed that its efficiency has declined appreciably and that it is approaching the end of its serviceable life. Hot water generated by the boiler is stored in a companion pressure tank with estimated capacity of approximately 700 gallons, also manufactured by Weber-Jarco. This paired system utilizes a 1/3 horsepower single phase centrifugal Burks pump to pressurize the storage tank. A pair of small 1/20 horsepower Grundfos pumps circulates hot water continuously through loops serving the classrooms, locker room, and kitchen. Hot water lines observed in the attic mechanical areas were ¾" copper with approximately 95% covered by ¾" foam pipe insulation. School staff informed that just recently a timer was installed on the circulation pumps and

Figure 90. Boiler nameplate specifies natural gas – unknown whether legitimately retrofitted for propane fuel

that a notable drop in propane use since then has been observed. OE engineers are still awaiting propane billing history data from Interstate Gas in order to verify these savings.

It is unknown whether the two temporary structures have their own DHW systems.

School Lighting

Lighting in the School is provided mainly by energy efficient linear T-8 fluorescents in ceiling mounted fixtures. Some areas have additional compact fluorescent fixtures and a there are just a few incandescent lights in various classrooms. No occupancy sensors were noted in any locations throughout the building. Exterior lighting is provided by metal halide lamps estimated to be 250 watts each, controlled by photocells that appeared to be in good working order as no outdoor lighting was observed to be on during the assessment.

It is assumed that the two temporary buildings have energy efficient T8 lighting.

School Plug and Process Loads

Plug and process loads in the School consist of standard computers and printers averaging one per classroom, approximately 30 computers in the computer lab, and a normal distribution of computers, printers, copiers, and other standard office equipment throughout the administrative offices area.

Significant process loads exist in the cafeteria kitchen, which is equipped with:

- Walk-in cooler with Heatcraft evaporator – with reach-in doors along one side
- Walk-in freezer with Heatcraft evaporator
- True chest reach-in milk cooler
- Steamcraft electric food steamer
- Garland commercial electric stovetop/oven
- Garland electric convection oven
- Duke Aerohot electric steam table
- Lockwood electric food warmer
- Salvajor food waste disposer
- Salvajor commercial dishwasher

Figure 91. Condensation dripping from ceiling in walk-in freezer.

Both the walk-in cooler and walk-in freezer were observed to have significant humidity issues likely attributable to lack of necessary maintenance of cooling fins on the evaporator coils and the location of condenser units. These units were observed mounted within the ceiling in a difficult to access location which likely negatively impacts their ability to reject heat, thus increasing cycling and costs of operation. Additionally, these condensers likely overheat their attic space location which can impact the efficiency of the refrigeration cabinets. The evaporators paired with these condensers were manufactured in 1996 and it is assumed that the condensers are of the same vintage.

School Initial Recommendations

OurEvolution has identified the following energy conservation measures and recommendations for the School:

- Remove from service the propane boiler that is grossly oversized for the small DHW loads that it serves. It can be replaced by a number of options, including but not limited to either a single high efficiency condensing propane water heater more appropriately sized to the load and utilizing the existing distribution network or several smaller electric tank water heaters located much closer to their individual points of use. Further analysis is required in order to determine optimal DHW system sizing and configuration to meet the actual loads of the school.
- Perform maintenance on walk-in cooler and freezer evaporator coils and ensure that fins are cleaned regularly to allow adequate flow.
- Perform required repairs to remediate the humidity problems with the walk-in cooler and walk-in freezer in the cafeteria kitchen.
    - Alternate: Insulate top of freezer and coolers to attempt to thermally isolate the condensers from the refrigeration cabinets.
    - Alternate: Consider replacing walk-in cooler and freezer condensers with roof top mounted units.
- Repair disconnected combustion air intake piping on air handler #F15.
- Either remove and seal the loose duct associated with Trane furnace #F11, or install and connect it to a ceiling register in the zone that system serves so that it is no longer blowing conditioned supply air into the attic.
- Evaluate the performance of the large duct furnace systems serving the east wing to ensure that they are appropriately sized and in satisfactory operating condition. Given their age it is possible that they are approaching the end of their serviceable life, and at such time as major repairs or replacement is required, comprehensive computer based modeling can ensure that the most efficient and cost effective replacement systems are selected.
- Install occupancy sensors in all classrooms, restrooms, and office areas so that lights are automatically shut off in those spaces when they are unoccupied.
- Perform a comprehensive evaluation of all thermostats to ensure that programmed temperatures are appropriate during occupied periods and that appropriate setback temperatures are programmed for periods when zones are unoccupied. OE recommends occupied thermostat set points to be no greater than 68°F heating and no less than 78°F cooling with setbacks in unoccupied periods to 55°F heating and 84°F cooling.

School Next Steps

Modeling this structure is necessary to quantify the savings associated with certain of the suggested measures. Therefore, subsequent work for this structure will include computer modeling in EnergyPro before providing specifications and cost evaluations of the recommended measures.

New Tribal School Bus Garage Initial Findings

New Tribal School Bus Garage Facility Description

The Tribal School Bus Garage consists of two side by side single story high bay structures. The original bus garage is approximately 1,600 square feet and the newer one is approximately 2,800 square feet. The older building is used primarily for storage, with the newer one housing most maintenance equipment. Hours of occupation are sporadic as necessary and the building is generally in an unoccupied state. Only the newer building was available for inspection during this assessment.

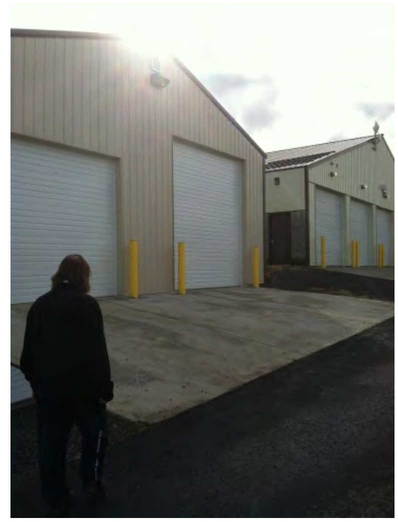


Figure 92. School Bus Garage entrances

New Tribal School Bus Garage Envelope

The Bus Garage is composed of conventional wood frame construction with a slab-on-grade foundation. This building has corrugated metal siding and has a pitched attic roof with raised seam metal roofing. There are no roof drainage systems; therefore water is shed around the entire perimeter of the structures. This can lead to excess moisture buildup at the base of the buildings. Care should be taken to ensure that vegetation and materials are not placed against the side of the building which could lead to moisture being held against building elements eventually leading to damage. The building has no windows. Entry doors and the large overhead bay doors are insulated metal. The exterior walls and the ceiling are clad in taped and sealed but unfinished drywall. It is estimated that walls are insulated to R-13 and the roof to R-30.

New Tribal School Bus Garage Heating Ventilation and Air Conditioning (HVAC)

The Bus Garage has no central HVAC system and no cooling. Heating is provided by a single Cadet electric unit heater with a capacity of 10 kW in the main shop area, and a Cadet electric resistance wall heater with a capacity of 800 watts in the restroom. Both heaters are controlled by manually operated non-programmable mechanical thermostats with no timers or setback capability. It was observed that the heater in the restroom was operating at full capacity during the assessment though no one was present in the building at the time. The shop area has a large exhaust fan on the east wall that is operated by a manual switch. The screen covering over the outside of the fan opening was observed to be compromised with a colony of insects having established a nest within the mechanism.

See the attached Observed Equipment Inventory for more information on these systems.

New Tribal School Bus Garage Domestic Hot Water (DHW)

No hot water system was observed in the Bus Garage.

New Tribal School Bus Garage Lighting

The interior lighting in the Bus Garage facility is provided by energy efficient 4', T-8 linear fluorescent lamps in ceiling mounted fixtures. No occupancy sensors were observed. Exterior lighting is provided by metal halide fixtures with photocell controls that appeared to be in good order at the time of the assessment as no lights were operating during daylight hours.

New Tribal School Bus Garage Plug and Process Loads

The only significant process load in the bus garage is a small shop air compressor that appears to remain unplugged when not in use.

New Tribal School Bus Garage Initial Recommendations

OurEvolution has identified the following energy conservation measures and recommendations for the Tribal School Bus Garage:

- Ensure adequate drainage at grade level to prevent moisture damage attributable to roof runoff.
- Install lighting occupancy sensors.
- Replace photocells on exterior lighting.
- Install timers on both electric resistance heating systems to ensure that they are not operating when the building is unoccupied.
- Repair exhaust fan screen to minimize risk of insect damage to building or the fan itself. Maintain fan louvers to ensure they close when fan is not operating thus minimizing air infiltration and exfiltration.

New Tribal School Bus Garage Next Steps

Modeling this structure is not necessary to quantify the savings associated with the suggested measures. Therefore, subsequent work for this structure will include providing specifications and cost evaluations of the recommended measures.

Tribal Farm Maintained Building

Tribal Farm Shop

Tribal Farm Shop Description

The Food Distribution Warehouse is a 5,000 square foot, high bay shop building that originally constructed in 1975. Approximately 80% of this facility is an open bay service shop for the farm equipment used to operate the Tribe's 6,000 acre farm. The remaining area consists of two offices, conference room, restrooms and break room. A loft above the offices is used for equipment and material storage. This facility is typically occupied from late February to December. In addition to the shop there is a residence on the Tribal Farm property. Due to deteriorating conditions, OE engineers were not granted access to this residence for assessment.

Figure 93. CDA Tribal Farm Complex

Tribal Farm Shop Building Envelope

The Tribal Farm Shop is constructed as a wood pole building with a corrugated metal roof. The exterior of the structure is clad in a combination of metal corrugated siding. This material was in fair condition at the time of the assessment. The entire building sits on an un-insulated above grade concrete slab. A combination fiberglass batt/vinyl vapor barrier was noted in the vaulted ceiling and wall systems. This material likely dates from the original construction of the building and was in a fair to poor condition. The estimated effective R-value of this material is R-9. The large bay doors on this structure are insulated metal. Poor air seals were noted on these doors, which likely allow significant air leakage into the structure. Due to the type of use, the seasonal nature of this building's occupancy and the lack of significant space conditioning in this area, this is not considered a significant opportunity for energy efficiency improvements.

Figure 94. Integrated fiberglass insulation vinyl vapor barrier observed in ceiling and walls.

Tribal Farm Shop Heating, Ventilation and Air Conditioning

The Tribal Farm main shop area is equipped with a PowRMatic, oil-fired unit heater. This unit was manufactured by Pinksburg, Inc. The nameplate on this unit was not legible, therefore system specifications are unknown. Judging by the condition of this unit, it was likely installed in the late 1970s. The capacity of this unit is estimated at 100,000 BTU/hour and is controlled

Figure 95. Unit heater with visible corrosion on flue piping and burners.

by a nonprogrammable thermostat. Building occupants indicate that this heater uses approximately 200 gallons of fuel oil per year. This unit was in poor condition with obvious signs of corrosion on flue piping and burners. At well over thirty years old, this unit has surpassed its serviceable life span.

The offices, break room, conference room and bathrooms are heated with a combination of 5, electric resistance wall heaters. These units have estimated heating capacities of 1,500-watts and are controlled by individual, nonprogrammable thermostats.

See the attached Observed Equipment Inventory for more information on these systems.

Tribal Farm Shop Domestic Hot Water

The Tribal Farm shop is equipped with a single Reliance 50-gallon electric tank water heater with 4500-watt heating elements manufactured in 2006.

Tribal Farm Shop Lighting

Clearwater Power completed a lighting retrofit at the Tribal Farm in 2011. The retrofits included installing high-bay, energy efficient T-5 linear fluorescent lighting in the main shop floor and linear T-8 fluorescent lighting in both recessed and surface mounted fixtures in the offices, break room, restrooms conference room and storage area. Building occupants indicated that they were happy with the lighting in the shop area but were not satisfied with the T-8 lighting due to a persistent flicker. OE engineers assessed one of the T-8 lighting fixtures and noted that it was equipped with a high efficiency electronic ballast, however the fixture examined had not been properly grounded. The building manager was informed that this condition may be the source of the flicker in the T-8 lighting systems.

Tribal Farm Shop Plug and Process Loads

The office area of the building had a normal distribution of office equipment including 2 computer workstations and at least one printer. The main process loads observed and discussed with the building manager include a large, two-stage compressor, 8, 7.5-hp pumps (150 hours/year service) and one 35-hp pump (300 hours/year service). The building manager indicated that the compressor system is rarely used and is turned off when not needed. Due to the size and relatively infrequent use of these pumps further pump testing of these units or applying pump specific energy conservation measures is not likely an economically viable option.

Tribal Farm Shop Initial Recommendations

Given the type of use that this structure receives and the fact that the lighting has recently been upgraded, no significant energy conservation opportunities were identified. Addressing the "flicker" seen in the upgraded T-8 lighting is the highest priority noted. Ensuring the energy efficiency measures are effective and that building occupants are satisfied with retrofits is of paramount importance when completing comprehensive energy conservation upgrades. Dissatisfied occupants may revert systems to older, inefficient technologies that they are familiar with as well as potentially publicizing their dissatisfaction with the improperly functioning energy efficiency technologies they have been exposed to. This can make energy efficiency retrofits difficult to implement in other facilities.

Tribal Development Corporation Maintained Buildings

Benewah Auto Initial Findings

Benewah Auto Facility Description

Benewah Auto is an approximately 1,650 square foot structure constructed in the late 1970s. This facility is used as a gas station, small retail store, small gaming area, parts store room and a 4-bay auto repair and tire shop. This facility is operated 7 days per week from 7:00 am to 10:00 pm.

Figure 96. Benewah Auto entry.

Benewah Auto Building Envelope

Benewah Auto is constructed of uninsulated concrete masonry walls on a slab-on-grade foundation. This structure is clad in wood lap siding on the east and north walls. This material was in fair condition at the time of the assessment. The west side of the structure contains the shop area and has corrugated metal siding. This material was in good condition at the time of the assessment. The south side of the structure has un-sided concrete masonry unit (CMU) walls. This structure has a covered entry way roofed in wood shakes. This material was in fair condition with obvious signs of moss growth and checking. The central structure roof is covered in a membrane roofing system. According to building occupants, this membrane was installed within the past 10 years. Though the membrane appeared to be intact, the underlayment was extremely spongy and appeared to be structurally deficient. Furthermore, due to adverse roof slopes, water drainage on the membrane roof was not allowed to reach the drainage scuppers resulting in standing water and debris on the roof deck. The shop roof is constructed of corrugated metal roofing material in good condition.

The interior of the retail space and storage area is finished in drywall with drywall ceilings. This area of the facility is insulated with fiberglass batt insulation to a level of R-19. The walls are uninsulated. In the conversion process wood wall framing was added and finished with drywall on the inside. The shop walls are insulated on three sides with a combination fiberglass batt/moisture barrier. This material was in poor condition and had and effective R-value of R-9. The remaining wall in the shop is of CMU construction and is uninsulated. The ceiling in the shop area is insulated with a combination of fiberglass batt/moisture barrier. This material was in poor condition and had and effective R-value of R-9. The four large bay doors in the shop area and main retail entrance doors had noticeably poor air seals which allow a significant amount of air leakage to/from the structure.


Figure 97. Carrier packaged air conditioner/electric furnace.

Benewah Auto Heating, Ventilation and Air Conditioning

The Benewah Auto facility has a combination of heating and cooling systems. These systems include two Carrier packaged AC/electric furnaces that serve the retail and parts storage areas. These roof-top-units were manufactured in 1986 and were in poor condition at the time of the assessment with obvious signs of corrosion on heat exchanger fins and shrouding. These units are designed to allow fresh ventilation air (OSA) into the system, however, due to conditions of the RTUs and staining on the ceiling, the amount of OSA entering the structure is questionable. The nameplates on these HVAC units had degraded to a point where very little information could be obtained. Based on the age and style of these RTUs, we estimate that they have cooling capacities of 2-tons and 4-tons with heating capacities of 15 kW and 20 kW respectively. The efficiency of these units is unknown, but 10 SEER is typically the upper range for this vintage. At 27 years old, these units have surpassed their serviceable life span and are definitely not operating at rated efficiencies. The distribution for these to packaged units contains a large amount of roof top ducting. This material was in poor condition at the time of the assessment with obvious signs of deterioration at connection points, therefore duct leakage is likely significant. Additionally, though this ducting may be integrally insulated, at 27 years old, this insulation has likely degraded to a point of inefficacy. The central HVAC systems are controlled by two programmable thermostats set to provide heating to 68°F and cooling to 78°F 24 hours per day, seven days per week with no setbacks.

Figure 98. Rooftop HVAC ducting.

The restroom is heated with a Cadet electric resistance wall heater. This unit has a capacity of 1,500-watts and is controlled by an integral, non-programmable thermostat.

The shop area is heated by a combination of 3, Brasch, ceiling mounted, electric resistance unit heaters. These units were manufactured in 1987 and each has a heating capacity of 10-kW. These unit heaters are controlled by individual manual switches with no type of thermostatic control. No interlocks between the large bay doors and these heaters were noted. These interlocks would prevent the use of these unit heaters when bay doors are open.

See the attached Observed Equipment Inventory for more information on these systems.

Benewah Auto Domestic Hot Water

Hot water heating for the Benewah Auto restroom is provided by a 15-gallon electric tank water heater with a 1500-watt heating element manufactured by A.O. Smith in 1986. No circulation pumps, timers, pipe insulation, or other enhancements were observed. This unit appeared to be in good working order at the time of the assessment but is likely at the end of its useful operating life and replacement with a smaller tank-less flash heater is recommended for this location.

Benewah Auto Lighting

Interior lighting at the Benewah Auto facility is provided mostly by T-12 linear fluorescent lamps. Approximately 2, energy efficient T-8 linear fluorescent lamps were noted in the retail space, however, the building manager indicated that due to the cost of the T-8 lamps, he was switching back to T-12. In addition to the T-12 lighting, the shop area is equipped with a 400-watt metal halide. Exterior lighting in the exterior fueling canopy and sign are provided by T-12 linear fluorescent lamps. In addition to the T-12 lighting, a series of metal halide were noted on the parapets above the store. These lamps did not appear to be functional at the time of the assessment.

Benewah Auto Plug and Process Loads

The office/retail desk has a normal distribution of office equipment including 2 computer workstations and at least one printer. In addition to the office equipment, the retail space is equipped with eight, vendor supplied reach in coolers with glass front doors. The shop area has a normal distribution of shop tools including a tire mounting machine and a Dresser 300 series, 3 HP air compressor that charges the shop's pneumatic systems. This compressor was powered on during the assessment in order to determine if air leakage was a possible issue with this system when it was not under load. No compressor cycling was observed during the assessment therefore, air leakage does not appear to be an issue in the air system.

Benewah Auto Initial Recommendations

OurEvolution has identified the following energy conservation measures and recommendations for the Benewah Auto facility:

-
- Add R-30 rigid insulation to roof deck during roof rehabilitation.
- Replace roof top air-conditioner/heating units with split system air source heat pumps. Air handler will be located on the interior of the structure. Ducting for replacement system should be placed on the building interior. This will likely include exposed, suspended ducting.
- Set programmable thermostats to better reflect occupancy patterns and energy efficiency set points. OE recommends occupied thermostat set points to be no greater than 68°F heating and no less than 78°F cooling with setbacks in unoccupied periods to 55°F heating and 84°F cooling.
- Replace T-12 linear fluorescent lamps and fixtures in retail and storage areas with high efficiency T-8 linear fluorescent lamps with electronic ballasts.
- Replace T-12 linear fluorescent lamps and fixtures and metal halide lamp in shop area with high output T-5 linear fluorescent lamps with electronic ballasts.
- Replace T-12 linear fluorescent lamps and fixtures in exterior canopy with high output T-5 linear fluorescent lamps with electronic ballasts.
- Replace T-12 linear fluorescent lamps and fixtures in sign with T-8 linear fluorescent lamps with electronic ballasts.
- Evaluate the use of propane fuel and upgraded unit heaters equipped with door interlocks in the shop area.
- Install a lighting occupancy sensor in restroom and parts storage area.

- Replace existing old 15-gallon electric tank water heater with a new tank-less electric flash heater.
- Insulate all hot water pipes and cold water inlet pipe to a distance 6 feet from the heater.

Benewah Auto Next Steps

Modeling this structure is necessary to complete evaluation of proposed heating and cooling system upgrades. Additional work for this facility will include providing specifications and cost analyses for the recommended energy conservation measures.

Echelon Plummer Initial Findings

Echelon Plummer Facility Description

Figure 99. Echelon Plummer entry.

The Echelon Plummer building is an approximately 50,000 square foot facility currently being leased by Ground Force, LLC, a company that specializes in producing water tanks for use in heavy construction. This facility is considered a heavy industrial manufacturing plant. This facility has variable occupancy that ranges from two, 10-hour shifts per day to idle depending on production levels.

Echelon Plummer Building Envelope

Figure 100. Damaged ceiling insulation noted on interior of structure.

The Echelon Plummer facility is a high bay, steel structure, clad in corrugated metal siding with a standing seam metal roof. This facility was constructed on a slab-on-grade foundation. The roof and wall systems are insulated with a combination fiberglass batt insulation/vapor barrier. This material was in very poor condition at the time of the assessment with obvious degradation in the form of holes that penetrated the entire building wall system and severely impacted insulation materials. The estimated R-value of the observed insulation is R-3. There is likely no insulation of the slab foundation. The offices located at the southwest portion of the building have additional fiberglass wall and ceiling insulation. The estimated R-value for these materials is R-19 and R-30 respectively.

Echelon Plummer Heating, Ventilation and Air Conditioning (HVAC)

Heating on the main shop floor is provided by a set of 6, Modine "High Efficiency 11", propane unit heaters suspended from the steel roof trusses. These units have a rated heating capacity of 320,000 BTU/hour and efficiency of 80%. The serial number on one of these units indicates that they were manufactured in 2006. The ventilation systems for this facility consists of two, through-wall, approximately 40" exhaust fans that are manually controlled. These units do not provide adequate ventilation air for the type of industry currently occupying the space. Several penetrations in the roof, which had been sealed, appear to have been originally used for ventilation.

The offices and break room located in the southwest portion of the structure are heated by personal space heaters and one window unit air conditioner was noted. A central cooling system was noted in the southeast portion of the structure. It is unclear what zone this system serves. This system includes a Tempstar, split system air conditioner manufactured in 2008 with a rated cooling capacity of 2-tons and efficiency rating of 13 SEER. This does not meet the Energy Star minimum standards (>=14.5 SEER). This unit is paired with a Tempstar air handler, manufactured in 2007 with no apparent heating capacity. These units were in good condition at the time of the assessment. A second, ductless, mini-split heat pump serves a small office area at the southeast portion of the facility. This unit was manufactured by LG and has a rated heating capacity of 11,500 BTU/hour and cooling capacity of 11,500 BTU/hour. This unit has a rated efficiency of 20 SEER. No age or heating efficiency could be determined for this unit.

See the attached Observed Equipment Inventory for more information on these systems.

Echelon Plummer Domestic Hot Water (DHW)

No water heaters were observed at the Echelon Plummer facility.

Echelon Plummer Lighting

The main shop area of the Echelon Plummer facility is lit by energy efficient high-bay T-5 linear fluorescent lamps in suspended fixtures. The office areas are equipped with T-8 linear fluorescent lamps in suspended and recessed fixtures. No occupancy sensors were noted during the field assessment.

Echelon Plummer Plug and Process Loads

The office area of the building had a normal distribution of office equipment including approximately 14 computer workstations. Additionally, the break room was equipped with an 18 cubic foot refrigerator, cold drink vending machine and dry snack vending machine. No Vending Misers were noted on these units.

The Echelon Plummer facility has extensive process loads associated with the type of industrial production that is currently being undertaken there. These loads include cranes, standard machine shop tools, paint drying booths, and maintenance tools. One of the main process loads of note is a large air compressor system that provides air to the production floor and pneumatic system. The core of this system is a Compress Air compressor with a 20 HP, Leeson electric motor. This unit was paired with an approximately 1,000 cubic foot tank. This air distribution system is made of steel with mostly welded seams. Connection points at fittings are threaded and end use points utilize rubber air hoses of varying lengths and ages. This unit was seen to be cycling a significant amount during the field assessment even when the pneumatic system was not being fully utilized. This may indicate that there are leaks within the distribution system. It has been shown that if all leaks in an air system add up to the equivalent of a ¼" diameter hole, energy losses associated with extra compressor cycling can add up to as much as $10,000 per year in facilities running a single shift.

Echelon Plummer Initial Recommendations

OurEvolution has identified the following energy conservation measures and recommendations for the Echelon Plummer facility:

- Complete leak testing of compressed air distribution system.
- Install occupancy sensors in restrooms, offices, break room and meeting areas.
- Install Vending Misers on vending machines (See attached product literature).

Echelon Plummer Next Steps

Modeling this structure is not necessary to quantify the savings associated with the suggested measures. Therefore, subsequent work for this structure will include providing specifications and cost evaluations of the recommended measures.

Benewah Market Initial Findings

Benewah Market Facility Description

Figure 101. Benewah Market entry.

The Benewah Market is an approximately 23,500 square foot single-story structure. The majority of the building is occupied by a grocery store with a full meat department, deli, bakery, and a small gaming area. Approximately 20% of the floor area at the northeast corner is occupied by an Ace Hardware retailer. The Plummer post office is located in a small retail space at the east side of the building. A small office space at the southeast corner is currently unoccupied. Another slightly larger office suite with entry facing south is occupied by the Tribe's Economic Development Corporation. The part of the building housing the hardware store, post office, and private offices is original and the construction date is unknown. The larger part of the building which houses the grocery store was an addition constructed in approximately 1984. The market operates from 7am to 7pm during winter with evening hours extended to 10pm during summer.

Benewah Market Building Envelope


Figure 102. Missing vinyl siding on exterior wall.

The Benewah Market is of conventional wood frame construction built over an uninsulated slab-on-grade foundation. Exterior walls are clad in vinyl siding in fair condition, with entire lengths of siding entirely missing at several locations and notable buildup of moss along the bottom at sidewalk level at many locations. Windows are dual-paned storefront glass in metal frames. Front entry doors are glass in metal frames with automatic openers. Exterior walls are estimated to be insulated to a value of R-19. The roof was observed to have R-30 fiberglass batt insulation with reflective foil backing installed toward the space. Notable gaps in the roof insulation were observed in the back stockroom area where it is exposed with no finished ceiling. The low-slope roof built over wood framing is covered with an impermeable membrane roofing system with an integrated drainage system with subsurface discharge. While the roof membrane appeared to be in good condition with adequate slopes to provide for proper diversion of water to drainage scuppers. During the assessment it was observed that due to accumulation of vegetative debris, the scuppers over the hardware store were blocked, resulting in standing water, several inches deep over nearly half the entire hardware store's total area. Left unattended this condition is certain to lead to early failure of the roof membrane system with serious impacts to the roof framing and finished building areas within. Action was taken at the time of the assessment to clear enough debris to allow the existing accumulation of water to drain but the condition will only reoccur until the roof is properly cleaned and maintained. During a subsequent cold weather visit to the Benewah Market in March 2013 the area of the roof immediately surrounding the Economic Development heat pump was observed to have substantial ice formation beneath the roof membrane, indicative of substantial moisture intrusion. This was further corroborated by evidence of moisture having affected areas of ceiling drywall near HVAC supply registers within the Economic Development conditioned space.

Benewah Market Heating Ventilation and Air Conditioning (HVAC)

Space heating and cooling loads for the Benewah Market are met by a built-up system that has integrated with the direct expansion refrigeration system that meets the store's process cooling loads. Primary heating is provided by electric resistance with support from a heat recovery system that captures waste heat from the refrigeration system. There is provision for outside air with economizer controls although it appeared that the linkage to the economizer had been disconnected. Though the building is only occupied 15 hours or less per day, the HVAC system thermostat is programmed to run hold the building at occupied temperatures 24 hours per day.

Figure 103. Refrigeration heat recovery system serving building HVAC.

Supplemental heating is provided for several areas of the Benewah Market. The stockroom is equipped with three newer Qmark electric unit heaters. Due to their location nameplate data were unavailable but these units are estimated to have capacities of 5 kW each. The thermostat controlling these units is mechanical manually operated with no timer or setback capability and was observed to be poorly calibrated such that the temperature indicators on the unit bore no resemblance to actual room conditions. The vestibule at the front entrance to the market has two 1000 watt Cadet wall heaters installed next to the front entry doors and an air curtain with 9 kW of electric resistance heating capacity is installed across the top of the door from the vestibule into the main market area.

The deli area was formerly cooled by an old evaporative "swamp" cooler that was observed to be in very poor condition and likely has not been serviceable for some time. It was further observed that ceiling opening through which that swamp cooler formerly provided ventilation is still being utilized for makeup air to compensate for room air being exhausted by the commercial kitchen hood in the deli. This hole is completely unobstructed other than by the swamp cooler itself with no register grill, screen, or other provision for filtering the air entering the building at that point. This opening is furthermore located directly above the deli's food preparation area.

The only heat source located in the hardware store is a 5 kW Powerhouse electric unit heater that was not functional at the time of the assessment. There is no cooling provided directly to the hardware store, however as it has an open access to the market it does benefit from both space heating and cooling in the main part of the building via natural convection, at least in the front area near the checkout counter. Occupants reported that during the coldest weather the rear of the hardware store never receives adequate heat.

The private office suites are served by two Ruud packaged heat pumps. The system serving the Economic Development suite was manufactured in 2003 and has capacity of 2.5 tons and auxiliary electric resistance heat estimated to be 7.2 kW, with SEER of 10 and COP of 3.12. The system serving the empty suite was manufactured in 2003 and has capacity of 2 tons and auxiliary electric resistance heat estimated to be 7.2 kW, with SEER of 10 and COP of 3.10.

The Post Office is heated by a new Armstrong Air electric resistance furnace installed within the last year and manufactured in 2011, with heating capacity of 36,000 Btu/hour. The Post Office has a single 1-ton window unit air conditioner mounted in a rear wall that rejects its heat into an interior storage area that can be sealed off from the rest of the space. This is an older unit with manufacture date unknown and an estimated SEER of 10.

Benewah Market Domestic Hot Water (DHW)

Hot water heating for the Benewah Market is provided by an 80-gallon electric tank water heater with 4000-watt heating elements manufactured by A.O. Smith in 2003. This unit has a circulation pump but no timers, pipe insulation, or other enhancements were observed. This unit appeared to be in good working order at the time of the assessment.

Hot water heating for the Economic Development Office is provided by a single Rheem 50-gallon electric tank water heater with 4500-watt elements manufactured in 1998. No pumps, timers, pipe insulation, or other enhancements were observed. This unit appeared to be in good working order at the time of the assessment.

Hot water heating for the empty office suite is provided by a single Richmond 6-gallon electric tank water heater with a 1200-watt element manufactured in 1991. No pumps, timers, pipe insulation, or other enhancements were observed. This unit appeared to be in good working order at the time of the assessment however, it is likely approaching the end of its useful life. If may be feasible to plumb this bathroom to share hot water with a neighboring suite. Otherwise plans should be made for a suitable replacement.

No hot water heater was observed in the Post Office. It appears its restroom may draw its hot water from one of the neighboring suites.

Benewah Market Lighting

Most interior lighting in the Benewah Market is provided by energy efficient T-8 linear fluorescent lamps in recessed fixtures. No lighting occupancy sensors were noted. Display lighting over the produce aisle as well as near the bakery and gaming area is very high efficiency 7.5 and 10 watt LED lamps in track fixtures. Some of the older display coolers have T12 fluorescent lighting inside the cases however several of them have been upgraded to either energy efficient T8 fluorescents or even more efficient LEDs. Metal halide fixtures provide outdoor lighting. The parking area is lit by three, 1,000-watt and another three either 400 or 600-watt lamps. The sidewalk area under the canopy along the front of the market is lit by 24 recessed fixtures with either 150 or 250 watt lamps.

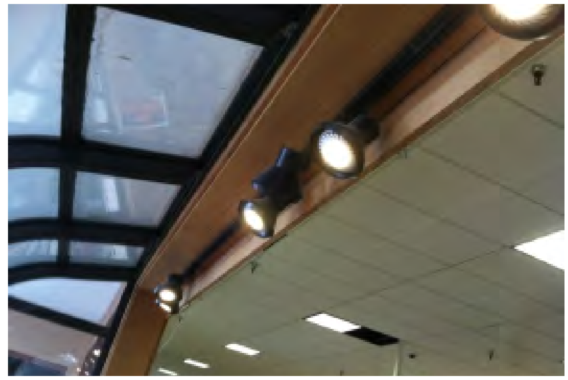


Figure 104. State of the art, extremely energy efficient LED lighting reduces energy costs by 90% compared to incandescent bulbs.

Benewah Market Plug and Process Loads

The Benewah Market has substantial process loads in its complex refrigeration system. An array of 18 compressors provide refrigeration to four walk-in coolers and a walk-in freezer for commercial products as well as a separate walk-in game cooler and walk-in game freezer used for keeping elk, deer and other game processing for private customers completely separate from public food stocks. The bakery also has a smaller walk-in freezer.

Figure 105. Typical icing observed on refrigeration compressors.

The compressor array was observed to have many deficiencies that may affect both performance and energy efficiency. Service records indicate that these aging units are a constant maintenance issue and reliability issues have resulted in significant product loss. Many refrigerant lines and expansion valves were observed to have heavy ice build-up. Thermal analysis of the compressors and associated electrical infrastructure revealed a number of thermal anomalies indicating poor contacts at service panel breakers and overload heaters in the motor starters.

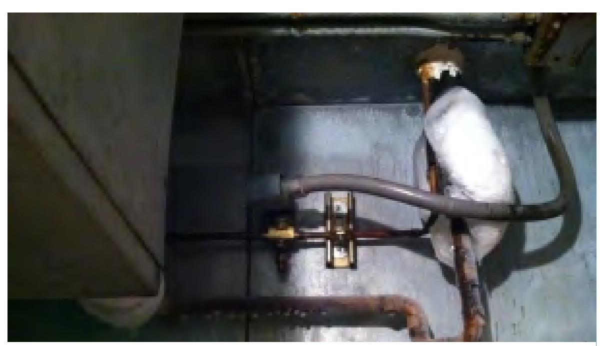


Figure 106. Persistent humidity and ice build-up in game freezer.

Heat rejection from the compressor array is served by staged Larkin commercial condensers. There are two of these modular systems, one made up of 8 individual condenser units and the other of 4.

Walk-in coolers and freezers were observed to have a variety of severe deficiencies. Both the main walk-in freezer and the game freezer were observed to have significant issues with ice buildup attributable to high humidity levels. Facility operators indicated that these problems are intransigent and have been for some time. It is likely that insulation surrounding both freezers is saturated with moisture, severely de-rating its effective R-value. Most walk-in door seals were in poor condition. OE Engineers observed that the fins on evaporator coils in all walk-ins were plugged with debris and in need of maintenance, which is likely a major contributor to observed humidity issues, though not the only one. The condensate drip pan beneath the evaporator in the domestic meat cooler is compromised by corrosion resulting in moisture that drips onto shelves and any product stored beneath it.

The central refrigeration compressor/condenser system also provides refrigeration for a normal array of reach-in low temperature and medium temperature product cases. The existing display cases are well past their serviceable life span (25+ years) in generally poor condition. The open-front dairy display case in particular is reported to have persistent problems with accumulation of condensation on the floor beneath and in front of it.

While refrigerant lines running throughout the store are insulated, deficiencies in this insulation were observed in several locations.

The market has a variety of stand-alone electric reach-in coolers throughout the front of the store and in the deli kitchen. These are of varying age and condition. Several of these are provided by specific vendors for display of their products and in such cases they are generally newer more energy efficient models. The sidewalk outside the front entry has three soft drink vending machines on which no Vending Misers were observed.

Additional process loads include ovens, fryers, grills, and stovetops in the deli and bakery, slot machines in the small gaming area, and computers and other standard office equipment in the manager's booth at the front of the market.

Benewah Market Initial Recommendations

OurEvolution has identified the following energy conservation measures and recommendations for the Benewah Market:

- Repair/replace damaged siding on the exterior of the building.
- Complete lighting retrofit by replacing any remaining T-12 fixtures with new energy efficient T-8 linear fluorescents.
- Replace outdoor metal halide lighting with energy efficient LED equivalent.
- Replace seals on all walk in cooler doors and provide automatic door closers.
- Replace evaporators equipped with electronically commutated motors (ECMs) in all walk-in coolers
- Replace the evaporator's condensate collection pan in the domestic meat cooler.
- Replace existing "series" compressor rack (18 total compressors) with one parallel low temperature rack and one parallel medium temperature rack with integrated controls.
- Replace all refrigeration cabinets with new, high efficiency enclosures with thermostatically controlled defrost and defogging capacity, and high efficiency evaporators. Consider included doors on all floor refrigeration cabinets.
- Install new insulated refrigerant lines.

- Replace existing roof mounted condensers with high efficiency units.
- Insulate all domestic hot water lines.
- Recondition the economizer mechanism on the main air handler to ensure it is able to provide 100% fresh outside air during periods when cooling is called for while outside temperatures are cooler than inside air.
- Insulate all accessible hot water pipes as well as hot water heater cold water inlet pipes to a distance of 6 feet from the tank.
- Institute a program of regular monthly roof maintenance to prevent accumulation of debris that can block the roof drainage system.
- Remove the old evaporative "swamp" cooler over the deli and install an appropriate register and filter system for the makeup air intake inside the deli.
- Replace missing ceiling insulation in the back stockroom area.

Benewah Market Next Steps

Modeling this structure is not necessary to quantify the savings associated with the suggested measures. Therefore, subsequent work for this structure will include providing specifications and cost evaluations of the recommended measures.

Additionally, OE was informed that there may be plans to build a brand new facility for the Benewah Market at some point in the near future. Obviously any such plans must be taken into consideration when considering capital expenditures on recommended energy efficiency measures. Some recommended measures may have sufficiently short payback periods that they are worth carrying out immediately regardless of future plans to move. Other measures may be portable in nature such that they could be incorporated into a new facility at another location. Regardless, OE strongly recommends completing detailed energy efficiency and building performance design review early enough in the planning process to ensure that cost effective measures identified have maximum probability of implementation in any such new construction. It is similarly recommended to perform thorough design review on any plans for repurposing of the existing Benewah Market physical plant.

Benewah Medical Maintained Buildings

New Benewah Medical Center (New BMC) Initial Findings

New BMC Facility Description

The New BMC is an approximately 50,000 square foot, multi-story building which serves as a medical and dental clinic for the entire Tribe and surrounding geographical area. The facility was constructed in 2012 and had only been occupied for a few weeks at the time of this assessment, with crews still at work on landscaping and other finishing details. The New BMC facility employs a staff of highly trained building maintenance and operations engineers that closely monitor and maintain the building systems. Interviews with this staff indicate that they have an ongoing energy management program that strives to optimize the mechanical and energy systems within the facility.

Figure 107. New Benewah Medical Center north facade.

New BMC Building Envelope

The new BMC is of steel frame construction with structural concrete, CMU, and brick façade finish elements to exterior walls and R-19 fiberglass batt insulation installed behind the drywall interior finish. The roof is a metal deck over steel framing with R-30 rigid insulation and an impermeable membrane roof covering. Built on a sloping lot, the foundation is below grade slab with concrete stem walls across the north end where entry to the second floor is at ground level. Construction plans indicate that though the slab itself is not insulated, there is 2-inch rigid insulation on both sides of the perimeter foundation footing extending up to the bottom of the slab on the inside and 6 inches above grade on the outside. All windows in the new BMC are dual-paned in metal frames and in excellent condition. With the exception of a few metal utility doors most entry doors are full light in storefront glass vestibules.

New BMC Heating Ventilation and Air Conditioning (HVAC)

Heating and cooling in the new BMC is served by a state of the art, built-up central system consisting of a pair of 1,000,000 BTU/hour staged Knight condensing propane boilers with rated efficiencies of 92%. These are paired with a 110-ton Carrier packaged chiller with EER of 9.7. The heating water and primary chilled water circulation pumps serving these components are equipped with variable frequency drives that deliver working fluid to variable air volume (VAV) terminal registers to zones throughout the building. Heating and cooling supply air to the VAV registers is delivered by three Temptrol air handlers with capacities totaling approximately 42,000 CFM of which a minimum 7,500 CFM is outside air, with higher OSA flows in economizer mode. Additional building

Figure 108. New BMC Chiller

ventilation is provided by an array of 13 large and small exhaust fans totaling 8,035 cubic feet per minute and running continuously during occupied hours

A collection of six Carrier split system heat pumps with capacities ranging from one to three tons and all having SEER of 13 provide supplementary cooling to zones requiring it, generally associated with high densities of computer based process loads.

New BMC Domestic and Process Water Heating

Domestic hot water for the new BMC is provided by a pair of high capacity electric water heaters with pressure storage tanks manufactured by A.O. Smith. These units employed recirculation pumps with timer controls and pipes were observed to be well insulated.

New BMC Lighting

The vast majority of lighting throughout the new BMC is energy efficient T-8 linear fluorescent lamps in ceiling mounted fixtures. Most zones were observed to have occupancy sensors installed. Exterior lighting is provided by 250-wall metal halides with functional photocells or other control mechanisms in good working order.

New BMC Plug and Process Loads

Plug and process loads throughout the new BMC are consistent with those normally found in medical clinic and medical office spaces, with normal distributions of personal computers, printers, photocopiers, medical equipment, and kitchen equipment in break rooms. Nearly all such equipment observed was new and in many cases Energy Star rated.

New BMC Initial Recommendations

New BMC facility employs a staff of highly trained building maintenance and operations engineers that closely monitor and maintain the building systems. Interviews with this staff indicate that they have an ongoing energy management program that strives to optimize the systems within this brand new facility. Since at the time of the assessment the building had only been operating and occupied for a very short time with no accumulated utility billing history, OE does not have any recommendations for this facility at this time.

Tribal Wellness Center Preliminary Findings

Tribal Wellness Center Facility Description

The Tribal Wellness Center building, constructed in 1997, is an approximately 42,000 square foot structure housing a swimming pool, therapy pool, spa, basketball and racquetball courts, yoga studio, physical therapy clinic, and locker rooms with saunas. The front portion of the building also houses a lobby with a snack bar and along with several offices and two large conference rooms.

Figure 109. Tribal Wellness Center front entry.

Wellness Center Building Envelope

The Wellness Center structure is of concrete masonry construction with a slab on grade foundation and a low slope membrane roof system that drains to a subsurface drainage removal system in good working order. Building operators informed OE engineers that the original roof system was compromised from the time of its original construction and was completely replaced approximately 8 years ago. The existing roof system appeared to be well maintained and in good condition at the time of the assessment with the exception of a single strip of protective walkway membrane that had come loose near the access hatch man-way.

Exterior walls are finished with drywall on the insides and are estimated to have R-13 insulation. It is unknown whether the slab was insulated at the time of construction but no detail calling for it was noted in the construction plans provided. The roof is estimated to have integrated R-30 rigid insulation. All windows are double-paned in metal frames and appeared to be in good operating condition. With the exception of approximately two insulated metal security doors all entry doors are swinging glass doors in metal frames. The front entry has a vestibule with inner doors observed to blocked open during mild conditions at the time of the assessment but it is assumed they are allowed to close during harsher winter weather conditions.

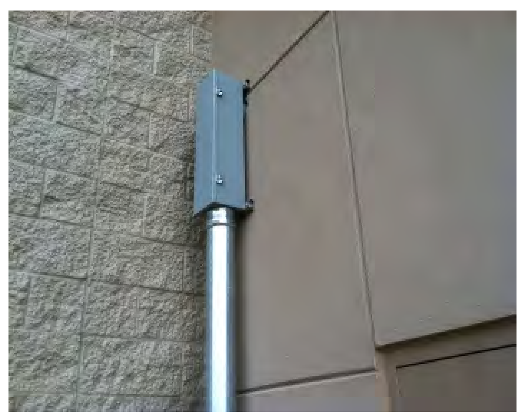


Figure 110. Exterior wall penetration with very poor seal.

An electrical penetration at the north side of the building near the snack bar was observed to have been very poorly sealed such that it creates an opportunity not only for air infiltration but also moisture intrusion and potentially pest infestation.

Wellness Center Heating Ventilation and Air Conditioning (HVAC)

Heating for the Wellness Center is provided by an array of ten York packaged heat pump roof top units (RTUs) ranging in capacities from 3 to 10 tons. Half of these are from original construction, manufactured in 1997 and having SEER of 10, except for the one 10-ton unit which has heating COP of 2 and cooling EER of 9. Of the other five units, one was replaced with a 13 SEER York packaged heat pump manufactured in 2009; and the other four were replaced with 13 SEER York packaged heat pumps manufactured in 2012. Most but not all of the packaged heat pumps have provision for mixing of outside air. All of the newer units appear to have economizers in good working order. Many of the older units appear to have had economizers that were taken out of service due to reliability issues, as evidenced by motors and various other parts lying about in the outside air intake. In addition some of the older units were observed to have severely compromised seals along the small part of their duct systems accessible at the rooftop (see photos).

Figure 112. Packaged Heat Pump RTUs.

Figure 111. Older York heat pump with economizer disabled

A single 2.5 ton York split heat pump system with SEER of 10 serves a small upstairs office behind the basketball court at the northeast corner of the building, with its air handler stuck in a small closet that is difficult to access. This system appeared to be somewhat neglected with a very dirty filter. Since there was a case of replacement filters found in the closet where the air handler is located OE engineers took it upon themselves to change the filter during the assessment.

Figure 113. Older York heat pump with compromised duct seals.

The swimming pool zones have 100% outside air provided by Dectron roof mounted energy recovery systems that control temperature and humidity. These systems have both heating and cooling modes similar to heat pumps. Warm humid air passes through dehumidifying coils and is cooled below the dew point, thereby condensing moisture. The heat from that process is captured by the system and can be combined with heat from compressor power consumption and recycled back into the air stream for space heating, along with supplementary heat from an integrated electric resistance duct heater when necessary. The units are also capable of rejecting heat to an air cooled condenser, which results in space cooling when called for. Both Dectron units serving the main swimming pool and smaller therapy pool appeared to be in good working order; however it should be noted that they are over 15 years old and thus likely approaching the end of their serviceable lives. Further assessment by qualified professionals intimately familiar with their particular characteristics is required in order to determine their actual condition and make recommendations for service or eventual replacement. Several heavy rubber floor mats were observed to be stacked on top of the ducting of the Dectron unit serving the main pool, creating a depression on top of the ducting that holds water and promotes accumulation of debris and growth of algae and potentially mold. This duct system was furthermore observed to be compromised such that it would benefit from thorough stripping of all joints followed by re-sealing with fresh fiberglass tape and mastic.

Figure 114. Dectron Pool Energy Recovery Units

Figure 115. Rubber mats piled on top of Dectron duct

Figure 116. Dectron duct system in need of air sealing

HVAC systems throughout the Wellness Center are controlled by a Johnson Controls DDC system. OE Engineers did not have the opportunity to observe this system but were informed that it may be programmed to operate the building in occupied mode 24 hours per day 7 days per week.

Exhaust fans are set to operate continuously serving zones throughout the Wellness Center including the basketball court, fitness areas, locker rooms, and pools.

See the attached Observed Equipment Inventory for more information on these systems

Wellness Center Domestic Hot Water (DHW)

A pair of identical Rheem Ruud Commercial electric tank water heaters was observed in the laundry area. Both of these units were manufactured in 1998 with capacities of 119 gallons and 24 kW elements. These units have rated recovery of 147 gallons per hour at 70°F temperature rise. Both hot and cold water pipes associated with these units were observed to be well insulated. These units are equipped with a recirculation pump that appears to run continuously. No timers or other enhancements associated with these units were observed. It appears that these two units provide DHW for the showers in both locker rooms in addition to serving the laundry area in which they are located.

A small utility closet at the northeast corner has a small Rheem electric tank water heater with capacity of 6 gallons and a 2,000 watt heating element, but staff indicated this unit has not been operable for many years, and having limited usefulness no replacement is anticipated. No pumps, timers, pipe insulation, or any other enhancements were observed on this unit.

No water heater for providing DHW to the break room kitchen near the conference rooms and restrooms at the front of the building was observed and it is assumed that they share hot water from the large tank heaters at the rear of the building.

Wellness Center Lighting

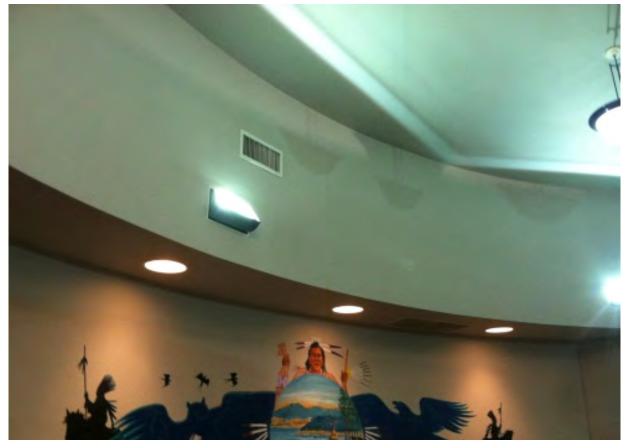


Figure 117. Diverse array of lighting systems at reception area/snack bar

Lighting throughout most of the Wellness Center is provided mainly by energy efficient linear T-8 fluorescents in ceiling mounted fixtures. The basketball court is lit by a mix of fifteen 6-lamp 4-foot energy efficient high output T-5 lamps in addition to a dozen older 2-lamp T-12 fixtures. The yoga studio and a few other small zones were observed to have CFL lamps in recessed cans. The conference rooms have a mix of dimmable incandescent lamps in recessed cans as well as ceiling mounted high output energy efficient T5 fluorescents. The reception/snack bar area is lit by a mix of incandescent lamps in recessed fixtures, suspended pendant fixtures with unknown lamps, and seven indirect wall mounted metal halide lamps with 250 watt ballasts located in the nearby IT server room.

No occupancy sensors were observed, and lighting throughout most of the facility was noted to be operational during the assessment regardless of whether or not zones were occupied or otherwise being used.

Exterior lighting was observed to be by metal halide fixtures with remote ballasts located in mechanical rooms within the building, including ten 1000 watt and seven 250 watt units. No exterior lighting was observed to be operating during daylight hours so it is assumed they are on either photocells or timers in good working condition.

Wellness Center Plug and Process Loads

The main process loads in the Wellness center are water heating for the main pool, therapy pool, wading pool, spa, and two steam rooms. An array of Coates swimming pool and spa heaters with varying capacities provide heating for these loads, including two 45 kW units, two 36 kW units, and a 24 kW unit, for a total of 186 kW of process water heating capacity.

Figure 118. Spa air pump with significant corrosion.

In addition to process heating for the pools, spa, and steam rooms, there is significant pumping associated with those features as well. Pumps observed include the main 7.5 hp pool pump along with five smaller air pumps and filtration pumps ranging from ½ to 2.25 hp. Most of these pumps appear to have been in service for some time thus it is assumed they are likely original from the time of construction. Particularly in harsh conditions such as those in which pool chemicals are present, pump impellers and associated hardware are subject to wear that reduces overall pump efficiency in an exponential manner; that is to say efficiency declines slowly over the first few years but at a certain point, usually between 5 and 7 years running several thousand hours per year after a pump is placed into service, its performance will begin to drop off dramatically. Overall pump efficiency (OPE) is a function of motor efficiency times pump impeller efficiency. For new premium efficiency equipment OPE is generally on the order of 70%. It is common to see this figure degrade to 50% or even substantially lower over the course of a few years depending on the duty to which the pump is dedicated. If the 7.5 hp pump observed here operates continuously during hours the pool is open, then it runs a minimum of 3,000 hours per year.

In addition to steam rooms assumed to be served by one of the Coates pool heaters, the locker rooms are equipped with saunas each served by 7.5 kW electric resistance infrared heaters. The sauna in the men's' locker room was observed to have a door with essentially no seal or latch such that it leaked a great deal of its heat into the locker room. It was further noted that at its highest setting it was difficult to get the sauna up to and maintain desired temperatures due to heat loss through the leaky door.

Figure 119. Gym PA audio system consumes 1250 watts "always on".

Other process loads in the Wellness Center include:

- A pro audio music amplification and public address system in the utility room adjacent to the basketball court. This system draws approximately 1,250 watts continuously and appeared to be maintained in a powered up condition.
- A server room with various computer and communications devices estimated to total approximately 5 kW in total load.
- A second complex high powered audio system also located in the server room, also assumed to be "always on."
- Standard kitchen equipment including a refrigerator, electric stove/oven, microwave and coffee maker in the break room.
- A microwave, two reach-in coolers with glass doors, and other associated food service equipment located in the snack bar.
- Towel warmers in the physical therapy unit.
- 2 Whirlpool Duet front loading washing machines and one matching dryer. Dryer exhaust is routed up through the roof and was observed to be obstructed at the time of the assessment.
- A normal distribution of computers, printers, and photocopiers throughout the front office areas, as well as two computers in the physical therapy clinic and one each at the snack bar and weight room help desk.

Wellness Center Initial Recommendations

OurEvolution has identified the following energy conservation measures and recommendations for the Wellness Center:

- Consider adding "Catalyst" energy management equipment on all packaged heat pumps. This technology controls fan speeds and adds fine economizer tuning which may decrease energy consumption in these units by 30 to 40% (See attached product literature).

- Comprehensive evaluation of the facility's HVAC DDC control system to ensure that it is only heating and cooling spaces during occupied hours and that appropriate schedules and temperature setbacks are observed.
- Develop an energy management protocol for the two audio systems, either by installing a timers or manually shutting them down when not in use. If left on continuously the gymnasium PA system costs approximately $3 per day or over $1000 per year even though it is likely only being used a small fraction of that time.
- Install new seals and latching hardware on sauna doors.
- Install new seals around steam room doors.
- Comprehensive evaluation by qualified technicians to assess the condition and projected serviceable life left in Dectron pool area dehumidification and temperature control systems.
- If not replaced, then recondition all exterior elements of Dectron duct system by stripping away old duct joint seals and applying new seals with approved fiberglass tape and mastic. Remove rubber floor mats currently stacked atop ducts and always keep this area clear.
- Install occupancy sensors in offices, and conference rooms to turn off lights when no people are present.
- Train staff to turn off lights in basketball courts when not being used.
- Ensure dryer vent outlet at rooftop is cleaned on a regular basis to eliminate obstructions. Consider moving dryer to location near exterior wall so that exhaust can be routed outdoors without having to go straight up 20+ feet.
- Replace all incandescent lighting in recessed cans with CFL or LED flood lamps.
- Replace metal halide exterior lighting with LED equivalent.
- Replace metal halide lamps in fixtures around reception rotunda with LED spots.
- Install timers on all domestic hot water heaters as well as circulation pumps so they are neither heating nor circulating hot water during unoccupied hours.
- Insulate all hot water pipes as well as cold water inlet pipes to a distance 6 feet from the tank at the small water heaters located in the janitor's closet and break room.
- Evaluate replacing aging circulation pumps.

Wellness Center Next Steps

Modeling this structure is not necessary to quantify the savings associated with the suggested measures. Therefore, subsequent work for this structure will include providing specifications and cost evaluations of the recommended measures.

EEFS SECTION III – COEUR D'ALENE TRIBAL BUILDINGS – UTILITIES BILLING ANALYSES REPORT

Utilities Billing Analyses Report - Introduction

The purpose of this memorandum is to summarize the existing energy use characteristics of buildings operated by the Coeur d'Alene Tribe in Plummer, Worley, Tensed, and DeSmet, Idaho, as determined by evaluation of their associated utility billings. Historical utility billing data were compiled and the following metrics were calculated for each building:

1) **Energy Use Index (EUI)** – Energy Use Index is defined as the average annual energy use per square foot of building area. This metric is used to quantify the energy usage "density" of a structure.
2) **Benchmarking** – In order to assess the energy usage of each structure, relative to similar structure within the same climate zone, the EUI for each structure was "benchmarked" with the average energy use for similar buildings as characterized by the 2005 U.S. Energy Information Administration (EIA) Residential Energy Consumption Survey (RECS) and Commercial Building Energy Consumption Survey (CBECS) for the northern Idaho climate zone.
3) **Totals Monthly Energy Consumption Profile** – This metric provides a graphic view of the energy usage of a building and is helpful in determining energy usage patterns and seasonal effects on energy usage.
4) **Energy Consumption Base Load (base load)** – The base load is defined as the average energy usage of a building during non-heating and non-cooling dominated periods of the year (typically spring and fall). The base load is generally composed of "year-around" energy loads including: lighting, refrigeration, water heating and plug loads.
5) **Energy Rate Analysis** – The total energy cost divided by the total energy consumed returns a metric that provides a means to compare overall energy rates across all buildings.

Energy Consumption Data Analysis

Methodology

All buildings covered in this analysis have electric service provided by one of three power companies: Plummer Public Utility District (PPUD), Kootenai Electric Company (KEC), or Clearwater Power Company (CPC). Buildings that use propane for space heating, domestic hot water, or other process heating loads have propane provided by Interstate Gas.

Typically, three years of data provides the most accurate base for energy consumption analyses. Therefore attempts were made to obtain a minimum of three years of historical billing data for both gas and electricity from the utilities mentioned above for each of the subject buildings.

Annual propane and electrical energy use were calculated from the total of a 12-month representative sample taken by averaging available historical data from each building. These figures were then converted to BTU source energy and divided by the conditioned floor area of each building in order to calculate the Energy Use Index in kBTU/ft^2/yr. Similarly, the sum of annual gas and electrical energy costs was divided by the area of each building to calculate the Energy Cost Index in dollars per square foot. The Energy Use Index for each building was compared to the average CBECS Energy Use Index benchmark for the northern Idaho climate zone, with differences expressed numerically in kBTU/ft^2/yr and as a percentage. Nominal rate analysis was performed to quantify the nominal cost in dollars per kWh for electricity and per kBtu for total energy consumption. Finally, the monthly energy usage profile and associated base loads for each building were determined. Application of these various metrics provides several means of comparing buildings, including energy use patterns, energy rates, etc. Results of these calculations are discussed in the following sections. Figure 120 provides a simple means to compare each building's actual energy intensity to their respective benchmarks.

Table 3 provides a summary of the key energy intensity and cost metrics for each building evaluated.

Table 3. Summary of Energy Use Indices

Building	Electric Utility	Conditioned Floor Area	Annual Electrical Consumption (kWh)	Annual Propane Consumption (gallons)	Annual Energy Cost ($)	SITE EUI (kBtu/sf/yr)	SOURCE EUI (kBtu/sf/yr)	ECI ($/sf/yr)	CBECS Benchmark	Virtual Rate $/kBtu	Benchmark Delta (%)
Natural Resources	KEC	9,600	2,186		$ 358	0.08	2.3	$ 0.04	97.8	$ 0.513	-98%
Tribal Farm	CLEARWATER	5,000	15,319		$ 1,903	10.5	31.6	$ 0.38	70.0	$ 0.036	-55%
Golf Course Pavilion	KEC	4,396	16,662		$ 1,462	24.7	49.1	$ 0.48	60.9	$ 0.019	-19%
City Link Bus Garage	KEC	8,000	51,673		$ 4,151	22.1	66.5	$ 0.52	70.0	$ 0.024	-5%
Tribal Headquarters	PLUMMER	13,500	94,184		$ 8,900	23.8	71.9	$ 0.66	85.8	$ 0.028	-16%
BIA	PLUMMER	1,046	7,349		$ 847	24.0	72.4	$ 0.81	97.8	$ 0.034	-26%
Camp Larson	KEC	1,200	10,301		$ 2,002	60.3	88.4	$ 1.98	94.4	$ 0.033	-6%
New Tribal School	CLEARWATER	44,000	312,061	12,887	$ 50,372	52.2	99.7	$ 1.14	72.9	$ 0.022	37%
Youth Shelter	PLUMMER	5,000	32,814		$ 2,819	22.4	105.6	$ 0.88	93.9	$ 0.039	13%
Facilities	KEC	6,250	67,440		$ 5,066	42.8	111.1	$ 0.85	70.0	$ 0.020	59%
Rose Creek Longhouse	KEC	8,410	51,673	5,789	$ 16,190	85.5	124.5	$ 1.82	96.0	$ 0.021	30%
Finance	PLUMMER	3,600	45,429		$ 4,030	43.1	130.0	$ 1.12	97.8	$ 0.026	33%
Roads Maintenance (old)	PLUMMER	2,200	32,814		$ 2,819	67.8	153.6	$ 1.39	70.0	$ 0.020	119%
Career Renewal & Child Services	PLUMMER	2,400	36,813		$ 3,088	52.4	158.0	$ 1.29	97.8	$ 0.025	62%
Felix Aripa	KEC	7,480	115,670		$ 8,953	52.8	159.3	$ 1.20	97.8	$ 0.023	63%
Desmet Longhouse	KEC	8,250	125,613	524	$ 15,611	58.0	162.6	$ 1.89	96.0	$ 0.033	69%
Tribal Court Services	PLUMMER	7,492	118,535		$ 7,631	54.0	163.0	$ 1.02	97.8	$ 0.019	67%
Echelon Plummer	KEC	50,000	817,460		$ 47,602	55.8	168.4	$ 0.95	75.2	$ 0.017	124%
ECLC	KEC	19,000	333,733		$ 22,826	61.9	180.9	$ 1.21	122.2	$ 0.020	48%
Fire Warehouse	PLUMMER	2,700	57,016		$ 4,618	69.7	210.4	$ 1.65	97.4	$ 0.024	116%
Housing Authority	PLUMMER	4,000	84,057		$ 6,413	71.7	216.4	$ 1.60	97.8	$ 0.022	121%
Food Distribution	KEC	4,800	117,853		$ 9,232	83.8	252.9	$ 1.92	47.0	$ 0.023	438%
Veterans' Center	KEC	2,230	57,813		$ 5,118	105.2	267.0	$ 2.41	147.7	$ 0.023	81%
Education	PLUMMER	3,600	94,360		$ 5,908	89.5	270.0	$ 1.64	97.8	$ 0.018	176%
New Tribal School Bus Garage	CLEARWATER	1,600	27,510		$ 2,699	192.3	304.4	$ 5.10	70.0	$ 0.027	335%
Fire Shop	PLUMMER	1,800	49,964		$ 4,170	104.6	315.6	$ 2.47	97.4	$ 0.024	224%
Senior Housing	KEC	4,200	123,365	1,214	$ 12,314	127.8	329.0	$ 2.93	60.0	$ 0.023	448%
Golf Course Pro Shop	KEC	13,500	435,160	208	$ 3,427	114.3	333.4	$ 0.27	72.6	$ 0.002	359%
Casino	KEC	410,000	9,564,816	440,505	$ 1,554,476	182.2	338.1	$ 3.79	128.0	$ 0.021	164%
Old Benewah Medical Center	PLUMMER	13,800	488,848		$ 24,472	120.9	364.9	$ 1.77	167.6	$ 0.015	118%
Wellness Center	PLUMMER	42,000	1,499,392		$ 67,636	121.8	367.7	$ 1.61	107.3	$ 0.013	243%
Police Headquarters	PLUMMER	1,800	66,582	208	$ 5,777	121.8	391.5	$ 1.61	97.4	$ 0.013	302%
Benewah Market	PLUMMER	22,000	1,120,000	0	$ 48,684	81.1	524.4	$ 2.10	230.7	$ 0.026	127%
Social Services	PLUMMER	1,200	73,232		$ 5,849	208.3	628.6	$ 4.87	97.8	$ 0.023	543%
IT Building	PLUMMER	7,455	480,403		$ 846	99.3	663.7	$ 0.11	213.8	$ 0.001	210%
Casino Conoco	KEC	3,600	276,373		$ 19,201	272.4	790.7	$ 5.40	210.4	$ 0.020	276%
Benewah Auto	PLUMMER	1,650	303,490	0	$ 14,964	627.8	1,894.5	$ 9.07	210.4	$ 0.014	801%

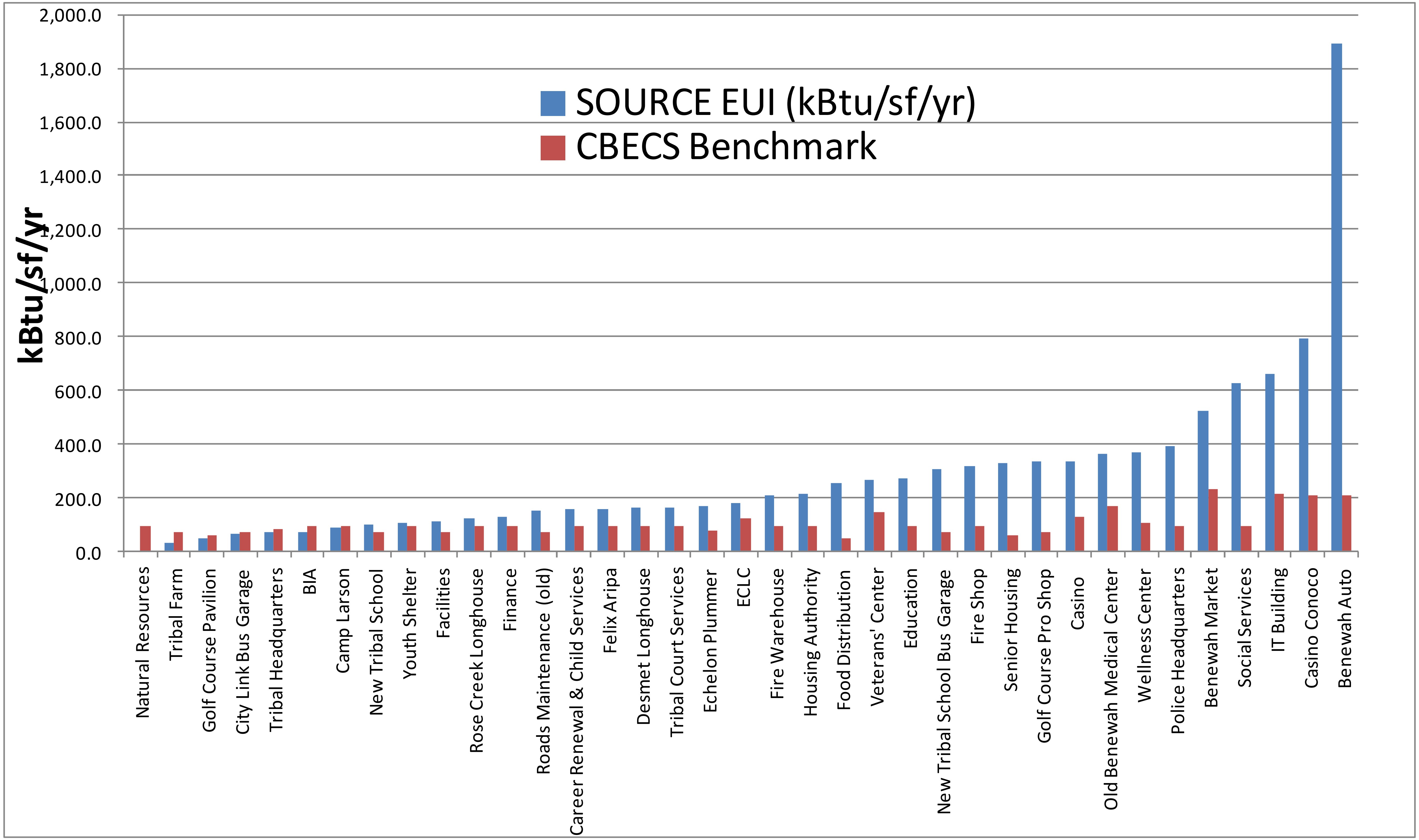
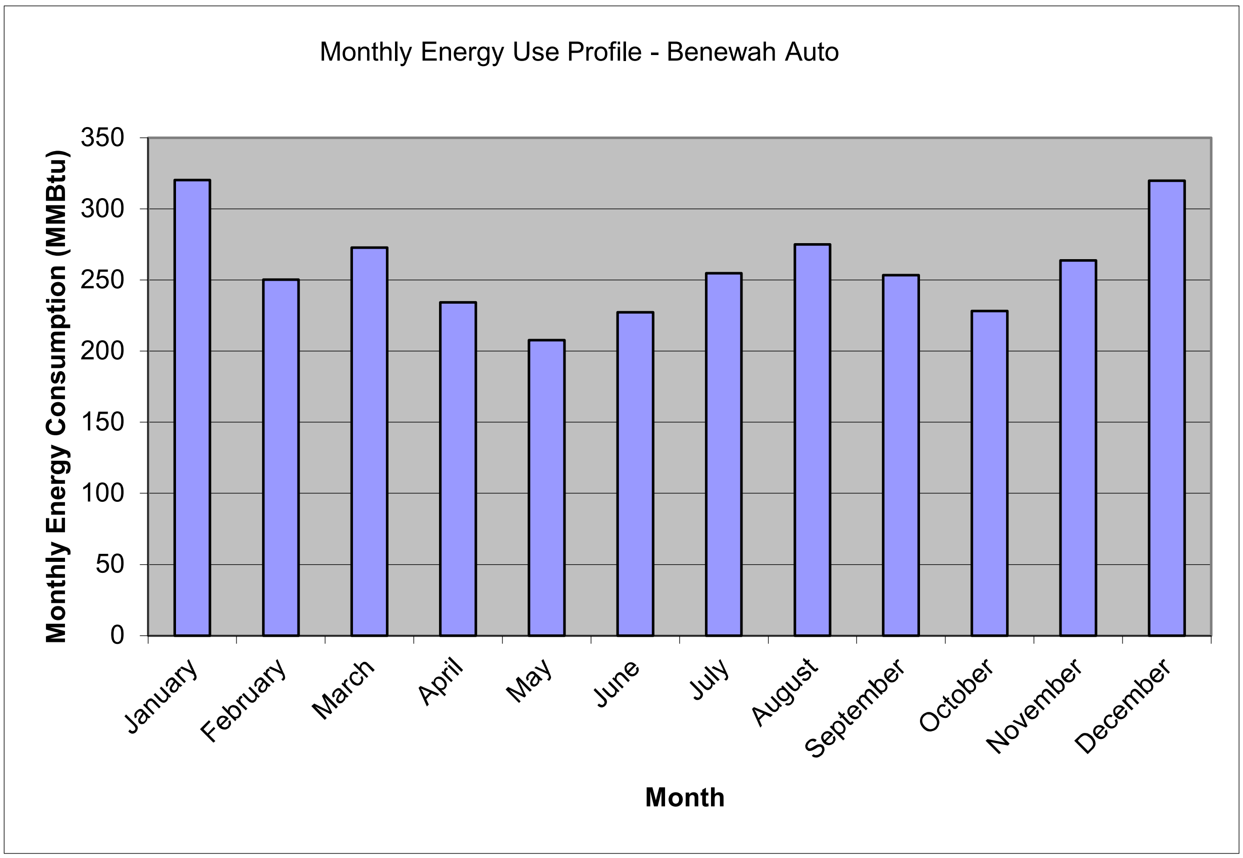


Figure 120. Energy Use Index and Benchmarks

Energy Use Index Details

Benewah Auto

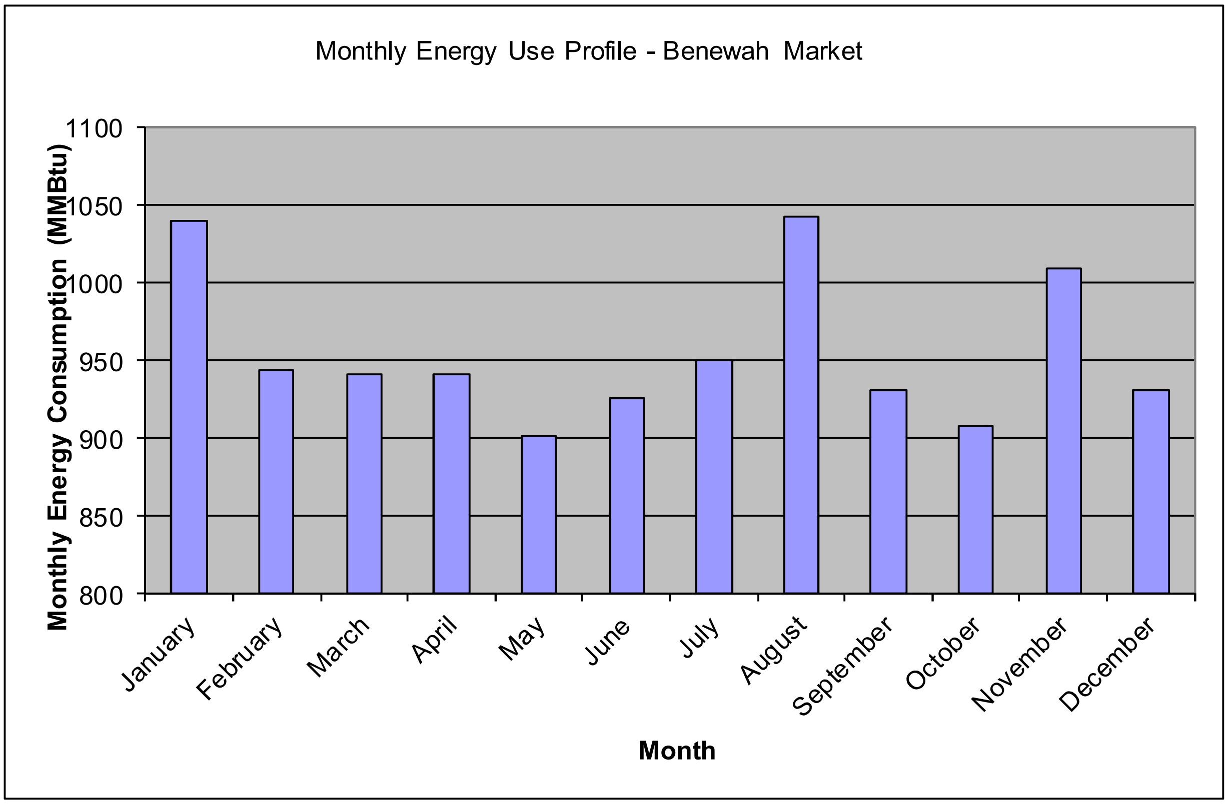
Benewah Auto is served by Plummer Public Utility District (PPUD). As can be seen in Table 1, based on the data provided, this building uses 1894.5 kBtu/sf/yr compared to a benchmark of 210.4kBtu/sf/yr, or 801% more energy than would be expected from the same type and occupancy building in the same climate zone. This results in associated annual energy costs of $9.07 per square foot, or total average annual energy cost of $14,964. The figure below details the monthly energy use profile for the Benewah Auto.



The data provided for Benewah Auto shows significant variations in billed energy use from month to month which tends to correlate to seasonality, with a net energy use reduction from the base load during spring and fall and an increase in summer attributable to cooling and in winter attributable to heating.

Benewah Market

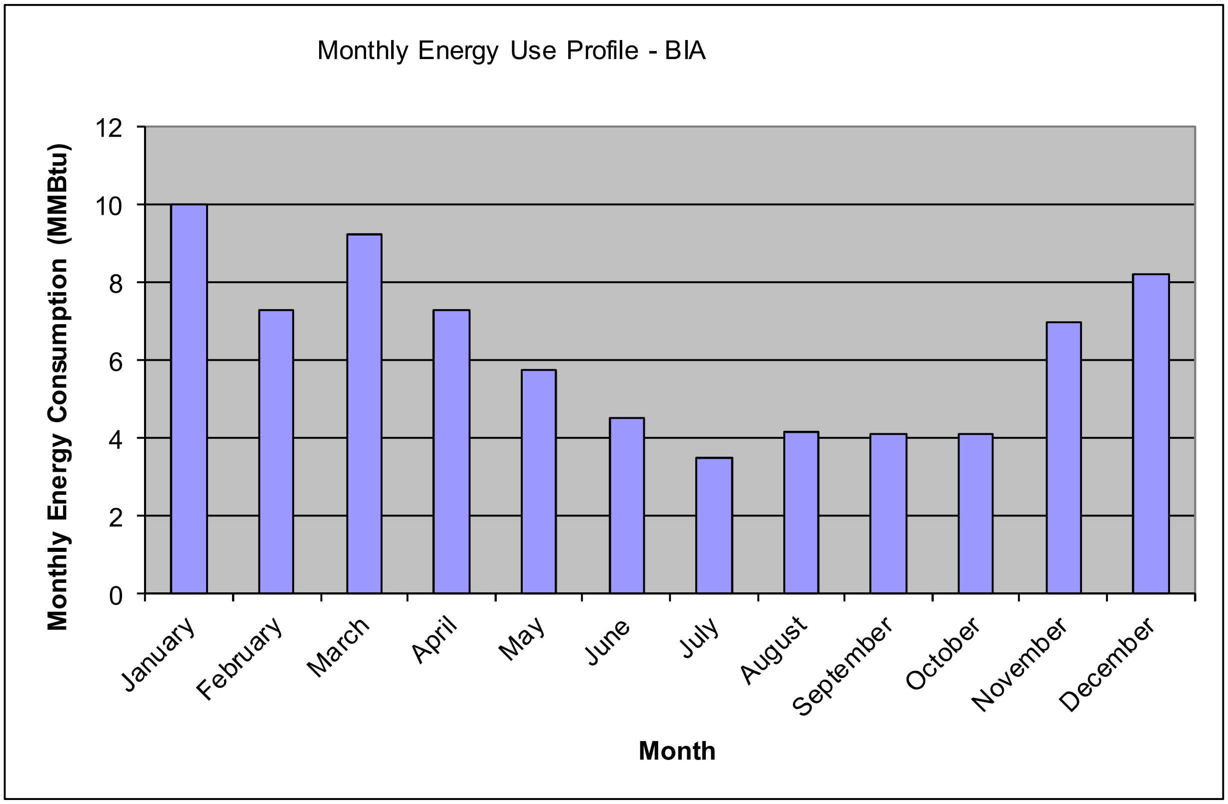
Benewah Market is served by PPUD. As can be seen in Table 1, based on the data provided, this building uses 524.4 kBtu/sf/yr compared to a benchmark of 230.73 kBtu/sf/yr, or 127% more energy than would be expected from the same type and size building in the same climate zone. This results in associated annual energy costs of $2.10 per square foot, and a total average annual energy cost of $48,684. The figure below details the monthly energy use profile for the Benewah Market.



The data provided for Benewah Market shows significant variations in billed energy use from month to month which clearly correlate to seasonality, with a net energy use reduction from the base load during spring and fall and increases in summer attributable to cooling and in winter attributable to heating.

Bureau of Indian Affairs (BIA)

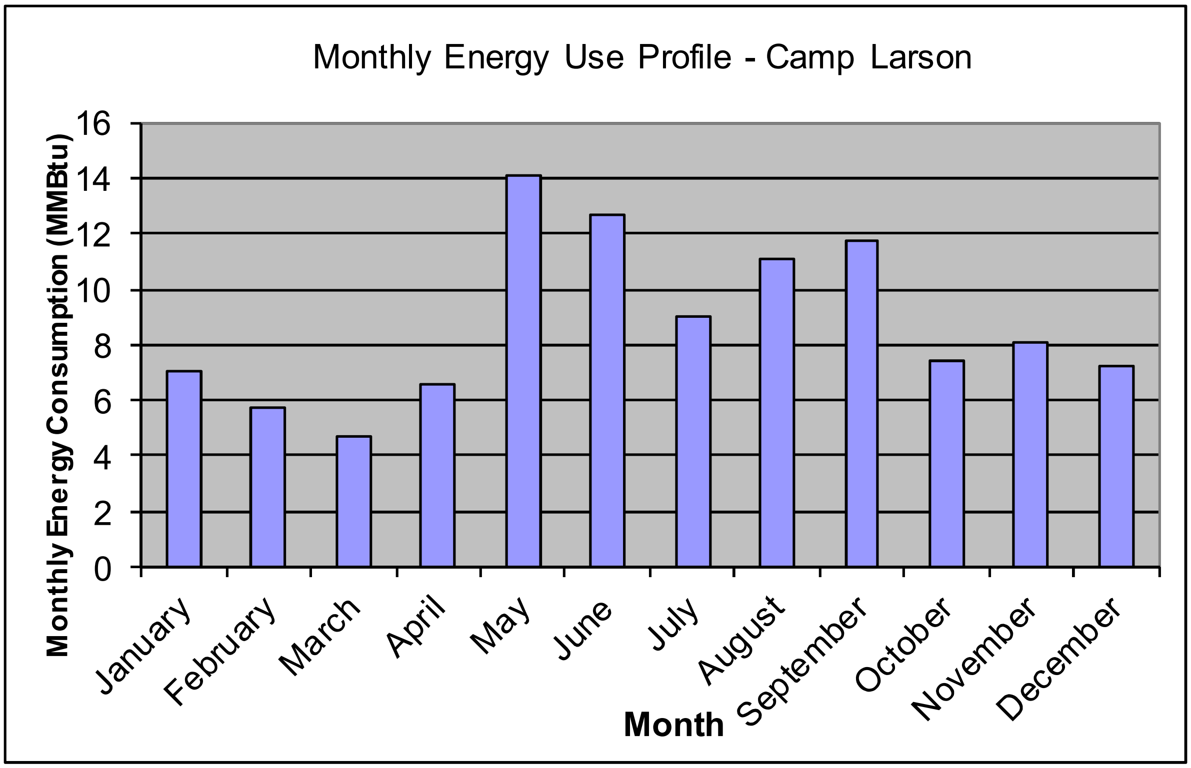
The BIA building is served by PPUD. As can be seen in Table 1, based on the data provided, this building uses 72.4 kBtu/sf/yr compared to a benchmark of 97.8 kBtu/sf/yr, or 26% less energy than would be expected from the same type and size building in the same climate zone. This results in associated annual energy costs of $0.81 per square foot, or total average energy cost of $847. The figure below details the monthly energy use profile for the BIA.



The data provided for The BIA building shows significant variations in billed energy use from month to month clearly correlate to seasonality, with markedly more energy used during the winter heating season than either the milder spring and fall months or even the summer cooling months. Building occupants report the BIA facility is typically utilized about half of normal business hours, which likely explains most of the lower energy density compared to other modular buildings used as office space by the Tribe.

Camp Larson

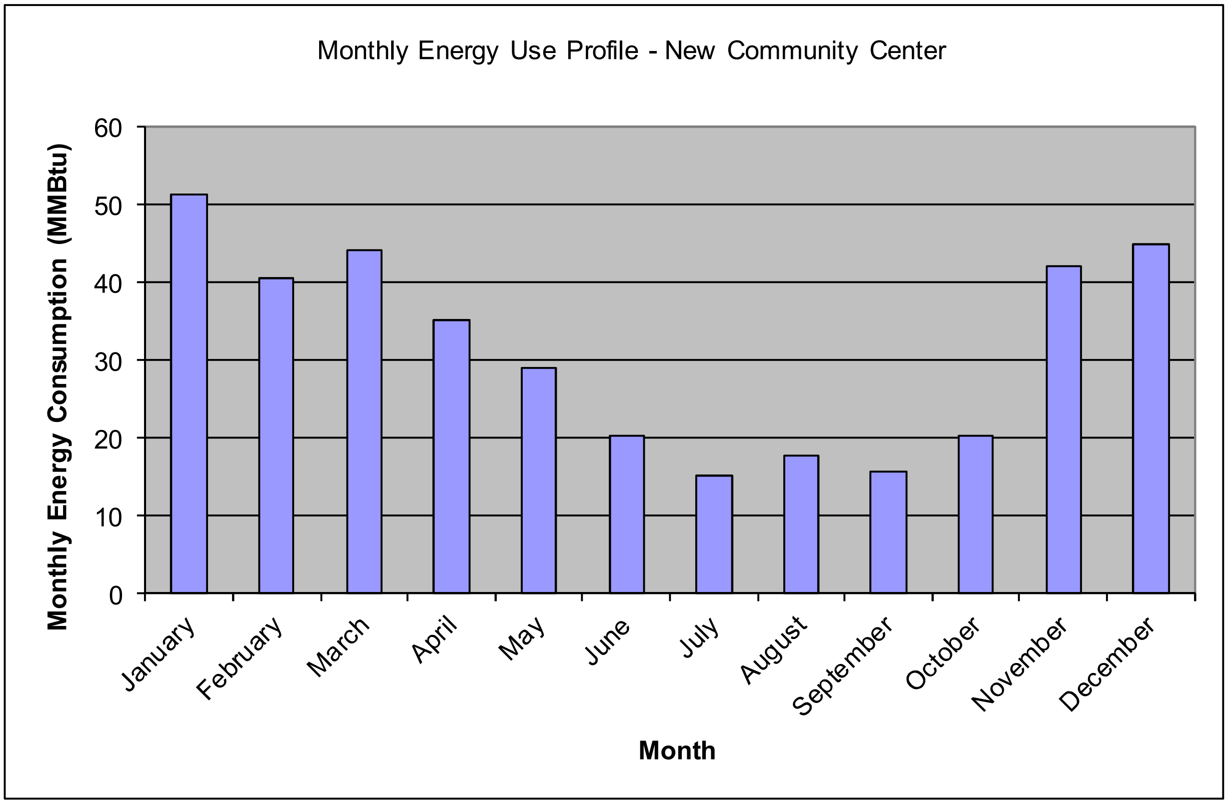
Camp Larson is served by Kootenai Electric Company (KEC). As can be seen in Table 1, based on the data provided, this building uses 88.4 kBtu/sf/yr compared to a benchmark of 94.4 kBtu/sf/yr, or 6% less energy than would be expected from the same type and size facility in the same climate zone. This results in annual energy costs of $1.98 per square foot and a total average energy cost of $2,128. The figure below details the monthly energy use profile for Camp Larson.



The data provided for Camp Larson shows significant variations in billed energy use from month to month clearly correlate to seasonality, with markedly more energy used during the summer months. This is mostly attributable to the fact that the facility is only utilized during the summer months. The camp supervisor reports that typically the only energy use during the months when it is closed is an electric heater in the pump house to keep the water system from freezing.

Career Renewal and Child Services

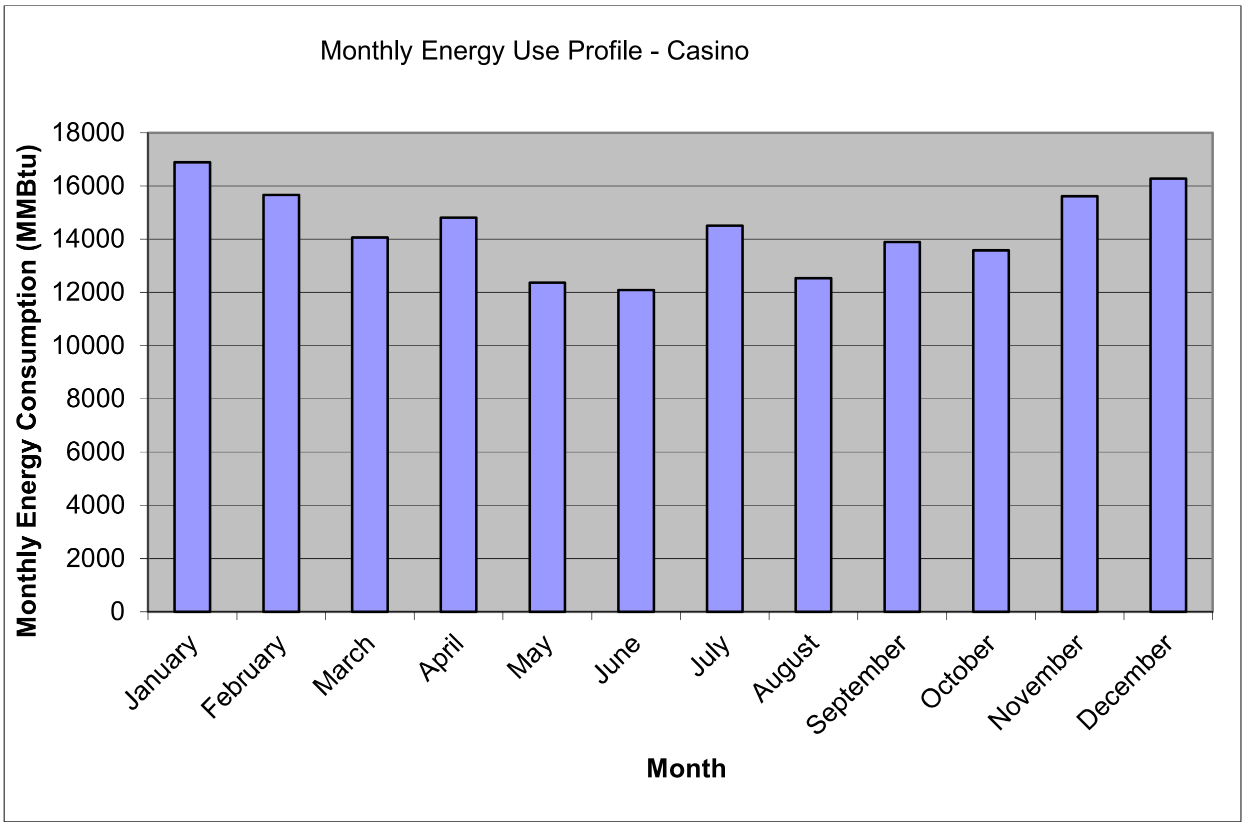
Career Renewal and Child Services are housed in a pair of modular neighboring modular buildings that share a single electric meter served by PPUD. As can be seen in Table 1, based on the data provided, this combined "building" uses 158.8 kBtu/sf/yr compared to a benchmark of 97.8 kBtu/sf/yr, or 62% more energy than would be expected from the same type and size building in the same climate zone. This results in associated annual energy costs of $1.29 per square foot, or total average energy cost of $3,088. The figure below details the monthly energy use profile for Career Renewal and Child Services.



The data provided for the Career Renewal and Child Services buildings shows significant variations in billed energy use from month to month clearly correlate to seasonality, with markedly more energy used during the winter heating season than either the milder spring and fall months or even the summer cooling months.

Coeur d'Alene Casino Resort Hotel (Casino)

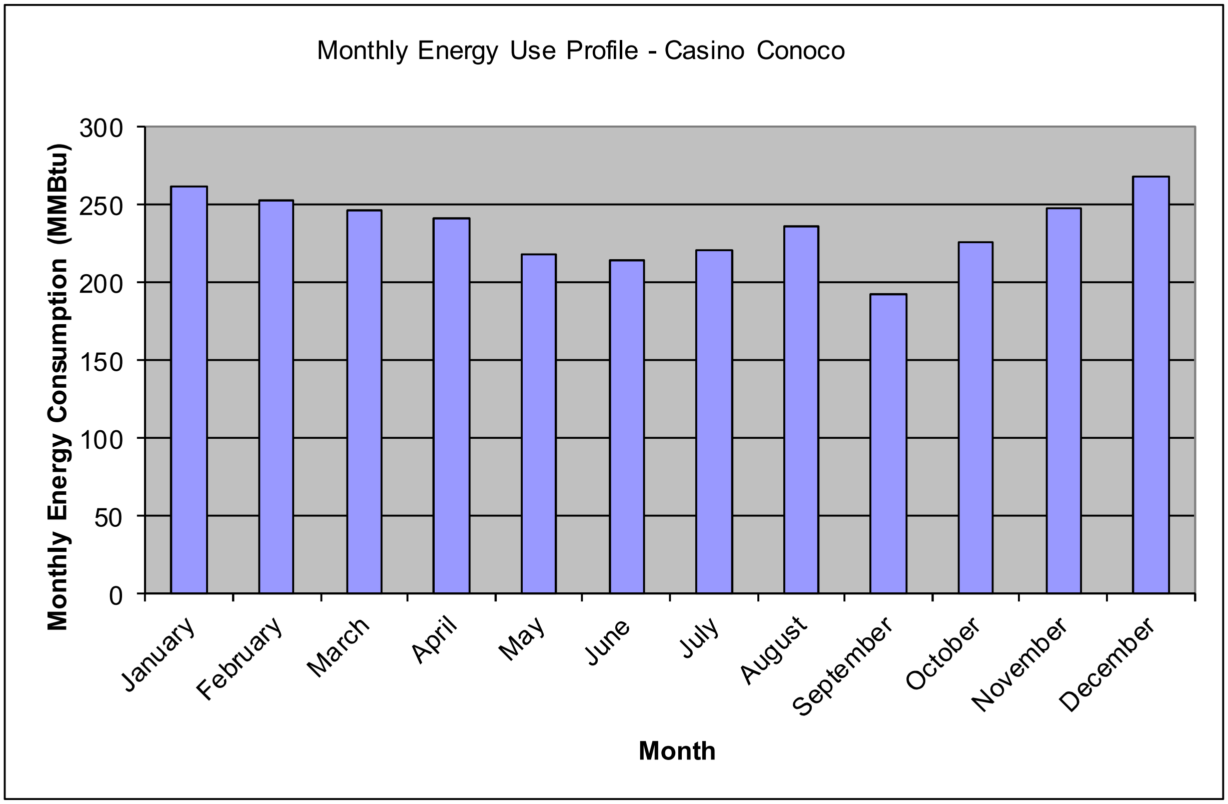
The Casino is served by KEC with propane delivered by Interstate Gas. As can be seen in Table 1, based on the data provided, this building uses 338.1 kBtu/sf/yr compared to a benchmark of 128.0 kBtu/sf/yr, or 164% more energy than would be expected from the same type and size building in the same climate zone. This results in associated annual energy costs of $3.79 per square foot, or total average energy cost of $1,554,476. The figure below details the monthly energy use profile for the Casino.



The data provided for the Casino shows only moderate variations in billed energy use from month to month correlated to seasonality. This is likely due to relatively consistent process loads such as gaming machines and the swimming pool, as well as ornamental fire features in the lobby and Red Tail Bar & Grill.

Casino Conoco

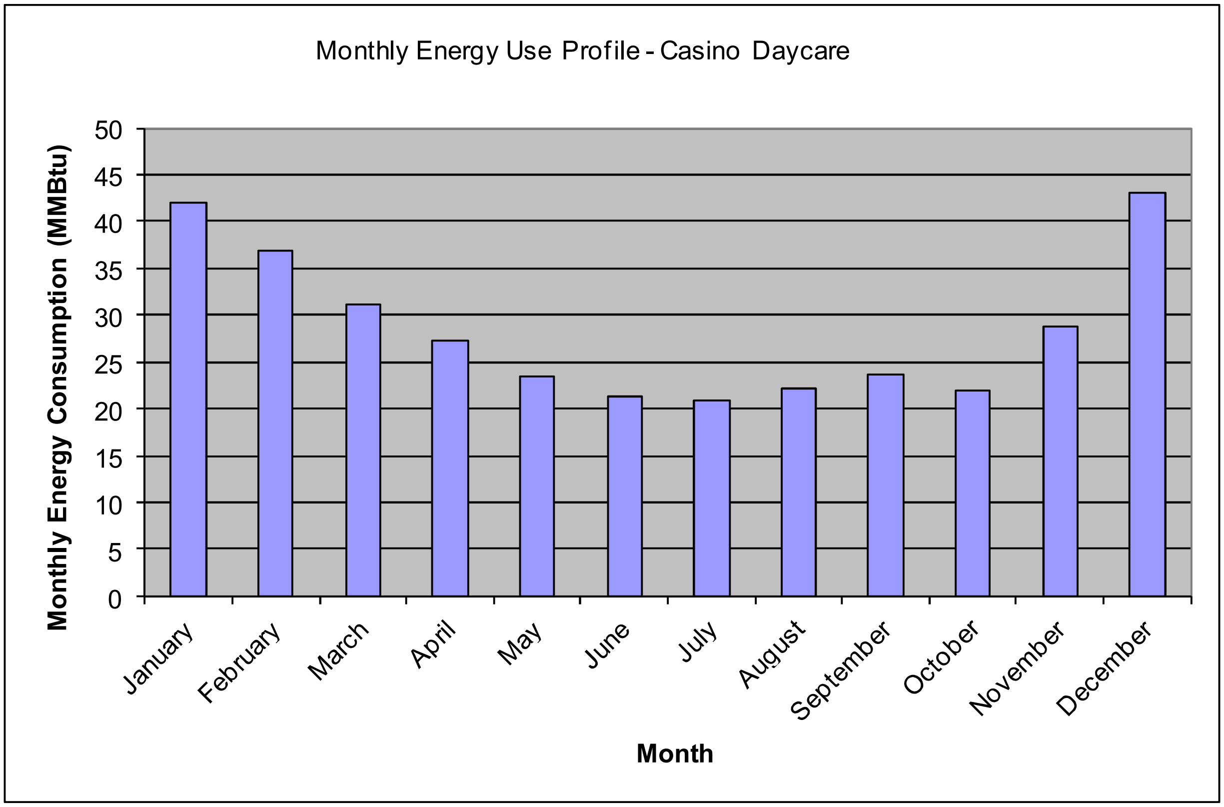
The Casino Conoco is served by KEC. As can be seen in Table 1, based on the data provided, this building uses 790.7 kBtu/sf/yr compared to a benchmark of 210.4 kBtu/sf/yr, or 276% more energy than would be expected from the same type and size building in the same climate zone. This results in associated annual energy costs of $5.40 per square foot, or total average energy cost of $19,201. The figure below details the monthly energy use profile for the Casino Conoco.



The data provided for the Casino Conoco shows only moderate variations in billed energy use from month to month correlated to seasonality. This is likely due to relatively consistent process loads such as gaming machines, gas pumps, and refrigeration. The relatively high energy density and energy cost is at least in some part attributable to the 24/7 operations of the facility.

Casino Daycare

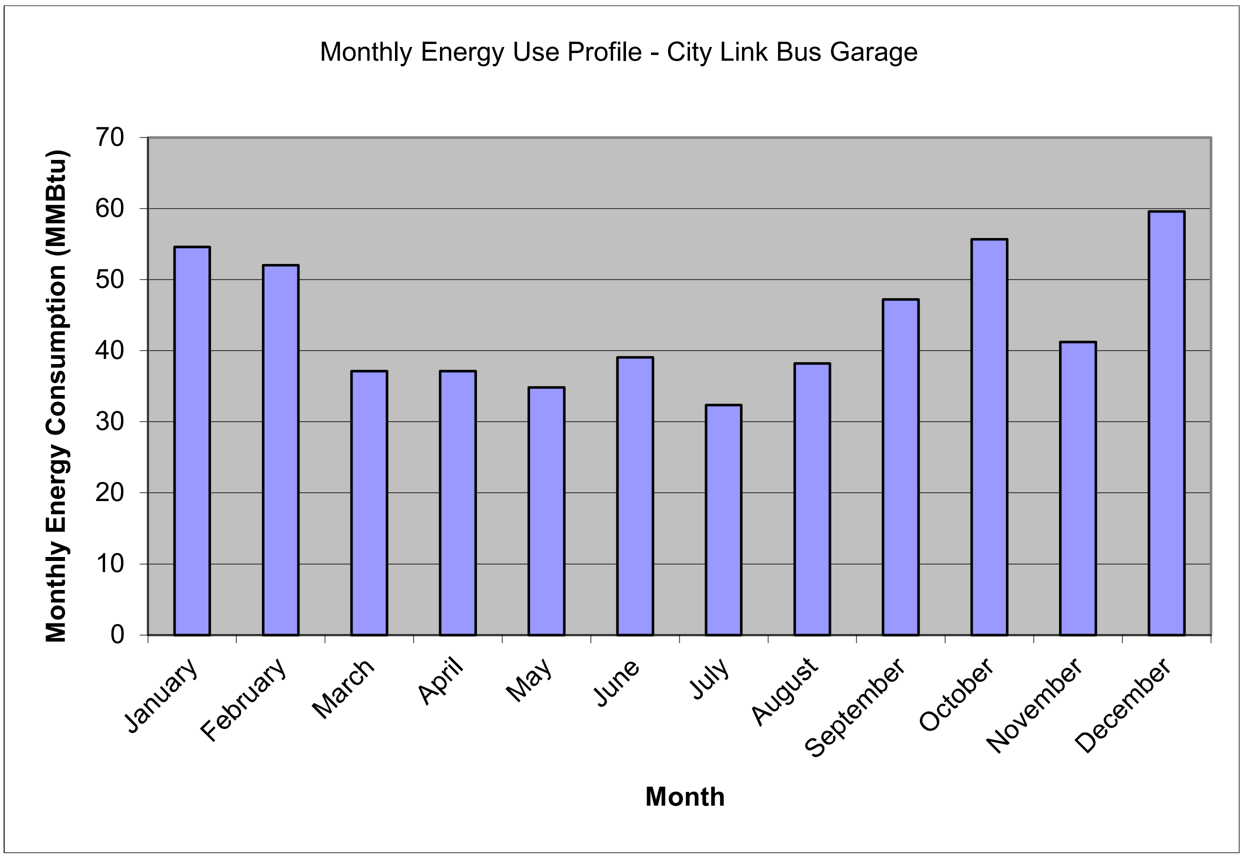
The Casino Daycare is served by KEC. As can be seen in Table 1, based on the data provided, this building uses 191.6 kBtu/sf/yr compared to a benchmark of 122.2 kBtu/sf/yr, or 57% more energy than would be expected from the same type and size building in the same climate zone. This results in associated annual energy costs of $1.54 per square foot, or total average energy cost of $2,767. The figure below details the monthly energy use profile for the Casino Daycare.



The data provided for the Casino Daycare shows significant variations in billed energy use from month to month correlated to seasonality. The relatively high energy density and energy cost is at least in some part attributable to the 24/7 operations of the facility.

City Link Bus Garage

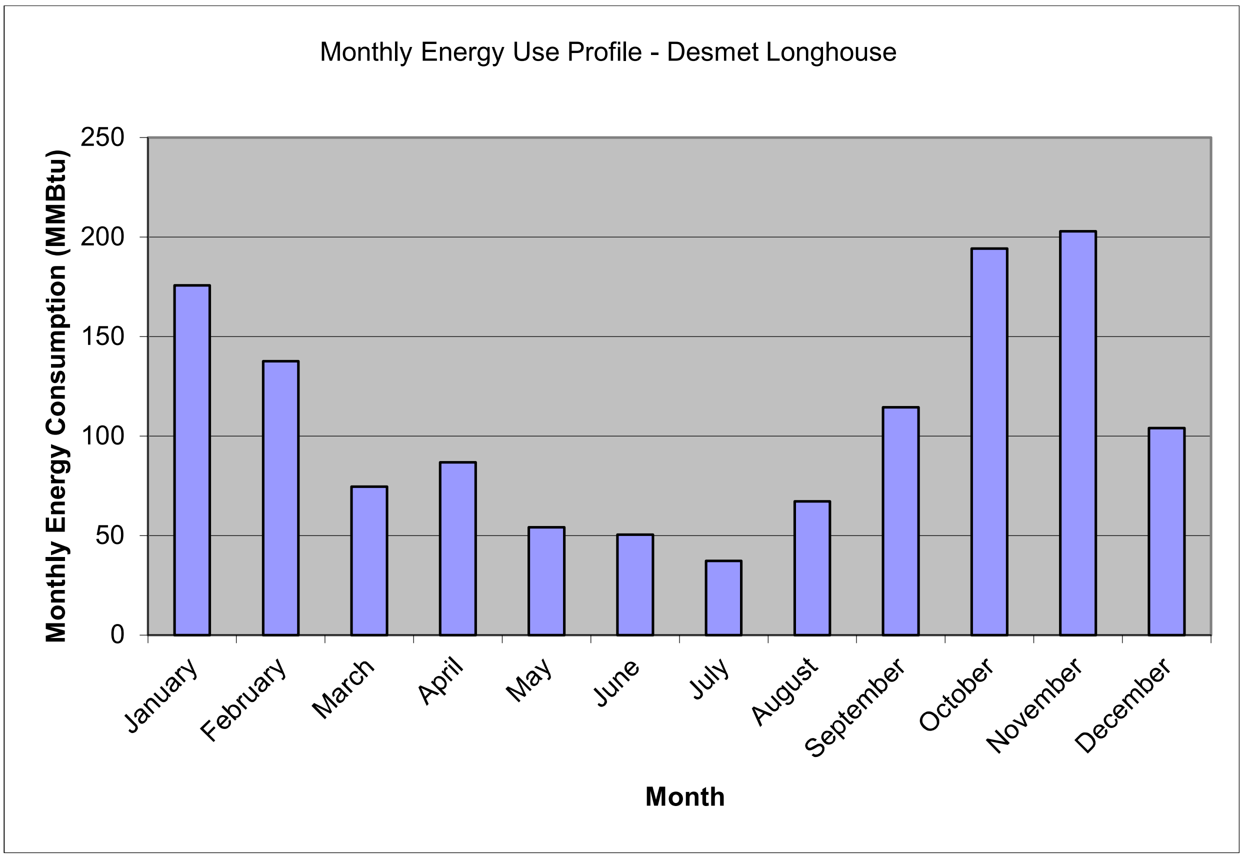
The City Link Bus Garage is served by KEC. As can be seen in Table 1, based on the data provided, this building uses 66.8 kBtu/sf/yr compared to a benchmark of 70.0 kBtu/sf/yr, or 5% less energy than would be expected from the same type and size building in the same climate zone. This results in associated annual energy costs of $0.52 per square foot, or total average energy cost of $4,151. The figure below details the monthly energy use profile for the City Link Bus Garage.



The data provided for the City Link Bus Garage shows significant variation in billed energy use from month to month correlated to seasonality, with highest energy use attributable to heating during the winter months. The relatively low energy density compared to other buildings in the Tribe's portfolio is likely due in some part to the facility being quite new and having been constructed with a building envelope, mechanical, hot water, and lighting systems designed to meet modern energy efficiency standards.

DeSmet Longhouse

The DeSmet Longhouse is served by Clearwater Power Company (CPC). As can be seen in Table 1, based on the data provided, this building uses 162.6 kBtu/sf/yr compared to a benchmark of 96.0 kBtu/sf/yr, or 69% more energy than would be expected from the same type and size building in the same climate zone. This results in associated annual energy costs of $1.89 per square foot, or total average energy cost of $15,611. The figure below details the monthly energy use profile for the DeSmet Longhouse.

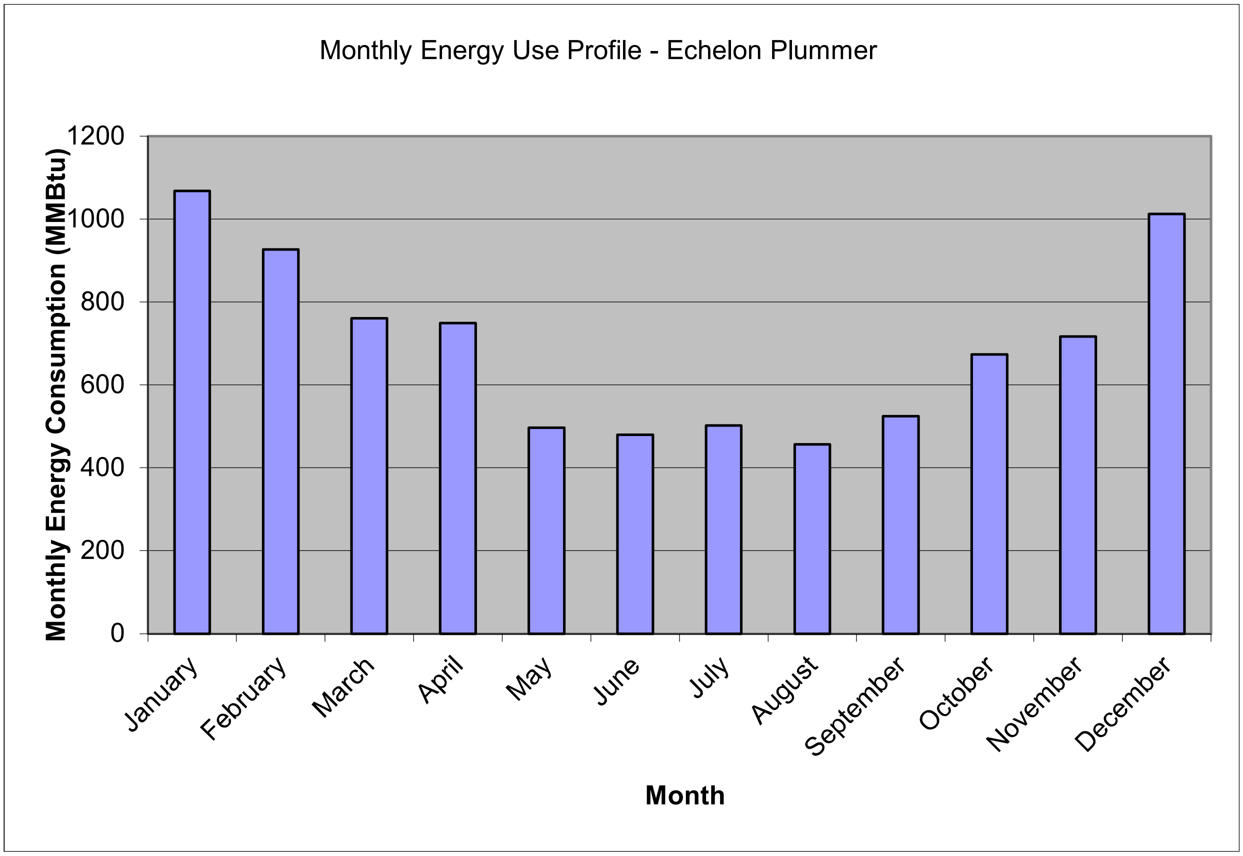


The data provided for the DeSmet Longhouse shows significant variation in billed energy use from month to month correlated to seasonality, with highest energy use attributable to heating during the winter months.

It is worth noting that, according to staff interviews, the DeSmet Longhouse has relatively low and sporadic hours of occupancy. There are likely very substantial energy savings available by simply operating the building in "unoccupied" mode as a default, and only initiate occupied thermostat and other settings immediately prior to it being utilized. Potential savings by implementing this management protocol could amount to several thousand dollars per year.

Echelon Plummer

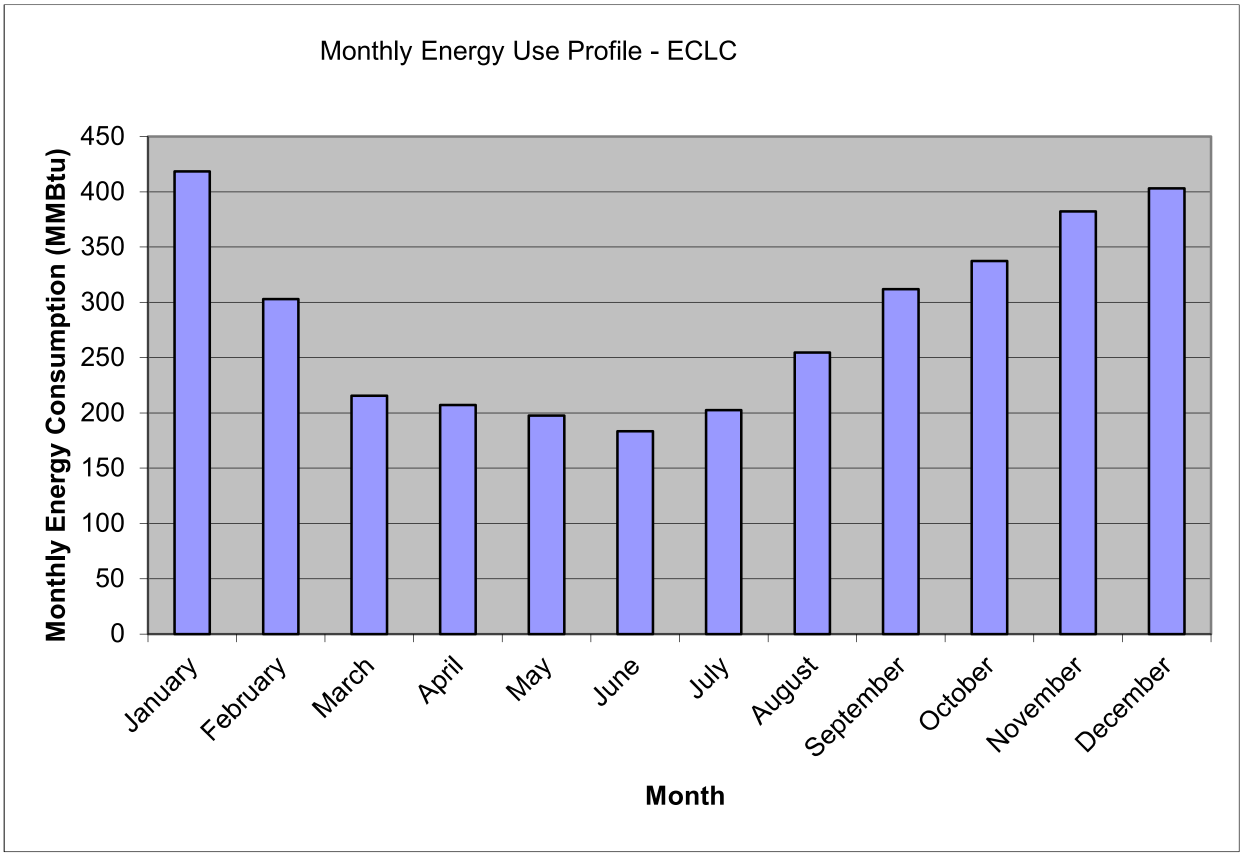
The Echelon Plummer building is served by KEC. As can be seen in Table 1, based on the data provided, this building uses 168.4 kBtu/sf/yr compared to a benchmark of 75.2 kBtu/sf/yr, or 124% more energy than would be expected from the same type and size building in the same climate zone. This results in associated annual energy costs of $0.95 per square foot, or total average energy cost of $47,602. The figure below details the monthly energy use profile for Echelon Plummer.



The data provided for Echelon Plummer shows significant variation in billed energy use from month to month correlated to seasonality, with highest energy use attributable to heating during the winter months. There is little or no spike in energy use during summer months since with the exception of a couple of small office spaces the facility has no cooling. Much of the base-load is likely attributable to lighting and process loads such as the large central air compressor system.

Early Childhood Learning Center (ECLC)

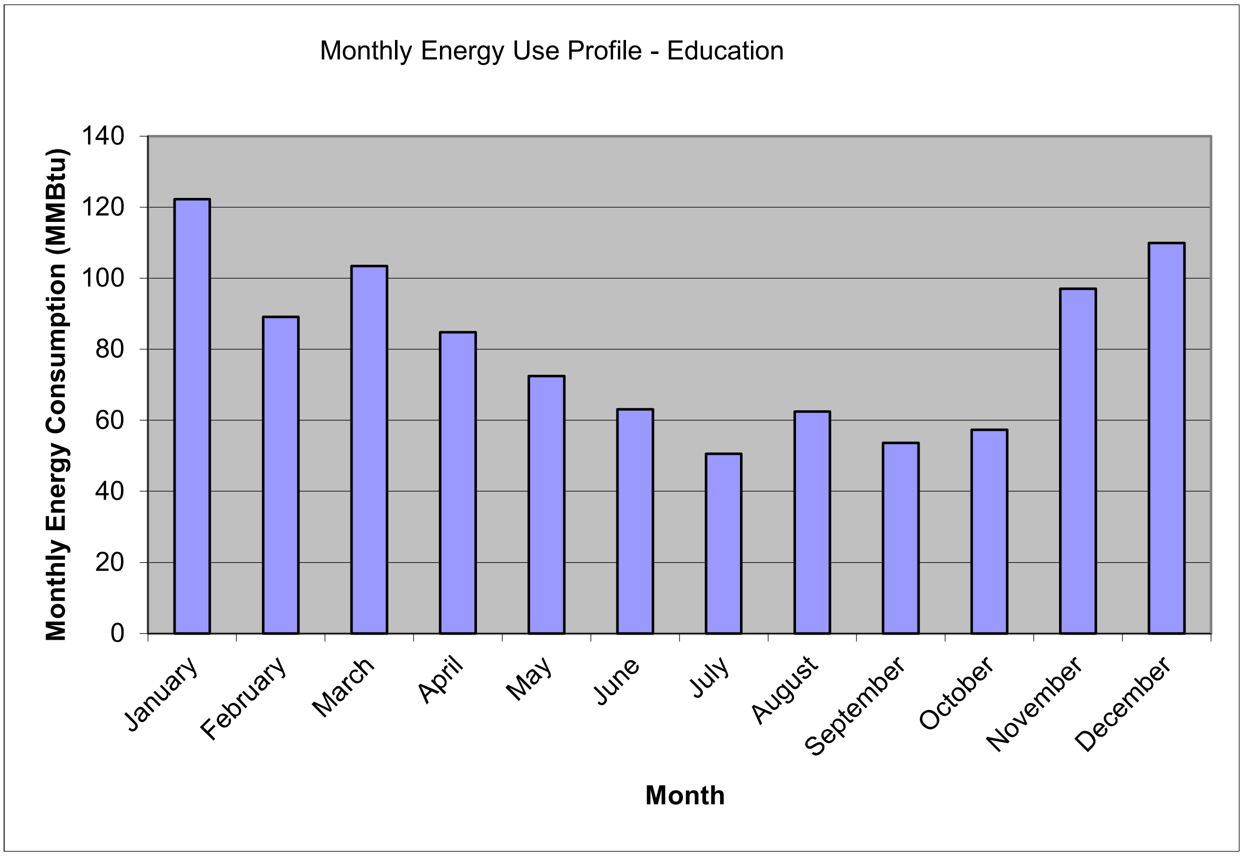
The ECLC is served by KEC. As can be seen in Table 1, based on the data provided, this building uses 180.9 kBtu/sf/yr compared to a benchmark of 122.2 kBtu/sf/yr, or 48% more energy than would be expected from the same type and size building in the same climate zone. This results in associated annual energy costs of $1.21 per square foot, or total average energy cost of $22,826. The figure below details the monthly energy use profile for the ECLC.



The data provided for the ECLC shows significant variation in billed energy use from month to month correlated to seasonality, with highest energy use attributable to heating during the winter months. It seems unusual however, that energy use would begin to climb in August and continue to increase throughout the fall and into winter. Normally in buildings that do have and run cooling systems there is slightly lower energy use in the milder spring and fall months but that is not in evidence here. Building occupants report generally being too cold during the hotter months when air conditioning is in use, and likewise OE early reported inconsistencies with respect to thermostat programming in the building. Consequently there may be significant energy savings associated with simple optimization of thermostat settings.

Department of Education (Education)

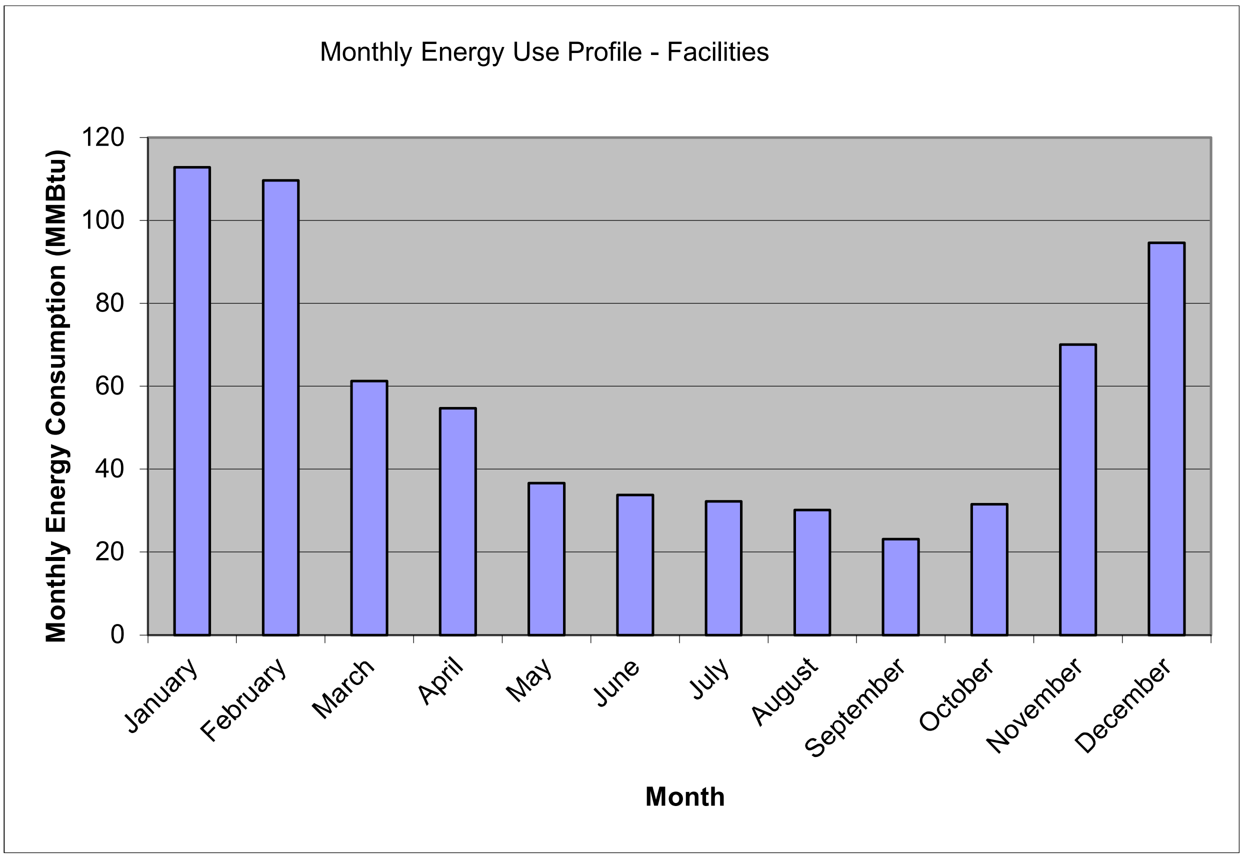
The Education building is served by PPUD. As can be seen in Table 1, based on the data provided, this building uses 176% more energy than would be expected from the same type and size building in the same climate zone. As can be seen in Table 1, based on the data provided, this building uses 168.4 kBtu/sf/yr compared to a benchmark of 75.2 kBtu/sf/yr, or 124% more energy than would be expected from the same type and size building in the same climate zone. This results in associated annual energy costs of $0.95 per square foot, or total average energy cost of $47,602. The figure below details the monthly energy use profile for the Education building.



The data provided for the Education building shows significant variations in billed energy use from month to month clearly correlate to seasonality, with significantly more energy used during the winter heating season than the milder autumn months, and a moderate spike in energy use during summer likely attributable to cooling loads.

Facilities

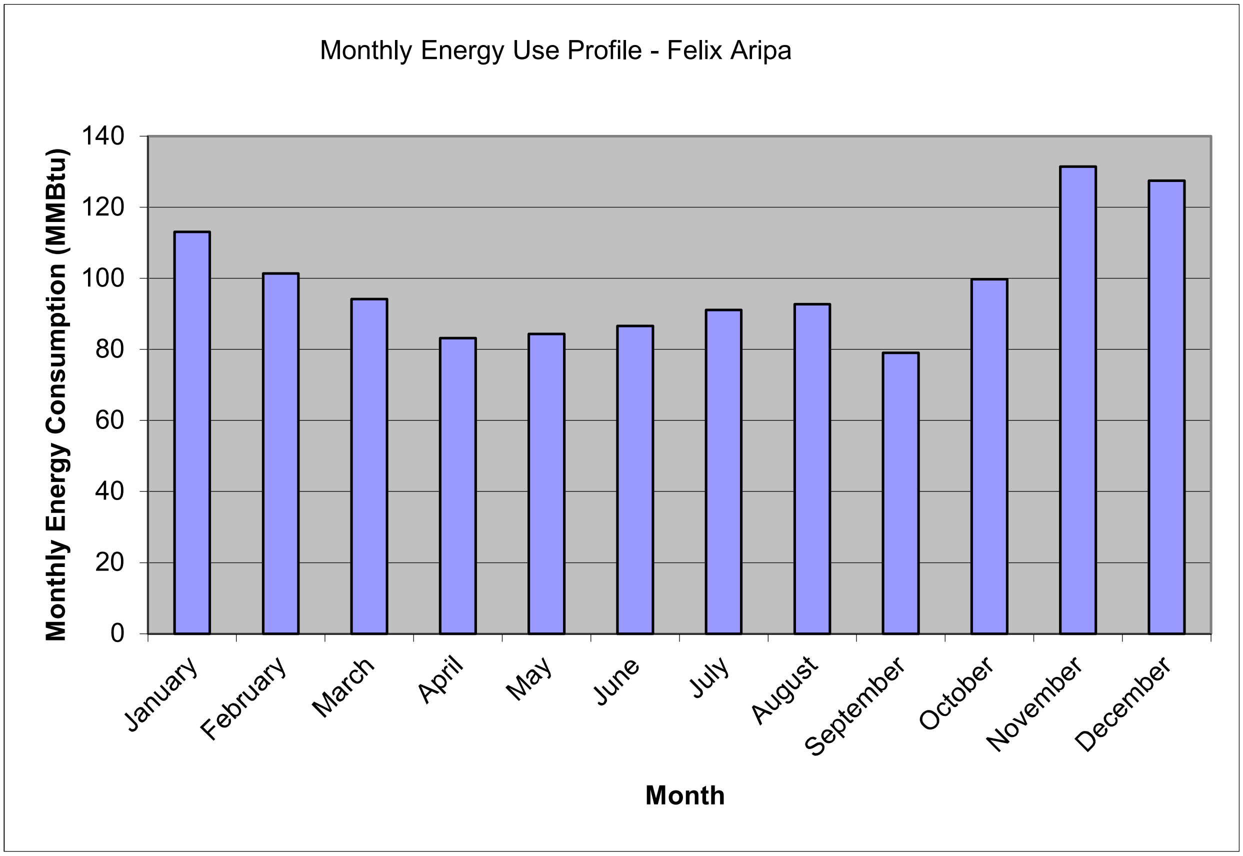
The Facilities building is served by KEC. As can be seen in Table 1, based on the data provided, this building uses 111.1 kBtu/sf/yr compared to a benchmark of 70.0 kBtu/sf/yr, or 59% more energy than would be expected from the same type and size building in the same climate zone. This results in associated annual energy costs of $.085 per square foot, or total average energy cost of $5,066. The figure below details the monthly energy use profile for the Facilities building.



The data provided for the Facilities building shows significant variation in billed energy use from month to month clearly correlate to seasonality, with significantly more energy used during the winter heating season. Cooling loads appear to be of low significance, likely because the majority of the area of the building is made up of shop space that does not require a great deal of cooling when shop doors are open.

Felix Aripa Fish & Wildlife Building (Felix Aripa)

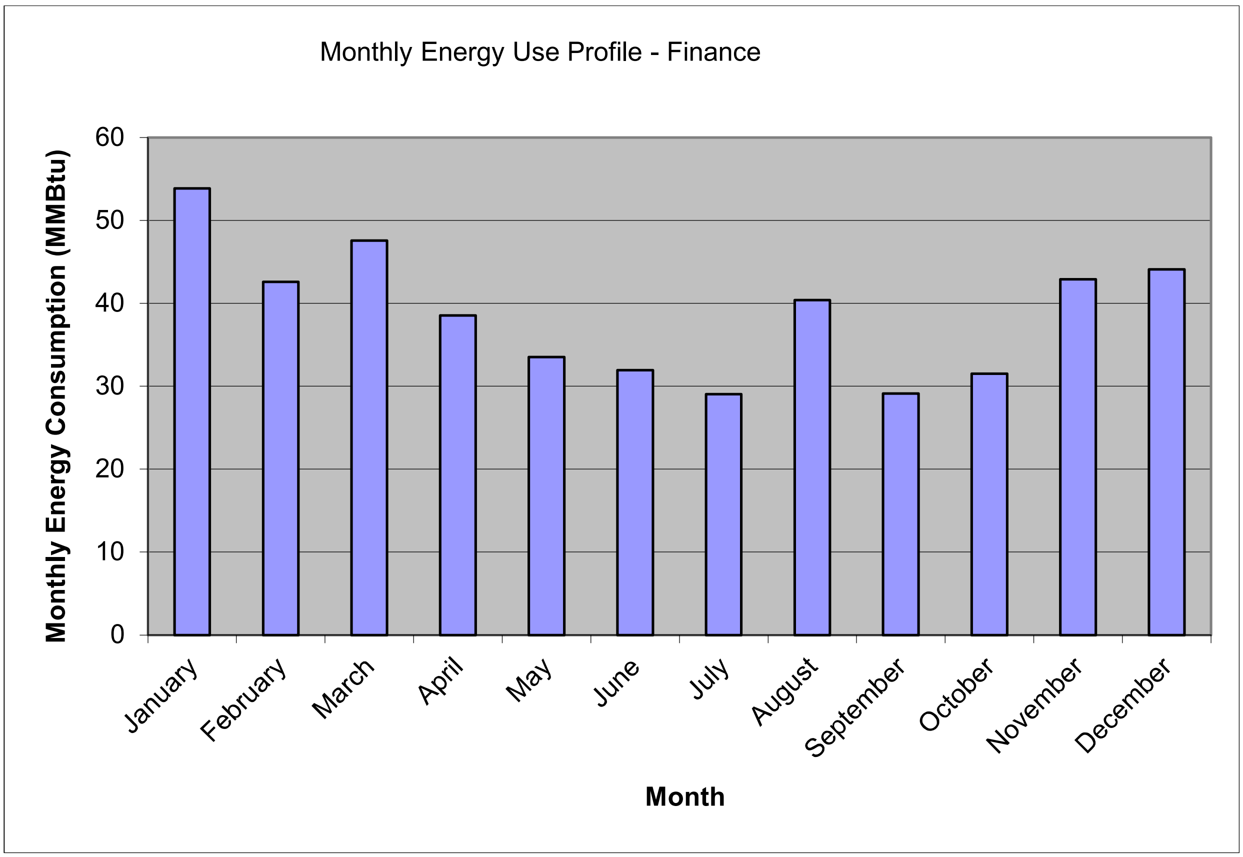
The Felix Aripa building is served by KEC. As can be seen in Table 1, based on the data provided, this building uses 159.3 kBtu/sf/yr compared to a benchmark of 97.8 kBtu/sf/yr, or 63% more energy than would be expected from the same type and size building in the same climate zone. This results in associated annual energy costs of $1.20 per square foot, or total average energy cost of $8,953. The figure below details the monthly energy use profile for the Felix Aripa building.



The data provided for the Felix Aripa building shows only moderate variations in billed energy use from month to month correlated to seasonality, with a net energy use reduction from the base load during spring and fall and increases in summer attributable to cooling and in winter attributable to heating.

Finance Building

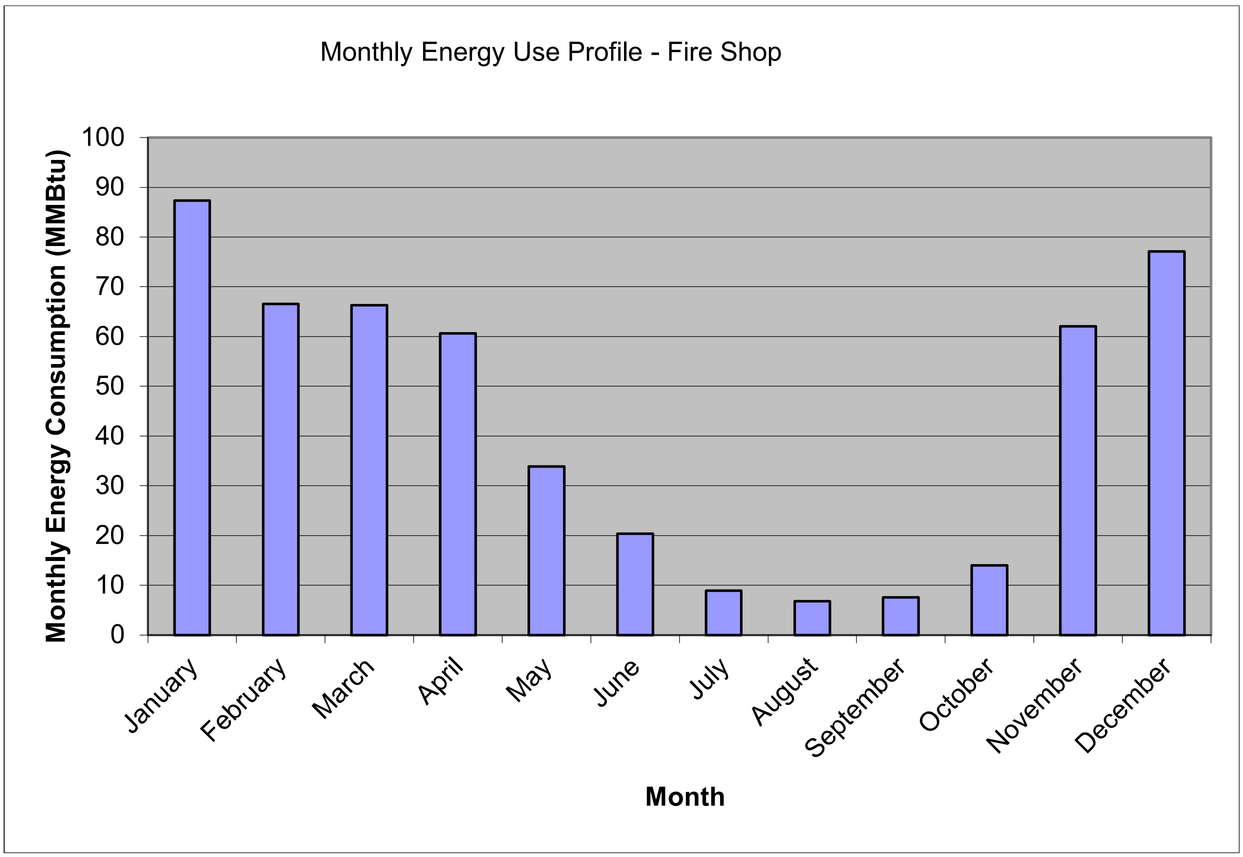
The Finance building is served by PPUD. As can be seen in Table 1, based on the data provided, this building uses 130.0 kBtu/sf/yr compared to a benchmark of 97.8 kBtu/sf/yr, or 33% more energy than would be expected from the same type and size building in the same climate zone. This results in associated annual energy costs of $1.12 per square foot, or total average energy cost of $4,030. The figure below details the monthly energy use profile for the Finance building.



The data provided for the Finance building shows significant variations in billed energy use from month to month correlated to seasonality, with a net energy use reduction from the base load during spring and fall and increases in summer attributable to cooling and in winter attributable to heating.

Fire Shop

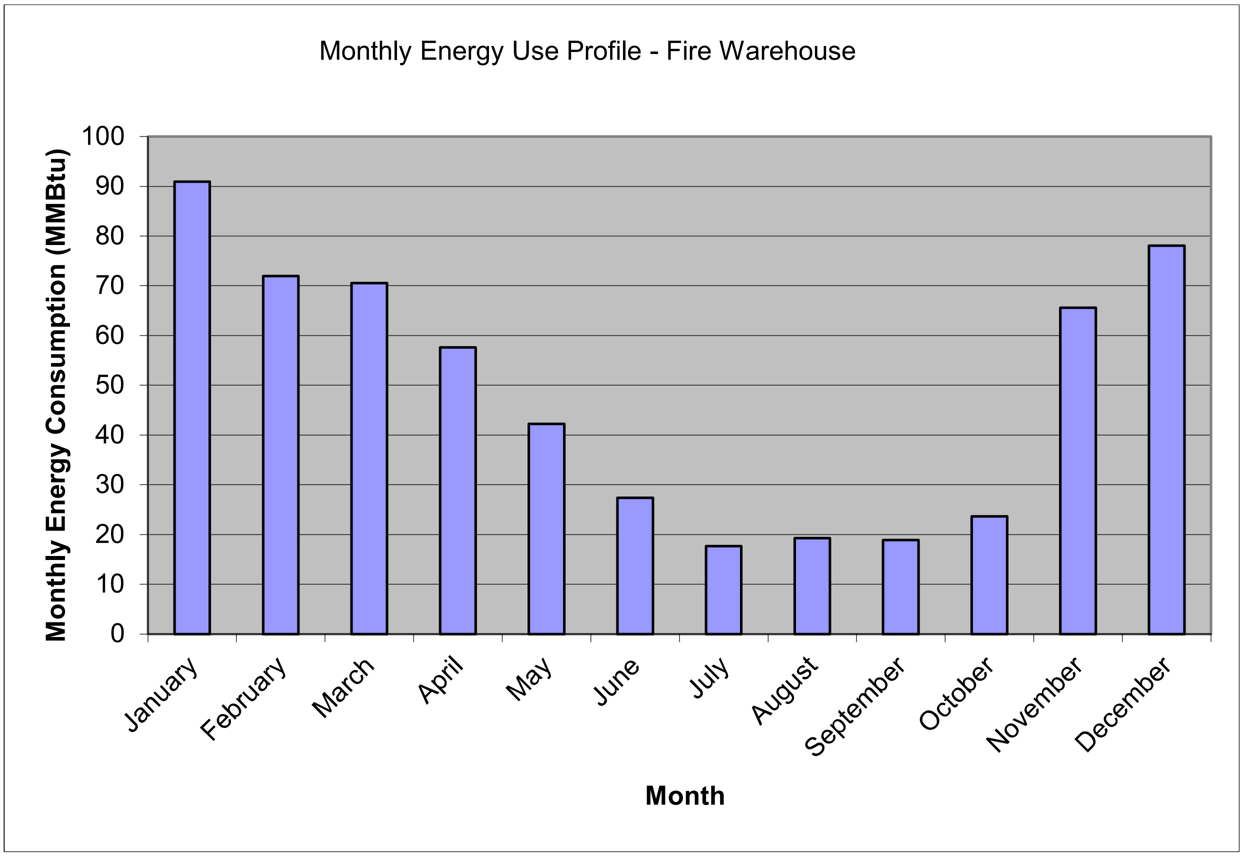
The Fire Shop is served by PPUD. As can be seen in Table 1, based on the data provided, this building uses 315.6 kBtu/sf/yr compared to a benchmark of 97.4 kBtu/sf/yr, or 224% more energy than would be expected from the same type and size building in the same climate zone. This results in associated annual energy costs of $2.47per square foot, or total average energy cost of $4,170.   The figure below details the monthly energy use profile for the Fire Shop.



The data provided for the Fire Shop shows significant variations in billed energy use from month to month correlated to seasonality, with a net energy use reduction from the base load during spring through the fall and increases in and in winter attributable to heating.   There is no increase in summer since the Fire Shop has no cooling.

Fire Warehouse

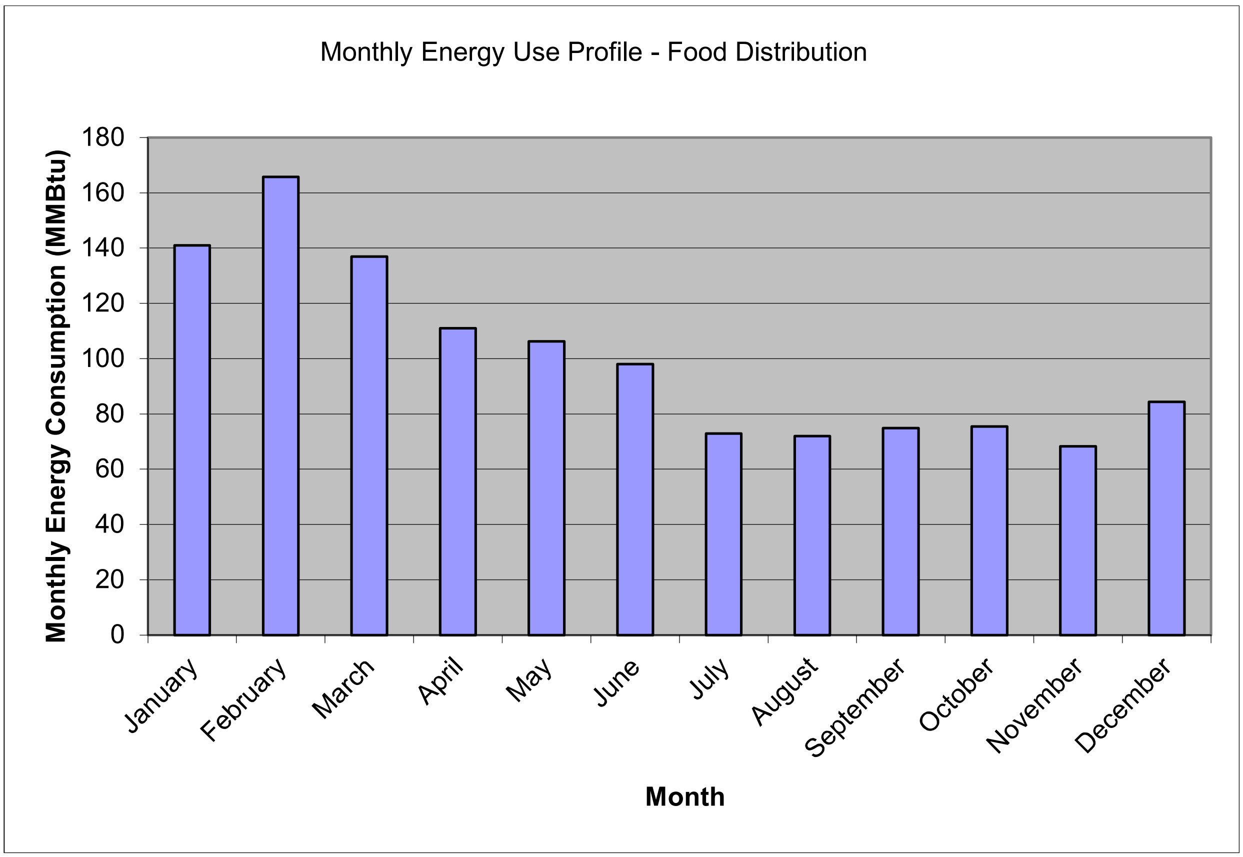
The Fire Warehouse is served by PPUD. As can be seen in Table 1, based on the data provided, this building uses 217.5 kBtu/sf/yr compared to a benchmark of 97.4 kBtu/sf/yr, or 123% more energy than would be expected from the same type and size building in the same climate zone. This results in associated annual energy costs of $1.65 per square foot, or total average energy cost of $4,618. The figure below details the monthly energy use profile for the Fire Warehouse.



The data provided for the Fire Warehouse shows significant variations in billed energy use from month to month correlated to seasonality, with a net energy use reduction from the base load during spring through the fall and increases in and in winter attributable to heating. There is only a slight increase in summer since the Fire Warehouse has only a couple of small window unit air conditioners that are not used much.

Food Distribution

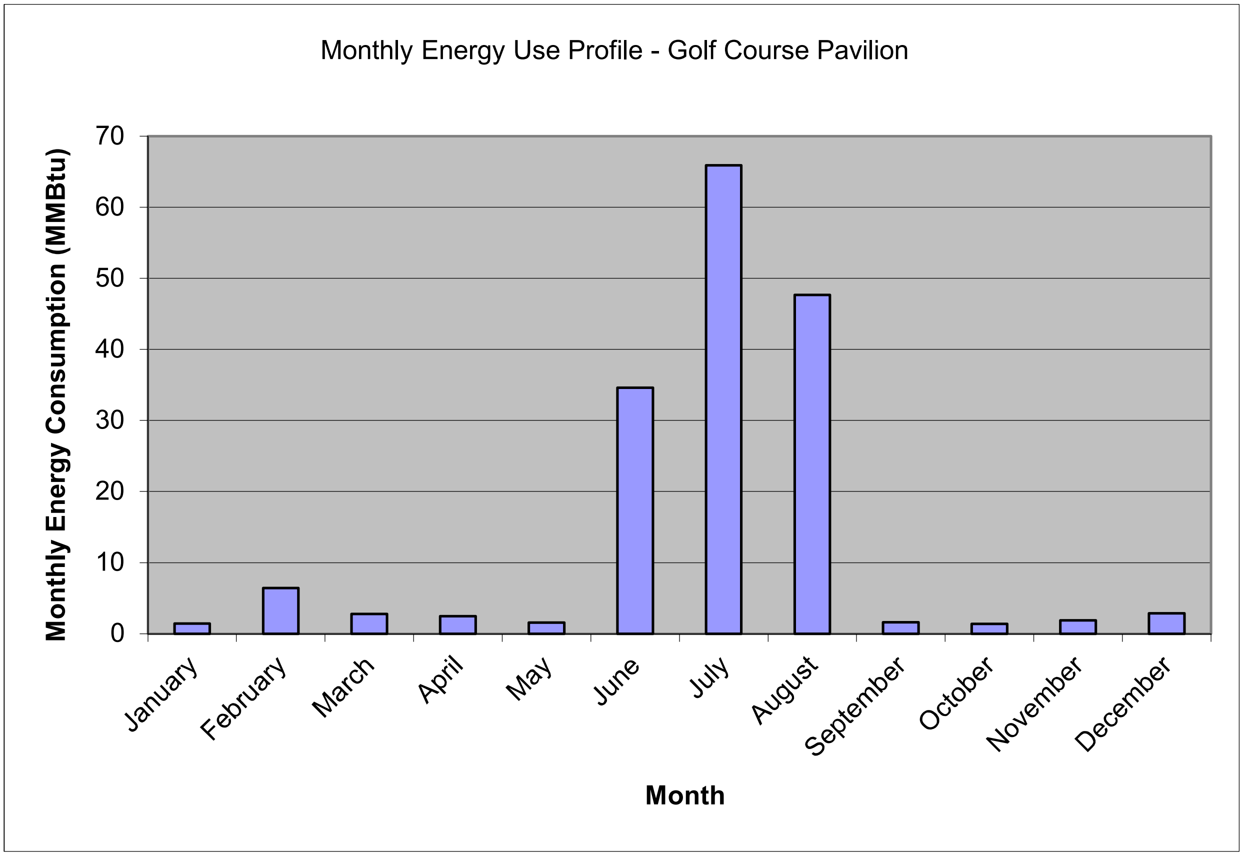
The Food Distribution building is served by KEC. As can be seen in Table 1, based on the data provided, this building uses 252.9 kBtu/sf/yr compared to a benchmark of 143.7 kBtu/sf/yr, or 76% more energy than would be expected from the same type and size building in the same climate zone. This results in associated annual energy costs of $1.92 per square foot, or total average energy cost of $9,232. The figure below details the monthly energy use profile for the Food Distribution building.



The data provided for the Food Distribution building shows significant variations in billed energy use from month to month correlated to seasonality, with a net energy use reduction from the base load during spring through the fall and increases in and in winter attributable to heating. Summer cooling energy is slight as there is only a single window unit air conditioner serving a small office zone, however it is likely that process refrigeration loads do increase during hotter weather, particularly since the walk-in cooler and freezer units reject their heat inside the conditioned space rather than outdoors.

Golf Course Pavilion

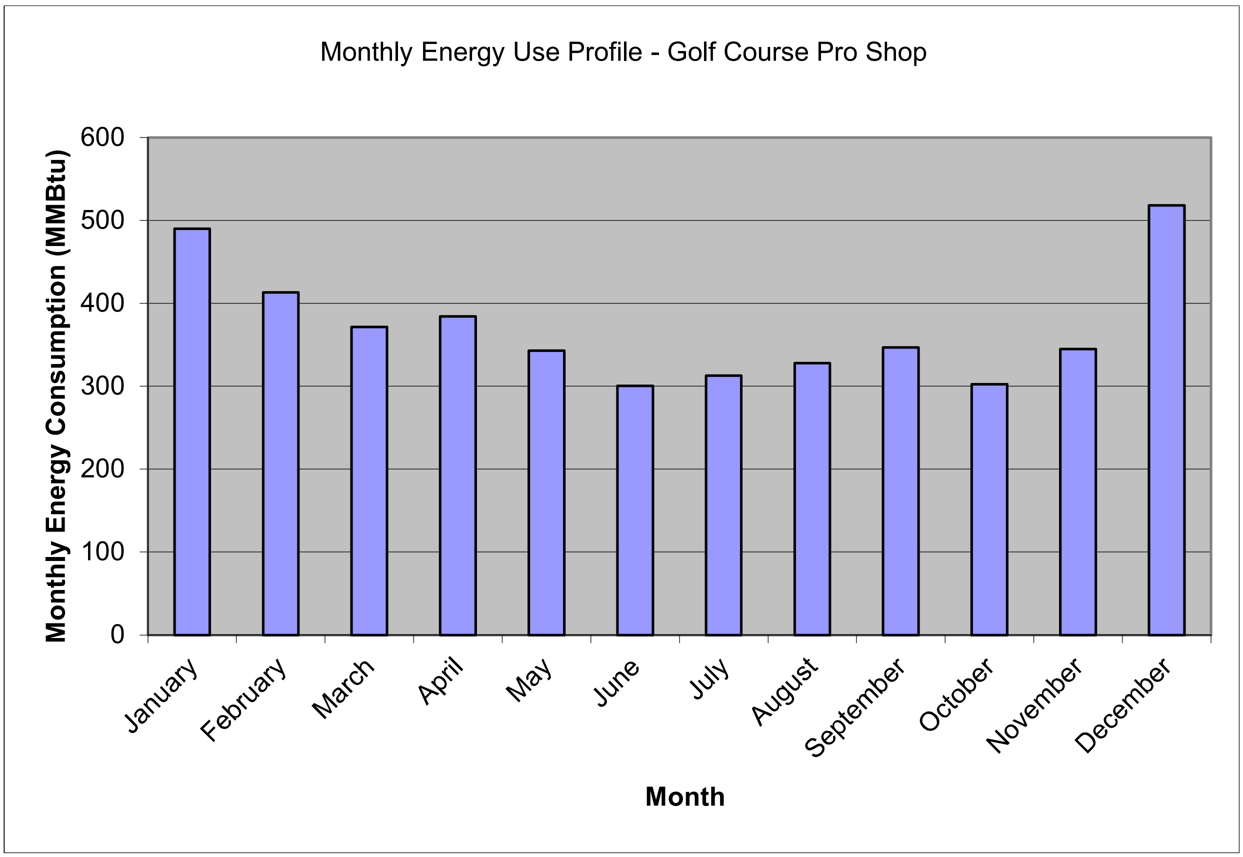
The Golf Course Pavilion is served by KEC. As can be seen in Table 1, based on the data provided, this building uses 49.1 kBtu/sf/yr compared to a benchmark of 60.9 kBtu/sf/yr, or 19% less energy than would be expected from the same type and size building in the same climate zone. This results in associated annual energy costs of $0.48 per square foot, or total average energy cost of $1,462. The figure below details the monthly energy use profile for the Golf Course Pavilion.



The data provided for the Golf Course Pavilion shows significant variations in billed energy use from month to month correlated to seasonality. It is important to note that this building is used for a relatively small number of hours during any week and only for a fraction of the year. The figure above clearly demonstrates that the vast majority of its energy use occurs between the months of June and August. Were it occupied on a fulltime basis its energy footprint would be significantly greater. Even the summer months would likely show higher energy use however the building currently has no cooling system.

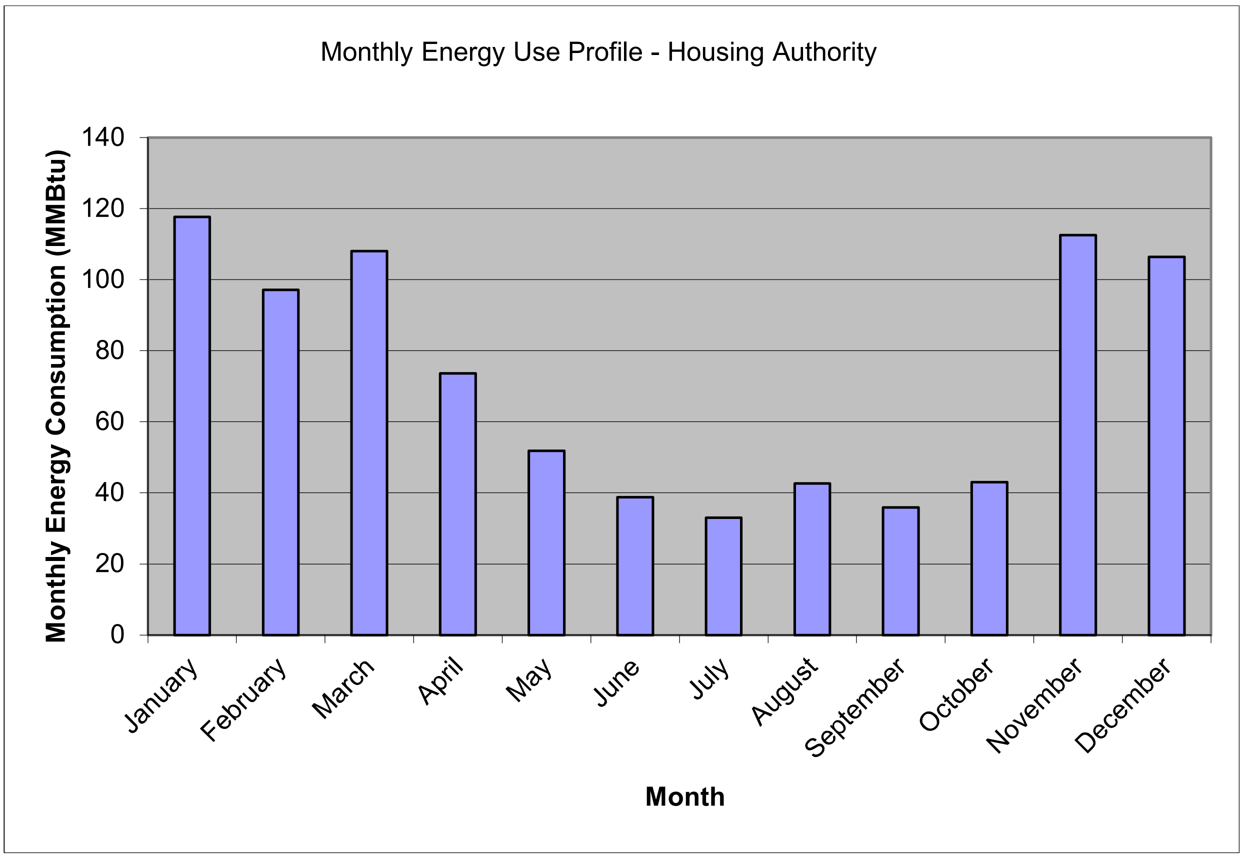
Golf Course Pro Shop

The Golf Course Pro Shop is served by KEC. As can be seen in Table 1, based on the data provided, this building uses 114.3 kBtu/sf/yr compared to a benchmark of 72.6 kBtu/sf/yr, or 359% more energy than would be expected from the same type and size building in the same climate zone. This results in associated annual energy costs of $0.27 per square foot, or total average energy cost of $3,427. The figure below details the monthly energy use profile for the Golf Course Pavilion.



Housing Authority

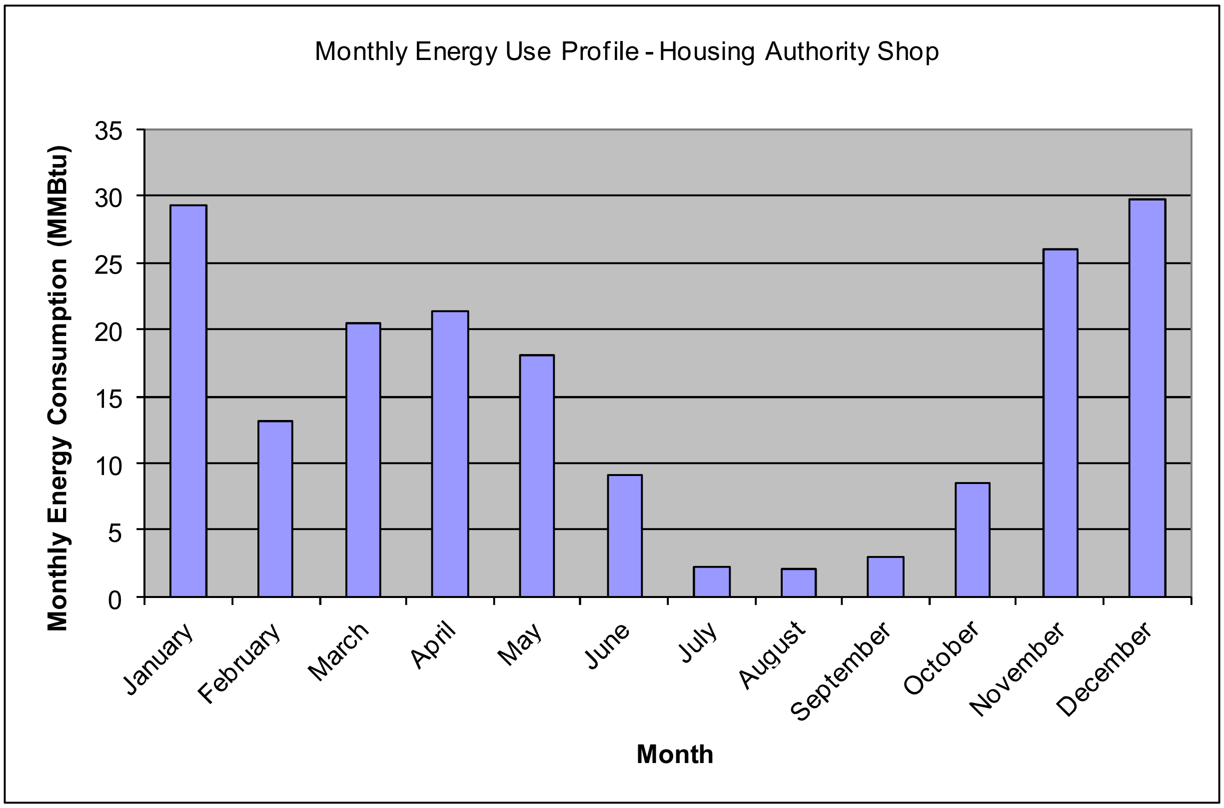
The Housing Authority building is served by PPUD. As can be seen in Table 1, based on the data provided, this building uses 216.4 kBtu/sf/yr compared to a benchmark of 97.8 kBtu/sf/yr, or 121% more energy than would be expected from the same type and size building in the same climate zone, . This results in associated annual energy costs of $1.60 per square foot, or total average energy cost of $6,413. The figure below details the monthly energy use profile for the Housing Authority building.



The data provided for the Housing Authority building shows significant variations in billed energy use from month to month correlated to seasonality, with a net energy use reduction from the base load during spring and fall and increases in winter attributable to heating and slight increases in summer attributable to cooling.

Housing Authority Shop

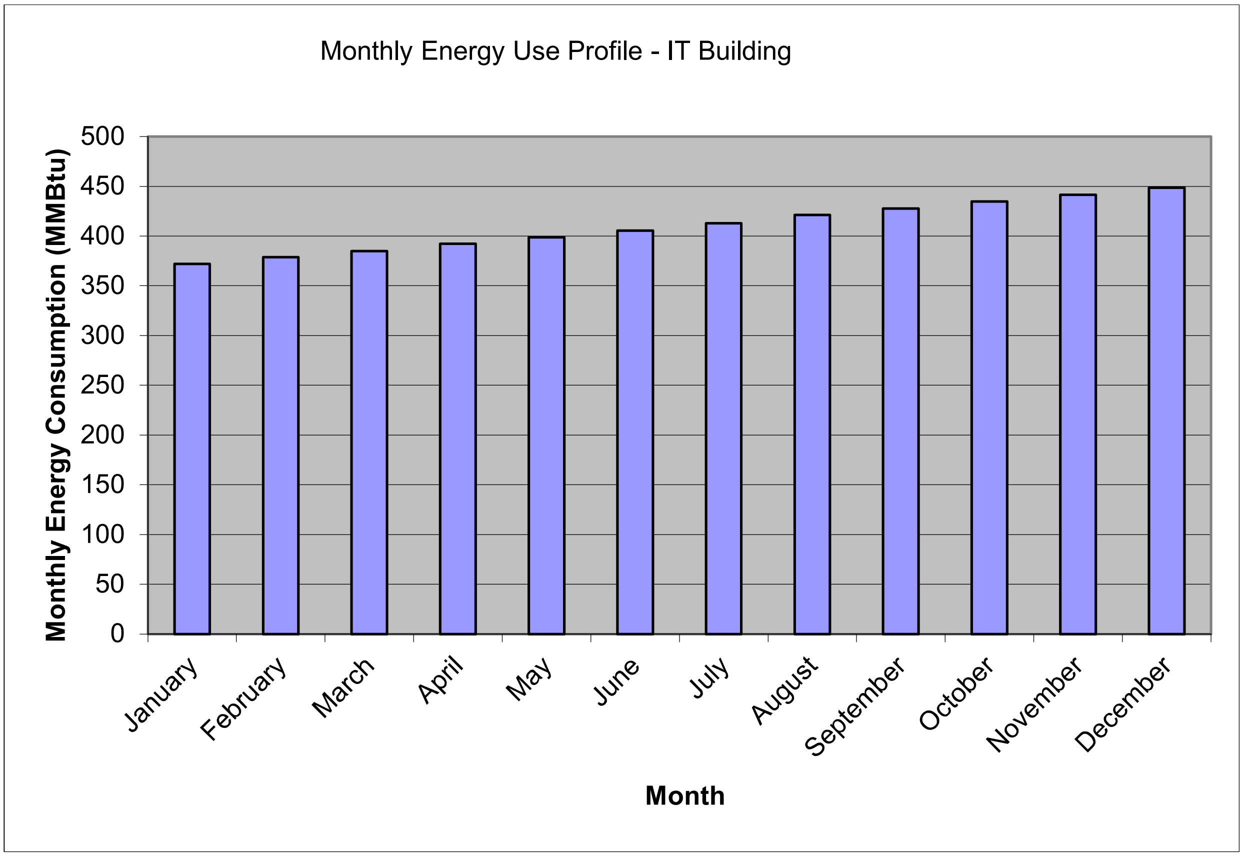
The Housing Authority Shop building is served by PPUD. As can be seen in Table 1, based on the data provided, this building uses 212.6 kBtu/sf/yr compared to a benchmark of 70 kBtu/sf/yr, or 204% more energy than would be expected from the same type and size building in the same climate zone, . This results in associated annual energy costs of $1.88 per square foot, or total average energy cost of $1,682. The figure below details the monthly energy use profile for the Housing Authority building.



The data provided for the Housing Authority building shows significant variations in billed energy use from month to month correlated to seasonality, with a net energy use reduction from the base load during spring and fall and increases in winter attributable to heating and slight increases in summer attributable to cooling.

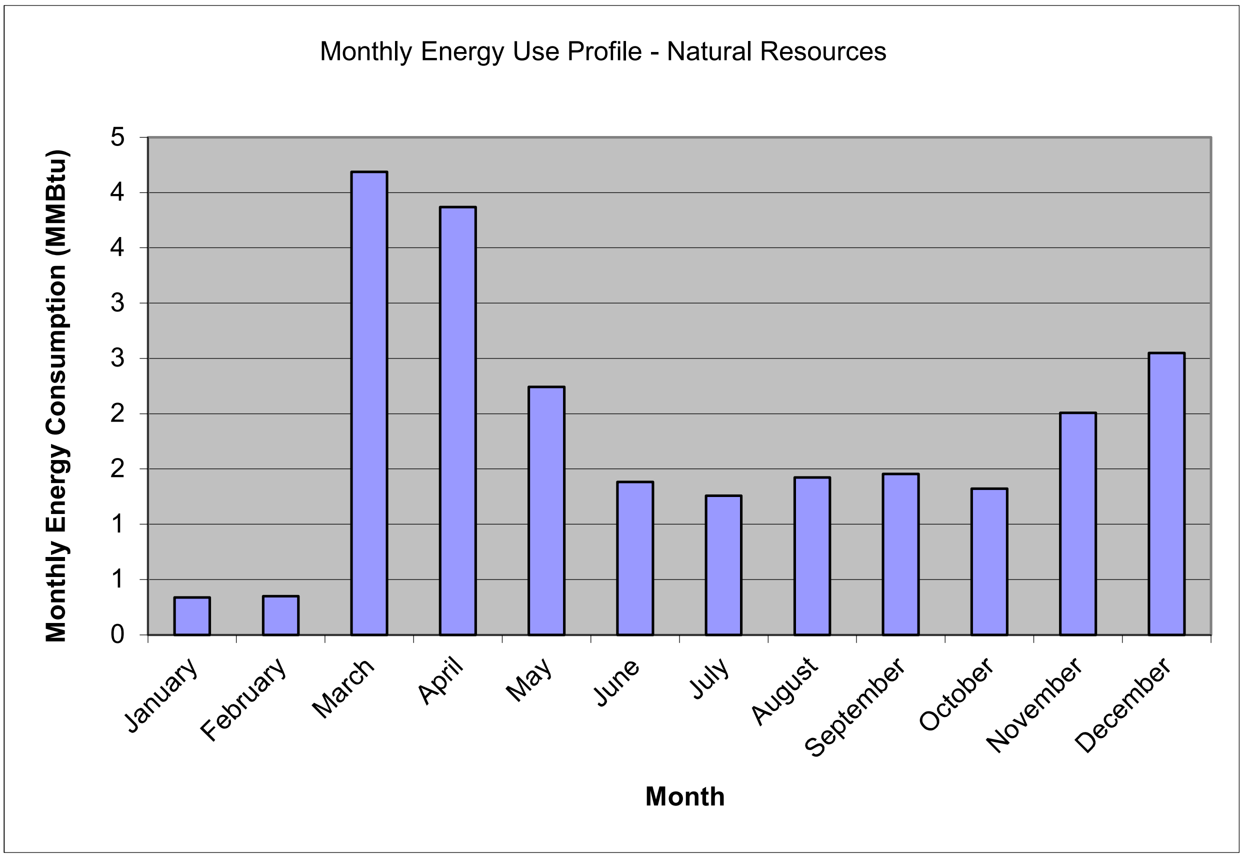
IT Building

The IT Building is served by PPUD. As can be seen in Table 1, based on the data provided, this building uses 663.7 kBtu/sf/yr compared to a benchmark of 213.8 kBtu/sf/yr, or 210% more energy than would be expected from the same type and size building in the same climate zone. This results in associated annual energy costs of $0.11 per square foot, or total average energy cost of $846. The figure below details the monthly energy use profile for the IT building.



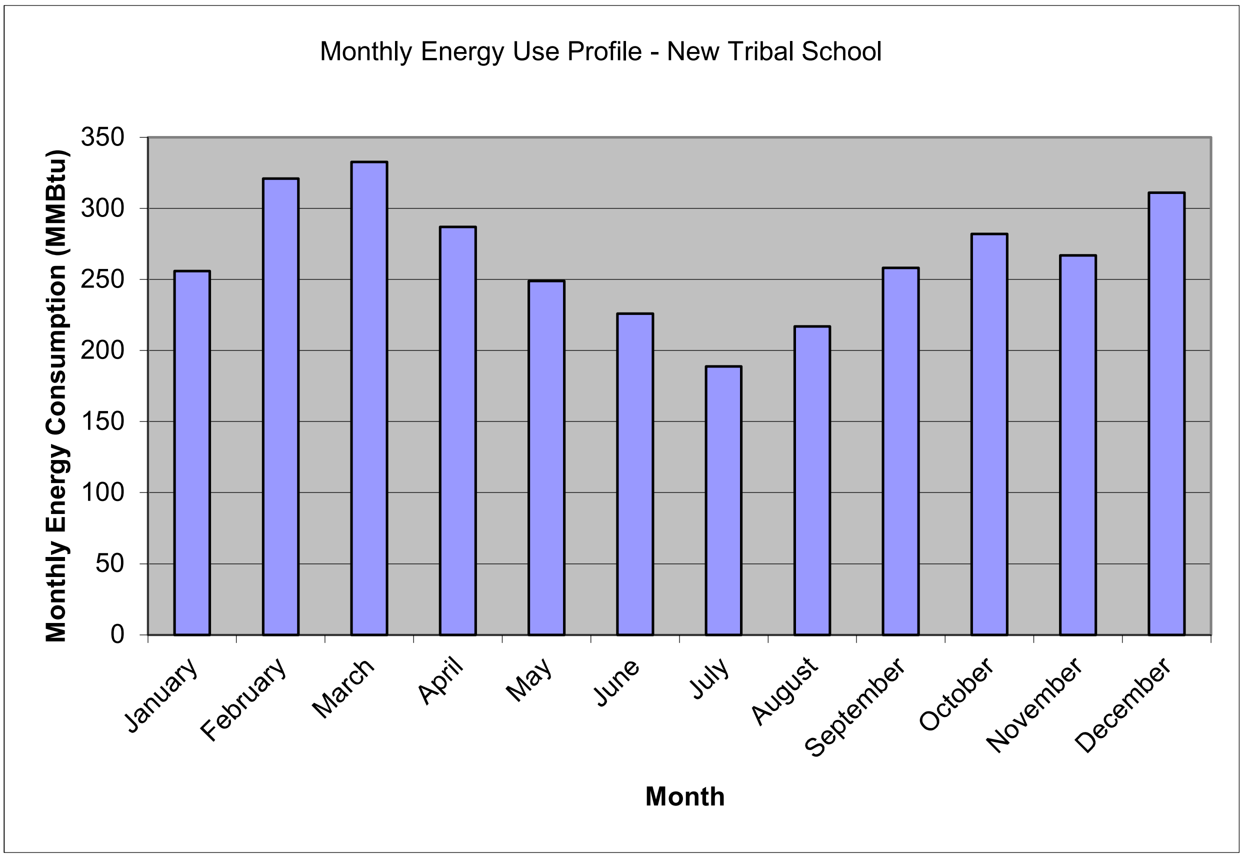
Natural Resources

The Natural Resources Building is served by KEC. Since it is a new building, only one year of historical billing data were available. As can be seen in Table 1, based on the data provided, this building uses 2.3 kBtu/sf/yr compared to a benchmark of 97.8 kBtu/sf/yr, or 98% less energy than would be expected from the same type and size building in the same climate zone. This results in associated annual energy costs of $0.04 per square foot, or total average energy cost of $358. The figure below details the monthly energy use profile for the Natural Resource building.



New Tribal School

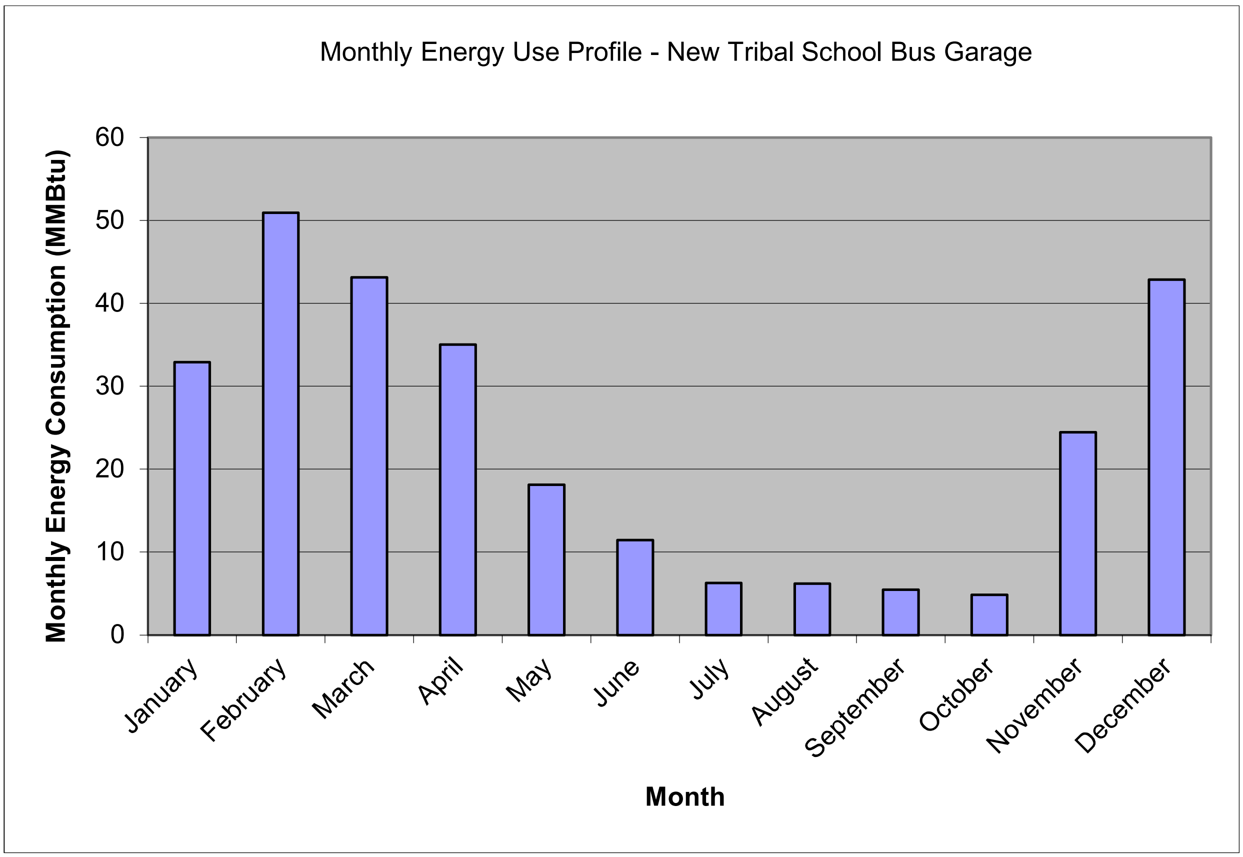
The New Tribal School is served by Clearwater Power Company with propane delivered by Interstate Gas. As can be seen in Table 1, based on the data provided, this building uses 99.7 kBtu/sf/yr compared to a benchmark of 97.8 kBtu/sf/yr, or 37% more energy than would be expected from the same type and size building in the same climate zone. This results in associated annual energy costs of $1.14 per square foot, or total average energy cost of $50,372. The figure below details the monthly energy use profile for the school.



The data provided for the school shows significant variations in billed energy use from month to month correlated to seasonality, with a net energy use reduction from the base load during spring and fall and increases in winter attributable to heating and decreases in summer and around Christmas associated with periods when school is not is session.

New Tribal School Bus Garage (Bus Garage)

The Bus Garage is served by Clearwater Power Company. As can be seen in Table 1, based on the data provided, this building uses 304.4 kBtu/sf/yr compared to a benchmark of 70.0 kBtu/sf/yr, or 335% more energy than would be expected from the same type and size building in the same climate zone. This results in associated annual energy costs of $5.10 per square foot, or total average energy cost of $2,699. The figure below details the monthly energy use profile for the bus garage.

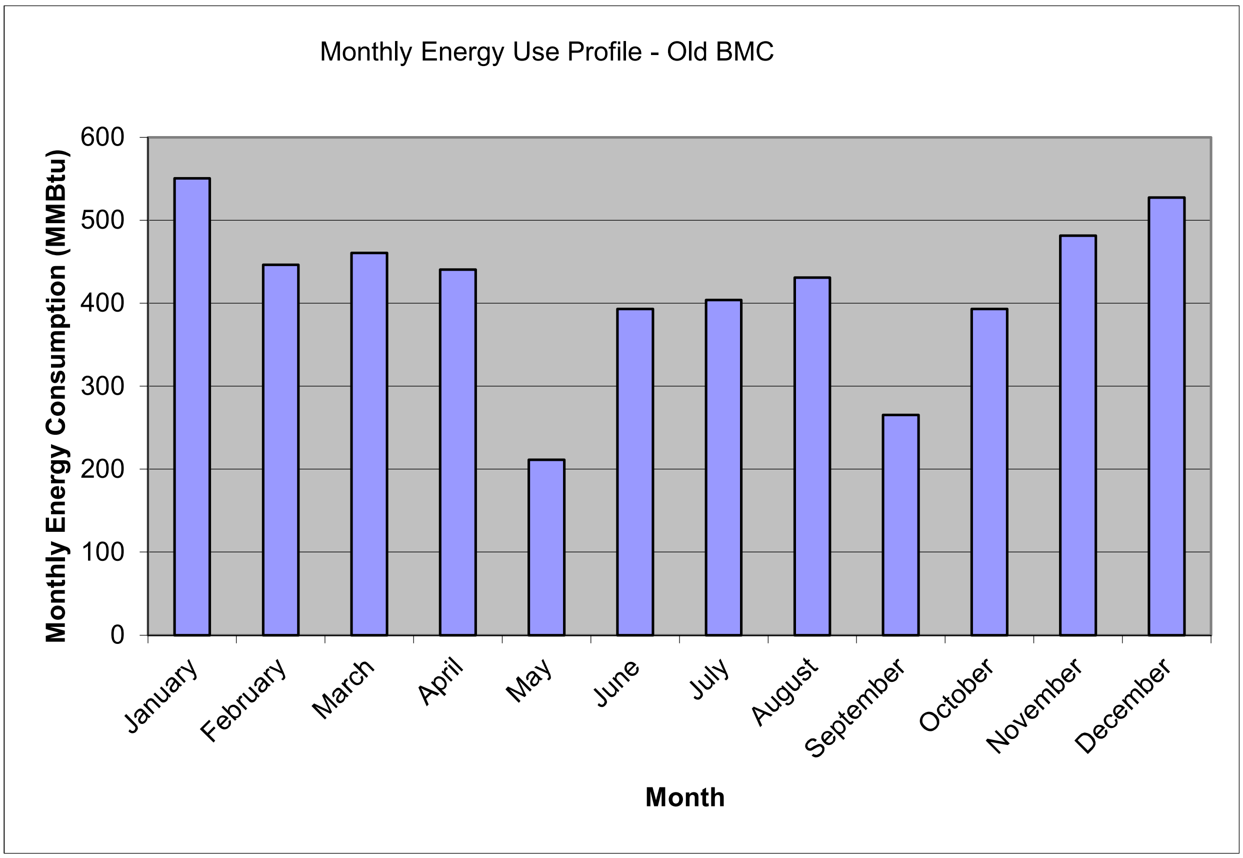


The data provided for the bus garage shows significant variations in billed energy use from month to month correlated to seasonality, with a net energy use reduction from the base load during spring and fall and increases in winter attributable to heating and decreases in summer and around Christmas associated with periods when school is not is session.

It is worthy of note that the energy use index for the Bus Garage is inordinately high. From what OE was able to gather during the site assessment, the primary reason is simply that electric resistance heaters get left on continuously even when no one is in the building. These systems are on mechanical thermostats with no timer or setback capability. While it may be necessary to keep some form of heat available in the restroom to prevent pipes from freezing, there are heat tapes and other types of far more efficient means of meeting that objective. It is highly recommended that the thermostats in the Bus Garage be replaced with programmable units that can better control when and how the heating systems are operating.

Old Benewah Medical Center (Old BMC)

The Old Benewah Medical Center is served by PPUD. As can be seen in Table 1, based on the data provided, this building uses 364.9 kBtu/sf/yr compared to a benchmark of 167.56 kBtu/sf/yr, or 118% more energy than would be expected from the same type and size building in the same climate zone. This results in associated annual energy costs of $1.77 per square foot, or total average energy cost of $24,472. The figure below details the monthly energy use profile for the Old BMC.



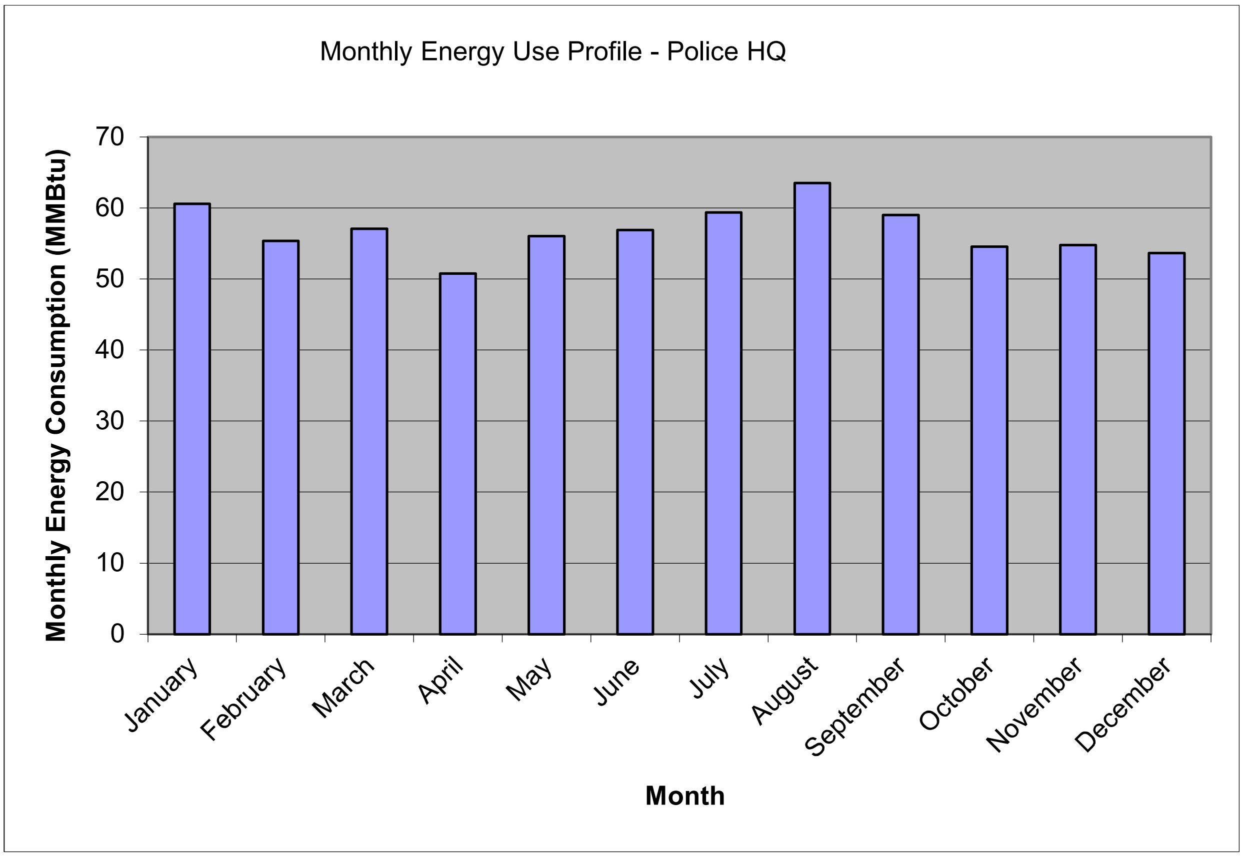
The data provided for the Old BMC shows significant variations in billed energy use from month to month correlated to seasonality, with a net energy use reduction from the base load during spring and fall and increases in winter attributable to heating and a significant spike in summer attributable to cooling.

It is important to note that with construction of the New Benewah Medical Center, the Old BMC has been vacated and is in the process of being repurposed as office space for a new set of occupants. Since a significant part of the original building's energy footprint was a function of its clinical setting, it is likely that significant reductions in its energy use patterns will be observable over the coming year.

Given that the Old BMC is in the process of being repurposed from a medical clinic with relatively high internal process loads to standard office space, it is likely that its energy use profile will change substantially over the coming year.

Tribal Police Headquarters (Police HQ)

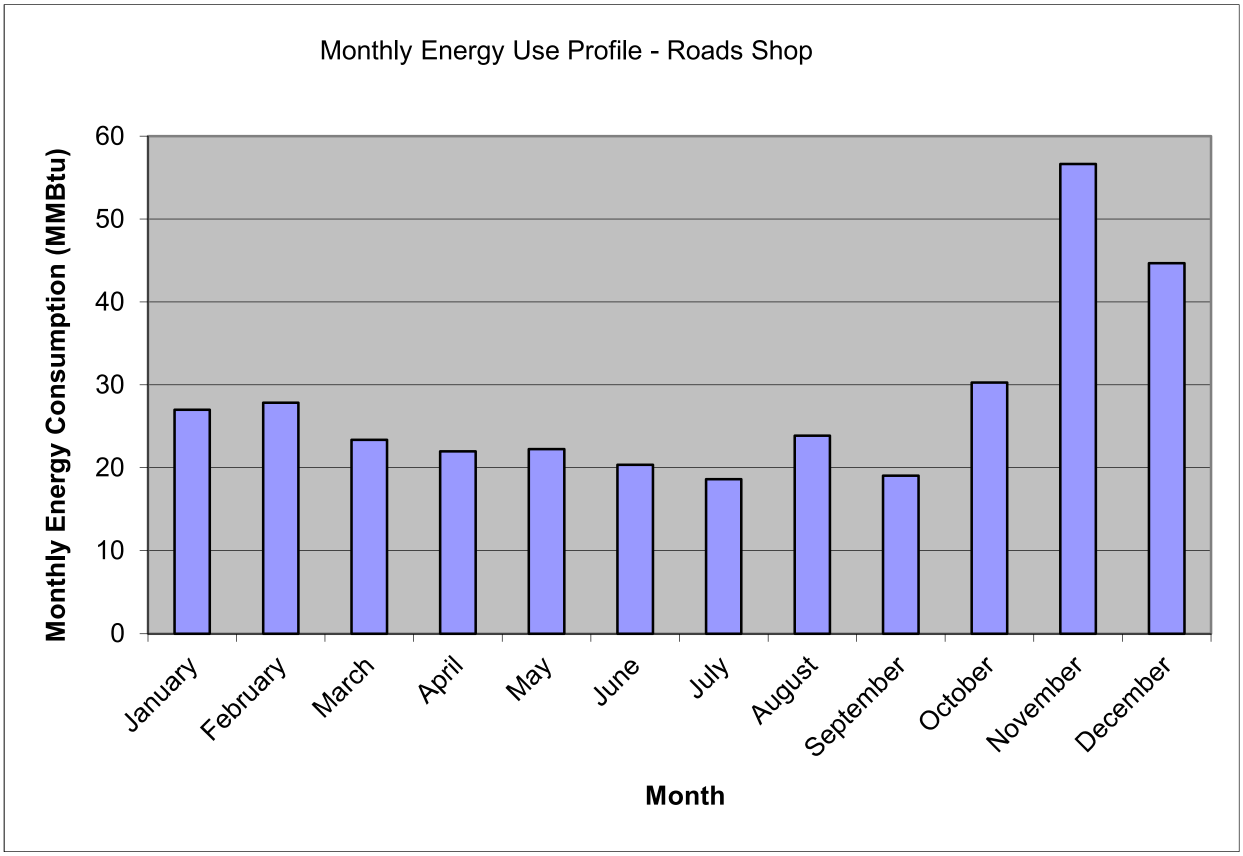
The Police HQ is served by PPUD with propane delivered by Interstate Gas. As can be seen in Table 1, based on the data provided, this building uses 391.5 kBtu/sf/yr compared to a benchmark of 97.4 kBtu/sf/yr, or 302% more energy than would be expected from the same type and size building in the same climate zone. This results in associated annual energy costs of $1.61 per square foot, or total average energy cost of $5,777. The figure below details the monthly energy use profile for the Police HQ.



The data provided for the Police HQ shows only moderate variations in billed energy use from month to month correlated to seasonality, likely due to a relatively high base load made up of mostly computing equipment.

Roads Maintenance Shop (Roads Shop)

The Roads Shop is served by PPUD with one auxiliary heating system that utilizes recycled waste oil when it is available. As can be seen in Table 1, based on the data provided, this building uses 153.6 kBtu/sf/yr compared to a benchmark of 70.0 kBtu/sf/yr, or 119% more energy than would be expected from the same type and size building in the same climate zone. This results in associated annual energy costs of $1.39 per square foot, or total average energy cost of $2,819. The figure below details the monthly energy use profile for the Roads Shop.

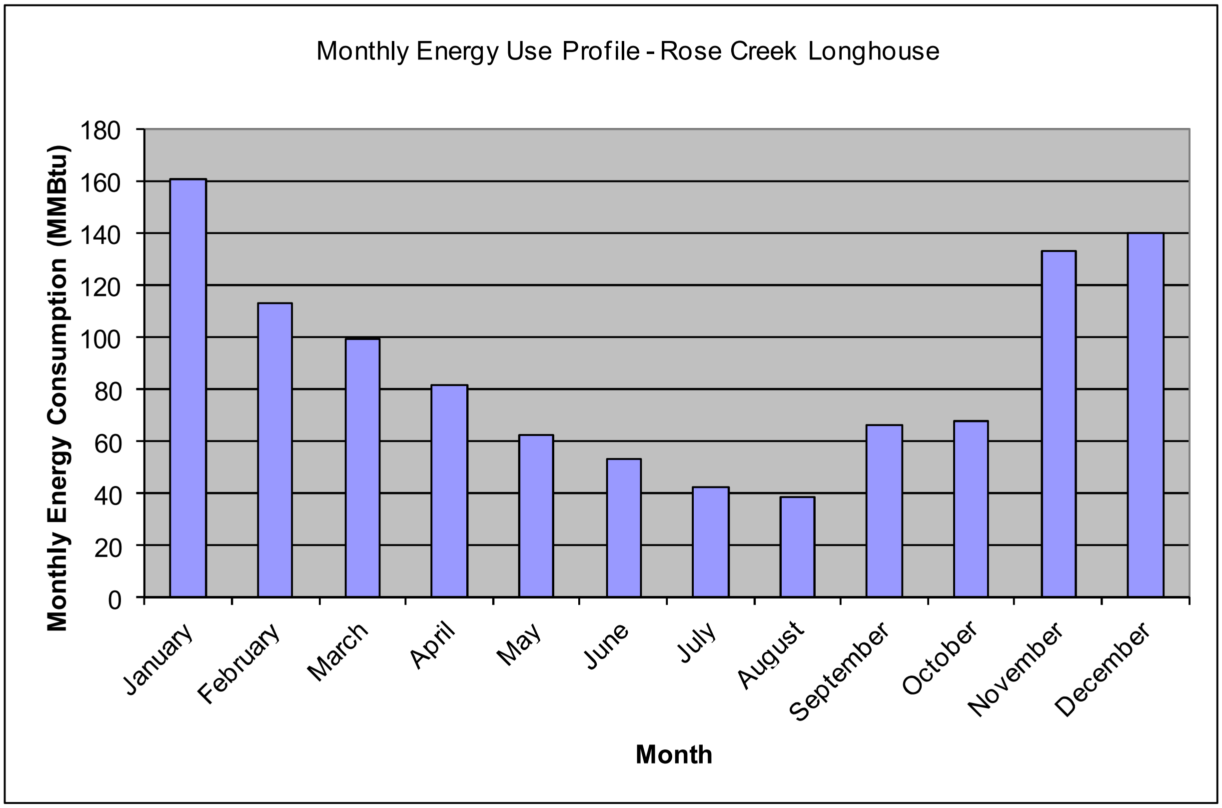


The data provided for the Roads Shop shows significant variations in billed energy use from month to month correlated to seasonality, with a significant increase in winter attributable to heating. There is no increase in summer as the building has no cooling.

The New Roads Maintenance Shop is not included in this analysis since it was only completed very recently hence there is no useful historical energy billing data available for it.

Rose Creek Longhouse

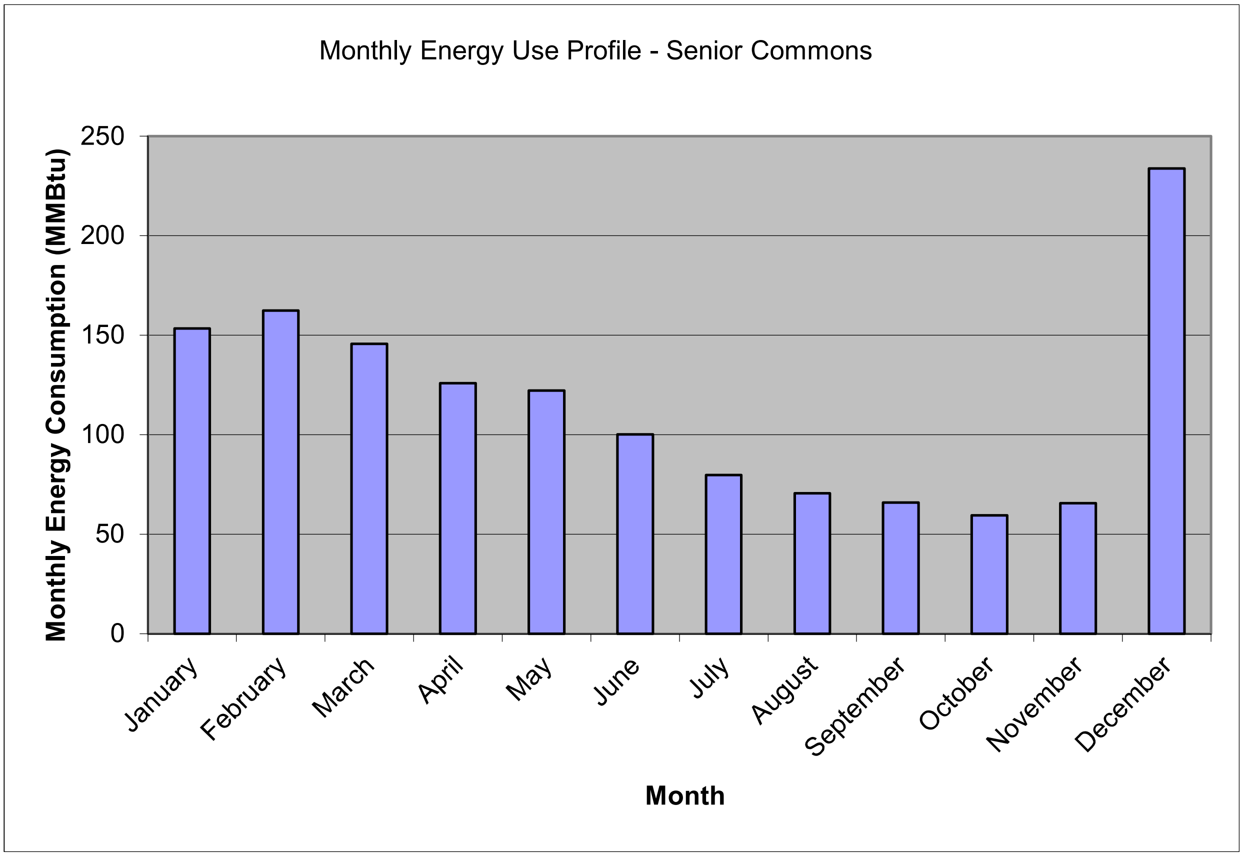
The Rose Creek Longhouse is served by Clearwater Power Company with propane delivered by Interstate Gas. As can be seen in Table 1, based on the data provided, this building uses 124.5 kBtu/sf/yr compared to a benchmark of 96.0 kBtu/sf/yr, or 27% more energy than would be expected from the same type and size building in the same climate zone. This results in associated annual energy costs of $1.82 per square foot, or total average energy cost of $5,680. The figure below details the monthly energy use profile for the Rose Creek Longhouse.



The data provided for the Rose Creek Longhouse shows significant variations in billed energy use from month to month correlated to seasonality, with a significant increase in winter attributable to heating but no corresponding increase in summer attributable to cooling. It is worth noting that the propane fuel consumption data provided appear anomalously high for this building. The fuel delivery data was verified with the vendor, and given that there are no or minimal propane deliveries in the summer months there is no reason to suspect a major leak. It appears that the building is simply heated a great deal during winter months whether it is occupied or not. An aggressive new approach to managing the building is recommended and will likely yield many thousands of dollars in annual savings.

Senior Housing Commons

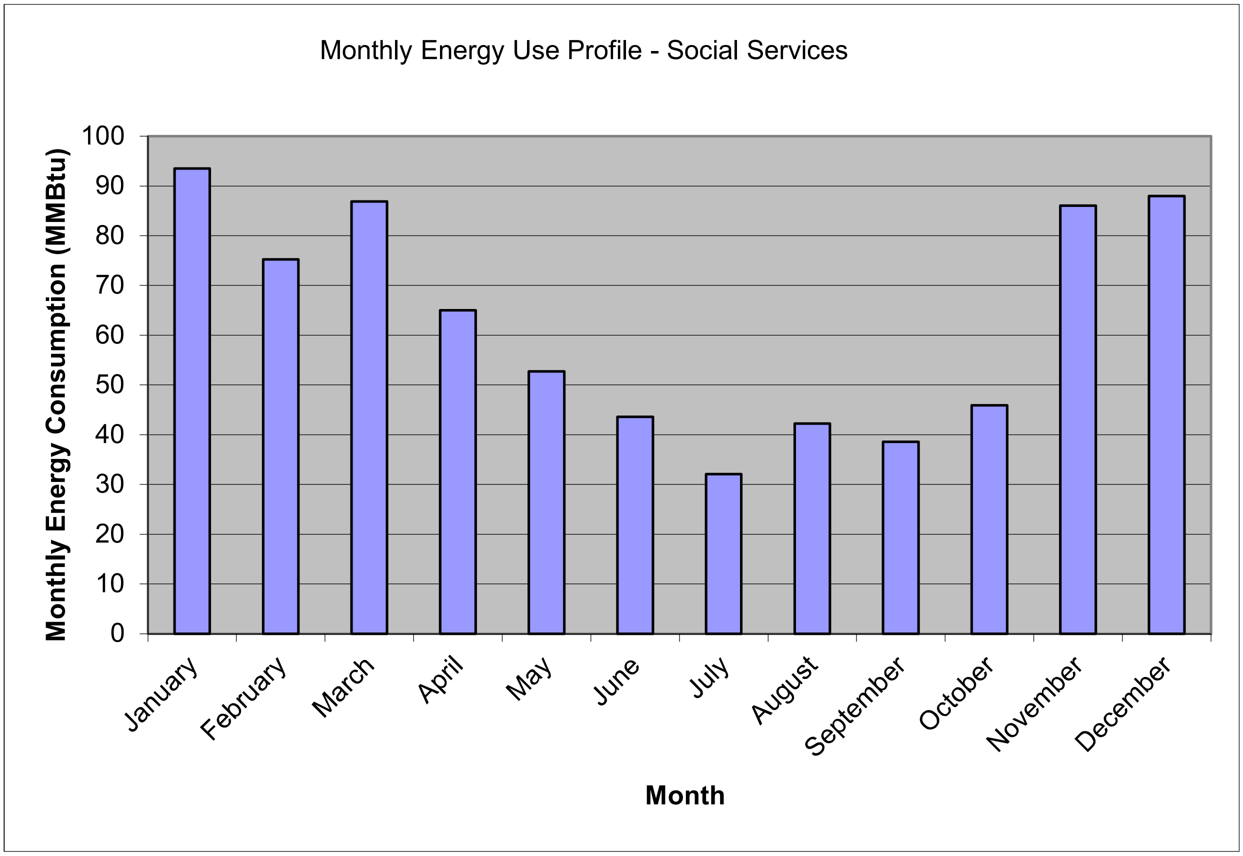
The Senior Housing Commons is served by KEC with propane delivered by Interstate Gas. As can be seen in Table 1, based on the data provided, this building uses 329.0 kBtu/sf/yr compared to a benchmark of 60.0 kBtu/sf/yr, or 448% more energy than would be expected from the same type and size building in the same climate zone. This results in associated annual energy costs of $2.93 per square foot, or total average energy cost of $12,314. The figure below details the monthly energy use profile for the Senior Housing Commons.



ason so is not clear. Further investigation of the day-to-day operations of the building is warranted.

Social Services

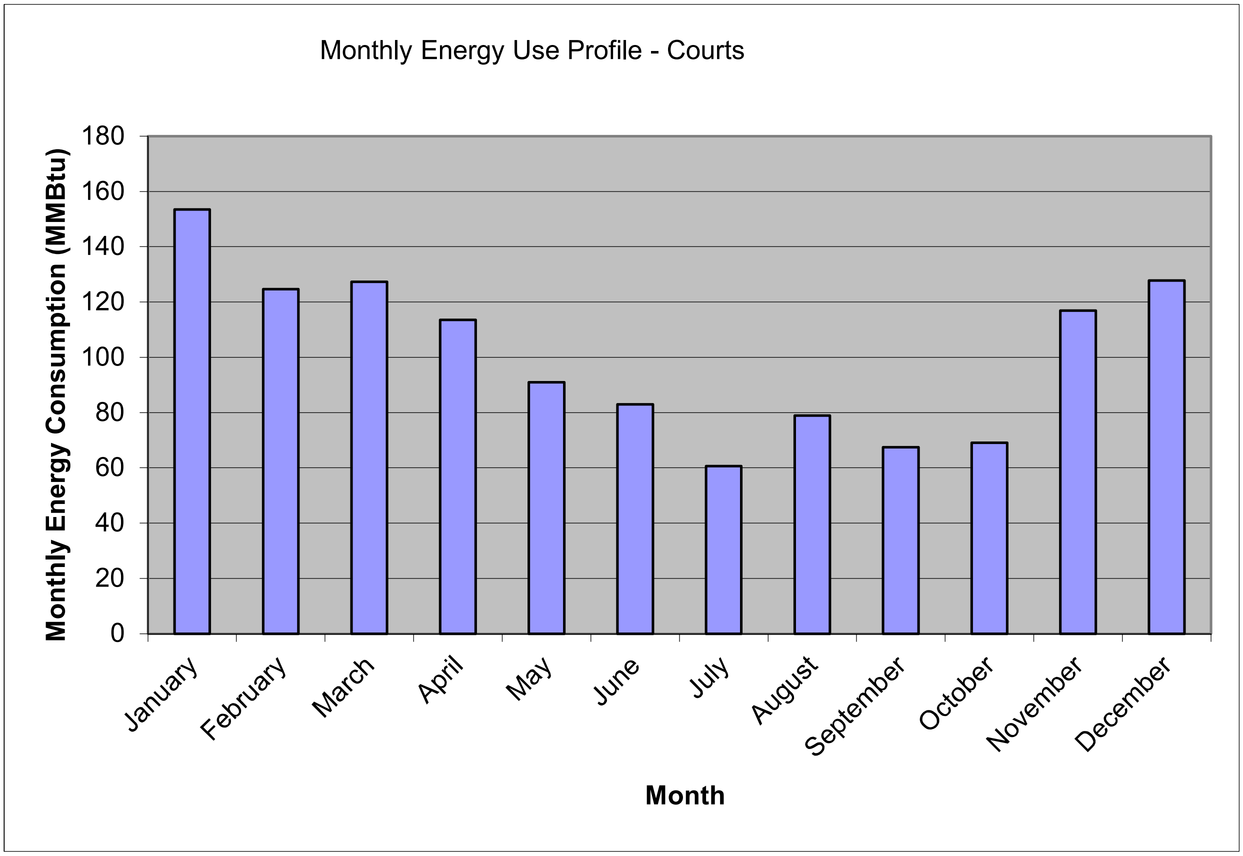
The Social Services building is served by PPUD. As can be seen in Table 1, based on the data provided, this building uses 628.6 kBtu/sf/yr compared to a benchmark of 97.8 kBtu/sf/yr, or 543% more energy than would be expected from the same type and size building in the same climate zone. This results in associated annual energy costs of $4.87 per square foot, or total average energy cost of $5,849. The figure below details the monthly energy use profile for the Social Services Building.



The data provided for the Social Services building shows significant variations in billed energy use from month to month correlated to seasonality, with a net energy use reduction from the base load during spring and fall and increases in winter attributable to heating and slight increases in summer attributable to cooling. It is worth noting that this building's EUI is significantly higher than other nearly identical modular buildings that are used in a similar manner. Assuming the data provided is accurate there is likely some seriously deficient condition in the heating system that warrants further investigation.

Tribal Court Services (Court)

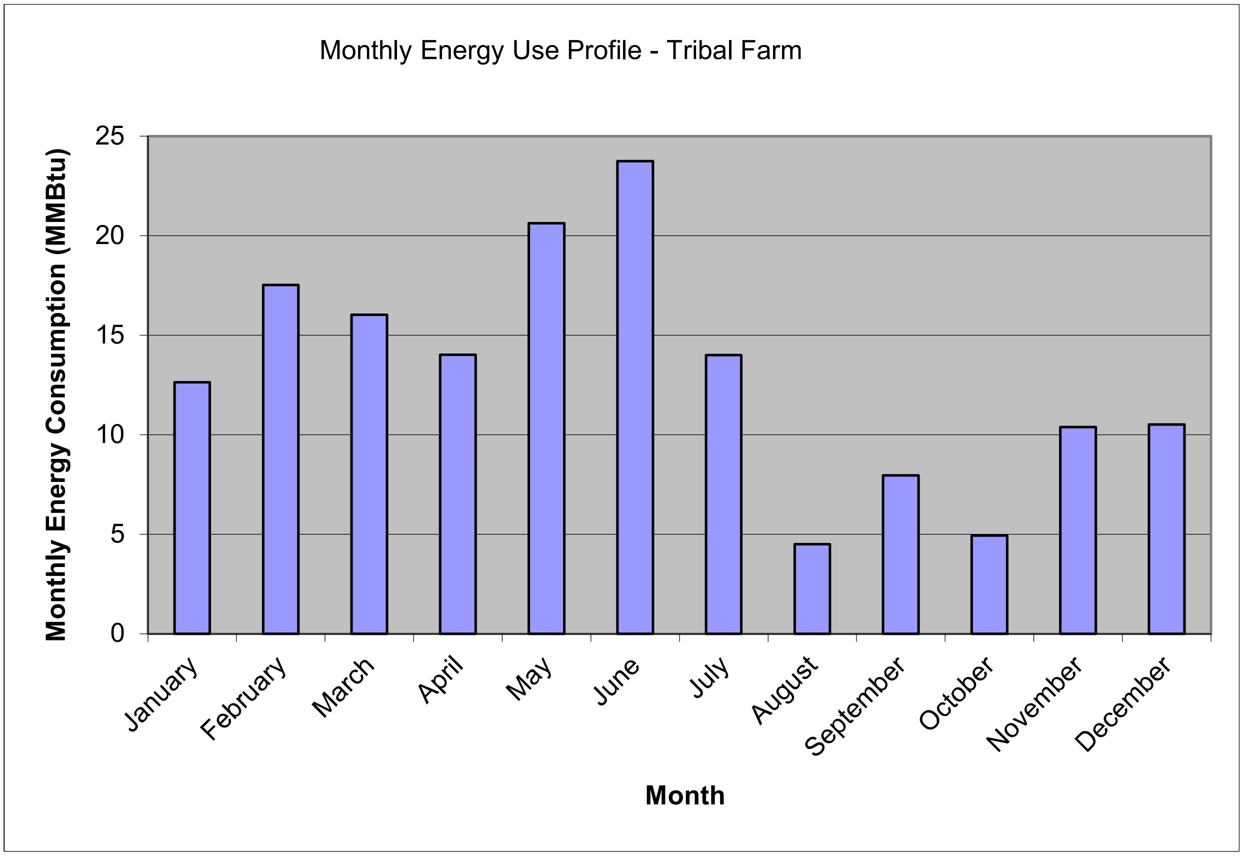
The Court building is served by PPUD. As can be seen in Table 1, based on the data provided, this building uses 628.6 kBtu/sf/yr compared to a benchmark of 97.8 kBtu/sf/yr, or 543% more energy than would be expected from the same type and size building in the same climate zone. This results in associated annual energy costs of $1.02 per square foot, or total average energy cost of $7,631. The figure below details the monthly energy use profile for the Court Building.



The data provided for the Court building shows significant variations in billed energy use from month to month correlated to seasonality, with a net energy use reduction from the base load during spring and fall and increases in winter attributable to heating and slight increases in summer attributable to cooling.

Tribal Farm

The Tribal Farm is served by Clearwater Power. As can be seen in Table 1, based on the data provided, this facility uses 31.6 kBtu/sf/yr compared to a benchmark of 70.0 kBtu/sf/yr, or 55% less energy than would be expected from the same type and size building in the same climate zone. This results in associated annual energy costs of $0.38 per square foot, or total average energy cost of $1,903. The figure below details the monthly energy use profile for the Tribal Farm.

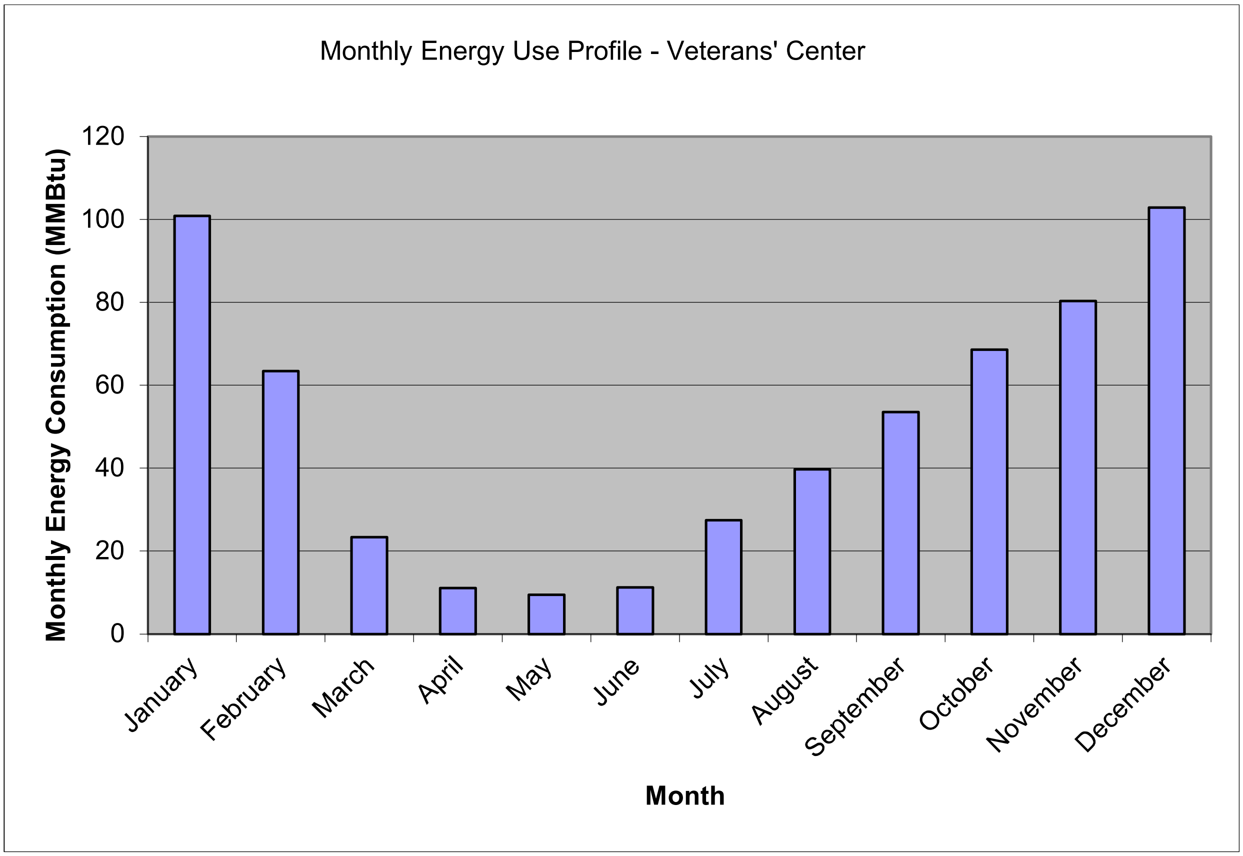


The data provided for the Tribal Farm shows significant variations in billed energy use from month to month correlated to seasonality. As an agricultural facility, these variations likely have more to do with the seasonal use than simply increases in heating or cooling loads.

It is worthy of note that the Tribal Farm has net costs per unit of energy that are among the highest paid by the Tribe. This is attributable to the fact that there are multiple meters serving the farm, several of which use almost no energy most months but are still billed a minimum maintenance charge. If these meters can be consolidated savings to the Tribe could add up to several hundred dollars per year.

Veterans' Center

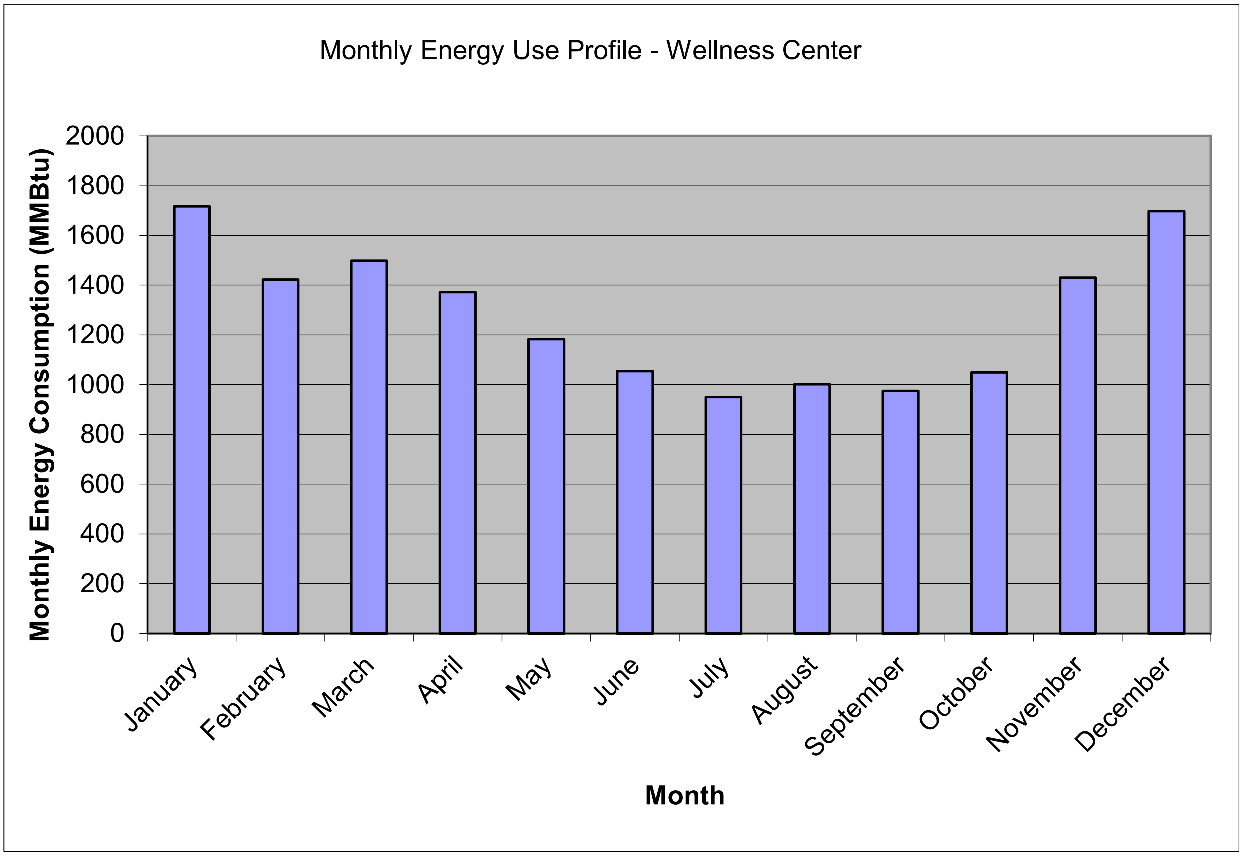
The Veterans' Center is served by KEC. As can be seen in Table 1, based on the data provided, this building uses 267.0 kBtu/sf/yr compared to a benchmark of 147.7 kBtu/sf/yr, or 81% more energy than would be expected from the same type and size building in the same climate zone. This results in associated annual energy costs of $2.41 per square foot, or total average energy cost of $5,118. The figure below details the monthly energy use profile for the Veterans' Center.



The data provided for the Veterans' Center shows significant variations in billed energy use from month to month correlated to seasonality, with a net energy use reduction from the base load during spring, summer, and fall, and increases in winter attributable to heating.

Wellness Center

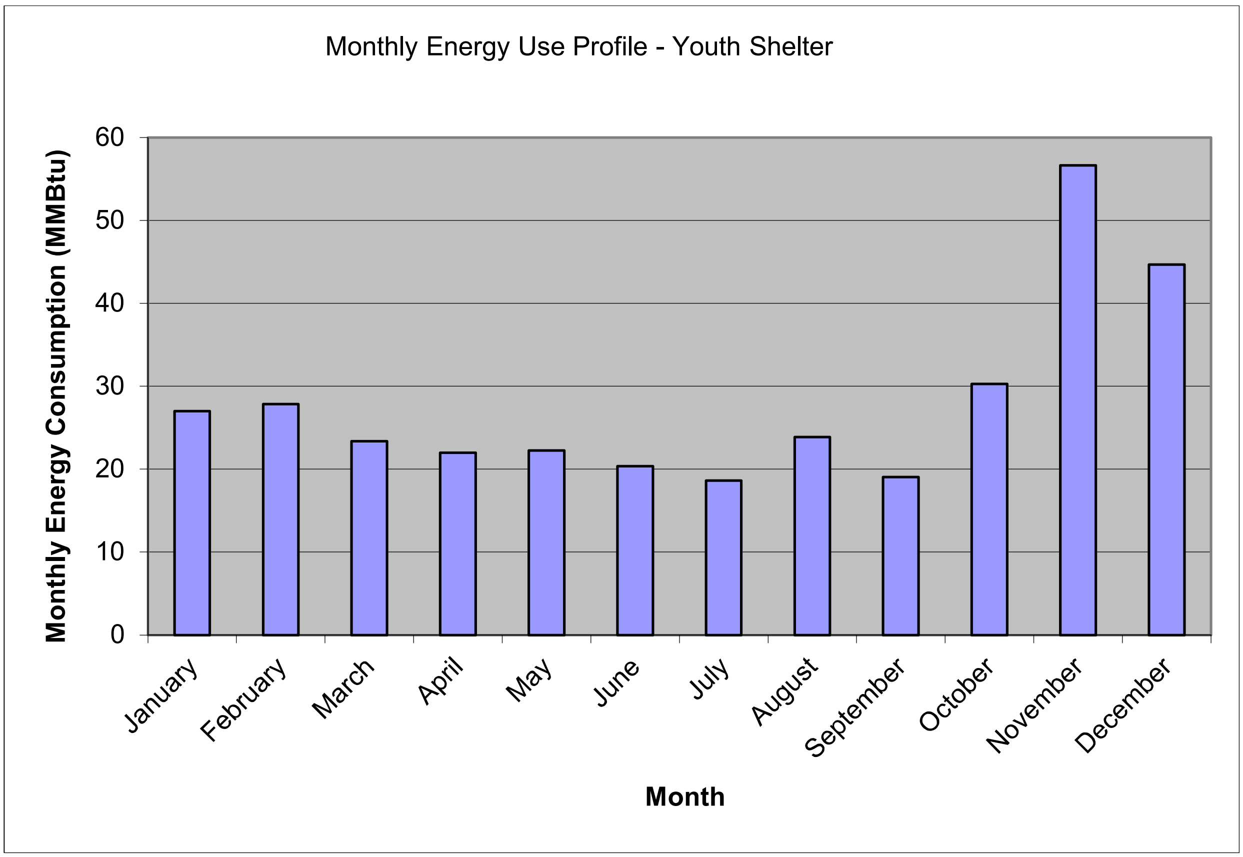
The Wellness Center is served by PPUD. As can be seen in Table 1, based on the data provided, this building uses 367.7 kBtu/sf/yr compared to a benchmark of 107.3 kBtu/sf/yr, or 243% more energy than would be expected from the same type and size building in the same climate zone, although it should be noted that CBECS does not provide comparison data for facilities with indoor swimming pools. This results in associated annual energy costs of $1.61 per square foot, or total average energy cost of $67,636. The figure below details the monthly energy use profile for the Wellness Center.



The data provided for the Wellness Center shows significant variations in billed energy use from month to month correlated to seasonality, with a net energy use reduction from the base load during spring, summer, and fall, and increases in winter attributable to heating.

Youth Shelter

The Youth Shelter is served by PPUD. As can be seen in Table 1, based on the data provided, this building uses 105.6 kBtu/sf/yr compared to a benchmark of 93.9 kBtu/sf/yr, or 13% more energy than would be expected from the same type and size building in the same climate zone. This results in associated annual energy costs of $0.88 per square foot, or total average energy cost of $2,819. The figure below details the monthly energy use profile for the Youth Shelter.



The data provided for the Youth Shelter shows significant variations in billed energy use from month to month correlated to seasonality, with a net energy use reduction from the base load during spring, and fall, and increases in winter attributable to heating and slight increases in summer attributable to cooling.

References

1) EIA US climate zones - http://www.eia.gov/emeu/recs/climate_zone.html
2) U.S. Energy Information Administration 2005 Residential Energy Consumption Survey – Detailed Tables -http://www.eia.gov/emeu/recs/recs2005/c&e/summary/pdf/alltables1-15.pdf
3) U.S. Energy Information Administration 2003 Commercial Building Energy Consumption Survey – Detailed Tables - http://www.eia.gov/emeu/cbecs/cbecs2003/detailed_tables_2003/2003set19/2003pdf/alltables.pdf

EEFS SECTION IV – COEUR D'ALENE TRIBE ENERGY CONSERVATION MEASURE PRIORITIZATION REPORT

Energy Conservation Measure Prioritization Report Executive Summary

As part of the Coeur d'Alene Tribe's Energy Efficiency Feasibility Study, OurEvolution engineers completed an energy project prioritization study for over two hundred energy conservation measures (ECMs) identified for potential implementation within 36 buildings owned and operated by the Coeur d'Alene Tribe. The majority of these measures were identified by OurEvolution engineers during several site visits and facility audits and described in the Field Energy Assessment Initial Findings Report. Additional energy conservation measures, specific to refrigeration system upgrades, were identified during a subsequent field evaluation completed by consultants representing the Energy Smart Grocer program. The types of ECMs evaluated for this prioritization study include: 1) upgrading heating, ventilation and air conditioning systems and controls; 2) lighting upgrades; 3) refrigeration system upgrades; 4) modifications to building operation and maintenance protocols; 4) building envelope modifications; 5) process load controls; and 6) further testing and evaluation.

Energy project prioritization was based on developing baseline and proposed energy performance models; calculating potential energy savings; developing implementation cost and potential rebate estimates; completing economic analyses; completing project criteria development, weighting and scoring of individual measures; completing individual ECM ranking per building; and completing building energy opportunity/necessity ranking across the Tribal buildings evaluated.

The measures with highest individual scores included: programming thermostats to better reflect actual occupancy and energy efficient set points, upgrading incandescent lamps to compact fluorescent, completing refrigeration system upgrades and replacing aging equipment.

In aggregate, this prioritization analysis identified approximately $172,000 in annual energy cost savings with a total implementation cost estimated at approximately 1.2 million dollars. This cost estimate includes approximately a $600,000 refrigeration system upgrade project at the Benewah Market and a $304,000 parking lot lighting upgrade project at the Casino. The annual energy cost savings potential in the Casino Resort and Hotel was the highest of any of the buildings evaluated. The measures considered for the Casino result in an estimated $85,686 in projected annual energy savings which accounts for over half of the energy cost savings potential identified for the entire Coeur d'Alene Tribe building portfolio. The second highest energy cost savings potential, accounting for approximately 10% of the portfolio wide energy cost savings, is associated with energy conservation measures specified for the Benewah Market.

The building with the highest projected annual energy savings as a percentage of total energy use is the Food Distribution Warehouse with a 70% energy use reduction predicted. Though the recommended measures at the Tribal Headquarters will require significant investment, based on the utility data provided, a 64.8% reduction in annual energy use is projected. In addition to energy savings, the measures recommended for the Tribal Headquarters building will significantly improve occupant comfort, health and safety as well as increase the overall performance of the building which will lead to greater building longevity.

The results of the portfolio wide prioritization are presented in three formats. These formats include: building ranking by annual energy cost savings estimates, building ranking by annual energy savings as a percent of total energy use, and building ranking by internal rate of return on ECM investments. Table 4 summarizes building ranking by annual energy cost savings, the Tribe's preferred initial prioritization criterion.

Table 4. Building Ranking by Annual Energy Cost Savings Potential

Rank	Facility	Estimated Net Incremental Cost of Implementation ($)	Projected Annual Energy Savings (kBtu/year)	Projected Annual Energy Savings (kWh/year)	Projected Annual Savings ($/year)	Annual Energy Savings (%)	Simple Payback (years)	Net Present Value of ECMs ($)	Internal Rate of Return (%)
1	CDA Casino Resort and Hotel	$325,608	3568401	1045839	$85,686	4.9%	3.8	$1,042,785	27.3%
2	Benewah Market	$597,440	1359435	398428	$16,215	31.1%	36.8	-$322,877	-4.3%
3	Food Distribution Warehouse	$32,853	281405	82475	$6,598	70.0%	5.0	$72,741	20.7%
4	Casino Conoco Gas Station	$19,205	309991	90853	$6,358	32.9%	3.0	$82,184	34.3%
5	Circling Raven Golf Course Pro Shop	$17,036	248388	72798	$5,671	16.5%	3.0	$73,398	34.5%
6	DeSmet Longhouse	$1,840	172666	50606	$5,349	36.2%	0.3	$83,048	294.5%
7	Rose Creek Longhouse	$742	154607	45313	$4,713	22.8%	0.2	$74,031	594.4%
8	Tribal Headquarters	$58,400	214975	63005	$4,457	66.9%	13.1	$13,978	5.4%
9	Early Childhood Learning Center	$31,425	182777	53569	$3,772	16.0%	8.3	$29,313	11.4%
10	Benewah Auto	$17,960	173674	50901	$3,240	16.8%	5.5	$33,945	18.4%
11	Tribal Wellness Center	$8,144	123448	36181	$2,894	2.4%	2.8	$37,983	36.8%
12	Fire Warehouse and Shop	$9,166	116807	34234	$2,738	38.8%	3.3	$34,522	31.0%
13	Tribal Court Services	$1,645	133232	39048	$2,366	32.9%	0.7	$35,920	146.2%
14	Senior Housing Complex	$6,083	93556	27420	$2,248	17.6%	2.7	$29,750	38.2%
15	New Tribal School	$6,000	85736	25128	$2,155	3.8%	2.8	$28,353	37.2%
16	Tribal Housing Authority	$3,989	79513	23304	$1,864	27.7%	2.1	$25,685	48.1%
17	Technology Center	$2,162	71016	20814	$1,665	4.3%	1.3	$24,300	78.7%
18	Tribal Facilities	$2,640	69779	20451	$1,637	30.3%	1.6	$23,391	63.6%
19	Felix Aripa Building	$2,475	67347	19738	$1,579	17.1%	1.6	$22,632	65.4%
20	Social Services	$2,580	66013	19347	$1,547	26.4%	1.7	$22,035	61.5%
21	Tribal Police HQ	$9,376	65390	19165	$1,438	28.6%	6.7	$17,580	14.8%
22	Department of Education	$3,963	69040	20234	$1,426	21.4%	2.8	$18,765	37.2%
23	Finance Department	$2,473	50590	14827	$1,320	32.6%	1.9	$18,539	54.9%
24	Veteran's Center	$279	46951	13761	$1,068	23.8%	0.3	$16,660	353.5%
25	Career Renewal & Child Services	$2,078	37937	11119	$889	30.2%	2.3	$12,085	44.1%
26	Casino Daycare	$1,949	35587	10430	$834	31.1%	2.3	$11,337	44.1%
27	Golf Course Pavilion	$10,335	25369	7435	$643	44.6%	16.1	$160	3.2%
28	Echelon Plummer	$1,250	26451	7752	$491	0.9%	2.5	$6,578	40.6%
29	Tribal School - New Bus Garage	$800	20562	6026	$482	21.9%	1.7	$6,867	61.8%
30	City Link	$3,618	21645	6344	$414	12.3%	8.7	$3,049	10.7%
31	Tribal Housing Authority Shop	$903	10498	3077	$246	17.2%	3.7	$3,026	28.3%
32	Old Roads Maintenance Shop	$855	8867	2599	$221	7.9%	3.9	$2,670	26.8%
33	BIA	$1,235	7250	2125	$208	28.9%	5.9	$2,101	17.1%
34	Youth Shelter	$12,855	-21874	-6411	-$551	-19.5%	-23.3	-$21,213	NA
Totals		***$1,199,361***	***7977028***	***2337933***	***$171,880***			***$1,565,318***	

Introduction and Purpose

This report describes the analyses and results of the energy project prioritization process. The energy conservation measures considered for this report are based on the results of energy audits conducted within 36 tribally owned facilities as summarized in the Coeur d'Alene Tribe Initial Findings report. In addition to the ECMs and conditions noted in the Field Energy Assessment Initial Findings Report this prioritization includes the evaluation of measures that were identified by OurEvolution and energy consultants representing the Energy Smart Grocer program subsequent to the initial field work. These additional measures include refrigeration upgrades at the Benewah Market, Tribal Casino Facilities, Tribal Casino Conoco, and the Tribal Food Distribution Warehouse. This report also includes a discussion of potential renewable energy projects and their relative feasibility for implementation on tribal lands. The purpose of this report is to provide decision makers with the necessary information to allocate resources to plan, schedule and implement energy projects within specific buildings as well as across the entire Tribally owned building portfolio.

Energy Project Prioritization Methodology

As outlined in the Initial Findings Report, there are significant opportunities within the buildings evaluated for the larger Energy Efficiency Feasibility Study. The majority of these opportunities are classified as energy conservation measures (ECMs); therefore the focus of this report is the evaluation of these ECMs. The energy project prioritization process can be generally summarized in the following steps:

1) Develop building specific baseline energy performance metrics for the existing conditions.
2) Develop building specific energy performance metrics for the "proposed" conditions which include potential energy conservation measure implementation.
3) Determine potential energy and cost savings between the existing and proposed conditions.
4) Complete economic assessment of specific and aggregate ECMs.
5) Develop assessment criteria and weighting.
6) Rank specific ECMs per building based on weighted criteria.
7) Develop aggregate "Building Rankings" based on economic criteria.

Developing Baseline and Proposed Building Energy Performance Metrics

In order to quantify the existing energy performance and potential energy savings from alternative energy conservation measure(s) (ECMs) as outlined in the Initial Field Findings Report, baseline building energy performance models were completed for each of the subject buildings. Two software packages were used to model the subject buildings. Building performance for structures with complex geometry and/or complex mechanical system ECMs were modeled using the ***EnergyPro Version 5.1*** software program as the building energy analysis tool. This program uses the DOE-2.1E hourly simulation tool, distributed by the Department of Energy, as the calculation engine. The DOE-2.1E simulation engine is considered to be one of the most accurate simulation tools for this application, and evaluates energy use and peak demand requirements on an hourly basis over the course of a representative "average" weather year compiled from 20 years of climate data for the region in question. EnergyPro reports projected net annual building performance, as calculated by DOE-2.1E. All other building energy performance models were completed using ***RETScreen International Clean Energy Project Analyses Software*** (Version 4.0) (RETScreen). The RETScreen is a bin-based renewable energy and energy efficiency project screening software suite provided by the Natural Resources Canada and includes climate data from over 4,700 ground-station locations plus NASA satellite date, as well as data from worldwide renewable energy resource maps. Lighting retrofit potential energy savings and rebates were calculated using the Bonneville Power Administration's (BPA) Lighting Retrofit Calculator provided by BPA staff.

After developing a baseline model of each of the buildings, the final aspect of the building performance analyses consisted of modeling individual and aggregate energy efficiency and conservation measures (ECMs) identified in the Initial Field Findings Report and other energy assessments, in order to develop comparative energy savings between the base case and "upgraded models".

Completing Economic Assessment for Potential ECMs

Several factors are considered in evaluating any specific energy conservation measure's economic impact. The first of these is the net incremental cost (NIC), which is defined as either the total capital cost of a standalone measure, or the difference in cost between a premium (energy efficient) measure and a standard measure which might otherwise be required. Any available utility rebates are deducted from the total project cost estimate to determine the net incremental project cost. Where applicable, utility rebate spreadsheets were completed to calculate potential rebates for specific measures. These utility spreadsheets were provided to the Tribe electronically for submission to the appropriate entities. Simple payback is another useful metric that defines the time period that is required to "payback" the initial capital investment through energy cost savings. Simple payback is calculated as the ratio of the NIC to the dollar value of the projected annual energy savings. Though useful as a coarse screening tool for simple projects, as its name would suggest, simple payback is a very basic economic metric that does not take into account economic factors such as the time-value of money, energy cost increases over time and inflation. Net Present Value (NPV) is a time series of discounted future cash flows associated with project costs and benefits, accounting for inflation and fuel escalation rates and assuming a 20-year life cycle for the measure. NPV is the preferred economic indicator for most energy projects. The economic factors utilized for this study were:

1) Discount Rate – 3% - National Institute of Science and Technology, Discount rate for energy projects, 2013.
2) Energy Escalation Rate – 0.97% - National Institute of Science and Technology, Energy Escalation Rate Calculator, 2013.
3) Period of Analyses – 20 years – Typical lifespan of the energy conservation measures specified for the proposed projects.

Internal Rate of Return (IRR) is the discount rate at which the NPV of a measure's cost becomes equal to the NPV of the benefits; the higher the IRR the more desirable the measure. Appendix D contains the complete economic evaluation spreadsheet used for this report.

Energy Project Ranking

Though economic factors are important to consider when developing project prioritization, other factors must also be considered. A matrix of criteria relative to the strategic fit, economic impact, and feasibility of each measure was developed in order to objectively prioritize the proposed measures. These criteria are defined as:

1) Routine Building O&M Requirement – Any measure that addresses conditions or issues that would need to be addressed as part of existing building operations, and not necessarily be considered an "energy conservation measure" project receives a higher score in this category. These issues include aging infrastructure that needs to be replaced in advance of failure.
2) Energy Savings Potential – Measures that result in higher annual energy savings receive higher scores in this category.
3) Internal Rate of Return – Measures that result in higher IRR's receive higher scores in this category.
4) Feasibility – Measures were judged on their technical feasibility with respect to complexity of implementation, technology availability, and operation and maintenance (O&M) requirements.

Measures that have lower complexity, proven available technology and/or lower O&M requirements receive higher scores in this category.

Each of these criteria was assigned a weighting factor relative to its overall significance to the operation of the building. These weightings used for this analysis are shown in Table 5.

Table 5. Energy Project Criteria Weighting

O&M	Economic Impact		Feasibility	Total
Routine Building O&M Requirement	Energy Savings Potential	Internal Rate of Return	Feasibility	
25%	25%	25%	25%	100%

Each proposed energy conservation measure or project was ranked on a scale of 1 to 10 for each of the individual criteria described above and a composite score was calculated by multiplying that rank by each criteria's weighting factor. ECMs with larger relative economic benefits were given higher scores in the economic categories. O&M and Feasibility rankings were assigned based on the assessor's knowledge of the installation, operation and maintenance requirements of specific ECMs. ECMs with the highest aggregate scores receive higher priority with respect to implementation. Once each of the individual measures was scored for each facility, a portfolio wide prioritization was undertaken to target "high priority" facilities within the Tribal buildings. Facilities that are associated with highest potential energy cost savings, energy savings as a percent of total use and/or highest IRR were considered "high priority".

Building Ranking

After completing individual project ranking, each of the buildings was evaluated to determine which had the highest need and/or opportunity for building performance improvement. Building prioritizations are based on the aggregate results of the energy modeling and economic analyses completed for individual energy conservation measures and building performance projects considered for each building. There are many ways in which to prioritize buildings with the greatest need or opportunity for building performance improvements. The building prioritizations completed for this study are based on:

1) Annual Energy Cost Savings Potential based on implementation of all energy conservation measures considered for the building.

2) Annual Energy Savings Potential (as a percentage of total annual building energy use) based on implementation of all energy conservation measures considered for the building.
3) Internal Rate of Return based on implementation of all energy conservation measures considered for the building.

Rankings based on the criteria stated above are rarely 100% in agreement, therefore Tribal decision makers will need to complete project implementation based on the criterion which best supports Tribal planning and budgeting. OE recommends using the Tables concurrently in order to develop a full understanding of the costs and merits of the relative ranking. For example, though the Tribal Casino and Resort has the highest energy savings potential, in order to achieve all of the predicted savings, a substantial investment must be made which results in a lower rate of return than other ECM packages specified for other buildings.

Tribal Portfolio - Building Ranking Results

The following sections summarize the building performance enhancement project prioritization determined for the Coeur d'Alene Tribal Building Portfolio.

Building Ranking by Annual Energy Cost Savings Potential

Table 6 summarizes the building ranking based on Annual Energy Cost Savings Potential. This table provides a listing from most energy cost savings potential to least energy cost savings potential for the buildings considered as part of this study.

Table 6. Building Ranking by Annual Energy Cost Savings Potential

Rank	Facility	Estimated Net Incremental Cost of Implementation ($)	Projected Annual Energy Savings (kBtu/year)	Projected Annual Energy Savings (kWh/year)	Projected Annual Savings ($/year)	Annual Energy Savings (%)	Simple Payback (years)	Net Present Value of ECMs ($)	Internal Rate of Return (%)
1	CDA Casino Resort and Hotel	$325,608	3568401	1045839	$85,686	4.9%	3.8	$1,042,785	27.3%
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12	Fire Warehouse and Shop	$9,166	116807	34234	$2,738	38.8%	3.3	$34,522	31.0%
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15	New Tribal School	$6,000	85736	25128	$2,155	3.8%	2.8	$28,353	37.2%
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21	Tribal Police HQ	$9,376	65390	19165	$1,438	28.6%	6.7	$17,580	14.8%
22	Department of Education	$3,963	69040	20234	$1,426	21.4%	2.8	$18,765	37.2%
23	Finance Department	$2,473	50590	14827	$1,320	32.6%	1.9	$18,539	54.9%
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30	City Link	$3,618	21645	6344	$414	12.3%	8.7	$3,049	10.7%
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32	Old Roads Maintenance Shop	$855	8867	2599	$221	7.9%	3.9	$2,670	26.8%
33	BIA	$1,235	7250	2125	$208	28.9%	5.9	$2,101	17.1%
34	Youth Shelter	$12,855	-21874	-6411	-$551	-19.5%	-23.3	-$21,213	NA
Totals		***$1,199,361***	***7977028***	***2337933***	***$171,880***			***$1,565,318***	

As can be seen in Table 6, the Tribal Casino Resort and Hotel has the highest energy cost savings potential associated with implementing the recommended ECMs. With a modest 4.9% energy reduction, the projected energy cost savings at the Casino is $85,686 which represents approximately half of the total energy cost savings projected for the entire Coeur d'Alene building portfolio. The Youth Shelter ranks last on this prioritization due to the fact that the recommended measures include providing additional heating and cooling capacity that is not currently being provided resulting in a net increase in energy use; however, this additional capacity is necessary to improve the overall comfort and building performance conditions within the Youth Shelter.

Building Ranking by Annual Energy Savings Potential

Table 7 summarizes the building ranking based on Annual Energy Savings Potential. This table provides a listing from most annual energy savings as a percentage of total annual building energy use to least annual energy savings as a percentage of total annual building energy use.

Table 7. Building Ranking by Annual Energy Savings Potential

Rank	Facility	Estimated Net Incremental Cost of Implementation ($)	Projected Annual Energy Savings (kBtu/year)	Projected Annual Energy Savings (kWh/year)	Projected Annual Savings ($/year)	Annual Energy Savings (%)	Simple Payback (years)	Net Present Value of ECMs ($)	Internal Rate of Return (%)
1	Food Distribution Warehouse	$32,853	281405	82475	$6,598	70.0%	5.0	$72,741	20.7%
2	Tribal Headquarters	$58,400	214975	63005	$4,457	66.9%	13.1	$13,978	5.4%
3	Golf Course Pavilion	$10,335	25369	7435	$643	44.6%	16.1	$160	3.2%
4	Fire Warehouse and Shop	$9,166	116807	34234	$2,738	38.8%	3.3	$34,522	31.0%
5	DeSmet Longhouse	$1,840	172666	50606	$5,349	36.2%	0.3	$83,048	294.5%
6	Tribal Court Services	$1,645	133232	39048	$2,366	32.9%	0.7	$35,920	146.2%
7	Casino Conoco Gas Station	$19,205	309991	90853	$6,358	32.9%	3.0	$82,184	34.3%
8	Finance Department	$2,473	50590	14827	$1,320	32.6%	1.9	$18,539	54.9%
9	Casino Daycare	$1,949	35587	10430	$834	31.1%	2.3	$11,337	44.1%
10	Benewah Market	$597,440	1359435	398428	$16,215	31.1%	36.8	-$322,877	-4.3%
11	Tribal Facilities	$2,640	69779	20451	$1,637	30.3%	1.6	$23,391	63.6%
12	Career Renewal & Child Services	$2,078	37937	11119	$889	30.2%	2.3	$12,085	44.1%
13	BIA	$1,235	7250	2125	$208	28.9%	5.9	$2,101	17.1%
14	Tribal Police HQ	$9,376	65390	19165	$1,438	28.6%	6.7	$17,580	14.8%
15	Tribal Housing Authority	$3,989	79513	23304	$1,864	27.7%	2.1	$25,685	48.1%
16	Social Services	$2,580	66013	19347	$1,547	26.4%	1.7	$22,035	61.5%
17	Veteran's Center	$279	46951	13761	$1,068	23.8%	0.3	$16,660	353.5%
18	Rose Creek Longhouse	$742	154607	45313	$4,713	22.8%	0.2	$74,031	594.4%
19	Tribal School - New Bus Garage	$800	20562	6026	$482	21.9%	1.7	$6,867	61.8%
20	Department of Education	$3,963	69040	20234	$1,426	21.4%	2.8	$18,765	37.2%
21	Senior Housing Complex	$6,083	93556	27420	$2,248	17.6%	2.7	$29,750	38.2%
22	Tribal Housing Authority Shop	$903	10498	3077	$246	17.2%	3.7	$3,026	28.3%
23	Felix Aripa Building	$2,475	67347	19738	$1,579	17.1%	1.6	$22,632	65.4%
24	Benewah Auto	$17,960	173674	50901	$3,240	16.8%	5.5	$33,945	18.4%
25	Circling Raven Golf Course Pro Shop	$17,036	248388	72798	$5,671	16.5%	3.0	$73,398	34.5%
26	Early Childhood Learning Center	$31,425	182777	53569	$3,772	16.0%	8.3	$29,313	11.4%
27	City Link	$3,618	21645	6344	$414	12.3%	8.7	$3,049	10.7%
28	Old Roads Maintenance Shop	$855	8867	2599	$221	7.9%	3.9	$2,670	26.8%
29	CDA Casino Resort and Hotel	$325,608	3568401	1045839	$85,686	4.9%	3.8	$1,042,785	27.3%
30	Technology Center	$2,162	71016	20814	$1,665	4.3%	1.3	$24,300	78.7%
31	New Tribal School	$6,000	85736	25128	$2,155	3.8%	2.8	$28,353	37.2%
32	Tribal Wellness Center	$8,144	123448	36181	$2,894	2.4%	2.8	$37,983	36.8%
33	Echelon Plummer	$1,250	26451	7752	$491	0.9%	2.5	$6,578	40.6%
34	Youth Shelter	$12,855	-21874	-6411	-$551	-19.5%	-23.3	-$21,213	NA
Totals		***$1,199,361***	***7977028***	***2337933***	***$171,880***			***$1,565,318***	

Based on the results of the energy conservation measures modeling process completed for each building, the Food Distribution Warehouse has the highest potential for energy savings. .

The building prioritization presented in Table 7 varies significantly from the prioritization presented in Table 6; however, there are four buildings common to the top ten facilities listed in each of these tables:

1) Food Distribution Warehouse
2) Benewah Market
3) Casino Conoco
4) Tribal Headquarters

Building Ranking by Internal Rate of Return

Table 8 summarizes the building ranking based on Internal Rate of Return of the net incremental costs of implementing the proposed energy conservation measures. This table provides a listing from greatest IRR to least IRR based on proposed energy conservation measures.

Table 8. Building Ranking by Internal Rate of Return

Rank	Facility	Estimated Net Incremental Cost of Implementation ($)	Projected Annual Energy Savings (kBtu/year)	Projected Annual Energy Savings (kWh/year)	Projected Annual Savings ($/year)	Annual Energy Savings (%)	Simple Payback (years)	Net Present Value of ECMs ($)	Internal Rate of Return (%)
1	Rose Creek Longhouse	$742	154607	45313	$4,713	22.8%	0.2	$74,031	594.4%
2	Veteran's Center	$279	46951	13761	$1,068	23.8%	0.3	$16,660	353.5%
3	DeSmet Longhouse	$1,840	172666	50606	$5,349	36.2%	0.3	$83,048	294.5%
4	Tribal Court Services	$1,645	133232	39048	$2,366	32.9%	0.7	$35,920	146.2%
5	Technology Center	$2,162	71016	20814	$1,665	4.3%	1.3	$24,300	78.7%
6	Felix Aripa Building	$2,475	67347	19738	$1,579	17.1%	1.6	$22,632	65.4%
7	Tribal Facilities	$2,640	69779	20451	$1,637	30.3%	1.6	$23,391	63.6%
8	Tribal School - New Bus Garage	$800	20562	6026	$482	21.9%	1.7	$6,867	61.8%
9	Social Services	$2,580	66013	19347	$1,547	26.4%	1.7	$22,035	61.5%
10	Finance Department	$2,473	50590	14827	$1,320	32.6%	1.9	$18,539	54.9%
11	Tribal Housing Authority	$3,989	79513	23304	$1,864	27.7%	2.1	$25,685	48.1%
12	Casino Daycare	$1,949	35587	10430	$834	31.1%	2.3	$11,337	44.1%
13	Career Renewal & Child Services	$2,078	37937	11119	$889	30.2%	2.3	$12,085	44.1%
14	Echelon Plummer	$1,250	26451	7752	$491	0.9%	2.5	$6,578	40.6%
15	Senior Housing Complex	$6,083	93556	27420	$2,248	17.6%	2.7	$29,750	38.2%
16	Department of Education	$3,963	69040	20234	$1,426	21.4%	2.8	$18,765	37.2%
17	New Tribal School	$6,000	85736	25128	$2,155	3.8%	2.8	$28,353	37.2%
18	Tribal Wellness Center	$8,144	123448	36181	$2,894	2.4%	2.8	$37,983	36.8%
19	Circling Raven Golf Course Pro Shop	$17,036	248388	72798	$5,671	16.5%	3.0	$73,398	34.5%
20	Casino Conoco Gas Station	$19,205	309991	90853	$6,358	32.9%	3.0	$82,184	34.3%
21	Fire Warehouse and Shop	$9,166	116807	34234	$2,738	38.8%	3.3	$34,522	31.0%
22	Tribal Housing Authority Shop	$903	10498	3077	$246	17.2%	3.7	$3,026	28.3%
23	CDA Casino Resort and Hotel	$325,608	3568401	1045839	$85,686	4.9%	3.8	$1,042,785	27.3%
24	Old Roads Maintenance Shop	$855	8867	2599	$221	7.9%	3.9	$2,670	26.8%
25	Food Distribution Warehouse	$32,853	281405	82475	$6,598	70.0%	5.0	$72,741	20.7%
26	Benewah Auto	$17,960	173674	50901	$3,240	16.8%	5.5	$33,945	18.4%
27	BIA	$1,235	7250	2125	$208	28.9%	5.9	$2,101	17.1%
28	Tribal Police HQ	$9,376	65390	19165	$1,438	28.6%	6.7	$17,580	14.8%
29	Early Childhood Learning Center	$31,425	182777	53569	$3,772	16.0%	8.3	$29,313	11.4%
30	City Link	$3,618	21645	6344	$414	12.3%	8.7	$3,049	10.7%
31	Tribal Headquarters	$58,400	214975	63005	$4,457	66.9%	13.1	$13,978	5.4%
32	Golf Course Pavilion	$10,335	25369	7435	$643	44.6%	16.1	$160	3.2%
33	Benewah Market	$597,440	1359435	398428	$16,215	31.1%	36.8	-$322,877	-4.3%
34	Youth Shelter	$12,855	-21874	-6411	-$551	-19.5%	-23.3	-$21,213	NA
Totals		***$1,199,361***	***7977028***	***2337933***	***$171,880***			***$1,565,318***	

As can be seen in Table 8, the Rose Creek Longhouse has the highest aggregate internal rate of return (IRR) for implementing the proposed energy conservation measures. This is likely due to the relatively low initial costs associated with the measures associated with this structure. Though the Benewah Market shows a negative IRR, it should be noted that this economic indicator is based only on energy savings and, as discussed in Energy Conservation Measure Prioritization by Building, other factors including reduced operation and maintenance expenditures, and reduced product loss show that the investment in energy conservation measures at the Benewah Market are economically feasible and necessary.

Tribal Portfolio - Building Ranking Results

Tables 8 to 10 provide critical information for energy conservation measure implementation planning throughout the Tribe's building portfolio. Though these lists do not completely agree with each other, there are seven buildings that appear two times in the top ten buildings presented in Tables 3 to 5. These buildings are:

1) Food Distribution Warehouse
2) Tribal Headquarters
3) Tribal Court Services
4) Casino Conoco
5) Finance Department
6) Benewah Market
7) Tribal Facilities

Ultimately, Tribal decision makers will need to decide, based on long term building use and development planning, the prioritizations provided in this document, budgetary conditions and other factors how to allocate funds for building upgrades.

Energy Conservation Measure Prioritization by Building

The following sections detail the economic analyses and energy conservation measure prioritization completed for this study. Each section describes the energy conservation measures considered in the economic analyses, any other opportunities or maintenance items that were identified as part of building operations that could not be modeled, economic analysis results and discussion, energy conservation measure prioritization and discussion and conclusions. Four facilities were not included as part of the prioritization process because they either had no ECMs identified, or the measures identified are operation and maintenance items already included in the prioritization. These facilities are: Camp Larsen, Natural Resources Building, Old Benewah Medical Center and New Benewah Medical Center.

Tribal Facilities Department Maintained Buildings

Tribal Headquarters

Tribal Headquarters - Energy Conservation Measure (ECM) Descriptions

The Tribal Headquarters building had the following energy conservation measures identified and evaluated for this study:

1) Install ductless (mini-split) heat pumps is all basement offices; install programmable thermostats and set to reflect the actual occupancy of the office and energy efficient set points. OE recommends that heating and cooling systems be activated one half hour before occupancy and left on one half hour after planned vacancy. Set points should be limited to 68°F heating and 78°F cooling during occupied periods and set back to 55°F heating and 84°F cooling during scheduled unoccupied periods.
2) Replace existing DX air conditioner/electric furnace pairing with high efficiency heat pumps; set programmable thermostats to reflect the actual occupancy of the office and energy efficient set points.
3) Install hot water pipe insulation on all accessible hot water piping.

In addition to the measures that were screened as part of the energy conservation measure prioritization process including economic evaluations, the following items were identified to be completed as part of routine maintenance to improve the general performance and longevity of the structure. Due to the unreliability of modeling these types of retrofits and the nature of these measures, these items were not considered as part of the economic evaluation.

1. Complete duct testing and sealing as necessary on all existing forced-air HVAC distribution systems.

Tribal Headquarters – Economic Analysis Results

Table 9 contains a summary of the economic analysis results for the Tribal Headquarters building. See Appendix D for the complete economic analysis conducted for this building.

Table 9. Tribal Headquarters – Economic Analysis Results

Facility	Energy Conservation Measure	Net Incremental Cost ($)	Annual Energy Savings (kBtu/year)	Annual Savings ($/year)	Annual Energy Savings (%)	Simple Payback (years)	Net Present Value ($)	Internal Rate of Return (%)
Tribal Headquarters	Install mini-split heat pumps in all basement offices and program thermostats to actual occupancy and energy efficient set points	$31,200	70,803	$1,452	22%	21.5	($7,261)	NA
	Replace existing DX AC electric furnaces with heat pumps and program thermostats to actual occupancy and energy efficient set points	$26,600	128,199	$2,629	40%	10.1	$15,874	9%
	Install pipe insulation	$600	15,973	$375	5%	1.6	$5,365	64%
	Totals	***$58,400***	***214,975***	***$4,457***	***67%***	***13.1***	***$13,978***	***5.4%***

As can be seen in Table 9, based on the annual energy usage data provided, the potential for energy savings is very large in the Tribal Headquarters. However, one of the proposed measures include providing heating and cooling that is not currently provided in the basement offices, therefore, this measure has an extremely large payback period, negative net present value and negative IRR. Replacing the existing direct expansion (DX) air conditioner/electric furnace pairings on the main floor of the headquarters is expected to provide the most energy savings of the measures considered with nominal economic return. Installing hot water pipe insulation appears to be the most cost effective measure.

Tribal Headquarters – Energy Conservation Measure (ECM) Prioritization Matrix

Table 10 contains the ECM Prioritization Matrix completed for the Tribal Headquarters building.

Table 10. Tribal Headquarters - ECM Prioritization Matrix

Tribal Headquarters	Routine Building O&M Requirement	Energy Savings Potential	Internal Rate of Return	Feasibility	Overall Score
Weighting Factor	*25%*	*25%*	*25%*	*25%*	*100%*
Replace aging DX AC/electric furnaces with high efficiency heat pumps	9	9	4	6	7.0
Install ductless heat pumps in all basement offices; install programmable thermostats and set properly	9	8	1	6	6.2
Pipe insulation	4	5	7	8	6.0

As can be seen in Table 10, replacing the existing HVAC infrastructure on the main floor of the Tribal Headquarters was the highest ranked measure considered. This is largely due to the advanced age of the existing infrastructure, the type of heating and cooling currently provided, and the potential for energy savings. Though this measure does require significant investment with no economic return, installing ductless heat pumps in the basement offices ranked second. This is due to the inadequate heating and cooling currently provided in these offices, the health and safety issues associated with the lack of central heating and cooling, energy savings potential, and the positive impacts this measure will have to the performance and longevity of this building.

Tribal Headquarters- Conclusions and Recommendations

The existing mechanical systems on the main floor of the Tribal Headquarters building have surpassed their serviceable lifespan and are thus likely to fail within the foreseeable future; therefore immediate investments in infrastructure are recommended. Additionally, the existing systems do not take advantage of heat pump technology which can dramatically reduce heating energy costs. Therefore OE recommends the replacement of the existing systems with high-efficiency heat pumps in the short term in order to avoid premium charges associated with "emergency" repair work. The offices located in the basement area of the Tribal Headquarters have limited HVAC service and no identified ventilation. Because these offices are being occupied by more and more Tribal Departments it is important for the health and safety of occupants and longevity of the structure that these spaces be adequately serviced, which will require significant investment. OE recommends installing ductless (mini-split) heat pumps and OSA air ventilation to all of the basement. Installing pipe insulation is a simple measure that should be completed as part of ongoing operation and maintenance of the structure.

Tribal Facilities

Tribal Facilities - Energy Conservation Measure (ECM) Descriptions

The Tribal Facilities building had the following energy conservation measures identified and evaluated for this study:

1) Install bay-door Interlocks to prevent HVAC operation while bay doors are open.
2) Replace weather stripping on all bay doors.
3) Install lighting occupancy sensors in shop and storage areas. OurEvolution recommends installing infrared-type occupancy sensors in areas best detected by motion, ultrasonic-type occupancy sensors are best in areas where occupants may be present but not in detectable motion.
4) Program thermostats to better reflect the actual occupancy of the building and energy efficient set points. OE recommends that heating and cooling systems be activated one half hour before

occupancy and left on one half hour after planned vacancy. Set points should be limited to 68°F heating and 78°F cooling during occupied periods and set back to 55°F heating and 84°F cooling during scheduled unoccupied periods.

5) Install hot water pipe insulation.

Tribal Facilities – Economic Analysis Results

Table 11 contains a summary of the economic analysis results for the Tribal Facilities building. See Appendix D for the complete economic analysis conducted for this building.

Table 11. Tribal Facilities – Economic Analysis Results

Facility	Energy Conservation Measure	Net Incremental Cost ($)	Annual Energy Savings (kBtu/year)	Annual Savings ($/year)	Annual Energy Savings (%)	Simple Payback (years)	Net Present Value ($)	Internal Rate of Return (%)
Tribal Facilities	Program thermostats to reflect actual occupancy and energy efficient setpoints	$150	10,495	$246	5%	0.6	$3,756	167%
	Install Bay-Door Interlocks, Change Thermostats - Shop	$1,500	26,237	$615	11%	2.4	$8,297	42%
	New bay door weather seals	$600	26,237	$616	11%	1.0	$9,187	105%
	Install Occupancy Sensors in Office Area	$120	1,749	$41	1%	2.9	$533	35%
	Install Occupancy Sensors in Shop Area	$120	1,067	$25	0.5%	4.8	$279	21%
	Pipe insulation	$150	3,993	$94	2%	1.6	$1,339	64%
	Totals	***$2,640***	***69,779***	***$1,637***	***30%***	***1.6***	***$23,391***	***64%***

As can be seen in Table 11, the highest internal rate of return is a result of modifying the existing thermostat settings to better reflect energy efficient set points and the actual occupancy of the building. However, the highest annual energy savings and net present values are achieved by upgrading the bay doors in the Tribal Facilities building. All of these energy conservation measures combined,yield approximately 30% in annual energy savings with a 64% internal rate of return.

Tribal Facilities – Energy Conservation Measure (ECM) Prioritization Matrix

Table 12 contains the ECM Prioritization Matrix completed for the Tribal Facilities building.

Table 12. Tribal Facilities - ECM Prioritization Matrix

Tribal Facilities	Routine Building O&M Requirement	Energy Savings Potential	Internal Rate of Return	Feasibility	Overall Score
Weighting Factor	25%	25%	25%	25%	100%
Program thermostats	3	8	9	9	7.3
Bay door weather stripping	5	5	8	7	6.3
Bay door interlocks	1	8	6	7	5.5
Occupancy sensors	1	6	6	8	5.3
Pipe insulation	1	4	6	9	5.0

As can be seen in Table 12, programming thermostats to better reflect actual building occupancy received the highest overall rank followed by completing upgrades to the bay doors. Pipe insulation ranked lowest based on the reported criteria.

Tribal Facilities- Conclusions and Recommendations

The results of the economic analyses and prioritization indicate that all of the proposed measures are reasonable and should be implemented in order of their prioritization ranking. Though lighting occupancy sensors and pipe insulation would yield minimal annual energy savings, over time they would pay for themselves and generate a modest annual cost reduction. These measures are recommended for implementation at some time, but are not considered to be high priority measures.

Former Social Services Buildings (Includes Career Renewal and Child Services Offices)

Social Services- Energy Conservation Measure (ECM) Descriptions

The former Social Services buildings had the following energy conservation measures identified and evaluated for this study:

1. Program thermostats to better reflect the actual occupancy of the buildings and energy efficient set points. OE recommends that heating and cooling systems be activated one half hour before occupancy and left on one half hour after planned vacancy. Set points should be limited to 68°F heating and 78°F cooling during occupied periods and set back to 55°F heating and 84°F cooling during scheduled unoccupied periods.
2. Upgrade 4’, 4-lamp, T12 linear fluorescent lighting to high-performance T8 linear fluorescent lighting with high-performance electronic ballasts. See Appendix E for lighting upgrade recommendations.
3. Replace exterior incandescent lamps with CFL equivalent.
4. Replace weather stripping on exterior doors.
5. Install hot water pipe insulation.

In addition to the measures that were screened as part of the energy conservation measure prioritization process, the following items were identified to be completed as part of routine maintenance to improve the general performance and longevity of the structure. Due to the unreliability of modeling these types of retrofits and the nature of these measures, these items were not considered as part of the economic evaluation.

1. Provide adequate crawlspace ventilation on east side of structure.
2. Ensure roof drainage systems discharge at least 3’ from the base of the building.
3. Relocate white board in Career Renewal so that it does not block the HVAC return register.
4. Conduct duct pressure testing and complete duct sealing as necessary.
5. Assess thermostat locations and move to “zone central” location where indicated.
6. Undercut doors to improve air balance.
7. Remove redundant separate refrigerators where operationally feasible.

Former Social Services – Economic Analysis Results

Table 13 contains a summary of the economic analysis results for the former Social Services buildings. See Appendix D for the complete economic analysis conducted for these structures.

Table 13. Former Social Services Buildings – Economic Analysis Results

Facility	Energy Conservation Measure	Net Incremental Cost ($)	Annual Energy Savings (kBtu/year)	Annual Savings ($/year)	Annual Energy Savings (%)	Simple Payback (years)	Net Present Value ($)	Internal Rate of Return (%)
Career Renewal & Child Services	Program thermostats to reflect actual occupancy and energy efficient setpoints	$100	18,430	$432	15%	0.2	$6,754	437%
	Upgrade 4', 4-Lamp, T12 Lighting to 4-Lamp, HP T8 Lighting (32W) and HP Electronic Ballast	$1,778	14,447	$339	11%	5.3	$3,644	20%
	Replace Weatherstripping on Exterior Doors	$50	1,067	$25	1%	2.0	$348	51%
	Pipe insulation	$150	3,993	$94	3%	1.6	$1,339	64%
	Totals	***$2,078***	***37,937***	***$889***	***30%***	***2.3***	***$12,085***	***44%***
			-					
Social Services	Program thermostats to reflect actual occupancy and energy efficient set points	$50	48,337	$1,133	19%	0.0	$17,920	2289%
	Upgrade 4', 2-Lamp, T12 Lighting to 2-Lamp, HP T8 Lighting (32W) and HP Electronic Ballast	$2,372	10,102	$237	4%	10.0	$1,453	9%
	Replace Outdoor 60W Incandescents with 23W CFL	$8	3,580	$84	1%	0.10	$1,323	1060%
	Pipe insulation	$150	3,993	$94	2%	1.6	$1,339	64%
	Totals	***$2,580***	***66,013***	***$1,547***	***26%***	***1.7***	***$22,035***	***62%***

As can be seen in Table 13, the highest internal rate of return and annual energy savings result from modifying the existing thermostat settings to better reflect the actual occupancy of the building and energy efficient set points. The proposed lighting upgrades also yield significant annual energy savings and NPV. Though modest energy savings are yielded from weather stripping and pipe insulation, there is a reasonable IRR associated with a modest investment in these measures. All of these energy conservation measures taken together yield approximately a 26% reduction in annual energy savings with a 62% internal rate of return.

Former Social Services – Energy Conservation Measure (ECM) Prioritization Matrix

Table 14 contains the ECM Prioritization Matrix completed for the Social Services buildings.

Table 14. Social Services- ECM Prioritization Matrix

Social Services (Includes Career Renewal and Child Services)	Routine Building O&M Requirement	Energy Savings Potential	Internal Rate of Return	Feasibility	Overall Score
Weighting Factor	*25%*	*25%*	*25%*	*25%*	*100%*
Relocate white board	6	7	10	10	8.3
Eliminate redundant refrigerators	2	10	10	10	8.0
Upgrade incandescent lamps to CFLs	6	5	10	10	7.8
Reprogram thermostats	3	8	10	9	7.5
Duct testing/sealing	7	8	7	7	7.3
Crawlspace ventilation	6	3	10	10	7.3
Upgrade T12 lighting to T8 lighting	6	7	7	8	7.0
Extend gutter discharge	6	1	8	8	5.8
Replace door seals	5	3	7	8	5.8
Undercut doors	1	3	4	8	4.0

As can be seen in Table 14, of the measures considered in the economic analysis, programming thermostats to better reflect the actual occupancy of the building and energy efficient set points had the highest overall ranking followed closely by upgrading exterior lighting to CFLs and completing linear fluorescent upgrades.

Relocating the white board away from the HVAC return register in the Career Renewal office, removing redundant refrigeration and completing duct testing and sealing had the highest overall rankings for the "building performance" measures noted above.

Former Social Services- Conclusions and Recommendations

The results of the economic analyses and prioritization indicate that most of the proposed measures are reasonable and should be implemented in order of their prioritization ranking. Undercutting doors may also increase occupant comfort which could lead to energy savings, but this measure is not considered to be a priority retrofit.

Veteran's Center

Veteran's Center- Energy Conservation Measure (ECM) Descriptions

The Veteran's Center had the following energy conservation measures identified and evaluated for this study:

1. Relocate and program thermostat to better reflect the actual occupancy of the building and energy efficient set points. OE recommends that heating and cooling systems be activated one half hour before occupancy and left on one half hour after planned vacancy. Set points should be limited to 68°F heating and 78°F cooling during occupied periods and set back to 55°F heating and 84°F cooling during scheduled unoccupied periods.
2. Replace weather stripping on exterior doors and seal windows.
3. Replace exterior incandescent lamps with CFL equivalent.
4. Remove excess refrigeration capacity.
5. Install hot water pipe insulation.

Veteran's Center – Economic Analysis Results

Table 15 contains a summary of the economic analysis results for the Veteran's Center. See Appendix D for the complete economic analysis conducted for this building.

Table 15. Veteran's Center – Economic Analysis Results

Facility	Energy Conservation Measure	Net Incremental Cost ($)	Annual Energy Savings (kBtu/year)	Annual Savings ($/year)	Annual Energy Savings (%)	Simple Payback (years)	Net Present Value ($)	Internal Rate of Return (%)
Veteran's Center	Relocate and program thermostat to reflect actual occupancy and energy efficient set points	$50	38,226	$896	19.4%	0.1	$14,161	1810%
	Weatherstrip Exterior Doors and Seal Windows	$75	2,944	$69	1.5%	1.1	$1,021	94%
	Replace Outdoor 60W Incandescents with 13W CFL	$4	1,788	$9	0.9%	0.4	$139	228%
	Pipe insulation	$150	3,993	$94	2%	1.6	$1,339	64%
	Totals	***$279***	***46,951***	***$1,068***	***24%***	***0.3***	***$16,660***	***353%***

As can be seen in Table 15, the highest internal rate of return and annual energy savings result from modifying the existing thermostat settings to better reflect the actual occupancy of the building and energy efficient set points. Though modest energy savings are yielded from upgrading exterior lighting, weather stripping and pipe insulation, there is a reasonable IRR associated with a modest investment in these measures. All of the energy conservation measures taken together yield an approximately 24% reduction in annual energy use with a significant 353% internal rate of return.

Veteran's Center – Energy Conservation Measure (ECM) Prioritization Matrix

Table 16 contains the ECM Prioritization Matrix completed for the Veteran's Center.

Table 16. Veteran's Center- ECM Prioritization Matrix

Veteran's Center	Routine Building O&M Requirement	Energy Savings Potential	Internal Rate of Return	Feasibility	Overall Score
Weighting Factor	*25%*	*25%*	*25%*	*25%*	*100%*
Relocate and program thermostat	5	8	10	9	8.0
Remove excess refrigeration	1	6	10	10	6.8
Upgrade 60W incandescent lighting to 13W CFL	5	4	8	10	6.8
Exterior door weatherstripping and window air sealing	5	3	7	9	6.0
Pipe insulation	4	4	7	8	5.8

As can be seen in Table 16, relocating the existing thermostat to a more central occupied location and programming it to better reflect the actual occupancy of the building and energy efficient set points had the highest overall ranking followed by the low-cost/no-cost measure of removing excess refrigeration capacity.

Upgrading exterior lighting, weather stripping, window sealing and pipe insulation are also fairly low cost measures that would generate reasonable energy savings with minimal effort.

Veteran's Center- Conclusions and Recommendations

The results of the economic analyses and prioritization indicate that all of the measures considered for this building yield positive economic and building performance gains, therefore we recommend implementing them in order of the prioritization presented above.

Bureau of Indian Affairs (BIA)

BIA- Energy Conservation Measure (ECM) Descriptions

The BIA office had the following energy conservation measures identified and evaluated for this study:

1. Reprogram thermostats to better reflect the actual occupancy of the building and energy efficient set points. OE recommends that heating and cooling systems be activated one half hour before occupancy and left on one half hour after planned vacancy. Set points should be limited to 68°F heating and 78°F cooling during occupied periods and set back to 55°F heating and 84°F cooling during scheduled unoccupied periods.
2. Upgrade 4', 2-lamp, T12 linear fluorescent lighting to high-performance T8 linear fluorescent lighting with high-performance electronic ballasts. See Appendix E for lighting upgrade recommendations.
3. Replace incandescent lamps in restrooms with CFL equivalent.
4. Install hot water pipe insulation.

In addition to the measures that were screened as part of the energy conservation measure prioritization process, the following item was identified to be completed as part of routine maintenance to improve the general performance and longevity of the structure.

1. Install roof drainage system (perimeter gutter)

BIA – Economic Analysis Results

Table 17 contains a summary of the economic analysis results for the BIA office. See Appendix D for the complete economic analysis conducted for this building.

Table 17. BIA – Economic Analysis Results

Facility	Energy Conservation Measure	Net Incremental Cost ($)	Annual Energy Savings (kBtu/year)	Annual Savings ($/year)	Annual Energy Savings (%)	Simple Payback (years)	Net Present Value ($)	Internal Rate of Return (%)
BIA	Change thermostats to reflect actual occupancy	$100	2,182	$77	9%	1.3	$1,119	78%
	Upgrade 4', 2-Lamp, T12 Lighting to 2-Lamp, HP T8 Lighting (32W) and HP Electronic Ballast	$981	966	$34	4%	28.9	($414)	-2%
	Upgrade 60W Incandescent to 13W CFL in restrooms	$4	109	$4	0.4%	1.0	$57	98%
	Pipe insulation	$150	3,993	$94	16%	1.6	$1,339	64%
	Totals	***$1,235***	***7,250***	***$208***	***29%***	***5.9***	***$2,101***	***17%***

As can be seen in Table 17, the highest internal rate of return is realized by upgrading incandescent lighting. Reprogramming thermostats and insulating hot water piping yield the most potential energy savings with reasonable IRRs. A negative economic impact was projected for completing T12 linear fluorescent upgrades. This is likely due to the limited use and associated low annual energy costs of the BIA office. All of these energy conservation measures taken together yield an approximately 29% reduction in annual energy use with a modest 17% internal rate of return. This IRR is likely skewed by the negative IRR associated with the proposed linear fluorescent lighting upgrades.

BIA – Energy Conservation Measure (ECM) Prioritization Matrix

Table 18 contains the ECM Prioritization Matrix completed for the BIA office.

Table 18. BIA- ECM Prioritization Matrix

Bureau of Indian Affairs	Routine Building O&M Requirement	Energy Savings Potential	Internal Rate of Return	Feasibility	Overall Score
Weighting Factor	*25%*	*25%*	*25%*	*25%*	*100%*
Program thermostat	5	8	7	9	7.3
Upgrade 60W incandescent lighting to 13W CFL	5	4	8	10	6.8
Pipe insulation	4	4	7	8	5.8
Upgrade T12 lighting to T8 lighting	5	7	1	9	5.5

As can be seen in Table 18, programming the existing thermostat to better reflect the actual occupancy of the building and energy efficient set points had the highest overall ranking followed by upgrading incandescent lighting and pipe insulation. Upgrading T12 linear fluorescent lighting received the lowest overall ranking.

BIA- Conclusions and Recommendations

Due to the limited use of the BIA building, overall energy costs are low therefore, even in measures with significant energy savings in terms of the percent of total energy use, annual energy cost savings are limited, which limits the measure's ability to create positive long term economic impacts. This is likely the case with upgrading the linear fluorescent lighting. Rebates are currently available for this retrofit which may not be available in the future and this measure may become necessary when replacement (T12) lamps become harder to procure.

OE recommends the top three measures considered for this structure as priority energy conservation measures. Lighting upgrades should be implemented for this structure when maintenance of these fixtures becomes constrained by lamp availability and prior to the end of the available rebates for this measure.

The Former Department of Education (Education)

Education- Energy Conservation Measure (ECM) Descriptions

The former Education office had the following energy conservation measures identified and evaluated for this study:

1. Reprogram thermostats to better reflect the actual occupancy of the building and energy efficient set points. OE recommends that heating and cooling systems be activated one half hour before occupancy and left on one half hour after planned vacancy. Set points should be limited to 68°F heating and 78°F cooling during occupied periods and set back to 55°F heating and 84°F cooling during scheduled unoccupied periods.
2. Replace weather stripping on exterior doors and seal windows.
3. Upgrade 4', 2-lamp, T12 linear fluorescent lighting to high-performance T8 linear fluorescent lighting with high-performance electronic ballasts. See Appendix E for lighting upgrade recommendations.
4. Replace incandescent lamps in restrooms with CFL equivalent.
5. Install hot water pipe insulation.

In addition to the measures that were screened as part of the energy conservation measure prioritization process, the following items were identified to be completed as part of routine maintenance to improve the general performance and longevity of the structure. Due to the unreliability of modeling these types of retrofits and the nature of these measures, these items were not considered as part of the economic evaluation.

1. Install roof drainage system (perimeter gutter).
2. Repair damaged siding and replace any damaged insulation associated with damage.
3. Water and air seal all compromised areas of the wall system with outdoor rated caulk.
4. Schedule maintenance for Bard, wall-mounted heat pumps; clean and straighten condenser fins.
5. Undercut interior doors to improve building air balance.

Former Education – Economic Analysis Results

Table 19 contains a summary of the economic analysis results for the former Education office. See Appendix D for the complete economic analysis conducted for this building.

Table 19. Former Education – Economic Analysis Results

Facility	Energy Conservation Measure	Net Incremental Cost ($)	Annual Energy Savings (kBtu/year)	Annual Savings ($/year)	Annual Energy Savings (%)	Simple Payback (years)	Net Present Value ($)	Internal Rate of Return (%)
Department of Education	Program thermostats to reflect actual occupancy and energy efficient setpoints	$100	46,189	$974	14%	0.1	$15,356	985%
	Weatherstrip exterior doors, seal windows	$195	3,242	$68	1%	2.9	$895	36%
	Upgrade 4', 2-Lamp, T12 lighting to 2-lamp, HP T8 lighting (32W) and HP electronic ballast	$3,517	14,983	$278	5%	12.6	$1,000	6%
	Replace 60W Incandescent with 13W CFL	$1	632	$11	0.2%	0.1	$175	1123%
	Pipe insulation	$150	3,993	$94	1%	1.6	$1,339	64%
	Totals	***$3,963***	***69,040***	***$1,426***	***21%***	***2.8***	***$18,765***	***37%***

As can be seen in Table 19, the highest internal rates of return are realized by upgrading incandescent lighting and reprogramming thermostats. Weather stripping and pipe insulation yield minor energy savings with reasonable IRR's for a nominal investment. Though proposed lighting upgrades yield significant energy savings, the long term economics do not indicate substantial economic gain. All of these energy conservation measures taken together would result in a projected annual energy savings of 21% with a reasonable 37% internal rate of return.

Former Education– Energy Conservation Measure (ECM) Prioritization Matrix

Table 20 contains the ECM Prioritization Matrix completed for the former Education building.

Table 20. Former Education- ECM Prioritization Matrix

Department of Education	Routine Building O&M Requirement	Energy Savings Potential	Internal Rate of Return	Feasibility	Overall Score
Weighting Factor	*25%*	*25%*	*25%*	*25%*	*100%*
Reprogram thermostats	5	8	10	9	8.0
Upgrade incandescent lighting to CFL	6	3	10	10	7.3
Gutters & siding repair	10	6	3	6	6.3
Replace exterior door weatherstripping and seal windows	5	4	6	8	5.8
Upgrade T12 Lighting to T8 Lighting	5	5	4	8	5.5
Service Bard HP	5	5	4	7	5.3
Pipe insulation	1	4	7	8	5.0
Undercut doors	1	3	4	8	4.0

As can be seen in Table 20, programming the existing thermostat to better reflect the actual occupancy of the building and energy efficient set points had the highest overall ranking followed by upgrading incandescent lighting.

Former Education- Conclusions and Recommendations

All of the measures considered have positive impacts on the annual energy use, overall performance and/or longevity of the building. Though upgrading linear fluorescent lighting does not yield a high IRR, it does result in significant energy savings and rebates are currently available for this retrofit which may not be available in the future. While not considered a high priority measure at this time, this measure may become necessary when replacement (T12) lamps become harder to procure. Pipe insulation does not rank high in the prioritization, but this measure is very cost effective and should also be considered. Undercutting doors may not result in economic benefits but may increase the occupant comfort and HVAC distribution efficiency which may reduce the amount of HVAC run time thereby reducing costs.

OE recommends implementing all of the measures considered for this structure in order of the priority presented above.

Finance Department (Finance)

Finance - Energy Conservation Measure (ECM) Descriptions

The Finance Department office had the following energy conservation measures identified and evaluated for this study:

1. Reprogram thermostats to better reflect the actual occupancy of the building and energy efficient set points. OE recommends that heating and cooling systems be activated one half hour before occupancy and left on one half hour after planned vacancy. Set points should be limited to 68°F heating and 78°F cooling during occupied periods and set back to 55°F heating and 84°F cooling during scheduled unoccupied periods.
2. Replace weather stripping on exterior doors and seal windows.
3. Complete maintenance on Bard wall-mounted heat pumps and straighten condenser fins.
4. Upgrade 4', 2-lamp, T12 linear fluorescent lighting to high-performance T8 linear fluorescent lighting with high-performance electronic ballasts. See Appendix E for lighting upgrade recommendations.
5. Replace incandescent lamps in restrooms with CFL equivalent.
6. Discontinue use of coffee burner and switch to insulated carafe style coffee maker.
7. Install hot water pipe insulation.

In addition to the measures that were screened as part of the energy conservation measure prioritization process, the following items were identified to be completed as part of routine maintenance to improve the general performance and longevity of the structure. Due to the unreliability of modeling these types of retrofits and the nature of these measures, these items were not considered as part of the economic evaluation.

1. Install roof drainage system (perimeter gutter).
2. Repair damaged siding and replace any damaged insulation associated with damage.
3. Water and air seal all compromised areas of the wall system with outdoor rated caulk.
4. Undercut interior doors to improve building air balance.

Finance – Economic Analysis Results

Table 21 contains a summary of the economic analysis results for the Finance Department office. See Appendix D for the complete economic analysis conducted for this building.

Table 21. Finance Department – Economic Analysis Results

Facility	Energy Conservation Measure	Net Incremental Cost ($)	Annual Energy Savings (kBtu/year)	Annual Savings ($/year)	Annual Energy Savings (%)	Simple Payback (years)	Net Present Value ($)	Internal Rate of Return (%)
Finance Department	Change thermostats to reflect actual occupancy	$150	28,745	$758	19%	0.2	$11,876	511%
	Replace weatherstripping on exterior doors	$52	3,451	$91	2%	0.6	$1,393	178%
	Complete maintenance on heat pumps	$500	2,692	$71	2%	7.0	$641	14%
	Upgrade 4', 2-Lamp, T12 lighting to 2-Lamp, HP T8 lighting (32W) and HP electronic ballast	$1,554	6,621	$173	4%	9.0	$1,230	10%
	Upgrade 60W incandescents to 13W CFLs in restrooms	$2	119	$3	0.1%	0.6	$47	158%
	Discontinue use of coffee burner, switch to carafe style	$65	4,968	$131	3%	0.5	$2,014	204%
	Pipe insulation	$150	3,993	$94	3%	1.6	$1,339	64%
	Totals	***$2,473***	***50,590***	***$1,320***	***33%***	***1.9***	***$18,539***	***55%***

As can be seen in Table 21, the highest internal rate of return is realized by reprogramming thermostats. Weather stripping, incandescent lighting upgrades, coffee preparation modifications also yield significant returns. Though upgrading linear fluorescent lamps does produce significant energy savings, the return on investment is modest. . All of these energy conservation measures taken together would result in a projected annual energy savings of 33% with a reasonable 55% internal rate of return.

Finance– Energy Conservation Measure (ECM) Prioritization Matrix

Table 22 contains the ECM Prioritization Matrix completed for the Finance Department building.

Table 22. Finance - ECM Prioritization Matrix

Finance Department	Routine Building O&M Requirement	Energy Savings Potential	Internal Rate of Return	Feasibility	Overall Score
Weighting Factor	25%	25%	25%	25%	100%
Relocate, reprogram thermostats	4	8	9	9	7.5
Upgrade to CFLs in restrooms	6	5	7	10	7.0
Complete maintenance on heat pumps	8	5	4	9	6.5
Upgrade T12 lighting to T8 lighting	5	7	3	8	5.8
Carafe coffee system	1	6	6	9	5.5
Replace weatherstripping on exterior doors	4	5	7	5	5.3
Gutters, repair & seal siding	10	2	4	5	5.3
Pipe insulation	1	6	5	8	5.0
Undercut doors	1	3	4	8	4.0

As can be seen in Table 22, programming the existing thermostat to better reflect the actual occupancy of the building and energy efficient set points had the highest overall ranking followed by upgrading incandescent lighting, heat pump maintenance and weather stripping. Upgrading T12 lighting scored in the middle of the considered measures though it did result in significant annual energy savings projections.

Finance - Conclusions and Recommendations

All of the measures considered have positive impacts on the annual energy use, overall performance and longevity of the building. Though upgrading linear fluorescent lighting does not yield a high IRR, it does result in significant energy savings and rebates are currently available for this retrofit which may not be available in the future. While not considered a high priority measure at this time, this measure may become necessary when replacement (T12) lamps become harder to procure. Pipe insulation did not rank high in the prioritization, but this measure is very cost effective and should also be considered.

Undercutting doors may not result in economic benefits but may increase the occupant comfort and HVAC distribution efficiency which may reduce the amount of HVAC run time thereby reducing costs.

OE recommends implementing all of the measures considered for this structure in order of the priority presented above.

Food Distribution Warehouse

Food Distribution Warehouse - Energy Conservation Measure (ECM) Descriptions

The Food Distribution Warehouse had the following energy conservation measures identified and evaluated for this study:

1. Install programmable thermostats and program to reflect the actual occupancy of the building and energy efficient set points. OE recommends heating and cooling systems are activated one half hour before occupancy and left on one half hour after planned vacancy. Set points should be limited to 68°F heating and 78°F cooling during occupied periods and set back to 55°F heating and 84°F cooling during scheduled unoccupied periods.
2. Air seal and insulate walls and ceiling (R19 walls, R38 ceiling).
3. Replace existing electric furnaces with air source heat pumps.
4. Replace shaded pole electric motors in walk-in coolers with electronically commutated motors.*
5. Upgrade 8', 2-lamp, T12 linear fluorescent lighting to high-bay T5 linear fluorescent lighting with high-performance electronic ballasts. See Appendix E for lighting upgrade recommendations.
6. Upgrade 4', 2-lamp, T12 linear fluorescent lighting to high-performance T8 linear fluorescent lighting with high-performance electronic ballasts. See Appendix E for lighting upgrade recommendations.
7. Replace exterior mercury vapor lamp fixture with LED fixture.
8. Install hot water pipe insulation.

*Energy savings and economic calculations for the proposed refrigeration system upgrades were completed by Energy Smart Grocers under a separate assessment.

It should be noted that the Food Distribution Warehouse is structurally compromised and in need of substantial renovation work. All of the ECMs described above are predicated on the assumption that all necessary rehabilitation work is completed prior to or in parallel with implementation of ECMs. The costs of the renovation work are not included in this economic analysis. As of the writing of this final report, the Food Distribution is undergoing extensive rehabilitation.

Food Distribution Warehouse – Economic Analysis Results

Table 23 contains a summary of the economic analysis results for the Food Distribution Warehouse. See Appendix D for the complete economic analysis conducted for this building.

Table 23. Food Distribution Warehouse – Economic Analysis Results

Facility	Energy Conservation Measure	Net Incremental Cost ($)	Annual Energy Savings (kBtu/year)	Annual Savings ($/year)	Annual Energy Savings (%)	Simple Payback (years)	Net Present Value ($)	Internal Rate of Return (%)
Food Distribution Warehouse	Install programmable thermostats and program to reflect actual occupancy and energy efficient set points	$130	31,869	$747	8%	0.2	$11,721	581%
	Air seal and insulate walls and ceiling	$18,944	82,595	$1,936	21%	9.8	$12,311	9%
	Replace electric furnaces with air source heat pumps	$11,410	120,650	$2,828	30%	4.0	$33,772	26%
	Replace shaded pole motors with ECMs in walk-in coolers	$240	32,570	$763	8%	0.3	$11,874	322%
	Upgrade warehouse lighting From 8', T12 to High Bay T5 w/program start ballast	$1,035	3,055	$73	1%	14.1	$159	5%
	Upgrade office 4', 2-Lamp, T12 Lighting to 2-Lamp, HP T8 Lighting (32W) and HP Electronic Ballast	$491	1,512	$35	0.4%	13.8	$86	5%
	Upgrade exterior mercury vapor lighting to new LED fixture (70W)	$453	5,162	$121	1%	3.7	$1,479	28%
	Pipe insulation	$150	3,993	$94	1%	1.6	$1,339	64%
	Totals	***$32,853***	***281,405***	***$6,598***	***70%***	***5.0***	***$72,741***	***21%***

As can be seen in Table 23, the highest internal rate of return is realized by reprogramming thermostats. With the available rebates, upgrading the shaded pole motors in the walk-in coolers also yields significant return. The highest energy savings associated with an individual measure is the 30% annual energy reduction projected for replacing the existing electric furnaces with heat pumps. All of these energy conservation measures taken together would result in a projected annual energy savings of 70% with a nominal 21% internal rate of return.

Proposed refrigeration system upgrade energy and economic analyses were completed by Energy Smart Grocer under a separate assessment.

Food Distribution Warehouse– Energy Conservation Measure (ECM) Prioritization Matrix

Table 24 contains the ECM Prioritization Matrix completed for the Food Distribution Warehouse.

Table 24. Food Distribution Warehouse - ECM Prioritization Matrix

Food Distribution Warehouse	Routine Building O&M Requirement	Energy Savings Potential	Internal Rate of Return	Feasibility	Overall Score
Weighting Factor	25%	25%	25%	25%	100%
Install and program thermostats	5	6	10	10	7.8
Upgrade walk-in cooler motors	5	6	9	8	7.0
Install heat pumps	5	10	5	6	6.5
Pipe insulation	5	4	6	8	5.8
Seal building penetrations	10	7	3	3	5.8
Upgrade exterior lighting to LED	4	3	5	8	5.0
Air seal	5	7	4	3	4.8
R-19 walls; R-38 roof	5	7	4	3	4.8
Upgrade Office T12 Lighting to T8 Lighting	6	2	3	8	4.8
Upgrade warehouse to T5 Lighting	5	3	3	8	4.8

As can be seen in Table 24, installing programmable thermostats and programming them to reflect the actual occupancy of the building and energy efficient set points had the highest overall ranking followed by upgrading walk-in cooler motors and installing heat pumps. Interior lighting upgrades were ranked the lowest due to their low potential energy savings and related IRR.

Food Distribution Warehouse - Conclusions and Recommendations

As previously stated, the Food Distribution Warehouse is in need of substantial structural improvement. The final disposition of this work and the longevity of the Food Distribution Warehouse at this location should be completed prior to completing energy efficiency upgrades to the building itself. However, with the existing rebates and the modular nature of the refrigeration, OE recommends completing the walk-in cooler motor upgrades in the near term. If the Food Distribution Warehouse remains at its current location and structural repairs are completed, the ECMs evaluated for this study should be completed in the priority presented above.

Early Childhood Learning Center (ECLC)

ECLC - Energy Conservation Measure (ECM) Descriptions

The ECLC had the following energy conservation measures identified and evaluated for this study:

1. Program thermostats to reflect the actual occupancy of the building and energy efficient set points. OE recommends that heating and cooling systems be activated one half hour before occupancy and left on one half hour after planned vacancy. Set points should be limited to 68°F heating and 78°F cooling during occupied periods and set back to 55°F heating and 84°F cooling during scheduled unoccupied periods.
2. At the end of their useful life (15-20 years), replace Phase I electric furnace/DX air conditioning systems with air source heat pumps.
3. Install timer on domestic water heater pump.
4. Replace upright freezer with Energy Star equivalent.
5. Install hot water pipe insulation.
6. Retrofitting classroom fluorescent with incandescent lighting – This measure was evaluated in order to illustrate the economic effect of a project that was slated for completion at the ECLC. This is NOT a recommended measure.

In addition to the main projects that were screened as part of the energy conservation measure prioritization process, the following items were identified to be completed as part of routine maintenance to improve the general performance and longevity of the structure. Due to the unreliability of modeling these types of retrofits and the nature of these measures, these items were not considered as part of the economic evaluation.

1. Evaluate and repair roof drainage gutters and discharge points.
2. Ensure that air handler filters are regularly maintained and replaced with appropriately sized filters and that filter covers are properly installed.

ECLC – Economic Analysis Results

Table 25 contains a summary of the economic analysis results for the ECLC. See Appendix D for the complete economic analysis conducted for this building.

Table 25. ECLC – Economic Analysis Results

Facility	Energy Conservation Measure	Net Incremental Cost ($)	Annual Energy Savings (kBtu/year)	Annual Savings ($/year)	Annual Energy Savings (%)	Simple Payback (years)	Net Present Value ($)	Internal Rate of Return (%)
Early Childhood Learning Center	Change thermostats to reflect actual occupancy - Phase I	$300	81,424	$1,670	7%	0.2	$26,193	563%
	Change thermostats to reflect actual occupancy - Phase II	$300	73,721	$1,512	6%	0.2	$23,688	510%
	Install timer on domestic water heater pump	$175	7,215	$148	1%	1.2	$2,177	86%
	Replace upright freezer with Energy Star equivalent	$850	5,851	$120	1%	7.1	$1,078	14%
	Replace Phase I heating and cooling systems	$27,000	87,322	$1,791	8%	15.1	$2,189	4%
	Retrofitting fluorescent lighting with incandescent lighting in classrooms	$2,500	(80,741)	-$1,656	-7%	N/A	($28,690)	NA
	Pipe insulation	$300	7,986	$187	1%	1.6	$2,678	64%
	Totals	***$31,425***	***182,777***	***$3,772***	***16%***	***8.3***	***$29,313***	***11%***

As can be seen in Table 25, the highest internal rate of return is realized by reprogramming thermostats. The two low cost measures of installing a timer on the water heater circulation pump and installing hot water pipe insulation also yield a reasonable IRR. Retrofitting the existing linear fluorescent lamps in the classrooms back to incandescent lighting shows a significant annual energy cost increase and negative net present value (NPV).

ECLC– Energy Conservation Measure (ECM) Prioritization Matrix

Table 26 contains the ECM Prioritization Matrix completed for the ECLC.

Table 26. ECLC - ECM Prioritization Matrix

Early Childhood Learning Center	Routine Building O&M Requirement	Energy Savings Potential	Internal Rate of Return	Feasibility	Overall Score
Weighting Factor	*25%*	*25%*	*25%*	*25%*	*100%*
Reprogram thermostats	5	7	9	9	7.5
Correct HVAC filter deficiencies	9	4	5	9	6.8
Replace aging freezer with Energy Star equivalent	5	4	5	10	6.0
Install timer on domestic water heater	3	4	7	9	5.8
Replace Phase I electric furnace/DX AC systems with heat pumps	3	7	4	6	5.0
Pipe insulation	1	4	6	8	4.8

As can be seen in Table 26, reprogramming thermostats to reflect actual occupancy received the highest ranking, followed closely by addressing HVAC filter issues.

ECLC - Conclusions and Recommendations

Though there are significant differences in the IRRs associated with the proposed measures, all of the proposed measures yield significant energy savings. Therefore OE recommends implementing all of the proposed measures in the order of priority presented above. Due to the initial and long term costs associated with retrofitting the existing linear fluorescent lighting with older incandescent lighting technology in addition to the construction, operation and maintenance requirements of such a project, we do not recommend implementing this retrofit.

Rose Creek Longhouse

Rose Creek Longhouse - Energy Conservation Measure (ECM) Descriptions

The Rose Creek Longhouse had the following energy conservation measures identified and evaluated for this study:

1. Program thermostats to reflect the actual occupancy of the building and energy efficient set points. OE recommends that heating and cooling systems be activated one half hour before occupancy and left on one half hour after planned vacancy. Set points should be limited to 68°F heating and 78°F cooling during occupied periods and set back to 55°F heating and 84°F cooling during scheduled unoccupied periods.
2. Replace weather stripping on exterior doors.
3. Upgrade incandescent lighting in wall sconces to CFL equivalent.
4. Turn off gas to commercial oven when the building is unoccupied.
5. Turn off reach-in refrigerator and ice maker when the building is unoccupied.
6. Install hot water pipe insulation.

Rose Creek Longhouse– Economic Analysis Results

Table 27 contains a summary of the economic analysis results for the Rose Creek Longhouse. See Appendix D for the complete economic analysis conducted for this building.

Table 27. Rose Creek Longhouse – Economic Analysis Results

Facility	Energy Conservation Measure	Net Incremental Cost ($)	Annual Energy Savings (kBtu/year)	Annual Savings ($/year)	Annual Energy Savings (%)	Simple Payback (years)	Net Present Value ($)	Internal Rate of Return (%)
Rose Creek Longhouse	Replace Weatherstripping on Exterior Doors	$52	4,451	$104	1.6%	0.5	$1,604	204%
	Upgrade 60W wall sconces to 13W CFL	$20	1,891	$44	0.3%	0.5	$683	225%
	Turn off gas to commercial oven when not needed	$350	60,000	$1,508	8.5%	0.2	$23,579	436%
	Reprogram thermostats to reflect actual occupancy	$100	75,342	$2,649	10.7%	0.0	$41,914	2676%
	Turn off reach-in refrigerator and ice maker when not needed	$70	8,931	$314	1.3%	0.2	$4,912	454%
	Pipe insulation	$150	3,993	$94	0.6%	1.6	$1,339	64%
	Totals	***$742***	***154,607***	***$4,713***	***22.8%***	***0.2***	***$74,031***	***594%***

As can be seen in Table 27, the highest internal rate of return is realized by reprogramming thermostats. The two low-cost/no-cost "operational" measures of turning off gas and power to refrigeration during unoccupied periods also have significant IRRs and energy savings. Of specific note, turning off gas to the commercial range and oven is projected to save over 8% of the annual energy used in the structure. This is due to the number of pilot lights that are continuously running on this unit. All of the energy conservation measures taken together would yield approximately 23% annual energy savings with a substantial 594% IRR.

Rose Creek Longhouse– Energy Conservation Measure (ECM) Prioritization Matrix

Table 28 contains the ECM Prioritization Matrix completed for the Rose Creek Longhouse.

Table 28. Rose Creek Longhouse - ECM Prioritization Matrix

Rose Creek Longhouse	Routine Building O&M Requirement	Energy Savings Potential	Internal Rate of Return	Feasibility	Overall Score
Weighting Factor	*25%*	*25%*	*25%*	*25%*	*100%*
Reprogram thermostats	5	9	10	9	8.3
Upgrade wall sconces to CFL	6	4	8	10	7.0
Replace weatherstripping on exterior doors	5	7	8	8	7.0
Turn off gas to commercial oven when not needed	2	8	8	8	6.5
Power off refrigerators when not in use	1	6	10	8	6.3
Pipe insulation	4	6	6	8	6.0

As can be seen in Table 28, reprogramming thermostats to better reflect the occupancy of the longhouse ranks the highest, followed by lighting upgrades and air sealing.

Rose Creek Longhouse - Conclusions and Recommendations

All of the measures proposed yield significant energy savings and reasonable IRRs. Though additional time may be required for Facilities staff to turn off gas and power to certain loads when the building is unoccupied, the return for this increased staff time appears to justify this type of building management. Due to the positive economics, OE recommends implementing the proposed measures in the priority presented above.

DeSmet Longhouse

DeSmet Longhouse - Energy Conservation Measure (ECM) Descriptions

The DeSmet Longhouse had the following energy conservation measures identified and evaluated for this study:

1. Program thermostats to reflect the actual occupancy of the building and energy efficient set points. OE recommends that heating and cooling systems be activated one half hour before occupancy and left on one half hour after planned vacancy. Set points should be limited to 68°F heating and 78°F cooling during occupied periods and set back to 55°F heating and 84°F cooling during scheduled unoccupied periods.
2. Complete servicing of 20-ton heat pump and straighten condenser fins.
3. Turn off gas to commercial oven when the building is unoccupied.
4. Turn off reach-in refrigerator and ice maker when the building is unoccupied.
5. Install hot water pipe insulation.

DeSmet Longhouse– Economic Analysis Results

Table 29 contains a summary of the economic analysis results for the DeSmet Longhouse. See Appendix D for the complete economic analysis conducted for this building.

Table 29. DeSmet Longhouse – Economic Analysis Results

Facility	Energy Conservation Measure	Net Incremental Cost ($)	Annual Energy Savings (kBtu/year)	Annual Savings ($/year)	Annual Energy Savings (%)	Simple Payback (years)	Net Present Value ($)	Internal Rate of Return (%)
DeSmet Longhouse	Program thermostats to reflect actual occupancy	$100	75,342	$2,649	16%	0.0	$41,914	2676%
	Service call to repair damaged fins on 20-ton heat pump	$750	12,401	$436	3%	1.7	$6,186	60%
	Turn off reach-in refrigerator and ice maker when not needed	$420	8,931	$314	2%	1.3	$4,572	76%
	Turn off propane to commercial oven when not needed	$420	72,000	$1,810	15%	0.2	$28,295	436%
	Pipe insulation	$150	3,993	$140	1%	1.1	$2,081	95%
	Totals	***$1,840***	***172,666***	***$5,349***	***36%***	***0.3***	***$83,048***	***295%***

As can be seen in Table 29, the highest internal rate of return and annual energy savings is realized by reprogramming thermostats. The two low-cost/no-cost "operational" measures of turning off gas and power to refrigeration during unoccupied periods also have significant IRRs and energy savings. Of specific note, turning off gas to the commercial range and oven is projected to save approximately 15% of the annual energy used in the structure. This is due to the number of pilot lights that are continuously running on this unit. All of the energy conservation measures taken together would yield approximately 36% annual energy savings with a substantial 295% IRR.

DeSmet Longhouse– Energy Conservation Measure (ECM) Prioritization Matrix

Table 30 contains the ECM Prioritization Matrix completed for the DeSmet Longhouse.

Table 30. DeSmet Longhouse - ECM Prioritization Matrix

DeSmet Longhouse	**Routine Building O&M Requirement**	**Energy Savings Potential**	**Internal Rate of Return**	**Feasibility**	**Overall Score**
Weighting Factor	*25%*	*25%*	*25%*	*25%*	*100%*
Reprogram thermostats	5	8	10	9	8.0
Service and repair damaged condenser fins on 20-ton heat pump	6	5	9	8	7.0
Turn off gas when oven not needed	1	8	8	8	6.3
Power off refrigerators when not in use	1	4	7	8	5.0
Pipe Insulation	1	3	4	8	4.0

As can be seen in Table 30, the highest ranked measure is to program thermostats to reflect actual building occupancy and energy efficient set points. This is followed by repairing issues with the main heating system.

DeSmet Longhouse- Conclusions and Recommendations

All of the measures proposed yield significant energy savings and support the longevity of the building. Though additional time may be required for Facilities staff to turn off gas and power to certain loads when the building is unoccupied, the return for this increased staff time appears to justify this type of building management. Due to the positive economics, OE recommends implementing all of the proposed measures in the priority presented above.

Roads Maintenance Shop (Includes Old and New Shops)

Roads Maintenance Shop - Energy Conservation Measure (ECM) Descriptions

The Roads Maintenance Shop had the following energy conservation measures identified and evaluated for this study:

1. Upgrade 8’, 2-lamp, T12 linear fluorescent lighting in Old Shop to high-performance T8 linear fluorescent lighting with high-performance electronic ballasts. See Appendix E for lighting upgrade recommendations.
2. Upgrade exterior 250W metal halide fixture on Old Shop to 90W LED fixture
3. Replace 100W incandescent exterior lighting on New Shop to 23W CFL
4. Replace 100W incandescent exterior spot lighting on New Shop to 23W CFL equivalent and repair existing photocell controls.
5. Install bay door interlocks in New Shop to prevent HVAC systems from running while doors are open.
6. Install hot water pipe insulation.

Roads Maintenance Shop – Economic Analysis Results

Table 31 contains a summary of the economic analysis results for the Roads Maintenance Shop buildings. See Appendix D for the complete economic analysis conducted for these buildings.

Table 31. Roads Maintenance Shop – Economic Analysis Results

Facility	Energy Conservation Measure	Net Incremental Cost ($)	Annual Energy Savings (kBtu/year)	Annual Savings ($/year)	Annual Energy Savings (%)	Simple Payback (years)	Net Present Value ($)	Internal Rate of Return (%)
Old Roads Maintenance Shop	Upgrade 4', 2-Lamp, 8', T12 Lighting to 4', 2-Lamp, HP T8 Lighting and HP Electronic Ballast	$330	3,109	$81	2.8%	4.1	$965	25%
	Upgrade exterior 250W metal halide Fixture to LED Fixture (90W)	$375	1,765	$46	1.6%	8.1	$366	12%
	Pipe insulation	$150	3,993	$94	3.6%	1.6	$1,339	64%
	Totals	***$855***	***8,867***	***$221***	***7.9%***	***3.9***	***$2,670***	***27%***
			-					
New Roads Maintenance Shop	Replace 100W incandescent exterior lighting with 23W CFL	$4	4,287	$112	Unknown	0.04	$1,769	2823%
	Replace 100 W incandescent flood lamps with 23W CFL equivalent and repair photocell controls	$8	8,573	$224	Unknown	0.04	$3,538	2823%
	Install Bay-Door Interlocks	$750	18,116	$455	Unknown	1.65	$6,494	62%
	Pipe insulation	$150	3,993	$94	Unknown	1.60	$1,339	64%
	Totals	***$912***	***34,970***	***$884***	***Unknown***	1.03	***$13,139***	***99%***

As can be seen in Table 31, the highest internal rate of return and annual energy savings are associated with upgrading incandescent lighting. All of the measures considered for the Old Shop result in energy savings of 2-4% with nominal first costs. Annual Energy Savings percentages are unknown for the New Shop because this is a relatively new structure with little historical billing data. All of the energy conservation measures taken together for the Old Roads Maintenance Shop yield 8% annual energy savings with a 15% IRR. All of the measures taking together for the New Roads Maintenance shop yield an 99% IRR. Also, as indicated in Table 31, the total cost for completing implementation of these measures is nominal.

Roads Maintenance Shop – Energy Conservation Measure (ECM) Prioritization Matrix

Table 32 contains the ECM Prioritization Matrix completed for the Roads Maintenance Shop.

Table 32. Roads Maintenance Shop - ECM Prioritization Matrix

Roads Shop (Old and New)	Routine Building O&M Requirement	Energy Savings Potential	Internal Rate of Return	Feasibility	Overall Score
Weighting Factor	*25%*	*25%*	*25%*	*25%*	*100%*
Upgrade 100W inc to 23W CFL	6	5	10	10	7.8
Upgrade incandescent floods to CFL + repair photocells	6	5	10	10	7.8
Upgrade T12 lighting to T8 lighting	6	4	5	8	5.8
Upgrade exterior 250W MH lighting to 90W LED	3	5	4	8	5.0
Install bay door interlocks	1	4	6	7	4.5
Pipe Insulation	1	5	4	8	4.5

As can be seen in Table 32, the highest ranked measures are associated with lighting upgrades. Bay door interlocks and pipe insulation were ranked lowest in terms of priority.

Roads Maintenance Shop - Conclusions and Recommendations

All of the measures considered for this building yield energy savings and positive economics and the cost of implementing all of the recommendations is nominal; therefore, OE recommends implementing all of the proposed measures in order of their priority ranking.

Fire Warehouse and Shop (Fire Warehouse)

Fire Warehouse - Energy Conservation Measure (ECM) Descriptions

The Fire Warehouse had the following energy conservation measures identified and evaluated for this study:

1. Replace bay door weather seals.
2. Weather-strip exterior doors (including doors in the connection between the office and garage area) and seal windows.
3. Upgrade office HVAC to ductless heat pumps (mini-split).
4. Install programmable thermostats and set to reflect actual occupancy and energy efficient set points. OE recommends that heating and cooling systems be activated one half hour before occupancy and left on one half hour after planned vacancy. Set points should be limited to 68°F heating and 78°F cooling during occupied periods and set back to 55°F heating and 84°F cooling during scheduled unoccupied periods.
5. Upgrade 8’, 2-lamp, T12 linear fluorescent lighting in Shop and Garage to high-bay T5 linear fluorescent lighting with high-performance electronic ballasts. See Appendix E for lighting upgrade recommendations.
6. Upgrade 4’, 2-lamp, T12 linear fluorescent lighting in offices and kitchen to high-performance T8 linear fluorescent lighting with high-performance electronic ballasts. See Appendix E for lighting upgrade recommendations.
7. Install hot water pipe insulation.
8. Eliminate redundant refrigeration capacity.
9. Replace main existing refrigerator with Energy Star equivalent.

In addition to the main projects that were screened as part of the energy conservation measure prioritization process, the following items were identified to be completed as part of routine maintenance to improve the general performance and longevity of the structure. Due to the unreliability of modeling these types of retrofits and the nature of these measures, these items were not considered as part of the economic evaluation.

1. Remove window-mounted air conditioner units when they are not needed.
2. Ensure adequate seals around window-mounted air conditioner units when installing.
3. Service the commercial range and oven to remediate gas leakage.
4. Install a carbon monoxide detector in commercial kitchen.

5. Complete quarterly cleaning and maintenance on electric resistance wall heaters.
6. Have compressor and distribution system assessed for leakage and complete repairs as necessary.

Fire Warehouse– Economic Analysis Results

Table 33 contains a summary of the economic analysis results for the Fire Warehouse. See Appendix D for the complete economic analysis conducted for this building.

Table 33. Fire Warehouse – Economic Analysis Results

Facility	Energy Conservation Measure	Net Incremental Cost ($)	Annual Energy Savings (kBtu/year)	Annual Savings ($/year)	Annual Energy Savings (%)	Simple Payback (years)	Net Present Value ($)	Internal Rate of Return (%)
Fire Warehouse and Shop	New bay door weather seals	$600	11,331	$266	5%	2.3	$3,630	46%
	Weatherstrip Exterior Doors, Seal Windows	$156	3,242	$76	1%	2.1	$1,054	50%
	Upgrade Office to Mini-Split Heat Pumps	$5,200	24,714	$579	8%	9.0	$4,138	10%
	Install programmable thermostats and set as recommended	$300	41,263	$967	13%	0.3	$15,048	326%
	Upgrade T12 Lighting in Shop and high-bay Garage to high-bay T5 Lighting	$1,360	12,918	$303	4%	4.5	$3,482	23%
	Upgrade 4', 2-Lamp, 8', T12 Lighting to 4', 2-Lamp, HP T8 Lighting and HP Electronic Ballast	$500	14,079	$330	4%	1.5	$4,748	68%
	Pipe insulation	$150	3,993	$94	2%	1.6	$1,339	64%
	Eliminate redundant refrigeration capacity	$0	4,242	$99	2%	0.0	$1,577	NA
	Replace main existing refrigerator with Energy Star equivalent	$900	1,024	$24	0.4%	37.5	($493)	NA
	Totals	***$9,166***	***116,807***	***$2,738***	***39%***	***3.3***	***$34,522***	***31%***

As can be seen in Table 33, the highest internal rate of return and annual energy savings is realized by installing programming thermostats programmed to reflect the actual occupancy of the structure and energy efficient set points. All but one of the measures have reasonable IRRs and generate annual energy savings of 2 to 5%. Upgrading the existing refrigerator to an Energy Star equivalent is not shown to be cost effective at this time. All of the energy conservation measures taken together would yield approximately 39% annual energy savings with a 31% IRR.

Fire Warehouse– Energy Conservation Measure (ECM) Prioritization Matrix

Table 34 contains the ECM Prioritization Matrix completed for the Fire Warehouse.

Table 34. Fire Warehouse and Shop - ECM Prioritization Matrix

Fire Warehouse and Shop	Routine Building O&M Requirement	Energy Savings Potential	Internal Rate of Return	Feasibility	Overall Score
Weighting Factor	*25%*	*25%*	*25%*	*25%*	*100%*
Install programmable thermostats	5	8	9	9	7.8
Eliminate redundant refrigerators	3	7	10	10	7.5
Remove AC units seasonally	6	6	9	8	7.3
Upgrade T12 lighting to T8 lighting in common areas	6	5	7	8	6.5
Bay door seals	6	6	6	8	6.5
Upgrade T12 lighting to high-bay T5 in shop and garage	6	5	6	8	6.3
Pipe insulation	5	4	7	8	6.0
Office door seals	6	3	6	8	5.8
Maintain wall heaters	6	3	5	8	5.5
Leak test compressor system, raise tank	1	6	7	7	5.3
Upgrade to mini-split heat pumps	2	7	4	4	4.3
Replace existing refrigerator with Energy Star equivalent	3	2	1	5	2.8

As can be seen in Table 34, the highest scoring measure was installing programmable thermostats. The second highest ranked measure is the no-cost opportunity of removing existing redundant refrigeration. At the time of the field assessment, many refrigerators were observed to be empty or significantly underutilized. Due to economics and the existence of an operational refrigerator, replacing the existing unit scored lowest in the rankings.

Fire Warehouse - Conclusions and Recommendations

Most of the measures considered for this building result in energy savings, however, the two relatively high cost measures of installing heat pumps and replacing the existing refrigeration systems do not result in significantly positive economics or score highly in the ranking criteria. Therefore these items are not considered high priority at this time. At the end of its serviceable life, the existing refrigerator should be replaced with an Energy Star rated equivalent. OE recommends completing all of the other measures in the order of priority presented above.

Felix Aripa Fish and Wildlife Building (Felix Aripa Building)

Felix Aripa Building - Energy Conservation Measure (ECM) Descriptions

The Felix Aripa Building had the following energy conservation measures identified and evaluated for this study:

1. Program thermostats to reflect the actual occupancy of the building and energy efficient set points. OE recommends that heating and cooling systems be activated one half hour before occupancy and left on one half hour after planned vacancy. Set points should be limited to 68°F heating and 78°F cooling during occupied periods and set back to 55°F heating and 84°F cooling during scheduled unoccupied periods.
2. Insulate exterior refrigeration lines on existing heat pumps.
3. Complete duct testing and sealing.
4. Install insulated blinds on north facing windows in reception.
5. Install hot water pipe insulation.

In addition to the main projects that were screened as part of the energy conservation measure prioritization process, the following items were identified to be completed as part of routine maintenance to improve the general performance and longevity of the structure. Due to the unreliability of modeling these types of retrofits and the nature of these measures, these items were not considered as part of the economic evaluation.

1. Insulate and weather-strip attic and crawlspace hatches.
2. Install return air grills in the open office area suspended ceilings to improve HVAC air balance.
3. Institute record keeping protocol for servicing electrostatic air filters.

Felix Aripa Building – Economic Analysis Results

Table 35 contains a summary of the economic analysis results for the Felix Aripa building. See Appendix D for the complete economic analysis conducted for this building.

Table 35. Felix Aripa Building – Economic Analysis Results

Facility	Energy Conservation Measure	Net Incremental Cost ($)	Annual Energy Savings (kBtu/year)	Annual Savings ($/year)	Annual Energy Savings (%)	Simple Payback (years)	Net Present Value ($)	Internal Rate of Return (%)
Felix Aripa Building	Program thermostats to reflect actual occupancy and energy efficient set points	$300	44,625	$1,046	11%	0.3	$16,297	353%
	Insulate exterior refrigerant lines on heat pumps	$125	4,522	$106	1%	1.2	$1,560	87%
	Complete duct testing and sealing	$500	11,434	$268	3%	1.9	$3,765	55%
	Install insulated blinds on north facing windows in reception	$1,400	2,773	$65	1%	21.5	($328)	NA
	Pipe insulation	$150	3,993	$94	1%	1.6	$1,339	64%
	Totals	***$2,475***	***67,347***	***$1,579***	***17%***	***1.6***	***$22,632***	***65%***

As can be seen in Table 35, the highest internal rate of return and annual energy savings is associated with reprogramming thermostats. All of the other measures evaluated yield incremental energy savings, however, installing insulated blinds does not produce positive economic results. All of the energy conservation measures taken together would result in 17% annual energy savings with a 65% IRR.

Felix Aripa Building – Energy Conservation Measure (ECM) Prioritization Matrix

Table 36 contains the ECM Prioritization Matrix completed for the Felix Aripa Building.

Table 36. Felix Aripa Building - ECM Prioritization Matrix

Felix Aripa Building	**Routine Building O&M Requirement**	**Energy Savings Potential**	**Internal Rate of Return**	**Feasibility**	**Overall Score**
Weighting Factor	*15%*	*25%*	*25%*	*10%*	*100%*
Reprogram thermostats	3	8	10	9	5.9
Duct testing/sealing	5	6	7	8	4.8
Insulate refrigerant lines	5	4	7	9	4.4
Seal crawlspace and attic hatches	1	4	7	9	3.8
Pipe insulation	4	3	6	8	3.7
North face window coverings	1	4	1	7	2.1

As can be seen in Table 36, the highest ranked measures are associated with completing building operations and maintenance changes including reprogramming thermostats, duct testing and sealing and insulating refrigerant lines. Installing hot water pipe insulation and window coverings were ranked the lowest based on the stated criteria.

Felix Aripa Building - Conclusions and Recommendations

All of the measures considered for this building yield incremental to significant energy savings and will aid in the long term improvement in building performance and longevity. Though installing window coverings on north facing windows in the reception area does not result in positive economic benefit, it would likely increase the comfort of building occupants, specifically in the reception area. Therefore, OE recommends implementing the recommended measures in the priority presented above.

Tribal Police Headquarters

Tribal Police Headquarters - Energy Conservation Measure (ECM) Descriptions

The Tribal Police Headquarters had the following energy conservation measures identified and evaluated for this study:

1. Replace weather stripping on exterior doors.
2. Replace two existing propane furnace/DX air conditioners with heat pumps with ground mounted condenser units.
3. Remove existing rooftop packaged HVAC unit (propane heater/air conditioner)
4. Complete duct testing and sealing
5. Add ductless air conditioner (mini-split) in server room.
6. Re-plumb exterior hose bib so that it provides cold water (not hot as existing). Address leaks in exterior hose bib.
7. Install hot water pipe insulation.

Tribal Police Headquarters – Economic Analysis Results

Table 37 contains a summary of the economic analysis results for the Tribal Police Headquarters. See Appendix D for the complete economic analysis conducted for this building.

Table 37. Tribal Police Headquarters – Economic Analysis Results

Facility	Energy Conservation Measure	Net Incremental Cost ($)	Annual Energy Savings (kBtu/year)	Annual Savings ($/year)	Annual Energy Savings (%)	Simple Payback (years)	Net Present Value ($)	Internal Rate of Return (%)
Tribal Police HQ	Replace weatherstripping on exterior doors	$26	1,962	$46	1%	0.6	$704	180%
	Replace 2 existing AC units with heat pumps, relocate to ground level	$5,000	40,748	$1,024	18%	4.9	$11,390	21%
	Remove existing rooftop packaged unit (excess capacity)	$500	-	See #2 above				NA
	Complete duct testing and sealing	$1,000	-	See #2 above				NA
	Add ductless air conditioner in server room	$2,500	-	See #2 above				NA
	Replumb exterior hose bib so that it provide cold water. Address leaks in exterior hose bib.	$200	18,686	$274	8%	0.7	$4,147	139%
	Pipe insulation	$150	3,993	$94	2%	1.6	$1,339	64%
	Totals	***$9,376***	***65,390***	***$1,438***	***29%***	***6.7***	***$17,580***	***15%***

As can be seen in Table 37, the highest internal rate of return and annual energy savings is associated with completing modifications and repairs to the existing HVAC system. Though these combined measures do require somewhat significant investment, together they are projected to result in 18% annual energy reductions while yielding a reasonable 21% IRR. The measures with the highest IRR are basic maintenance items including replacing weather stripping and completing modifications to the exterior hose bib plumbing. All of the energy conservation measures taken together would result in 29% annual energy savings with a 15% IRR.

Tribal Police Headquarters – Energy Conservation Measure (ECM) Prioritization Matrix

Table 38 contains the ECM Prioritization Matrix completed for the Tribal Police Headquarters.

Table 38. Tribal Police Headquarters - ECM Prioritization Matrix

Tribal Police Headquarters	Routine Building O&M Requirement	Energy Savings Potential	Internal Rate of Return	Feasibility	Overall Score
Weighting Factor	*15%*	*25%*	*25%*	*10%*	*100%*
Repair duct system	8	10	10	9	7.1
Repair DHW plumbing (exterior hose bib)	8	5	8	10	5.5
Upgrade split systems to heat pumps, remove packaged unit	8	6	5	6	4.6
Replace weatherstripping on exterior doors	6	3	8	8	4.5
Pipe insulation	1	3	6	8	3.2
Install mini-split AC to cool server room	1	5	5	5	3.2

As can be seen in Table 38, the highest ranked measures are associated with upgrading the existing, aging HVAC systems and addressing plumbing issues noted at the exterior hose bib. Maintenance issues including replacing weather stripping and installing pipe insulation were lower in the ranking, but yield energy savings at a nominal cost. Installing air conditioning capacity in the server room ranked the lowest based on the stated criteria.

Tribal Police Headquarters - Conclusions and Recommendations

All of the measures considered for this building yield incremental to significant energy savings and will aid in the long term improvement in building performance and longevity. Leaking plumbing has both energy and building health implications as they can lead to the degradation of building materials. Though adding air conditioning capacity to the server room ranked the lowest in terms of the stated criteria, adding this capacity will likely increase the lifespan of the computer systems it serves. OE recommends completing the recommended measures in the order that they are presented above.

Youth Shelter

Youth Shelter - Energy Conservation Measure (ECM) Descriptions

The Youth Shelter had the following energy conservation measures identified and evaluated for this study:

1. Install new separate split system heat pump for upstairs zone.
    a. Install programmable thermostats and set to reflect actual occupancy and energy efficient set points. OE recommends that heating and cooling systems be activated one half hour before occupancy and left on one half hour after planned vacancy. Set points should be limited to 68°F heating and 78°F cooling during occupied periods and set back to 55°F heating and 84°F cooling during scheduled unoccupied periods.
2. Replace existing DX AC unit with heat pump sized for ground floor only.
    a. Install programmable thermostats and set to reflect actual occupancy and energy efficient set points
3. Replace failing metal-framed windows
4. Install hot water pipe insulation.

In addition to the main projects that were screened as part of the energy conservation measure prioritization process, the following items were identified to be completed as part of routine maintenance to improve the general performance and longevity of the structure. Due to the unreliability of modeling these types of retrofits and the nature of these measures, these items were not considered as part of the economic evaluation.

1. Insulate and weather-strip attic hatch.

Table 39 contains a summary of the economic analysis results for the Youth Shelter. See Appendix D for the complete economic analysis conducted for this building.

Table 39. Youth Shelter – Economic Analysis Results

Facility	Energy Conservation Measure	Net Incremental	Annual Energy Savings	Annual Savings	Annual Energy	Simple Payback	Net Present Value	Internal Rate of
Youth Shelter	Install new separate split system heat pump for upstairs zone; install programmable	$5,705	(14,323)	-$357	-13%	(16.0)	($11,196)	NA
	Replace existing DX AC unit with heat pump sized for ground floor only; install programmable thermostats	$2,500	(14,323)	-$357	-13%	(7.0)	($8,084)	NA
	Replace failing metal-framed windows with dual pane vinyl	$4,500	2,778	$69	2%	65.0	($3,272)	NA
	Pipe insulation	$150	3,993	$94	4%	1.6	$1,339	64%
	Totals	***$12,855***	***(21,874)***	***-$551***	***-20%***	***(23.3)***	***($21,213)***	***NA***

As can be seen in Table 39, all but one of the measures requires significant investment with no positive economic return. Installing hot water pipe insulation results in modest annual energy savings with a positive IRR and replacing failed windows results in modest annual energy savings.

Youth Shelter – Energy Conservation Measure (ECM) Prioritization Matrix

Table 40 contains the ECM Prioritization Matrix completed for the Youth Shelter.

Table 40. Youth Shelter - ECM Prioritization Matrix

Youth Shelter	Routine Building O&M Requirement	Energy Savings Potential	Internal Rate of Return	Feasibility	Overall Score
Weighting Factor	*25%*	*25%*	*25%*	*25%*	*100%*
Install programmable thermostats with appropriate set points	5	7	10	8	7.5
Seal attic hatch	3	4	8	10	6.3
Pipe insulation	4	6	4	8	5.5
Install new upstairs heat pump system	10	1	1	7	4.8
Replace existing electric furnace/DX AC system with heat pump	8	2	1	8	4.8
Replace metal-framed windows	5	4	1	8	4.5

As can be seen in Table 40, installing programmable thermostats with proposed new HVAC systems is also ranked high due to its relation to building controls. The second highest ranked measure is an operation and maintenance issue that can have significant effect on overall building performance. Replacing metal-framed windows was ranked the lowest in terms of the stated criteria.

Youth Shelter - Conclusions and Recommendations

Though installing new HVAC systems did not score in the top three measures, these items will have significant impacts on the building occupant's comfort and the overall performance of the building. With the advanced age of the AC system, planning for investment in HVAC upgrades will be necessary in the short term. Addressing maintenance measures will also improve the overall performance of the building increasing the longevity of the structure, though not yielding significant energy savings. Due to the function of this structure, OE recommends completing all of the measures recommended above focusing initially on maintenance items and planning for investment to upgrade the mechanical systems in the near future.

Technology Center

Technology Center - Energy Conservation Measure (ECM) Descriptions

The Technology Center had the following energy conservation measures identified and evaluated for this study:

1. Program thermostats to reflect actual building occupancy and energy efficient set points. OE recommends that heating and cooling systems be activated one half hour before occupancy and left on one half hour after planned vacancy. Set points should be limited to 68°F heating and 78°F cooling during occupied periods and set back to 55°F heating and 84°F cooling during scheduled unoccupied periods.
2. Replace weather stripping on exterior doors.
3. Replace exterior metal halide wall packs with new LED fixture (70W)
4. Install hot water pipe insulation.

Technology Center – Economic Analysis Results

Table 41 contains a summary of the economic analysis results for the Technology Center. See Appendix D for the complete economic analysis conducted for this building.

Table 41. Technology Center – Economic Analysis Results

Facility	Energy Conservation Measure	Net Incremental Cost ($)	Annual Energy Savings (kBtu/year)	Annual Savings ($/year)	Annual Energy Savings (%)	Simple Payback (years)	Net Present Value ($)	Internal Rate of Return (%)
Technology Center	Program thermostats to reflect actual occupancy and energy efficient set points	$300	56,272	$1,319	3%	0.2	$20,627	445%
	Replace weatherstripping on exterior doors	$100	2,773	$65	0.2%	1.5	$934	67%
	Replace exterior metal halides with LED equivalent (90W)	$1,612	7,978	$187	0.5%	8.6	$1,400	11%
	Pipe insulation	$150	3,993	$94	0.2%	1.6	$1,339	64%
	Totals	***$2,162***	***71,016***	***$1,665***	***4%***	***1.3***	***$24,300***	***79%***

As can be seen in Table 41, all of the measures result in incremental annual energy savings and positive economics with IRRs ranging from 11% to 445%. The low-cost/no-cost measure of making adjustments to the existing thermostat settings yields the most significant energy savings, IRR and NPV and has a simple payback of just 2.4 months. All of the energy conservation measures taken together would result in a 4% annual energy savings with a combined IRR of 79%.

Technology Center – Energy Conservation Measure (ECM) Prioritization Matrix

Table 42 contains the ECM Prioritization Matrix completed for the Technology Center.

Table 42. Technology Center - ECM Prioritization Matrix

Technology Center	Routine Building O&M Requirement	Energy Savings Potential	Internal Rate of Return	Feasibility	Overall Score
Weighting Factor	*25%*	*25%*	*25%*	*25%*	*100%*
Reprogram thermostats	5	8	8	9	7.5
Pipe Insulation	5	3	6	7	5.3
Door seals	5	3	5	8	5.3
Replace MH exterior lighting with LED equivalent	3	3	5	9	5.0

As can be seen in

Table 42, the highest ranked measure is reprogramming thermostats to better reflect the actual occupancy of the building. Pipe insulation and door seals were ranked nearly identically and lighting upgrades were ranked the lowest.

Technology Center - Conclusions and Recommendations

All of the recommended measures result in annual energy savings and positive economics. Though completing lighting upgrades was ranked the lowest, largely due to initial costs, this upgrade has an expected life span of 100,000 hours which far exceeds the 8.6 year simple payback calculated for this measure. Therefore, this measure has a net present value higher than the door seals and pipe insulation. OE recommends completing all of the measures recommended in order of the priority presented above.

Former Tribal Court Services

Former Tribal Court Services - Energy Conservation Measure (ECM) Descriptions

The former Tribal Court Services building had the following energy conservation measures identified and evaluated for this study:

1. Program thermostats to reflect actual building occupancy and energy efficient set points. OE recommends that heating and cooling systems be activated one half hour before occupancy and left on one half hour after planned vacancy. Set points should be limited to 68°F heating and 78°F cooling during occupied periods and set back to 55°F heating and 84°F cooling during scheduled unoccupied periods.
2. Replace weather stripping on exterior doors and seal windows.
3. Upgrade 4’, T12 lighting in Court Room to T8 equivalent. See Appendix E for lighting upgrade recommendations.
4. Upgrade 100W incandescent lighting to 23W CFL equivalent.
5. Install occupancy sensors in offices, meeting rooms and restrooms (ultrasonic in restrooms, infrared in offices and meeting rooms).
6. Install hot water pipe insulation.

In addition to the main projects that were screened as part of the energy conservation measure prioritization process, the following items were identified to be completed as part of routine maintenance to improve the general performance and longevity of the structure. Due to the unreliability of modeling these types of retrofits and the nature of these measures, these items were not considered as part of the economic evaluation.

1. Complete duct testing and seal as necessary.
2. Complete monthly servicing of air handler filters.
3. Install ceiling fans in atrium foyer to better distribute conditioned air.

Former Tribal Court Services – Economic Analysis Results

Table 43 contains a summary of the economic analysis results for the Tribal Court Services building. See Appendix D for the complete economic analysis conducted for this building.

Table 43. Former Tribal Court Services – Economic Analysis Results

Facility	Energy Conservation Measure	Net Incremental Cost ($)	Annual Energy Savings (kBtu/year)	Annual Savings ($/year)	Annual Energy Savings (%)	Simple Payback (years)	Net Present Value ($)	Internal Rate of Return (%)
Tribal Court Services	Change thermostats to reflect actual occupancy	$200	82,481	$1,450	20%	0.1	$22,802	733%
	Replace weatherstripping on exterior doors and seal windows	$384	25,029	$440	6%	0.9	$6,605	117%
	Upgrade 4', T12 Lighting in Court Room to T8 equivalent	$318	3,072	$54	1%	5.9	$548	17%
	Upgrade 100W Incandescent to 23W CFL	$12	9,841	$173	2%	0.1	$2,732	1457%
	Install Lighting Occupancy Sensors in Offices, Restrooms, Meeting Rooms	$581	8,817	$155	2%	3.7	$1,894	28%
	Pipe insulation	$150	3,993	$94	1%	1.6	$1,339	64%
	Totals	***$1,645***	***133,232***	***$2,366***	***33%***	***0.7***	***$35,920***	***146%***

As can be seen in Table 43, all of the measures result in incremental to significant annual energy savings and positive economics with IRRs ranging from 17% to 733%. The low-cost/no-cost measure of making adjustments to the existing thermostat settings yields the most significant energy savings and NPV and has a simple payback of just 1.2 months. Upgrading incandescent lighting alone, a very simple measure, results in 2% annual energy savings with a remarkable 1457% IRR. All of the energy conservation measures taken together would result in a 33% annual energy savings with a combined IRR of 140%.

Former Tribal Court Services – Energy Conservation Measure (ECM) Prioritization Matrix

Table 44 contains the ECM Prioritization Matrix completed for the Tribal Court Services building.

Table 44. Former Tribal Court Services - ECM Prioritization Matrix

Tribal Court Services	Routine Building O&M Requirement	Energy Savings Potential	Internal Rate of Return	Feasibility	Overall Rank
Weighting Factor	*25%*	*25%*	*25%*	*25%*	*100%*
Reprogram thermostats	5	10	9	9	8.3
Air Seal Doors and Windows	6	8	8	10	8.0
Upgrade Incandescent Lamps to CFL	6	4	10	10	7.5
Duct testing/sealing	8	7	6	8	7.3
Upgrade T12s to T8s	6	4	5	8	5.8
Occupancy sensors	1	5	5	7	4.5
Pipe insulation	1	3	6	8	4.5

As can be seen in Table 42 the highest ranked measure was to reprogram thermostats to better reflect actual occupancy and energy efficient set points. This is followed closely by air sealing, incandescent lamp upgrades and addressing duct leakage. Upgrading T12 lighting to T8 lighting scored fairly low due to its marginal effects on annual energy usage. Pipe insulation and installing occupancy sensors ranked the lowest in terms of the stated criteria.

Former Tribal Court Services - Conclusions and Recommendations

All of the recommended measures result in annual energy savings and positive economics. It should be noted in order to produce the returns projected for reprogramming thermostats, operation and maintenance issues such as duct testing and sealing, addressing moisture issues and air sealing will need to be completed. Though these measures produce annual energy savings, due to the unknown future of this structure, upgrading T12 lighting, installing occupancy sensors and pipe insulation are not considered high priority items at this time. Since the time of this study, the Tribe has relocated the Tribal Court Services facilities and plans on demolishing this structure; therefore, no measures are recommended for this facility.

Tribal Casino Resort Maintained Buildings

Casino Daycare

Casino Daycare- Energy Conservation Measure (ECM) Descriptions

The Casino Daycare facility had the following energy conservation measures identified and evaluated for this study:

1. Upgrade 4', 2-lamp, T12 linear fluorescent lighting T8 linear fluorescent lighting with high-performance electronic ballasts. See Appendix E for lighting upgrade recommendations.
2. Install pipe insulation.

In addition to the main projects that were screened as part of the energy conservation measure prioritization process, the following items were identified to be completed as part of routine maintenance to improve the general performance and longevity of the structure. Due to the unreliability of modeling these types of retrofits and the nature of these measures, these items were not considered as part of the economic evaluation.

1. Augment existing emergency lighting with plug-in style LED flashlights.
2. Undercut interior doors to improve air balance within the building.

Casino Daycare – Economic Analysis Results

Table 45 contains a summary of the economic analysis results for the Casino Daycare. See Appendix D for the complete economic analysis conducted for this building.

Table 45. Casino Daycare – Economic Analysis Results

Facility	Energy Conservation Measure	Net Incremental Cost ($)	Annual Energy Savings (kBtu/year)	Annual Savings ($/year)	Annual Energy Savings (%)	Simple Payback (years)	Net Present Value ($)	Internal Rate of Return (%)
Casino Daycare	Upgrade 4', 2-Lamp, T12 Lighting to 2-Lamp, HP T8 Lighting (32W) and HP Electronic Ballast	$1,799	31,594	$741	28%	2.4	$9,998	42%
	Pipe insulation	$150	3,993	$94	3%	1.6	$1,339	64%
	Totals	***$1,949***	***35,587***	***$834***	***31%***	***2.3***	***$11,337***	***44%***

As can be seen in Table 45, implementing the recommended energy conservation measures results in significant energy savings with a total estimated cost of just under $2000. Both of the measures taken together would result in an estimated 31% annual energy savings with an IRR of 44%.

Casino Daycare – Energy Conservation Measure (ECM) Prioritization Matrix

Table 46 contains the ECM Prioritization Matrix completed for the Casino Daycare facility.

Table 46. Casino Daycare - ECM Prioritization Matrix

Casino Daycare	Routine Building O&M Requirement	Energy Savings Potential	Internal Rate of Return	Feasibility	Overall Score
Weighting Factor	*25%*	*25%*	*25%*	*25%*	*100%*
Upgrade T12s to T8s	6	7	7	8	7
LED emergency lighting	4	2	5	10	5.3
Pipe Insulation	3	4	5	8	5
Undercut doors	1	3	4	8	4

As can be seen in Table 46, the highest ranked measure is upgrading T12 linear fluorescent lighting to high-performance T8 lighting. This is mostly due to the high energy savings associated with this measure in addition to its favorable economics. Undercutting doors was ranked lowest with respect to the stated criteria.

Casino Daycare - Conclusions and Recommendations

All of the measures considered are economically viable, therefore, OE recommends implementing the measures in the order presented above.

Circling Raven Golf Course Pro Shop (Pro Shop)

Pro Shop- Energy Conservation Measure (ECM) Descriptions

The Pro Shop had the following energy conservation measures identified and evaluated for this study:

1. Upgrade 100W incandescent recessed lighting to 23W CFL equivalent.
2. Upgrade 50W MR16 lighting in showroom to 8W LED lamps.
3. Install Catalyst technology on packaged HVAC units.
4. Complete commercial kitchen upgrades.*
    a. Upgrade shaded pole evaporator fan motor in walk-in to electronically commutated motor.
    b. Upgrade T12 lighting in reach-in refrigerator to LED.
    c. Install floating head pressure controls on low temperature freezer compressor unit.
    d. Install floating head pressure controls on medium temperature compressor unit.

*Energy savings and economic calculations for the proposed refrigeration system upgrades were completed by Energy Smart Grocers under a separate assessment.

In addition to the main projects that were screened as part of the energy conservation measure prioritization process, the following items were identified to be completed as part of routine maintenance to improve the general performance and longevity of the structure. Due to the unreliability of modeling these types of retrofits and the nature of these measures, these items were not considered as part of the economic evaluation.

1. Inspect both gas water heaters to ensure that they were properly converted for use with propane gas; if so, label appropriately, if not, immediately retrofit for combustion of propane gas and label.
2. Provide minimum monthly maintenance on exterior refrigeration condenser units.

Pro Shop – Economic Analysis Results

Table 47 contains a summary of the economic analysis results for the Pro Shop. See Appendix D for the complete economic analysis conducted for this building.

Table 47. Pro Shop – Economic Analysis Results

Facility	Energy Conservation Measure	Net Incremental Cost ($)	Annual Energy Savings (kBtu/year)	Annual Savings ($/year)	Annual Energy Savings (%)	Simple Payback (years)	Net Present Value ($)	Internal Rate of Return (%)
Circling Raven Golf Course Pro Shop	Upgrade 100W recessed Incandescents to 23W CFL equivalent	$30	19,287	$311	1%	0.1	$4,900	1047%
	Upgrade 50W MR16 lighting in showroom to 8W LED equivalent	$0	4,604	$74	0.3%	0.0	$1,177	NA
	Upgrade shaded pole motor to ECM	$30	4,072	$66	0.3%	0.5	$1,011	222%
	Upgrade T12 lighting in reach-in refrigerator to LED	$42	3,154	$51	0.2%	0.8	$765	123%
	Install floating head controls on LT compressor unit	$679	17,847	$288	1%	2.4	$3,902	44%
	Install floating head controls on MT compressor unit	$2,205	26,417	$426	2%	5.2	$4,610	20%
	Catalyst technology on packaged units (rebate potential $250/ton)*	$13,750	165,022	$2,659	11%	5.2	$28,825	20%
	Pipe insulation	$300	7,986	$129	1%	2.3	$1,750	44%
	Totals	***$17,036***	***248,388***	***$4,003***	***17%***	***4.3***	***$46,940***	***24%***

As can be seen in Table 47, upgrading incandescent lighting (both 100W and MR16) yields significant return on investment with very fast simple payback periods. The most energy savings projected is associated with installing Catalyst controls on the packaged HVAC units. All of the measures taken together are estimated to yield 17% annual energy savings with a 24% IRR.

Pro Shop – Energy Conservation Measure (ECM) Prioritization Matrix

Table 48 contains the ECM Prioritization Matrix completed for the Pro Shop facility.

Table 48. Pro Shop - ECM Prioritization Matrix

Golf Course Pro Shop	Routine Building O&M Requirement	Energy Savings Potential	Internal Rate of Return	Feasibility	Overall Score
Weighting Factor	*25%*	*25%*	*25%*	*25%*	*100%*
Upgrade 100W inc. to 23W CFLs	6	3	10	10	7.3
Upgrade shaded pole motor to ECM	5	2	9	9	6.3
Upgrade T12 reach-in lighting to LED	4	2	8	9	5.8
Upgrade 50W MR16 to 8W LED	3	2	10	7	5.5
Install Catalyst Technology	1	9	5	6	5.3
Install floating head controls on LT compressors	4	3	6	7	5.0
Install floating head controls on MT compressors	4	4	5	7	5.0
Pipe Insulation	1	6	4	8	4.8

As can be seen in Table 48, the highest ranked measure is upgrading the 100W recessed incandescent lighting in the restaurant and common areas. This is largely due from the simplicity of this upgrade and its very favorable economics. Upgrading the walk-in cooler evaporator fan motor, installing HVAC controls, upgrading halogen spot lighting and upgrading the lighting in the reach-in refrigerator were all ranked closely. Compressor controls and pipe insulation ranked lowest based on the stated criteria.

Pro Shop - Conclusions and Recommendations

The top five measures were scored fairly closely and result in significant energy savings with positive economics. Except for the HVAC controls, all of these measures are very common and can be completed without major disruption to ongoing business. Installing compressor controls can be a complex upgrade and, based on the costs and energy savings, left these measures at the bottom of the ranking. OE recommends completing the top five measures in order of the prioritization presented above. Compressor controls and pipe insulation are not considered high priority energy conservation measures at this time.

Golf Course Pavilion

Golf Course Pavilion- Energy Conservation Measure (ECM) Descriptions

The Golf Course Pavilion had the following energy conservation measures identified and evaluated for this study:

1. Replace existing electric resistance unit heaters with 4, ductless heat pump systems (mini-split); control with programmable thermostats set to reflect the actual occupancy and energy efficient set points. OE recommends that heating and cooling systems be activated one half hour before occupancy and left on one half hour after planned vacancy. Set points should be limited to 68°F heating and 78°F cooling during occupied periods and set back to 55°F heating and 84°F cooling during scheduled unoccupied periods.
2. Turn off commercial refrigerator when building is scheduled for vacancy.
3. Install pipe insulation on all accessible hot water lines.

Golf Course Pavilion – Economic Analysis Results

Table 49 contains a summary of the economic analysis results for the Golf Course Pavilion. See Appendix D for the complete economic analysis conducted for this building.

Table 49. Golf Course Pavilion – Economic Analysis Results

Facility	Energy Conservation Measure	Net Incremental Cost ($)	Annual Energy Savings (kBtu/year)	Annual Savings ($/year)	Annual Energy Savings (%)	Simple Payback (years)	Net Present Value ($)	Internal Rate of Return (%)
Golf Course Pavilion	Install 4 mini-split heat pumps to offset resistance heating and provide necessary cooling; install programmable thermostats as part of this upgrade	$10,000	18,393	$431	32%	23.2	($2,872)	NA
	Turn off commercial refrigerator when not needed	$35	4,109	$144	7%	0.2	$2,257	418%
	Pipe insulation	$300	2,867	$67	5%	4.5	$774	23%
	Totals	***$10,335***	***25,369***	***$643***	***45%***	***16.1***	***$160***	***3%***

As can be seen in Table 49, installing ductless heat pumps yields significant energy savings in terms of the percentage of total use however, due to the limited use of this building, the annual savings does not create a positive net present value or IRR. Simply turning off the commercial refrigeration when the building is not scheduled for occupancy yields modest energy savings with little investment. Installing hot water pipe insulation yields reasonable energy savings with a modest IRR. Taken together, the proposed measures yield an estimated annual energy savings of 45% with a 3% IRR.

Golf Course Pavilion – Energy Conservation Measure (ECM) Prioritization Matrix

Table 50 contains the ECM Prioritization Matrix completed for the Golf Course Pavilion.

Table 50. Golf Course Pavilion - ECM Prioritization Matrix

Golf Course Pavillion	Routine Building O&M Requirement	Energy Savings Potential	Internal Rate of Return	Feasibility	Overall Score
Weighting Factor	*25%*	*25%*	*25%*	*25%*	*100%*
Turn off commercial refrigerator when not needed	4	5	9	8	6.5
Pipe Insulation	5	4	4	8	5.3
Install 4-mini-split heat pumps	1	9	1	5	4.0

As can be seen in Table 50, the highest ranked measure is operational in nature and requires staff to turn off the commercial refrigeration when the building is not scheduled for occupancy, and turn it back on in time for scheduled events. Installing pipe insulation and upgrading the HVAC systems ranked very closely.

Golf Course Pavilion - Conclusions and Recommendations

The top two measures would be relatively simple to implement for limited capital expense while yielding significant energy savings. OE recommends completing these upgrades in the short term. Upgrading the HVAC system in the Golf Course Pavilion results in significant energy savings, but due to the limited use of the building, the economics of this measure are not favorable. However, by adding heat pumps to this building, this would provide cooling capacity that does not currently exist, which, in turn, would likely increase occupant comfort in the summer months when this structure sees the most use. Therefore this measure should be considered as part of long term budgeting for this structure.

Tribal Casino Conoco (Conoco)

Conoco- Energy Conservation Measure (ECM) Descriptions

The Conoco had the following energy conservation measures identified and evaluated for this study:

5. Upgrade 150W exterior metal halide wall packs to 40W LED fixtures.
6. Upgrade 400W metal halide parking lot lighting to 70W LED fixtures.
7. Install Catalyst technology on packaged HVAC units.
8. Install lighting occupancy sensors in restrooms.
9. Complete commercial kitchen upgrades.*
    a. Install anti-sweat heat controls on medium temperature walk-in and reach-in refrigerators.
    b. Install anti-sweat heat controls on low temperature walk-in and reach-in refrigerators.
    c. Upgrade T8 lighting in walk-in and reach-in refrigerator doors with LED.
    d. Upgrade T12 lighting in reach-in refrigerator to LED
    e. Install floating head pressure controls on low temperature freezer compressor units.
    f. Install floating head pressure controls on medium temperature compressor units.

*Energy savings and economic calculations for the proposed refrigeration system upgrades were completed by Energy Smart Grocers under a separate assessment.

In addition to the main projects that were screened as part of the energy conservation measure prioritization process, the following items were identified to be completed as part of routine maintenance to improve the general performance and longevity of the structure. Due to the unreliability of modeling these types of retrofits and the nature of these measures, these items were not considered as part of the economic evaluation.

1. Schedule service call for cooler condenser to remediate icing on expansion valve.
2. Repair/reconfigure roof drainage over entrance awning.
3. Repair rubber walkway paths connections to roof top membrane system to eliminate water retention.

Conoco – Economic Analysis Results

Table 51 contains a summary of the economic analysis results for the Conoco. See Appendix D for the complete economic analysis conducted for this building.

Table 51. Tribal Casino Conoco – Economic Analysis Results

Facility	Energy Conservation Measure	Net Incremental Cost ($)	Annual Energy Savings (kBtu/year)	Annual Savings ($/year)	Annual Energy Savings (%)	Simple Payback (years)	Net Present Value ($)	Internal Rate of Return (%)
Casino Conoco Gas Station	Upgrade 150W metal halide wall packs to 40W LED equivalent	$1,612	4,140	$85	0.4%	19.0	($219)	NA
	Upgrade 400W metal halide parking lot lighting to 70W LED fixture	$3,895	11,823	$242	1%	16.1	$64	3%
	Install anti-sweat heat controls MT walk-in and reach-in	$0	39,198	$804	4%	0.0	$12,750	NA
	Install anti-sweat heat controls LT walk-in and reach-in	$0	12,116	$249	1%	0.0	$3,941	NA
	Upgrade T8 lighting in walk-in and reach-in doors to LED	$1,368	44,355	$910	5%	1.5	$13,099	68%
	Install floating head controls on LT compressor unit	$1,455	38,243	$784	4%	1.9	$11,026	55%
	Install floating head controls on MT compressor unit	$4,410	52,833	$1,084	6%	4.1	$12,903	25%
	Catalyst Technology on packaged units (rebate potential $250/ton)*	$6,375	103,999	$2,133	11%	3.0	$27,638	35%
	Install lighting occupancy sensors in restrooms	$89	3,283	$67	0.3%	1.3	$981	77%
	Totals	***$19,205***	***309,991***	***$6,358***	***33%***	***3.0***	***$82,184***	***34%***

As can be seen in Table 51, installing anti-sweat heat controls is projected to be 100% subsidized by the utility while yielding a significant 5% annual energy savings. The highest energy savings is produced by installing HVAC controls which results in 11% annual savings with a reasonable 35% IRR. Upgrading metal halide lighting yields little energy savings with marginal to negative returns. All of the measures considered together yield a projected 33% annual energy savings with a reasonable 34% IRR.

Conoco – Energy Conservation Measure (ECM) Prioritization Matrix

Table 52 contains the ECM Prioritization Matrix completed for the Conoco facility.

Table 52. Tribal Casino Conoco - ECM Prioritization Matrix

Tribal Casino Conoco	Routine Building O&M Requirement	Energy Savings Potential	Internal Rate of Return	Feasibility	Overall Score
Weighting Factor	25%	25%	25%	25%	100%
Install anti-sweat heat controls on low-temperature and medium-temperature walk-ins and reach-ins	2	6	10	8	6.5
Upgrade T8 lighting in walk-in and reach-in doors to LED	3	6	6	9	6.0
Install Catalyst Technology	1	8	5	6	5.0
Install compressor controls on low temperature units	2	6	6	7	5.3
Install compressor controls on medium temperature units	2	6	5	7	5.0
Upgrade 400W MH Parking Lot Lighting to 70W LED	3	3	3	8	4.3
Install Lighting Occupancy Sensors	1	2	5	8	4.0
Upgrade 150W MH Wall Packs to 40W LED	3	1	1	8	3.3

As can be seen in Table 52, the highest ranked energy conservation measure for the Conoco is installing anti-sweat heat controls on all of the walk-in and reach-ins. This is due to the existing rebates, energy savings potential and relative ease of implementation. Upgrading lighting in the coolers and installing HVAC and compressor controls were all ranked fairly closely. Retrofitting parking lot lighting, wall packs and installing occupancy sensors were ranked the lowest based on the stated criteria.

Conoco - Conclusions and Recommendations

The top five measures considered yield significant energy savings and show positive economic indicators. OE recommends implementing these items in the order presented above. Due to the overall cost, relatively low energy savings and financial return associated with upgrading existing exterior lighting and installing occupancy sensors, these measures are not considered to be appropriate measures at this time.

City Link Bus Garage (City Link)

City Link - Energy Conservation Measure (ECM) Descriptions

The City Link facility had the following energy conservation measures identified and evaluated for this study:

1. Replace 175W metal halide wall packs with 40W LED fixtures.
2. Install occupancy sensors in offices.
3. Discontinue use of coffee burner and switch to carafe style coffee maker.
4. Install pipe insulation on accessible hot water piping.

In addition to the main projects that were screened as part of the energy conservation measure prioritization process, the following items were identified to be completed as part of routine maintenance to improve the general performance and longevity of the structure. Due to the unreliability of modeling these types of retrofits and the nature of these measures, these items were not considered as part of the economic evaluation.

1. Undercut office doors to provide better HVAC air balance.

City Link – Economic Analysis Results

Table 53 contains a summary of the economic analysis results for the City Link facility. See Appendix D for the complete economic analysis conducted for this building.

Table 53. City Link Bus Garage – Economic Analysis Results

Facility	Energy Conservation Measure	Net Incremental Cost ($)	Annual Energy Savings (kBtu/year)	Annual Savings ($/year)	Annual Energy Savings (%)	Simple Payback (years)	Net Present Value ($)	Internal Rate of Return (%)
City Link	Replace exterior 175W metal halide wall packs with 40W LED fixtures	$3,224	9,795	$230	6%	14.0	$511	5%
	Install lighting occupancy sensors in offices	$179	2,225	$52	1%	3.4	$654	30%
	Discontinue use of coffee burner, switch to carafe style	$65	5,631	$132	3%	0.5	$2,030	206%
	Pipe insulation	$150	3,993	$94	2%	1.6	$1,339	64%
	Totals	***$3,618***	***21,645***	***$507***	***12%***	***7.1***	***$4,534***	***14%***

As can be seen in Table 53, switching from a burner style to carafe style coffee preparation yields the highest IRR and produces significant energy savings from a simple, low-cost measure. Though upgrading exterior lighting yields the most projected energy savings, with a simple payback of 14 years, a nominal 5% IRR and high initial cost this measure does not appear to be economical. Taken together the proposed measures are projected to yield 12% annual energy savings with a modest 14% IRR.

City Link – Energy Conservation Measure (ECM) Prioritization Matrix

Table 54 contains the ECM Prioritization Matrix completed for the Conoco facility.

Table 54. City Link Bus Garage - ECM Prioritization Matrix

City Link Bus Garage	Routine Building O&M Requirement	Energy Savings Potential	Internal Rate of Return	Feasibility	Overall Score
Weighting Factor	*25%*	*25%*	*25%*	*25%*	*100%*
Carafe style coffee system	1	5	9	10	6.3
Pipe Insulation	1	4	7	8	5.0
Upgrade 175W MH to 90W LED	3	7	2	6	4.5
Occupancy sensors in offices	1	3	5	7	4.0

As can be seen in Table 54, switching from a "burner-style" to a "carafe-style" coffee maker received the highest ranking, followed by installing insulation on all accessible hot water piping. Though upgrading exterior lighting does yield significant energy savings, the initial costs and complexity of this retrofit push it to the lower ranges. Installing occupancy sensors ranks lowest in terms of the stated criteria.

City Link - Conclusions and Recommendations

OE recommends completing the top two measures considered for the City Link facility. Due to the relatively new construction of the facility and marginal economic benefits, upgrading exterior lighting and installing occupancy sensors are not considered high priority retrofit opportunities measures at this time.

Tribal Casino Resort Hotel (Casino)

Casino - Energy Conservation Measure (ECM) Descriptions

The Casino facility had the following energy conservation measures identified and evaluated for this study:

1. Upgrade parking lot lighting from 400W metal halide fixtures to 70W LED fixtures.
2. Upgrade “Entrance Foyer” lighting from 100W incandescent spots to 23W CFL.
3. Upgrade MR16 halogen lamps in bars and buffets to LED equivalent lamps (4W).
4. Upgrade recessed 100W incandescent lamps in buffet area to 23W CFL equivalent.
5. Reduce the run time of 400,000 BTU/hour fire feature from 12 hours per day to 6 hours per day.
6. Reduce the run time of two, 150,000 BTU/hour fireplaces from 12 hours per day to 6 hours per day.
7. Chinook Steakhouse
    a. Install floating head controls on low temperature compressor(s).*
    b. Install floating head controls on medium temperature compressor(s).*
8. Sweetgrass Restaurant
    a. Upgrade shaded pole evaporator motors to electronically commutated motors (ECMs).*
    b. Install new gaskets on low temperature walk-in doors.*
    c. Install new gaskets on medium temperature walk-in doors.*
    d. Install floating head controls on low temperature compressor(s).*
    e. Install floating head controls on medium temperature compressor(s).*
9. Deli Food Court
    a. Upgrade shaded pole evaporator motors to electronically commutated motors (ECMs).*
    b. Upgrade T12 lighting in reach-in doors to LED.*
    c. Install floating head controls on medium temperature compressor(s).*
10. Nighthawk Lounge
    a. Upgrade shaded pole evaporator motors to electronically commutated motors (ECMs).*
    b. Install floating head controls on medium temperature compressor(s).*
11. Red Tail Bar and Grill
    a. Install ECM for compressor head fans.*
    b. Install floating head controls on low temperature compressor(s).*
    c. Install floating head controls on medium temperature compressor(s).*

12. Room Service Bakery
    a. Install floating head controls on low temperature compressor(s).*
    b. Install floating head controls on medium temperature compressor(s).*

*Energy savings and economic calculations for the proposed refrigeration system upgrades were completed by Energy Smart Grocers under a separate assessment.

In addition to the main projects that were screened as part of the energy conservation measure prioritization process, the following items were identified to be completed as part of routine maintenance to improve the general performance and longevity of the structure. Due to the unreliability of modeling these types of retrofits and the nature of these measures, these items were not considered as part of the economic evaluation.

1. Require maintenance staff to ensure that in-room HVAC systems are turned off up exiting an unoccupied room.
2. Require quarterly inspection and maintenance of all in-room HVAC systems

Casino – Economic Analysis Results

Table 55 contains a summary of the economic analysis results for the Casino facility. See Appendix D for the complete economic analysis conducted for this building.

Table 55. Tribal Casino and Resort – Economic Analysis Results

Facility	Energy Conservation Measure	Net Incremental Cost ($)	Annual Energy Savings (kBtu/year)	Annual Savings ($/year)	Annual Energy Savings (%)	Simple Payback (years)	Net Present Value ($)	Internal Rate of Return (%)
CDA Casino Resort and Hotel	Upgrade parking lot lighting fixtures from 400W HPS to 70W LED	$304,000	1,636,387	$38,357	2%	7.9	$313,155	12%
	Upgrade "Entrance Foyer" lighting from 100W incandescent spots to 23W CFL	$120	133,100	$3,120	0.2%	0.0	$49,361	2626%
	Upgrade MR16 halogen lamps in bars and buffets to LED equivalent lamps	$3,840	71,564	$1,677	0.1%	2.3	$22,875	45%
	Upgrade recessed 100W incandescent lamps in buffet area to 23W CFL equivalent	$150	166,377	$3,900	0.2%	0.0	$61,702	2626%
	Reduce run time of 400,000 BTU/hour "fire feature " from 12 hpd to 6 hpd	$0	876,000	$22,020	1%	0.0	$349,212	NA
	Reduce run time of two 150,000 BTU/hour fireplaces from 12 hpd to 6 hpd	$0	328,500	$8,257	0.45%	0.0	$130,955	NA
	Chinook Steakhouse - Install floating head controls on LT compressor(s)	$679	17,847	$418	0.02%	1.6	$5,975	63%
	Chinook Steakhouse - Install floating head controls on MT compressor(s)	$2,205	26,417	$619	0.04%	3.6	$7,679	29%
	Sweetgrass Restaurant - Upgrade shaded pole evaporator motors to ECM	$540	73,284	$1,718	0.10%	0.3	$26,718	322%
	Sweetgrass Restaurant - Install gaskets on LT walk-in doors	$49	2,465	$58	0.003%	0.8	$869	120%
	Sweetgrass Restaurant - Install gaskets on MT walk-in doors	$100	2,688	$63	0.004%	1.6	$902	65%
	Sweetgrass Restaurant - Install floating head controls on LT compressor(s)	$1,455	38,243	$896	0.05%	1.6	$12,803	63%
	Sweetgrass Restaurant - Install floating head controls on MT compressor(s)	$2,205	26,417	$619	0.04%	3.6	$7,679	29%
	Deli Food Court - Upgrade shaded pole evaporator motors to ECM	$60	8,143	$191	0.01%	0.3	$2,969	322%
	Deli Food Court - Upgrade T12 lighting in reach-in doors to LED	$84	6,307	$148	0.01%	0.6	$2,263	179%
	Deli Food Court - Install floating head controls on MT compressor(s)	$3,234	38,744	$908	0.05%	3.6	$11,263	29%
	Nighthawk Lounge - Upgrade shaded pole evaporator motors to ECM	$90	12,215	$286	0.02%	0.3	$4,453	322%
	Nighthawk Lounge - Install floating head controls on MT compressor(s)	$2,205	26,417	$619	0.04%	3.6	$7,679	29%
	Red Tail Bar and Grill - Install ECM for compressor head fans	$0	2,850	$67	0.004%	0.0	$1,060	NA
	Red Tail Bar and Grill - Install floating head controls for LT compressor(s)	$679	17,847	$418	0.02%	1.6	$5,975	63%
	Red Tail Bar and Grill - Install floating head controls for MT compressor(s)	$2,205	26,417	$619	0.04%	3.6	$7,679	29%
	Room Service Bakery - Install floating head controls for LT compressor(s)	$679	17,847	$418	0.02%	1.6	$5,975	63%
	Room Service Bakery - Install floating head controls for MT compressor(s)	$1,029	12,328	$289	0.02%	3.6	$3,584	29%
	Totals	***$325,608***	***3,568,401***	***$85,686***	***5%***	***3.8***	***$1,042,785***	***27%***

As can be seen in Table 55, all of the measures result in modest energy reductions, but due to the extreme energy use seen in the Casino complex, as would be expected, the cost savings of these seemingly small energy savings is significant. The no-cost measure of reducing the run times of fire features has the highest net present value of any measure while reducing the annual energy use by a projected 1.45%. Upgrading parking lot lighting has the highest projected annual energy savings of any of the measures considered. Due to its high initial costs, upgrading parking lot lighting has the highest simple payback period of 7.9 years. However, it should be noted that the proposed LED upgrades have an expected life of 100,000 hours (approximately 23 years of current parking lot lighting usage); therefore, this measure yields a projected $313,000 net present value with a 12% IRR. All of the energy conservation measures taken together would result in a projected 5% annual energy savings valued at nearly $86,000 per year with a 27% IRR.

Casino – Energy Conservation Measure (ECM) Prioritization Matrix

Table 56 contains the ECM Prioritization Matrix completed for the Casino facilities.

Table 56. Tribal Casino and Resort - ECM Prioritization Matrix

Tribal Casino Resort	Routine Building O&M Requirement	Energy Savings Potential	Internal Rate of Return	Feasibility	Overall Score
Weighting Factor	*25%*	*25%*	*25%*	*25%*	*100%*
Reduce run time of 400K Btuh window fire	1	8	10	10	7.3
Reduce run time of 150K Btuh fireplaces	1	7	10	10	7.0
Upgrade "Entrance Foyer" lighting from 100W incandescent spots to 23W CFL	4	4	10	10	7.0
Upgrade recessed 100W incandescent lamps in buffet area to 23W CFL equivalent	4	4	10	10	7.0
Upgrade parking lighting from 400W MH to LED equivalent	3	9	5	8	6.3
Red Tail Bar and Grill - Install ECM for compressor head fans	4	2	10	9	6.3
Deli Food Court - Upgrade shaded pole evaporator motors to ECM	4	3	8	9	6.0
Sweetgrass Restaurant -Upgrade shaded pole evaporator motors to ECM	3	4	7	9	5.8
Nighthawk Lounge - Upgrade shaded pole evaporator motors to ECM	4	3	7	9	5.8
Deli Food Court - Upgrade T12 lighting in reach-in doors to LED	4	3	7	8	5.5
Upgrade MR16 halogen lamps in bars and buffets to LED equivalent lamps	4	4	4	10	5.5
Sweetgrass Restaurant - Install gaskets on LT walk-in doors	4	2	6	9	5.3
Sweetgrass Restaurant - Install gaskets on MT walk-in doors	4	2	5	9	5.0
Chinook Steakhouse - Floating head controls on MT compressor(s)	2	3	5	6	4.0
Sweetgrass Restaurant - Install floating head controls on LT compressor(s)	2	3	5	6	4.0
Red Tail Bar and Grill - Install floating head controls for LT compressor(s)	2	3	5	6	4.0
Room Service Bakery - Install floating head controls for LT compressor(s)	2	3	5	6	4.0
Chinook Steakhouse - Floating head controls on LT compressor(s)	2	3	4	6	3.8
Sweetgrass Restaurant - Install floating head controls on MT compressor(s)	2	3	4	6	3.8
Deli Food Court - Install floating head controls on MT compressor(s)	2	3	4	6	3.8
Nighthawk Lounge - Install floating head controls on MT compressor(s)	2	3	4	6	3.8
Red Tail Bar and Grill - Install floating head controls for MT compressor(s)	2	3	4	6	3.8
Room Service Bakery - Install floating head controls for MT compressor(s)	2	3	4	6	3.8

As can be seen in Table 56, the top ranked energy conservation measures are the no-cost rescheduling of the fire features within the Casino. These are closely followed by the proposed lighting upgrades. Upgrading shaded pole motors are the highest ranked refrigeration system upgrades followed by repairing gaskets on walk-in doors. Installing floating head controls, though effective at reducing energy were ranked lowest, largely due to their marginal energy savings, IRRs and the overall complexity of the retrofit which may impact operations within the respective food preparation sites.

Casino - Conclusions and Recommendations

OE suggests completing the recommended measures in the order presented above. Upgrading parking lot lighting will require significant investment; however, this measures yields the greatest projected annual energy savings and, as evidenced by the approximately $313,000 net present value, due to the longevity of this type of upgrade (100,000 run-time hours), will continue to generate positive income well into the future. Installing floating head controls is also recommended but is not considered high priority at this time. This measure would best be accomplished during planned renovations, and associated service interruptions, within the respective food preparation areas.

Tribal Housing Authority Maintained Buildings

Tribal Housing Authority Office and Shop (Tribal Housing Authority)

Tribal Housing Authority - Energy Conservation Measure (ECM) Descriptions

The Tribal Housing Authority Office and Shop had the following energy conservation measures identified and evaluated for this study:

1. Program thermostats to reflect actual building occupancy and energy efficient set points. OE recommends that heating and cooling systems be activated one half hour before occupancy and left on one half hour after planned vacancy. Set points should be limited to 68°F heating and 78°F cooling during occupied periods and set back to 55°F heating and 84°F cooling during scheduled unoccupied periods.
2. Repair and re-install fiberglass batt insulation in attic area.
3. Replace weather stripping on exterior doors.
4. Upgrade 4', 4-lamp, T12 lighting to 4-lamp, HP T8 lighting with HP electronic ballasts.
5. Upgrade 4', 2-lamp, T12 lighting to 4-lamp, HP T8 lighting with HP electronic ballasts.
6. Upgrade 4', 1-lamp, T12 lighting to 4-lamp, HP T8 lighting with HP electronic ballasts. See Appendix E for lighting upgrade recommendations.
7. Upgrade 60W incandescent flood lamps to 13W CFL equivalent.
8. Install occupancy sensors in office areas.
9. Install occupancy sensors in restrooms.
10. Install Vending Miser on vending soda vending machine.
11. Install timer switch for electric resistance heater in shop area.
12. Install insulation on all accessible hot water piping.

In addition to the main projects that were screened as part of the energy conservation measure prioritization process, the following items were identified to be completed as part of routine maintenance to improve the general performance and longevity of the structure. Due to the unreliability of modeling these types of retrofits and the nature of these measures, these items were not considered as part of the economic evaluation.

1. Complete duct testing and sealing as necessary.

2. At the end of its serviceable life, replace Rheem DX air-conditioner with Energy Star rated air source heat pump.
3. Complete quarterly maintenance on all HVAC filters.
4. Evaluate Rheem condenser coils for signs of freezing due to air handler mismatch.
5. At the end of its serviceable life, replace existing refrigerator with Energy Star equivalent.

Tribal Housing Authority – Economic Analysis Results

Table 57 contains a summary of the economic analysis results for the Tribal Housing Authority facilities. See Appendix D for the complete economic analysis conducted for this building.

Table 57. Tribal Housing Authority and Shop – Economic Analysis Results

Facility	Energy Conservation Measure	Net Incremental Cost ($)	Annual Energy Savings (kBtu/year)	Annual Savings ($/year)	Annual Energy Savings (%)	Simple Payback (years)	Net Present Value ($)	Internal Rate of Return (%)
Tribal Housing Authority	Change thermostats to reflect actual occupancy	$150	41,980	$984	15%	0.2	$15,460	663%
	Repair and re-install fiberglass batt insulation in attic area	$1,000	1,920	$45	1%	22.2	($257)	NA
	Replace weatherstripping on exterior doors	$52	3,754	$88	1%	0.6	$1,345	172%
	Upgrade 4', 4-lamp, T12 lighting to 4-Lamp, HP T8 lighting (32W) and HP electronic ballasts	$978	12,492	$293	4%	3.3	$3,694	31%
	Upgrade 4', 2-lamp, T12 lighting to 2-Lamp, HP T8 lighting (32W) and HP electronic ballasts	$900	6,061	$142	2%	6.3	$1,380	16%
	Upgrade 4', 1-lamp, T12 lighting to 1-Lamp, HP T8 lighting (32W) and HP electronic ballasts	$214	601	$14	0.2%	15.2	$16	4%
	Upgrade 60W incandescent flood lamps to 13W CFL equivalent	$6	4,710	$110	2%	0.1	$1,745	1859%
	Occupancy sensors in office areas	$450	1,749	$41	1%	11.0	$213	8%
	Occupancy sensors in restrooms	$90	717	$17	0.2%	5.4	$179	19%
	Install Vending Miser on vending machine	$0	1,536	$36	1%	0.0	$571	NA
	Pipe insulation	$150	3,993	$94	1%	1.6	$1,339	64%
	Totals	***$3,989***	***79,513***	***$1,864***	***28%***	***2.1***	***$25,685***	***48%***
			-					
Tribal Housing Authority Shop	Upgrade 4', 2-Lamp, T12 Lighting to 2-Lamp, T8 Lighting	$818	4,270	$100	7%	8.2	$793	12%
	Install timer switch for electric resistance heater	$85	6,229	$146	10%	0.6	$2,233	174%
	Totals	***$903***	***10,498***	***$246***	***17%***	***3.7***	***$3,026***	***28%***

As can be seen in Table 57, programming thermostats to better reflect the actual occupancy of the building and energy efficient set points yields the highest projected annual energy savings. Installing a timer on the shop heating system also results in high projected annual energy savings. Upgrading incandescent lighting upgrades, while producing modest energy savings has the highest IRR except for the no-cost measure of installing vending machine controls. Upgrading attic insulation does not yield positive economics, but may improve the comfort of building occupants in this area. Taken together, the measures yield approximately 28% in projected annual energy savings with an IRR of 48% in the office. The shop measures are projected to save 17% annual energy with a 28% IRR.

Tribal Housing Authority – Energy Conservation Measure (ECM) Prioritization Matrix

Table 58 contains the ECM Prioritization Matrix completed for the Tribal Housing Authority facilities.

Table 58. Tribal Housing Authority and Shop - ECM Prioritization Matrix

Tribal Housing Authority and Shop	Routine Building O&M Requirement	Energy Savings Potential	Internal Rate of Return	Feasibility	Overall Score
Weighting Factor	*25%*	*25%*	*25%*	*25%*	*100%*
Reprogram thermostats	5	8	9	9	7.8
Upgrade 60W inc. to 13W CFL floods	6	5	10	10	7.8
Install timer switch on Shop electric resistance heater	4	7	8	8	6.8
Upgrade T12 to T8	6	7	5	8	6.5
Install Vending Miser	1	3	10	10	6.0
Replace weatherstripping on exterior doors	4	3	8	9	6.0
DHW pipe insulation	5	3	6	8	5.5
Occupancy sensors in offices, restrooms	1	5	4	7	4.3
Repair attic insulation	3	3	1	8	3.8

As can be seen in Table 58, the top ranked energy conservation measure is reprogramming thermostats to better reflect the actual occupancy and energy efficient set points. This is followed closely by upgrading incandescent lighting to CFL. Installing a timer on the Shop electric resistance heater is also ranked highly due to the relatively low cost and ease of installation with significant energy savings and economic return. Repairing attic insulation received the lowest ranking in terms of the stated criteria.

Tribal Housing Authority - Conclusions and Recommendations

OE recommends implementing the proposed measures in the priority presented above. Though retrofitting T12 linear fluorescent lighting returns only modest energy savings and economic returns, existing rebates offset the cost of this retrofit by up to 40% and may not be available in the future when T12 lamps are no longer in production which will necessitate this retrofit.

Senior Housing Complex Common Area (Senior Housing Complex)

Senior Housing Complex - Energy Conservation Measure (ECM) Descriptions

The Senior Housing Complex had the following energy conservation measures identified and evaluated for this study:

1. Upgrade 100W incandescent spot lighting with 23W CFL equivalent.
2. Replace 60W incandescent lighting in the restrooms with 13W CFL equivalent.
3. Upgrade 4’, 2-lamp, T12 lighting to 4-lamp, HP T8 lighting with HP electronic ballasts.
4. Repair or reconfigure 250W metal halide exterior lighting to only operate after dark.
5. Replace existing propane-fired water heater with a high efficiency condensing water heater.
6. Install Vending Miser on vending machine.
7. Install insulation on all accessible hot water piping.

In addition to the main projects that were screened as part of the energy conservation measure prioritization process, the following items were identified to be completed as part of routine maintenance to improve the general performance and longevity of the structure. Due to the unreliability of modeling these types of retrofits and the nature of these measures, these items were not considered as part of the economic evaluation.

1. Assess potential for retrofitting existing apartment ductless heat and cooling systems with auxiliary heat strips that will allow them to perform at local climatic conditions.

Senior Housing Complex – Economic Analysis Results

Table 59 contains a summary of the economic analysis results for the Senior Housing Complex. See Appendix D for the complete economic analysis conducted for this building.

Table 59. Senior Housing Complex – Economic Analysis Results

Facility	Energy Conservation Measure	Net Incremental Cost ($)	Annual Energy Savings (kBtu/year)	Annual Savings ($/year)	Annual Energy Savings (%)	Simple Payback (years)	Net Present Value ($)	Internal Rate of Return (%)
Senior Housing Complex	Replace 100W incandescent spot lighting with 23W CFL equivalent	$40	46,041	$1,079	9%	0.04	$17,076	2725%
	Replace 60W incandescent lighting in restrooms to 13W CFL equivalent	$8	586	$14	0.1%	0.6	$210	174%
	Upgrade 4', 2-Lamp T12 Lighting in Hallways to 4', 2-Lamp T8	$1,145	5,034	$118	1%	9.7	$760	9%
	Repair/reconfigure 250W metal halide exterior lighting to	$240	3,737	$88	1%	2.7	$1,156	38%
	Replace existing propane-fired water heater with a high efficiency condensing unit	$4,500	32,628	$820	6%	5.5	$8,638	19%
	Install Vending Miser on vending machine	$0	1,536	$36	0.3%	0.0	$571	NA
	Pipe insulation	$150	3,993	$94	1%	1.6	$1,339	64%
	Totals	***$6,083***	***93,556***	***$2,248***	***18%***	***2.7***	***$29,750***	***38%***

As can be seen in Table 59, replacing 100W incandescent lamps with 23W CFL has the greatest projected annual energy savings and IRR. Upgrading the existing, aging propane water heater with a premium efficiency condensing unit has the second highest potential energy savings. Though upgrading lighting in the restrooms returns minimal annual energy savings (due to the small number of lamps), the return on investment is significant. Taken together, all of the measures yield a projected annual energy savings of 18% with a respectable 38% IRR.

Senior Housing Complex – Energy Conservation Measure (ECM) Prioritization Matrix

Table 60 contains the ECM Prioritization Matrix completed for the Senior Housing Complex.

Table 60. Senior Housing Complex - ECM Prioritization Matrix

Senior Housing Complex	Routine Building O&M Requirement	Energy Savings Potential	Internal Rate of Return	Feasibility	Overall Score
Weighting Factor	*25%*	*25%*	*25%*	*25%*	*100%*
Upgrade 100W inc to 23W CFL in common areas	6	9	10	10	8.8
Replace existing water heater with high efficiency condensing unit	8	7	5	9	7.3
Upgrade 60W inc to 13W CFL in restrooms	6	3	8	10	6.8
Install Vending Miser	1	3	10	10	6.0
Replace 250W MH timer with photocell	6	4	6	8	6.0
Pipe Insulation	4	3	7	8	5.5
Upgrade T12 lighting to T8 lighting	5	4	5	8	5.5

As can be seen in Table 60, the top ranked energy conservation measure is upgrading incandescent lighting due to the relative ease of installation and favorable economics. Replacing the existing water heater with a high efficiency condensing unit also received a high score and it addresses a substantial health and safety issue.This is largely due to the deteriorated condition of the existing unit and the large potential energy savings projected from this upgrade. The lowest ranked measure is upgrading linear fluorescent lighting.

Senior Housing Complex - Conclusions and Recommendations

All of the recommended measures return annual energy savings with reasonable economic returns and none of the measures is extremely technically challenging. OE recommends implementing the proposed measures in the priority presented above. Though retrofitting T12 linear fluorescent lighting returns only modest energy savings and economic returns, existing rebates offset the cost of this retrofit by nearly 40% and may not be available in the future when T12 lamps are no longer in production which will necessitate this retrofit.

Tribal School Maintained Buildings

New Tribal School (Tribal School)

Tribal School - Energy Conservation Measure (ECM) Descriptions

The Tribal School had only one main energy conservation measure identified and evaluated for this study:

1. Replace existing 600 gallon boiler with two, staged, 180,000 BTU/hour tank-less water heaters.

In addition to this main project that was screened as part of the energy conservation measure prioritization process, the following items were identified to be completed as part of routine maintenance to improve the general performance and longevity of the structure. Due to the unreliability of modeling these types of retrofits and the nature of these measures, these items were not considered as part of the economic evaluation.

1. Repair disconnected combustion air intake on air handler #F15.
2. Remove or seal loose supply duct on air handler #F11.
3. Perform regular maintenance on walk-in cooler and freezer evaporator coils; ensure that fins are cleaned to allow adequate air flow.

Tribal School – Economic Analysis Results

Table 61 contains a summary of the economic analysis results for the Tribal School. See Appendix D for the complete economic analysis conducted for this building.

Table 61. Tribal School - Economic Analysis Results

Facility	Energy Conservation Measure	Net Incremental Cost ($)	Annual Energy Savings (kBtu/year)	Annual Savings ($/year)	Annual Energy Savings (%)	Simple Payback (years)	Net Present Value ($)	Internal Rate of Return (%)
New Tribal School	Replace existing boiler with 2 staged tankless on demand water heaters	$6,000	85,736	$2,155	4%	2.8	$28,353	37%
	Totals	***$6,000***	***85,736***	***$2,155***	***4%***	***2.8***	***$28,353***	***37%***

As can be seen in Table 61, the act of replacing the existing boiler system with a pair of staged 180,000 BTU/hour tank-less water heaters would yield significant energy and cost savings with a reasonable 37% IRR.

Tribal School – Energy Conservation Measure (ECM) Prioritization Matrix

No prioritization was completed for the Tribal School as only one measure was assessed for viability.

Tribal School - Conclusions and Recommendations

The existing water heating system has surpassed its serviceable life span and is vastly oversized for the current application. Replacing the existing system is expected to reduce the water heating energy requirements by 58% and total annual energy use at the school by approximately 4% while yielding positive economic returns. OE recommends implementing the proposed measures as a priority building upgrade.

New Tribal School Bus Garage

Tribal School Bus Garage - Energy Conservation Measure (ECM) Descriptions

The Tribal School Bus Garage had the following energy conservation measures identified and evaluated for this study:

1. Install timer on 10kW unit heater.
2. Install timer on 800W unit heater in restroom.
3. Install infrared occupancy sensors on interior lighting.
4. Replace photocell on exterior high pressure sodium fixtures.
5. Install insulation on all accessible hot water piping.

In addition to the main projects that were screened as part of the energy conservation measure prioritization process, the following items were identified to be completed as part of routine maintenance to improve the general performance and longevity of the structure. Due to the unreliability of modeling these types of retrofits and the nature of these measures, these items were not considered as part of the economic evaluation.

1. Ensure adequate drainage at grade level to prevent moisture damage attributable to uncontrolled roof runoff.
2. Repair exhaust fan screen; maintain louvers to ensure that they close when fan is not operating.

Tribal School Bus Garage – Economic Analysis Results

Table 62 contains a summary of the economic analysis results for the Tribal School Bus Garage. See Appendix D for the complete economic analysis conducted for this building.

Table 62. Tribal School Bus Garage – Economic Analysis Results

Facility	Energy Conservation Measure	Net Incremental Cost ($)	Annual Energy Savings (kBtu/year)	Annual Savings ($/year)	Annual Energy Savings (%)	Simple Payback (years)	Net Present Value ($)	Internal Rate of Return (%)
Tribal School - New Bus Garage	Install timer on 10kW unit heater (model assumes heater is left on 10 days per year)	$150	8,191	$192	9%	0.8	$2,899	130%
	Install timer on 800W unit heater in restroom (model assumes heater is left on 10 days per year)	$100	655	$15	1%	6.5	$147	15%
	Install lighting occupancy sensors in restrooms and common area	$250	2,133	$50	2%	5.0	$550	21%
	Replace photocell on exterior 100W high pressure sodium fixtures	$150	5,589	$131	6%	1.1	$1,932	89%
	Pipe insulation	$150	3,993	$94	4%	1.6	$1,339	64%
	Totals	***$800***	***20,562***	***$482***	***22%***	***1.7***	***$6,867***	***62%***

As can be seen in Table 62, installing timer controls on the large unit heater that serves the main garage area is projected to save approximately 9% of the total annual energy use of this structure with a 130% IRR. Install lighting controls also has significant beneficial energy use impacts. Taken together, with a modest $800 capital cost, the proposed measures yield a projected 22% annual energy savings with a 62% IRR.

Tribal School Bus Garage – Energy Conservation Measure (ECM) Prioritization Matrix

Table 63 contains the ECM Prioritization Matrix completed for the Tribal School Bus Garage.

Table 63. Tribal School Bus Garage - ECM Prioritization Matrix

Tribal School Bus Garage	Routine Building O&M Requirement	Energy Savings Potential	Internal Rate of Return	Feasibility	Overall Score
Weighting Factor	*25%*	*25%*	*25%*	*25%*	*100%*
Install timers on unit heaters	1	8	8	8	6.3
Pipe Insulation	5	5	6	8	6.0
Replace exterior lighting photocells	1	6	7	9	5.8
Install timer on restroom wall heater	1	4	5	8	4.5
Install occupancy sensors	1	4	5	8	4.5

As can be seen in Table 63, the top ranked energy conservation measure is installing a timer on the large unit heater that serves the garage. This is due to the relatively high energy savings associated with this very simple measure. Installing pipe insulation and replacing photo-controls on exterior lighting were the next highest rank. Installing lighting occupancy sensors and a timer on the restroom wall heater were ranked the lowest, largely due to the relatively small amount of occupancy that this building receives.

Tribal School Bus Garage - Conclusions and Recommendations

All of the measures considered yield energy savings, positive economic return and will benefit the overall operation of this facility. With a total installed cost estimate of $800, OE recommends completing all of the measures in the priority presented above.

Tribal Development Corporation Maintained Buildings

Benewah Auto

Benewah Auto - Energy Conservation Measure (ECM) Descriptions

Benewah Auto had the following energy conservation measures identified and evaluated for this study:

1. Replace existing rooftop electric heater, DX air-conditioner packaged units with high-efficiency heat pumps; relocate existing ducting to within conditioned space.
    a. Set programmable thermostats to better reflect actual occupancy and energy efficient set points. OE recommends that heating and cooling systems be activated one half hour before occupancy and left on one half hour after planned vacancy. Set points should be limited to 68°F heating and 78°F cooling during occupied periods and set back to 55°F heating and 84°F cooling during scheduled unoccupied periods.
2. Replace existing 10 kW unit heaters in shop area with occupancy sensor equipped 2kW radiant heaters above shop workstations.
3. Upgrade 8’, 2-lamp, T12 lighting to HP T8 lighting with HP electronic ballasts.
4. Install insulation on all accessible hot water piping.

Benewah Auto – Economic Analysis Results

Table 64 contains a summary of the economic analysis results for Benewah Auto. See Appendix D for the complete economic analysis conducted for this building.

Table 64. Benewah Auto – Economic Analysis Results

Facility	Energy Conservation Measure	Net Incremental Cost ($)	Annual Energy Savings (kBtu/year)	Annual Savings ($/year)	Annual Energy Savings (%)	Simple Payback (years)	Net Present Value ($)	Internal Rate of Return (%)
Benewah Auto	Replace existing packaged RTU electric resistance heater, DX air-conditioners with high efficiency heat pumps; relocate all ducting to within conditioned space; program thermostats	$11,410	49,489	$725	5%	15.7	$420	3%
	Replace existing 10 kW unit heaters with occupancy-sensor equipped 2kW radiant heaters above workstations	$4,200	45,052	$660	4%	6.4	$6,389	16%
	Upgrade 8', 2-Lamp, T12 lighting to 2-lamp, HP T8 lighting with HP electronic ballasts	$2,200	75,141	$1,761	7%	1.2	$25,796	82%
	Pipe insulation	$150	3,993	$94	0.4%	1.6	$1,339	64%
	Totals	***$17,960***	***173,674***	***$3,240***	***17%***	***5.5***	***$33,945***	***18%***

As can be seen in Table 64, upgrading the existing T12 linear fluorescent lighting is projected to reduce annual energy usage by 7% and related costs by approximately $1,800 per year with an 82% IRR. Replacing the existing heating and cooling systems is projected to yield an additional 5% annual energy savings. All of the proposed measures taken together are expected to reduce total energy usage by 17% year with an 18% IRR.

Benewah Auto – Energy Conservation Measure (ECM) Prioritization Matrix

Table 65 contains the ECM Prioritization Matrix completed for Benewah Auto.

Table 65. Benewah Auto - ECM Prioritization Matrix

Benewah Auto	Routine Building O&M Requirement	Energy Savings Potential	Internal Rate of Return	Feasibility	Overall Score
Weighting Factor	*25%*	*25%*	*25%*	*25%*	*100%*
Upgrade T12 lighting to T8 lighting	5	7	7	8	6.8
Replace existing packaged heating and cooling systems with high efficiency heat pumps; relocate ducting to within conditioned space; program thermostats.	5	6	3	6	5.0
Replace 3-10kW unit heaters w/ 6-2kW radiant heaters	3	6	4	6	4.8
Pipe Insulation	1	5	7	8	5.3

As can be seen in Table 65, the top ranked energy conservation measure is upgrading the T12 linear fluorescent lighting. Upgrading heating systems and installing piping insulation were ranked very similarly. Though the IRR for installing new heat pumps is relatively low, the existing units are at an advanced age and will require replacement in the near future, therefore this measure scored well in the Routine Building O&M Requirement criterion.

Benewah Auto - Conclusions and Recommendations

All of the measures considered yield energy savings, positive economic return and will benefit the overall operation of this facility. With the advanced age of the existing heating and cooling systems, early planning for replacement is certainly in order. OE recommends completing the proposed measures in the prioritization order presented above.

Echelon Plummer

Echelon Plummer - Energy Conservation Measure (ECM) Descriptions

The Echelon Plummer facility had the following energy conservation measures identified and evaluated for this study:

1. Install lighting occupancy sensors in restrooms, offices, break room and meeting room (ultrasonic in restrooms, infrared in offices, break room and meeting room).
2. Install Vending Miser on vending machine.
3. Install insulation on all accessible hot water piping.

In addition to the main projects that were screened as part of the energy conservation measure prioritization process, the following items were identified to be completed as part of routine maintenance to improve the general performance and longevity of the structure. Due to the unreliability of modeling these types of retrofits and the nature of these measures, these items were not considered as part of the economic evaluation.

1. Install exhaust ventilation.
2. Complete leak testing of compressed air distribution system and address any leaks identified.

Echelon Plummer – Economic Analysis Results

Table 66 contains a summary of the economic analysis results for the Echelon Plummer facility. See Appendix D for the complete economic analysis conducted for this building.

Table 66. Echelon Plummer – Economic Analysis Results

Facility	Energy Conservation Measure	Net Incremental Cost ($)	Annual Energy Savings (kBtu/year)	Annual Savings ($/year)	Annual Energy Savings (%)	Simple Payback (years)	Net Present Value ($)	Internal Rate of Return (%)
Echelon Plummer	Install occupancy sensors in restrooms, offices, break room and meeting room	$1,100	20,922	$362	0.7%	3.0	$4,668	34%
	Install Vending Miser on Vending Machine	$0	1,536	$36	0.1%	0.0	$571	NA
	Pipe insulation	$150	3,993	$94	0.1%	1.6	$1,339	64%
	Totals	***$1,250***	***26,451***	***$491***	***0.9%***	***2.5***	***$6,578***	***41%***

As can be seen in Table 66, the proposed measures yield marginal energy savings. With a total cost of $1,250, all of the energy conservation measures taken together would yield a 0.9% annual energy savings, 41% IRR with a 2.5 year simple payback period.

Echelon Plummer – Energy Conservation Measure (ECM) Prioritization Matrix

Table 67 contains the ECM Prioritization Matrix completed for the Echelon Plummer facility.

Table 67. Echelon Plummer - ECM Prioritization Matrix

Echelon Plummer	Routine Building O&M Requirement	Energy Savings Potential	Internal Rate of Return	Feasibility	Overall Score
Weighting Factor	*25%*	*25%*	*25%*	*25%*	*100%*
Vending Miser	1	3	10	10	6.0
Pipe Insulation	1	3	6	9	4.8
Install occupancy sensors	1	4	5	7	4.3

As can be seen in Table 67, the top ranked measures is the simple, no-cost item of installing a Vending Miser on the vending machine. Though this measure yields marginal energy savings, the positive economics and the ease of installation of this energy conservation measure lead to its top ranking. Installing occupancy sensors was ranked lowest in terms of the stated criteria.

Echelon Plummer - Conclusions and Recommendations

The measures considered for the Echelon Plummer facility are projected to yield very small total energy savings. Due to their low costs and ease of implementation, installing a Vending Miser and hot water pipe insulation are recommended. Installing occupancy sensors is not considered a high priority energy conservation measure at this time.

Benewah Market and Offices (Benewah Market)

Benewah Market - Energy Conservation Measure (ECM) Descriptions

The Benewah Market facilities had the following energy conservation measures identified and evaluated for this study:

1. Complete refrigeration system upgrades.
    a. Reduce the total volume and thermal capacity of refrigeration cases on the sales floor.
    b. Replace the existing aging floor cases with high efficiency cases with doors (where applicable) and integrated controls.
    c. Replace the existing 16 individual compressor/case/walk-in parings with a low temperature compressor rack consisting of two “parallel configured” low-temperature compressors with integrated controls and a medium temperature compressor rack consisting of three “parallel configured” compressors with integrated controls.
    d. Replace the existing roof top condensers with two high-efficiency units with integrated control features.
    e. Replace 15 evaporators in the walk-in coolers and freezers with high efficiency units equipped with electronically commutated motors and integrated control features.
    f. Replace and reconfigure refrigerant lines.
2. Upgrade 4’, 2-lamp, T12 lighting in stock room to 4’, 2-lamp T8
3. Install Vending Miser on vending machine.
4. Install pipe insulation on all accessible hot water piping.

In addition to the main projects that were screened as part of the energy conservation measure prioritization process, the following items were identified to be completed as part of routine maintenance to improve the general performance and longevity of the structure. Due to the unreliability of modeling these types of retrofits and the nature of these measures, these items were not considered as part of the economic evaluation.

1. Repair damaged siding.
2. Institute regular monthly roof inspection and maintenance to reduce ponding observed on membrane roof system.
3. Remove non-operational “swamp cooler” from above deli and install appropriate register and filter for deli makeup air.

Benewah Market – Economic Analysis Results

Table 68 contains a summary of the economic analysis results for the Benewah Market facilities. See Appendix D for the complete economic analysis conducted for this building.

Table 68. Benewah Market – Economic Analysis Results

Facility	Energy Conservation Measure	Net Incremental Cost ($)	Annual Energy Savings (kBtu/year)	Annual Savings ($/year)	Annual Energy Savings (%)	Simple Payback (years)	Net Present Value ($)	Internal Rate of Return (%)
Benewah Market	Complete Refrigeration System Upgrades - See Description* and Appendix D	$597,090	1,346,603	$16,065	31%	37.2	($324,922)	-4%
	Upgrade 4', 2-lamp T12 lighting in stock room to 4', 2-lamp T8	$200	7,304	$86	0.19%	2.3	$1,163	44%
	Install Vending Miser on Vending Machine	$0	1,536	$18	0.04%	0.00	$285	NA
	Pipe insulation	$150	3,993	$47	0.10%	3.2	$597	32%
	Totals	***$597,440***	***1,359,435***	***$16,215***	***31%***	***36.8***	***($322,877)***	***-4%***

As can be seen in Table 68, completing lighting upgrades, installing vending machine controls and pipe insulation yield very marginal energy reductions in terms of total annual energy use. The proposed refrigeration upgrades are expected to yield approximately 31% annual energy reduction; however the economic analysis results presented for the refrigeration system upgrades do not take into account other important factors including decreased O&M expenses, energy escalation rates, reduced product loss, and the necessity of upgrading aging infrastructure to remain a viable business. For this reason, a separate analysis was completed for the proposed refrigeration system upgrades which compare the 30-year costs of "business as usual" operations which would rely on the existing infrastructure to the 30-year costs of operating with upgraded refrigeration. Table 69 details the main findings of this more in-depth analysis.

Table 69. Benewah Market Refrigeration Upgrade Economic Analysis Results

Life Cycle Cost Analysis	
Energy Cost Escalation Rate	2.1%
Discount Rate	1.50%
Project Capital Cost	$676,000
Net Present Value Existing	$2,411,725.50
Net Present Value Proposed	$1,993,804.71
Difference	$417,920.80

Table 69 illustrates that the net present value of operating the market's existing refrigeration system is projected to be approximately $418,000 more than operations with upgraded refrigeration systems. This is due to a combination of factors including energy savings, operation and maintenance savings, and reduced “shrinkage” of freezer stock. See Appendix D for the complete economic evaluation of the proposed refrigeration system upgrades.

Benewah Market – Energy Conservation Measure (ECM) Prioritization Matrix

Table 70 contains the ECM Prioritization Matrix completed for the Benewah Market facilities.

Table 70. Benewah Market - ECM Prioritization Matrix

Benewah Market and Offices	Routine Builidng O&M Requirement	Energy Savings Potential	Internal Rate of Return	Feasibility	Overall Score
Weighting Factor	*25%*	*25%*	*25%*	*25%*	*100%*
Complete refrigeration system upgrades	9	9	2	5	6.3
Vending Misers	1	1	10	10	5.5
Upgrade T12 lighting to T8	4	2	5	8	4.8
Hot water pipe insulation	4	2	4	8	4.5

As can be seen in Table 70, completing major refrigeration system upgrades is the highest ranked measure, mostly due to the necessity of these upgrades and the potential for very significant energy and other cost savings. The other measures are cost effective, but do not have the same potential for energy savings when compared to refrigeration upgrades.

Benewah Market - Conclusions and Recommendations

Though completing upgrades to the refrigeration systems at the Benewah Market will require significant investment, these upgrades are necessary in order to maintain a viable business at the current location. The existing systems are plagued with issues that result in approximately $10,000 per year in maintenance costs alone, just to keep the system somewhat functional. In addition, when issues do arise, product is often degraded or lost due to inadequate refrigeration or freezing capacity. This likely leads to decreased sales as customers lose confidence in the frozen and refrigerated product quality. Therefore OE recommends long term planning that will allow for the budgeting of the proposed refrigeration system upgrades. OE recommends completing implementation of the remaining three proposed measures as part of the larger project.

Benewah Medical Maintained Buildings

Tribal Wellness Center

Tribal Wellness Center - Energy Conservation Measure (ECM) Descriptions

The Tribal Wellness Center facilities had the following energy conservation measures identified and evaluated for this study:

1. Upgrade 60W recessed incandescent flood lighting to 13W CFL equivalent.
2. Upgrade 250W metal halide “up lighting” in entry rotunda to 70W LED fixtures.
3. Upgrade 250W metal halide exterior wall packs to 70W LED fixtures.
4. Turn off basketball court lighting when not in use.
5. Install pipe insulation on all accessible hot water piping.
6. Implement energy management protocols for high power sound systems.

In addition to the main projects that were screened as part of the energy conservation measure prioritization process, the following items were identified to be completed as part of routine maintenance to improve the general performance and longevity of the structure. Due to the unreliability of modeling these types of retrofits and the nature of these measures, these items were not considered as part of the economic evaluation.

1. Schedule assessment of Dectron pool dehumidification system by qualified technician.
2. Recondition exterior elements of Dectron duct system; remove any debris or materials currently stored on top of the ducting.
3. Install door latches and seals on sauna.
4. Install new seals around steam room doors.
5. Ensure rooftop dryer vent outlet is maintained monthly.

Tribal Wellness Center – Economic Analysis Results

Table 71 contains a summary of the economic analysis results for the Tribal Wellness Center facilities. See Appendix D for the complete economic analysis conducted for this building.

Table 71. Tribal Wellness Center – Economic Analysis Results

Facility	Energy Conservation Measure	Net Incremental Cost ($)	Annual Energy Savings (kBtu/year)	Annual Savings ($/year)	Annual Energy Savings (%)	Simple Payback (years)	Net Present Value ($)	Internal Rate of Return (%)
Tribal Wellness Center	Upgrade recessed 60W incandescent floods to 13W CFL equivalent	$36	32,249	$756	0.6%	0.05	$11,953	2121%
	Upgrade 250W MH uplights in entry rotunda to 70W LED fixtures	$2,821	26,550	$622	0.5%	4.5	$7,130	23%
	Upgrade 250W MH exterior wall packs to 70W LED fixtures	$4,837	29,748	$697	0.6%	6.9	$6,362	14%
	Turn off basketball court lighting when not in use	$0	14,949	$350	0.3%	0.00	$5,557	NA
	Install pipe insulation	$450	11,980	$281	0.2%	1.6	$4,016	64%
	Energy management of sound systems	$0	7,973	$187	0.2%	0.0	$2,964	NA
	Totals	***$8,144***	***123,448***	***$2,894***	***2.4%***	***2.8***	***$37,983***	***37%***

As can be seen in Table 71, all of the measures proposed yield energy savings; however, due to the large amount of total energy consumed at the Tribal Wellness Center, all of the measures together are projected to reduce annual consumption by just 2.4%. However, this 2.4% reduction results in nearly $3,000 in annual cost reduction. Taken together the measures have a simple payback of just over three years with a 37% IRR.

Tribal Wellness Center – Energy Conservation Measure (ECM) Prioritization Matrix

Table 72 contains the ECM Prioritization Matrix completed for the Tribal Wellness Center.

Table 72. Tribal Wellness Center - ECM Prioritization Matrix

Tribal Wellness Center	Routine Building O&M Requirement	Energy Savings Potential	Internal Rate of Return	Feasibility	Overall Rank
Weighting Factor	*25%*	*25%*	*25%*	*25%*	*100%*
Turn off basketball court lighting when not in use	8	5	10	10	8.3
Turn audio systems off when not in use	8	4	10	10	8.0
Upgrade 60W recessed floods to CFL	5	7	9	10	7.8
Upgrade 250W MH to 70W LED Rotunda	4	6	7	8	6.3
Upgrade 250W MH to 70W LED Exterior Fixtures	4	6	7	8	6.3
Pipe Insulation	5	4	7	8	6.0
Door seals on saunas and steam rooms	1	3	7	8	4.8

As can be seen in Table 72, the two no-cost measures of turning off lighting and sound systems when not in use were ranked the highest of the measures considered. This is due to their energy savings potential, and cost and ease of implementation. Lighting upgrades, specifically replacing recessed incandescent lighting, were also ranked highly. Installing door seals on saunas and steam rooms were ranked lowest based on the stated criteria.

Tribal Wellness Center - Conclusions and Recommendations

Instituting better controls on building loads is always a very cost effective solution to energy management. Therefore OE recommends implementing protocols for managing basketball court lighting and sound system operation. Though the costs of upgrading metal halide lighting to LED fixtures is significant, these measures are expected to last 100,000 hours, far exceeding the four to seven year simple payback period associated with these upgrades. In the case of the interior metal halide fixtures, retrofitting to LEDs will also reduce internal cooling loads significantly which will reduce cooling costs. Pipe insulation and replacing door seals on the sauna and steam room should be completed as part of routine building maintenance.

Renewable Energy Assessment and Opportunities

The main purpose of the Coeur d'Alene Tribe's Energy Efficiency Feasibility Study is to identify and prioritize potential energy conservation measures to be implemented in Tribal buildings in order to: 1) improve building performance, 2) reduce energy consumption within target buildings, and 3) reduce energy costs. Investments in energy efficiency tend to be far more cost effective than investments in renewable energy and therefore, OE recommends completing energy efficiency upgrades prior to committing resources to developing renewable energy projects.

Several factors are involved in developing renewable energy projects. These factors include: existing utility rates, resource type and availability, available technology, and economic considerations. The following sections briefly describe the main renewable energy resources and opportunities identified for study.

Solar Energy

Solar energy utilizes the energy produced by the sun which is either converted into heat for domestic water heating, process loads, space heating or electrical production, or converted directly into electricity via photovoltaic processes. On average the Coeur d'Alene, Idaho region receives approximately 5.1 kWh of solar energy per square meter per day annually (NREL, Renewable Energy Data Center, 2013). This is a high solar energy resource which is nearly equivalent to the 5.6 kWh per square meter per day received by Los Angeles, California and much greater than the 4.2 kWh received in Germany which is the largest implementer of solar energy in the world.

The costs of solar energy vary widely depending on the type of technology, available incentives and site specific conditions including shading, angle of installation and available land. According to a recent report by Lawrence Berkeley National Laboratory, the installed costs of solar photovoltaics have been steadily falling in the last five years to an average installed cost in 2011 of $6.10 per watt for residential and small commercial installations (<10 kW) and $4.90 per watt for systems over 100 kW. Large scale, utility-sector photovoltaic projects (>2000 kW) had median installed costs of $3.40 per watt. Using these costs and the available solar resource in the Coeur d'Alene region, the average electrical energy cost over the 20-year expected life of a photovoltaic of a 10kW solar array would be $0.19 per kWh. If the proposed system produced power for 30 years, the cost of energy produced by the solar array would drop to approximately $0.13 per kWh. A 100 kW photovoltaic power plant would produce energy at an estimated cost of $0.11 per kWh over the same 30-year period.

The Tribe currently receives its electrical energy from the Bonneville Power Administration's Columbia River dams which provide energy at a very competitive price. The average energy costs seen in the buildings evaluated for this study is $0.07 per kWh. Therefore, based on the existing economics, implementing solar power within the Tribal lands as a potential source of revenue or cost savings is currently not feasible without significant economic incentives, rebates or grants. However, solar energy may have its place within Tribal energy planning. As a backup power source, photovoltaics are often a good choice. These systems combine photovoltaic panels with batteries for energy storage which typically provide adequate storage for 3 to 5 days of autonomous power. Sizing battery banks for any longer periods becomes cost and space restrictive. Though battery storage is limited, in periods of strong solar resource, and with energy conservation practices in place, these systems can provide power for extended periods (beyond battery storage alone).

Biomass

Biomass (energy) is defined as any plant material, vegetation, wood, or agricultural waste that is used a fuel or energy source. Biomass can represent a significant energy opportunity for rural, agricultural and forest-based communities. It can reduce the cost of heating by converting to an inexpensive biomass fuel source such as woodchips or pellets. This type of biomass resource utilization is very simple to implement requiring individual biomass burners (woodstoves and/or boilers) at target facilities. However, operation and maintenance of large building scale thermal biomass plants can be onerous including maintaining fuel stockpiles, servicing equipment and complying with emission standards. In a study completed for the Tribe by McNeil Technologies in 2008, McNeil engineers estimated that wood waste from Stimson Lumber and material from fire suppression amounts to approximately 15,000 tons per year which is "far below the 125,000 tons used annual in a typical 10 MW generating facility". In conclusion, McNeil indicated that there is not enough biomass resource to supply an electric generating facility, but that there may be enough for thermal applications (space and water heating) which are "economic at smaller scales".

According to a previous report complete by McKinstry in 2012, the Tribe owns some amount of biomass resources, which they could use for heating (space and/or domestic water heater) at their facilities or at a small-scale power plant. Though no biomass inventory was completed or presented in the previous report, McKinstry estimated that a 4-5 MW power plan could be supported. This would be a very small plant which economies of scale generally do not favor. In order to fully evaluate the potential for biomass, the resource must be fully quantified. Therefore, due to the age of the previous McNeil report, and the advancement of technology in this arena, OE recommends completing a new biomass feasibility study for new and existing Tribal Lands which includes an investment-grade biomass resource assessment in order to determine the biomass resource potential within Tribal lands which includes not only wood waste but also agricultural waste materials.

Wind Power

Wind power makes up the largest proportion of electrical "renewable energy" production in the world, with approximately 460 terawatt-hours of global production in 2011. Wind power plants range in scale from small (<1 kW) micro-turbines used for residential and small agricultural operations to large scale power plants that include hundreds of 5 MW wind turbines. The size of the plant depends on many factors including available wind resource, availability of land, environmental impacts, dedicated loads and/or utility interties. Wind resources vary greatly across the country and across small geographic areas as it is dependent on local geologic and atmospheric features. In general the State of Idaho has relatively low wind resources when considering large scale wind power plants; however, this resource should be evaluated on a site by site basis as smaller areas with adequate resource may be identified. In terms of the Tribe's energy planning, smaller, grid intertied systems should be considered. These systems are designed to power specific loads or buildings using a "net-metering" agreement with the utility. Net-metering is an arrangement between the utility and the consumer that allows the consumer to produce energy and put it directly into the utilities power grid. The consumer benefits by having the meter generate a credit for the energy it produces which offsets the total amount of energy that the consumer must pay for. This is beneficial because it generally allows the consumer to offset energy costs at retail rates. This type of arrangement is far simpler to implement than a utility scale project that would require the Tribe to register as a utility and sell power to the grid via an agreement with the large energy providers in the area. A previous study of the wind resources on Coeur d'Alene Tribal lands was completed in 2008 by McNeil Technologies. Though this study identified and characterized sites in terms of land ownership, modeled wind resource quality and proximity to local roads and infrastructure, site specific wind resource assessments were not completed because the "data needed for serious commercial development" could not be collected. According to the study, this was due to "fragmented land ownership" and difficulty in obtaining permission from land owners to site anemometers and towers necessary for collecting wind resource data.

The Coeur d'Alene Tribe was recently contacted by TWN Wind Power Inc., which is a tribally-owned wind power development company with preliminary wind resource assessments of the Tribal

Headquarters and Tribal Casino Resort. OE recommends continued communications with TWN to further assess and develop the wind resource and project potential at the Tribal Casino. The Casino represents the most significant energy load within the Tribal building portfolio and would be a great application of the "grid-intertie" arrangement described above.

SECTION V – POTENTIAL FUNDING SOURCES AND STRATEGIES FOR ENERGY PROJECT IMPLEMENTATION

The following section details potential funding sources, strategies and next steps for implementing the energy conservation measures delineated in this report. These sources and strategies include:

- Utility rebates and incentives
- Non-Profit Programs
- State Programs
- Federal Programs
- Internal Incentive and Administrative Programs and Controls

Utility Rebate and Incentive Programs

The Tribe is served by two electric cooperatives (Kootenai Electric Cooperative [KEC] and Clearwater Power Cooperative [CPC]) and one public utility district (Plummer Power). All of these entities are customers of the Bonneville Power Administration (BPA). BPA is a federal nonprofit agency based in the Pacific Northwest which is a self-funded part of the U.S. Department of Energy. BPA covers its costs by selling products and services from 31 federal hydroelectric projects (dams) in the Columbia River Basin, one nonfederal nuclear power plant and several other small nonfederal power plants. According to its website, “BPA promotes energy efficiency, renewable resources and technologies” as part of their core agency responsibilities. Energy project incentives are administered by the individual utilities (KEC, CPC, Plummer Power) with funding, administrative and technical support provided through BPA. Both KEC and CPC have existing programs that support the existing suite of BPA funded incentive programs. As of the writing of this document, Plummer Power does not provide access to the BPA programs.

There are two main types of incentive programs administered by BPA. These programs include funding for “deemed” measures and “custom programs and projects”. These two incentive pathways are discussed below.

BPA Deemed Energy Efficiency Measures

Deemed energy measures consist of energy efficiency projects that have been pre-approved by BPA’s Regional Technical Forum (RTF) which is an independent technical advisory committee that develops standards and recommendations for energy efficiency project incentives. Deemed measures are measures that have established energy savings per unit based on a history of measured results and an ability to replicate energy savings. These measures are not subject to measurement and verification (M&V) due to the fact that the energy savings per unit of energy efficiency project has been pre-established by the RTF. These measures include:

- Commercial & Industrial Lighting – Incentives are based on replacing existing lighting with BPA approved upgrades with energy savings calculated using the BPA Lighting Calculator v. 3.1. Incentives for lighting measures considered for this study were estimated based on light counts provided by McKinstry and the BPA calculator. These spreadsheets were provided to the Tribe via DVD with the final hardcopy submittal.

- Grocery Refrigeration – Through the Energy Smart Grocer, administered by PECI program, the following commercial refrigeration upgrade types are considered "deemed measures".
    - Auto-closers (walk-in and reach-in)
    - Vending machine controllers
    - Anti-sweat heat controls
    - Evaporator fans
    - High efficiency doors for refrigerators and freezers
    - Gaskets
    - Motors
    - Strip curtains
    - Night covers
- Heating, Ventilation and Air Conditioning (HVAC) – The HVAC incentive program includes deemed measures for the following:
    - Commercial ductless heat pumps – Provides incentives for small commercial applications up to 20,000 square feet.
    - Heat pumps for commercial buildings – Provides incentives for upgrades and conversions in commercial buildings up to 50,000 square feet.
    - Unitary Air Conditioning for Commercial Buildings
    - Web-enabled Programmable Thermostats

- Commercial Shell Measures
    - Small Commercial Window Retrofits – Provides incentives for retrofit of existing single-pane windows in small commercial buildings under 5,000 square feet.
    - Small Commercial Insulation Retrofits – Provides funding for retrofitting insulation in attic, wall or floor in small commercial buildings under 5,000 square feet.

- Commercial Kitchen Measures
    - Refrigerator and Freezer Upgrades – Provides incentives up to $150 per refrigerator and up to $350 per freezer for installation of premium efficiency equipment meeting the Consortium for Energy Efficiency (CEE) Tier 2 standards. Typically these incentives cover approximately 70% of the cost premium associated with purchasing high efficiency equipment over standard.
    - Ice Makers - Provides incentives between $100 and $240 for installation of premium efficiency (CEE Tier 2) air-cooled ice makers.
    - Steamers – Provides incentives up to $200 for installation of premium efficiency (RTF Tier 2) units.
    - Hot food holding cabinets – Provides incentives up to $400 for installation of premium efficiency units (CEE Tier 2).

        - Pre-Rinse Spray Valves – Provides incentive of $100 per efficient pre-rinse spray valves (0.65 gpm or less).
        - Convection ovens – Provides incentive of up to $200 per qualified unit (Energy Star approved).
        - Combination Ovens - BPA reimburses up to $1,750 for qualified electric combination ovens that have a cooking efficiency of 70% or greater with an idle energy rate of 3.5kW or less.
        - Dishwashers - BPA reimburses $100 to $750 for qualified commercial dishwashers that meet the RTF efficiency standard.
        - Fryers - BPA reimburses $125 per installation on qualified commercial electric fryers. The electric fryer must meet RTF eligibility requirements where eligibility is based on cooking energy efficiency and the idle energy rate of the unit.
- Plug Load Measures
    - Smart Power Strips - Smart Power Strips are a conservation measure aimed at reducing plug loads of electronic equipment in commercial office spaces. BPA provides reimbursement for load-sensing smart power strips - strips that work by detecting changes in current from a control device entering low power or turning off.
    - Network Computer Power Management - Although most PCs and laptops have the ability to switch into low-power, energy savings mode during times of inactivity, only a small percentage actually make use of these settings. One approach to reducing energy use from networked PCs is to use third party software that implements a power management policy via the network. BPA offers incentives for this type of energy management strategy and the Coeur d'Alene Tribe was recently contacted by the TWN Energy Services, which is a Tribal enterprise that provides networked computer energy management solutions.
        - TWN Energy Services Contact Information – Marc Soulliere, President/CEO, 604.200.0079, marcs@twnwindpower.com
        - Information on Data Center power management technology - http://www.twnenergy.com/our_solution.html
        - Information on Personal Computer power management technology - http://www.twnenergy.com/pc_power.html

The BPA Energy Efficiency and Implementation Manual which details all of the available programs, deemed and custom measures incentive amounts and requirements can found in Appendix F.

BPA Custom Incentives

Because there are always emerging technologies and strategies to address complex energy issues, BPA has developed a process whereby BPA customers can apply for incentives that are not already "deemed measures". Custom incentive projects are subject to the following general requirements (excerpted from the current BPA Energy Efficiency Implementation Manual [Appendix F]):

- All measures or projects that do not have a BPA deemed reimbursement level, deemed busbar energy savings, or for which cost-effectiveness has not been determined, must be submitted as custom projects.
- The measures must be designed to result in improvements in the energy efficiency of electricity distribution or use and must have a savings life of at least one year. The proposed baseline annual energy usage for each measure must be documented and provide a basis for establishing annual energy savings.
- The measures have not been installed prior to approval of the custom project by BPA.
- The expected project simple payback (project cost/annual energy cost savings) must be six months or greater.
- The BPA M&V Protocol Selection Tool for custom projects must be used to select an appropriate M&V plan. The implemented plan will be either (i) Engineering Calculations with a Verification Plan or (ii) a Comprehensive M&V Plan.
  A consultant may be necessary in order to complete the required energy savings estimates, calculations, planning and measurement and verification.
- Custom Programs and Project Reimbursement Levels can be found in Section 4.1 of the BPA Energy Efficiency Implementation Manual (Appendix F).

Non-Profit Grant Programs

Bonneville Environmental Foundation's (BEF) Solar 4R Schools program began in 2002. This competitive grant program seeks to install small-scale photovoltaic systems at K-12 schools interested in increasing the visibility of renewable energy. Successful projects will include outreach and educational components to encourage community adoption and use of photovoltaics.

The school agrees to: own and maintain the solar energy system, provide access to a network in order to transfer solar data and offer and implement an educational and/or public outreach strategy. Solar 4R Schools donates the photovoltaic system and monitoring equipment, performs all installations with help from school staff, and provides a renewable energy curriculum framework to the school. Once the systems are running, the students are able to access photovoltaic monitoring data on school computers as they learn about renewable energy. The data can also be displayed over the school or district website so that the general public can see it. Solar 4R Schools has developed curriculum modules that incorporate solar and photovoltaic technology concepts to assist teachers with implementing solar energy education in the classroom.

Solar 4R Schools will typically fund 50-100% of costs for approved demonstration systems sized less than 10 kilowatts and will occasionally consider partially funding other larger photovoltaic projects. Solar 4R Schools usually requires a funding partner or requires matching funds from the project applicant. Grants are awarded on a quarterly basis. Solar 4R Schools grants are available to any school in the United States. See the Solar 4R Schools website for more details on funding and the application process.

Contact Information:

Renewable Energy Programs
Bonneville Environmental Foundation
240 SW 1st Ave
Portland, OR 97204
Phone: (503) 248-1905
Phone 2: (866) 233-8427
Fax: (503) 248-1908
E-Mail: Info@B-E-F.org
Web Site: http://www.b-e-f.org/

State Bond Program

Legislation enacted in Idaho in April 2005 (Senate Bill 1192) allows independent (non-utility) developers of renewable energy projects in the state to request financing from the Idaho Energy Resources Authority, a state bonding authority created in March 2005 by the Environment, Energy and Technology Energy Resources Authority Act (House Bill 106). The authority was created to finance the construction of electric generation and transmission projects by electric utilities. SB 1192 extended the financing opportunities to independent renewable energy producers that are not "qualifying facilities" under the federal Public Utility Regulatory Policies Act of 1978 (PURPA).

For the purposes of this program, renewable energy is defined as "a source of energy that occurs naturally, is regenerated naturally or uses as a fuel source, a waste product or byproduct from a manufacturing process including, but not limited to, open or closed-loop biomass, fuel cells, geothermal energy, waste heat, cogeneration, solar energy, water power and wind."

Contact Information:

Ron Williams
Idaho Energy Resources Authority
1015 West Hays Street
Boise, ID 83702
Phone: (208) 344-6633
Fax: (208) 344-0077
Web Site: http://www.iera.info

State Loan Program

The Idaho Governor's Office of Energy Resources (OER) State Energy Loan Program offers low-interest loans to make building improvements that will conserve energy and increase energy efficiency projects in Idaho. Loans are leveraged by utility incentives as well as federal and state tax credits and deductions. Loans are 4% interest with 5 year terms. Applications are evaluated on the basis of credit; all loans must be secured with real estate and/or equipment. As of February 1, 2011, loan applicants will be charged credit analysis fees incurred by the Idaho Governor's Office of Energy Resources. Fees for residential loans are $100 and fees for commercial loans are $250. The fee is due after the project analysis is completed and before the credit analysis is initiated. Loans are available for retrofit only, with the exception of some renewable resources.

Contact Information:

Tammy Japhet
Office of Energy Resources
304 N. 8th Street, Suite 250
PO Box 83720
Boise, ID 83720-0199
Phone: (208) 332-1660
Fax: (208) 332-1661
Web Site: http://www.energy.idaho.gov

Federal Energy Project Incentive and Potential Funding Sources

The following sections delineate potential funding and incentive programs from the Federal Government. Though not always applicable to Tribes and their enterprises, Federal tax deduction information was included for informational purposes.

Energy Efficient Commercial Buildings Tax Deduction

The federal Energy Policy Act of 2005 established a tax deduction for energy-efficient commercial buildings applicable to qualifying systems and buildings placed in service from January 1, 2006, through December 31, 2007. This deduction was subsequently extended through 2008, and then again through 2013 by Section 303 of the federal Energy Improvement and Extension Act of 2008 (H.R. 1424, Division B), enacted in October 2008.

A tax deduction of $1.80 per square foot is available to owners of new or existing buildings who install (1) interior lighting; (2) building envelope, or (3) heating, cooling, ventilation, or hot water systems that reduce the building's total energy and power cost by 50% or more in comparison to a building meeting minimum requirements set by ASHRAE Standard 90.1-2001. Energy savings must be calculated using qualified computer software approved by the IRS.

Deductions of $0.60 per square foot are available to owners of buildings in which individual lighting, building envelope, or heating and cooling systems meet target levels that would reasonably contribute to an overall building savings of 50% if additional systems were installed.

The deductions are available primarily to building owners, although tenants may be eligible if they make construction expenditures. In the case of energy efficient systems installed on or in government property, tax deductions will be awarded to the person primarily responsible for the system's design. Deductions are taken in the year when construction is completed.

The IRS released interim guidance (IRS Notice 2006-52) in June 2006 to establish a process to allow taxpayers to obtain a certification that the property satisfies the energy efficiency requirements contained in the statute. IRS Notice 2008-40 was issued in March of 2008 to further clarify the rules. NREL published a report (NREL/TP-550-40228) in February 2007 which provides guidelines for the modeling and inspection of energy savings required by the statute.

Contact Information:

Public Information - IRS
U.S. Internal Revenue Service
1111 Constitution Avenue, N.W.
Washington, DC 20224
Phone: (800) 829-1040
Web Site: http://www.irs.gov

Tribal Energy Program

The U.S. Department of Energy's (DOE) Tribal Energy Program promotes tribal energy sufficiency, economic growth and employment on tribal lands through the development of renewable energy and energy efficiency technologies. The program provides financial assistance, technical assistance, education and training to tribes for the evaluation and development of renewable energy resources and energy efficiency measures. Program funding is awarded through a competitive process.

DOE's Tribal Energy Program consists of program management through DOE headquarters, program implementation and project management through DOE's field offices, and technical support through DOE laboratories. Program management for the Tribal Energy Program is carried out by DOE's Weatherization and Intergovernmental Program, which provides programmatic direction and funding to DOE field offices for program implementation. DOE's field offices, specifically the Golden Field Office, issue solicitations and manage resulting projects.

Contact Information:

Lizana Pierce
U.S. Department of Energy
Golden Field Office
1617 Cole Boulevard, MS 1501
Golden, CO 80401
Phone: (303) 275-4727
Fax: (303) 275-4753
E-Mail: lizana.pierce@go.doe.gov
Web Site: http://www.eere.energy.gov/tribalenergy

USDA – Rural Energy for America Program (REAP) Grants and Loan Guarantees

The REAP promotes energy efficiency and renewable energy for agricultural producers and rural small businesses through the use of (1) grants and loan guarantees for energy efficiency improvements and renewable energy systems, and (2) grants for energy audits and renewable energy development assistance. REAP is administered by the U.S. Department of Agriculture (USDA). In addition to mandatory funding levels, up to $25 million in discretionary funding may be issued each year. The American Taxpayer Relief Act of 2012 (H.R. 8) extended discretionary funding for FY 2013.

Annual grant solicitations typically occur in March or April. For the April 2013 grant solicitation, grants for renewable energy were required to be between $2,500 and $500,000 (up to 25% of eligible project costs). Energy efficiency grants were required to be between $1,500 and $250,000 (up to 25% of eligible project costs).

Of the total REAP funding available, approximately 88% is dedicated to competitive grants and loan guarantees for energy efficiency improvements and renewable energy systems. These incentives are available to agricultural producers and rural small businesses to purchase renewable energy systems (including systems that may be used to produce and sell electricity) and to make energy efficiency improvements. Funding is also available to conduct relevant feasibility studies, with approximately 2% of total funding being available for feasibility studies. Eligible renewable energy projects include wind, solar, biomass and geothermal; and hydrogen derived from biomass or water using wind, solar or geothermal energy sources. These grants are limited to 25% of a proposed project's cost, and a loan guarantee may not exceed $25 million. The combined amount of a grant and loan guarantee must be at least $5,000 (with the grant portion at least $1,500) and may not exceed 75% of the project's cost. In general, a minimum of 20% of the funds available for these incentives will be dedicated to grants of $20,000 or less. The USDA likely will announce the availability of funding for this component of REAP through a Notice of Funds Availability (NOFA).

The USDA will also make competitive grants to eligible entities to provide assistance to agricultural producers and rural small businesses "to become more energy efficient" and "to use renewable energy technologies and resources." These grants are generally available to state government entities, local governments, tribal governments, land-grant colleges and universities, rural electric cooperatives and public power entities, and other entities, as determined by the USDA. These grants may be used for conducting and promoting energy audits; and for providing recommendations and information related to energy efficiency and renewable energy. Of the total REAP funding available, approximately 9% is dedicated to competitive grants for energy technical assistance.

Contact Information:

Public Information - RBS
U.S. Department of Agriculture
Rural Business - Cooperative Service
USDA/RBS, Room 5045-S, Mail Stop 3201
1400 Independence Avenue SW
Washington, DC 20250-3201
Phone: (202) 690-4730

Fax: (202) 690-4737
E-Mail: webmaster@rurdev.usda.gov
Web Site: http://www.rurdev.usda.gov/rbs

Internal Policies and Strategies for Energy Efficiency

Ideally, implementing energy efficiency projects can be a self-funding cycle once initial, high-value projects are implemented. This is to say that savings generated from a successful energy efficiency project can be applied to future projects. This is an important concept as it creates a pool of resources that are dedicated to addressing energy efficiency projects for a period determined by Tribal decision makers. Though this is a fairly simple concept, in practice this can be challenging requiring communication between building managers, accounts payable personnel, Tribal decision makers and administrative staff. All parties would have to agree on “baseline” energy performance in order to understand the “savings” generated from energy efficiency projects, and how long these “savings” would be allocated to the energy efficiency project fund.

One point of concern raised from building operators and managers throughout the EEFS process was that, without external sources of funding, energy efficiency upgrades would need to be completed using existing department budgets. This would create an unplanned and/or unfunded debit in the department budget and there is currently no mechanism for returning the cost savings associated with the energy efficiency project to the responsible department. Again, simple in concept, creating such a mechanism would require concentrated efforts from many levels within the Tribal government. However, the return on this investment would likely be significant, as departments would be incentivized to complete energy projects.

Information is vital to realizing energy savings. Based on conversations with building operators and managers, currently no energy usage or billing information is typically provided to building operators, managers or occupants. Therefore, there is no way for building operators to know how much energy the facility is using, how it compares to historical use, or if energy efficiency measures are having the desired effect. As part of the EEFS process, OE developed a baseline database of building energy usage for the subject buildings using the EPA’s Portfolio Manager. If maintained on a monthly basis, this could provide building operators access to the data for their respective facilities, which will allow them to make informed operational decisions with respect to energy use.

As part of this EEFS process, the Coeur d’Alene Tribe hosted four “Energy Workgroup Meetings”. Attendees of these meeting included Tribal staff representing many Tribal departments, Tribal government officials, utilities representatives from BPA, Kootenai Electric Cooperative, Clearwater Power Cooperative and Plummer Power and OurEvolution engineers. These meetings coincided with the main DRAFT deliverables associated with this EEFS. Minutes from the last three of these meetings can be found in Appendix G. OE recommends reconvening these workgroups semi-annually to follow up on energy efficiency project implementation, opportunity and information sharing.

SECTION VI – APPENDICES

APPENDIX A – OBSERVED EQUIPMENT INVENTORY

Facility	Equipment Type	Fuel	Make	Model	Year of Manufacture	Capacity	Additional Information
Tribal Headquarters - Attorneys' Office	Wall Heater (x3)	Electric	Cadet	--	--	1,800-watt	
	Packaged Terminal Heat Pump	Electric	--	--	--	Estimated ,7000 BTU/hour cooling, 11,000 BTU/hour heating	
	Domestic Water Heater	Electric	U.S. Heater Group	E52-50R-0450	1994	3,375-watts	
Tribal Headquaters - Veteran's Services	Packaged Terminal Heat Pump	Electric	Carrier	--	1994	7000 BTU/hour cooling, 11,000 BTU/hour heating	11 EER
	Wall Heater (x2)	Electric	--	--	--	800-watt	
	Domestic Water Heater	Electric	U.S. Heater Group	E52-50R-0450	1994	3,375-watts	
Tribal Headquarters - Culture and Language Department	Window Mount Air Conditioner (x2)	Electric	--	--	--	1-ton	
	Packaged Terminal Heat Pump	Electric	--	--	--	Estimated ,7000 BTU/hour cooling, 11,000 BTU/hour heating	
	Wall Heater (x8)	Electric	Cadet	--	--	800-watt	
Tribal Headquarters - Enrollment	DX Air Conditioner	Electric	Ruud	UAKA-024JAZ	1999	2-ton	10 SEER
	Central Furnace/Air Handler	Electric	Ruud	UBHA-14J11SFAA	1999	9.8 kW	
	Packaged Terminal Heat Pump	Electric	Carrier	--	1994	7000 BTU/hour cooling, 11,000 BTU/hour heating	11 EER
	Ductless Mini-split A/C	Electric	Fujitsu	AOU24CL/ASU24CL	2002	2-ton	18 SEER
	Domestic Water Heater	Electric	U.S. Heater Group	E52-50R-0450	1994	3,375-watts	
Tribal Headquarters - Chairman's Office	A/C Condenser	Electric	Trane	TTR036C	1993	3-ton cooling	10 SEER
	Central Furnace/Air Handler	Electric	Trane	TEV036B100A0	1993	Estimated 20 kW heat strip	
Tribal Headquarters - Council Chambers	A/C Condenser	Electric	Carrier	38CKB042	1996	3.5-tons	10 SEER
	Central Furnace/Air Handler	Electric	Carrier	FB4ANF048	1996	20 kW	
	Packaged Terminal Heat Pump	Electric	Carrier	--	1994	7000 BTU/hour cooling, 11,000 BTU/hour heating	11 EER
Tribal Headquarters - Reception	A/C Condenser	Electric	Trane	TTR025C	1993	2.5-tons	10 SEER
	Central Furance/Air Handler	Electric	Trane	TWV025B140A1	1993	Estimated 20 kW heat strip	
Tribal Headquarters - Council Offices	A/C Condenser	Electric	Trane	TTR060C	1993	5-tons	10 SEER
	Central Furnace/Air Handler	Electric	Trane	--	--	Estimated 20 kW heat strip	--
Tribal Headquarters - Council Fires	A/C Condenser	Electric	Trane	TTR025C	1993	2.5-tons	10 SEER
	Central Furance/Air Handler	Electric	Trane	TWV025B140A1	1993	Estimated 20 kW heat strip	
Tribal Headquarters - Public Works	A/C Condenser	Electric	Trane	TTR036C	1993	3-ton cooling	10 SEER
	Central Furnace/Air Handler	Electric	Trane	TEV036B100A0	1993	Estimated 20 kW heat strip	
	Packaged Terminal Heat Pump	Electric	Carrier	--	1994	7000 BTU/hour cooling, 11,000 BTU/hour heating	11 EER
Tribal Headquarters - Administrator's Office and Human Resources	A/C Condenser	Electric	Carrier	38CKB042	1996	3.5-tons	10 SEER
	Central Furnace/Air Handler	Electric	Carrier	FB4ANF048	1996	20 kW	

Facility	Equipment Type	Fuel	Make	Model	Year of Manufacture	Capacity	Additional Information
Tribal Facilities	Heat Pump (x2)	Electric	Carrier	HPP060C1231B	2006	5-tons cooling, 59,000 BTU/hour heating	10 SEER
	Heat Pump	Electric	Ducane	HP10B24	2000	2-tons cooling, 22,000 BTU/hour heating	10 SEER
Casino Daycare	Packaged Heat Pump (x2)	Electric	Bard	WH361-A15	2002	3-ton cooling, 34,400 heating, 15 kW auxiliary heating	9 EER, 2.9 COP
	Domestic Water Heater	Electric	Ruud Pacemaker	PE-2-52-2	2012	50-gallons, 4,500-watts	
Social Services	Packaged (Wall Mounted) Heat Pump (x6)	Electric	Bard	WH361-A15	1999	3-ton cooling, 34,400 BTU/hour heating, 15 kW auxiliary heating	9 EER, 2.9 COP
	Domestic Water Heater	Electric	--	--	Estimated 1999	Estimated 1,500 watts	
Senior Housing Common Area	Heat Pump (x2)	Electric	York	HP048X1022G	2005	4-tons cooling, 47,000 BTU/hour heating	10.5 EER, 8.0 HSPF
	Central Furnace/Air Handler (x2)	Electric	York	N1AHD2006G	2005	Estimated 20 kW heat strip	
	Refrgerator Condenser	Electric	ConPak	PSE181D	--		
	Evaporative "Swamp" Cooler	Electric	Essick	ECR4000	--		
	Water Heater	Propane	Bradford-White	75T803X	1995	75-gallon, 80,000 BTU/hour	80%
	Water Heater	Electric	A.O. Smith	ECT 52 200	2005	50-gallons, 4,500-watts	
Senior Housing Apartments	Mini-Split Ductless Heat Pumps (x20)	Electric	ComfortStar		2005	2-tons cooling, 20,000 BTU/hour heating	16 SEER
	Water heater (x20)	Electric	A.O. Smith	ECT 52 200	2005	50-gallons, 4,500-watts	
Circling Raven Golf Course	Packaged Heat Pump (x2)	Electric	Carrier	50TFQ009-521	2002	8.5-tons cooling, 98,000 BTU/hour heat	8.9 EER, 7.5 HSPF
	Heat Pump Condenser	Electric	Carrier	38YCK048-3.31	2002	4-tons cooling, 47,000 BTU/hour heating	
	Central Furnace/Air Handler	Electric	Carrier	CF5AA045	2002	10 kW auxiliary heating	
	Mini-Split Ductless Heat Pumps (x2)	Electric	Fujitsu	--	2002	2-tons of cooling	17.5 SEER
	Domestic Water Heater	Natural Gas	Rheem/Ruud	HE119-199N	2002	199,000 BTU/hour	Currently used with propane fuel
Golf Course Pavillion	Radiant Heaters (x10)	Electric	Thermazone	--	--	2,400-watts	
	Domestic Water Heater	Electric	A.O. Smith	ECT 80 200	2007	4,500-watts	
Veteran's Center	Heat Pump	Electric	York	HP060X1221A	2002	5-tons cooling, 59,000 BTU/hour heating	12 SEER, 7.7. HSPF
	Air Handler/Aux Furnace	Electric	York	F2FP060N06B	2002	Estimated 15 kW heat strip	
	Domestic Water Heater	Electric	Whirlpool	EE3J50RD045V	2002	4,500	
Bureau of Indian Affairs	Packaged (Wall Mounted) Heat Pump (x2)	Electric	Bard	WH361-A15	1999	3-ton cooling, 34,400 BTU/hour heating, 15 kW auxiliary heating	9 EER, 2.9 COP
	Domestic Water Heater	Electric	Rheem	81VP6S	2002	2,000 watts	
Department of Education	Packaged (Wall Mounted) Heat Pump (x4)	Electric	Bard	WH361-A15	2001	3-ton cooling, 34,400 BTU/hour heating, 15 kW auxiliary heating	9 EER, 2.9 COP
	Domestic Water Heater	Electric	GSW	SS06SEB30	--	6 gallons, 1,500 watts	
Finance Department	Packaged (Wall Mounted) Heat Pump (x5)	Electric	Bard	WH361-A15	1997	3-ton cooling, 34,400 BTU/hour heating, 15 kW auxiliary heating	9 EER, 2.9 COP
	Mini-Split Air Conditioner	Electric	Mistubishi	Mr. Slim	2001	1-ton	26 SEER
	Domestic Water Heater	Electric	Rheem	81VP6S	2002	2,000 watts	

Facility	Equipment Type	Fuel	Make	Model	Year of Manufacture	Capacity	Additional Information
Food Distribution Warehouse	Wall Heater	Electric	Cadet	--	--	1500-watts	
	Wall Heater	Electric	Cadet	--	--	1500-watts	
	Room Air Conditioner	Electric	--	--	--	Estimated 2,500 watts	
	Central Furnace/Air Handler	Electric	--	--	--	Estimated 7.5 kW	
	Central Furnace/Air Handler	Electric	--	--	--	Estimated 7.5 kW	
	Domestic Water Heater	Electric	U.S. Craftmaster	E1F20USC15V	1998	6-gallon, 1,000 watts	
	Cooler Condenser	Electric	Copeland	FJAM-A300-TFC-020	2012	2-ton	
	Freezer Condensers (x3)	Electric	--	--	--	1.5-ton per unit	
Early Childhood Learning Center	A/C condenser (x6)	Electric	Lennox	HS29-048-9Y	2003	4-tons cooling	9.8 EER
	Central Furnace/Air Handler (x6)	Electric	Lennox	CB29M-51-1P	2003	20 kW heating	
	Heat Pump Condenser (x4)	Electric	York	HP060X1321A	2006	5-tons cooling, 59,000 BTU/hour heating	12 SEER, 7.75 HSPF
	Central Furnace/Air Handler (x4)	Electric	York	AHP60D3XH21H	2006	Estimated 20 kW heat strip	No heat strip marked on nameplate
	Ductless Mini-split A/C	Electric	Fujitsu	AOU24RLXFW	unknown	2-ton	Energy Star rated
	Makeup Air Ventilator/Swamp Cooler	Electric	Reznor	A1-E.20-G10	2006	--	
	Domestic Water Heater	Electric	Bradford-White	M250T6DS-1NCWW	2012	50-gallons, 4,500-watts	
	Domestic Water Heater	Electric	Bradford-White	MI80R6DS13	2003	80-gallons, 4,500-watts	Circ. Pump, no timer
Rose Creek Longhouse	Heat Pump	Electric	York	E1FB180	2001	15-tons cooling, 185,000 BTU/hour heating	8.7 EER, 3.0 COP
	Heat Pump	Electric	York	E1FB180	2002	15-tons cooling, 185,000 BTU/hour heating	8.7 EER, 3.0 COP
	Heat Pump Air Handler	Electric	York	F1EH180A33A	2001	Estimated 15 kW heat strip	No heat strip marked on nameplate
	Heat Pump Air Handler	Electric	York	F1EH180A33A	2002	Estimated 15 kW heat strip	No heat strip marked on nameplate
	Furnace/Air Handler	Propane*	Modine	DFS300AMRHN20A1	2010	240,000 BTU/hour output	Nameplate specifies Natural Gas
	Furnace/Air Handler	Propane*	Modine	DFS300AMRHN20A1	2010	240,000 BTU/hour output	Nameplate specifies Natural Gas
	Water Heater	Propane	Rheem-Ruud	G100-200	2004	97-gallons, 199,900 BTU/hour input	
DeSmet Longhouse	Heat Pump	Electric	York	THGD60S43S1A	2009	5-tons, 58,000 BTU/hour heating	7.7 HSPF, 13 SEER
	Heat Pump	Electric	York	E1FB240A25B	2009	20-tons, 220,000 BTU/hour heating	8.6 EER, 2.9 COP
	Central Furnace/Air Handler	Electric	York	F1EH240AA	2009	Estimated 20 kW heat strip	
	Central Furnace/Air Handler	Electric	York	AHP60D3XH21H		Estimated 20 kW heat strip	
	Direct Industrial Air Heater	Propane	Captive-Aire Systems	A1D.250-G10	2009	144,480 BTU/hour	
	Domestic Water Heater	Propane	Takagi	T-H2-DV-D	2009	199,000 BTU/hour	
Fire Warehouse	Wall Heater (x6)	Electric	Cadet	--	--	1,500 watts	
	Window Mount Air Conditioner	Electric	Gold Star	--	--	Estimated 5,000 BTU/hour cooling	
	Window Mount Air Conditioner	Electric	Kenmore	--	--	5,000 BTU/hour cooling	9.7 EER
	Unit Heater (x2)	Electric	--	--	--	Estimated 4,000 watts	
	Domestic Water Heater	Electric	U.S. Water Heater Group	E52-50R-0450	1994	50 gallon, 4,500 watts	
	Domestic Water Heater	Electric	--	--	Estimated 15-20 yrs	Estimated 10 gallon, 1,200 watts	

Facility	Equipment Type	Fuel	Make	Model	Year of Manufacture	Capacity	Additional Information
Roads Maintenance Shop (Old)	Unit Heaters (x2)	Electric	Modine	--	--	Estimated 4,000 watts	
	Oil Fired Unit Heater	Waste Oil	Clean Burn	CB-1750	2010	170,000 BTU/hour	
	Window Mount Air Conditioner	Electric	--	--	--	Estimated 1-ton cooling	
	Domestic Water Heater	Electric	Rheem	--	--	10-gallon, 1,000 watts	
Roads Maintenance Shop (New)	Unit Heaters (x2)	Propane	Modine	Hot Dawg	2012	125,000 BTU/hour	80% efficient
	Wall Heater (x2)	Electric	Cadet	--	2012	1,500 watts	
	Domestic Water Heater	Electric	Ruud Pacemaker	PE2-52-2	2012	50gallon, 4,500 watts	
New Tribal School	Heat Pump (15)	Electric	Carrier	25HBC330A300	2010	2.5 tons cooling, 30,000 BTU/hour heating	13 SEER
	Central Furnace/Air Handler (x10)	Propane	Trane	TDX1B060A9361AB	2009	56,000 BTU/hour	93.3 AFUE
	Central Furnace/Air Handler (x5)	Propane	Trane	TUH1B060A9361AA	2009	57000 BTU/hour	95.0 AFUE
	Mini-Split Ductless air conditioner	Electric	Carrier	38HDC024310			
Department of Natural Resources	Heat Pump (HP-1)	Electric	Carrier	2HBC536A003	2011	3-tons cooling, 36,000 BTU/hour heating	Energy Star Rated
	Heat Pump (HP-2)	Electric	Carrier	2HBC536A003	2011	3-tons cooling, 36,000 BTU/hour heating	Energy Star Rated
	Heat Pump (HP-3)	Electric	Carrier	2HBC542A003	2011	3.5-tons cooling, 42,000 BTU/hour heating	Energy Star Rated
	Heat Pump (HP-4)	Electric	Carrier	2HBC536A003	2011	3-tons cooling, 36,000 BTU/hour heating	Energy Star Rated
	Heat Pump (HP-5)	Electric	Carrier	2HBC536A003	2011	3-tons cooling, 36,000 BTU/hour heating	Energy Star Rated
	Heat Pump (HP-6)	Electric	Carrier	2HBC524A003	2011	2-tons cooling, 24,000 BTU/hour heating	Energy Star Rated
	Heat Pump (HP-7)	Electric	Carrier	2HBC560A003	2011	5-tons cooling, 60,000 BTU/hour heating	Energy Star Rated
	Air Handler/Aux Furnace (AHU-1)	Electric	Carrier	FX4DNF037000	2011	15 kW auxiliary heating	
	Air Handler/Aux Furnace (AHU-2)	Electric	Carrier	FX4DNF037000	2011	15 kW auxiliary heating	
	Air Handler/Aux Furnace (AHU-3)	Electric	Carrier	FX4DNF043000	2011	15 kW auxiliary heating	
	Air Handler/Aux Furnace (AHU-4)	Electric	Carrier	FX4DNF037000	2011	15 kW auxiliary heating	
	Air Handler/Aux Furnace (AHU-5)	Electric	Carrier	FX4DNF037000	2011	15 kW auxiliary heating	
	Air Handler/Aux Furnace (AHU-6)	Electric	Carrier	FX4DNF025000	2011	5 kW auxiliary heating	
	Air Handler/Aux Furnace (AHU-7)	Electric	Carrier	FX4DNF061000	2010	15 kW auxiliary heating	
	Baseboard Heater	Electric	Cadet	5524	2011	1,000 watts	
	Domestic Water Heater	Electric	Bradford-White	M2HE50S6DS-1NCWW	2011	50-gallons, 4,500 watts	
Felix Aripa Fish and Wildlife Building	Heat Pump (x5)	Electric	York	HP060X1221A	2002	5-tons cooling, 59,000 BTU/hour heating	12 SEER, 7.7. HSPF
	Air Handler/Aux Furnace (x5)	Electric	York	F2FP060N06B	2002	Estimated 15 kW heat strip	
	Domestic Water Heater	Electric	US/Craftmaster	EE3J50RD045V	2008	50-gallons, 4,500 watts	

Facility	Equipment Type	Fuel	Make	Model	Year of Manufacture	Capacity	Additional Information
Tribal Farm	Unit Heater	Fuel Oil	PowRMatic	--	Estimated Late 1970s	100,000 BTU Estimated	
	Wall Heater	Electric	Cadet	--	--	1,500-watts Estimated	
	Domestic Water Heater	Electric	Reliance	630SHMSE	2006	50-gallons, 4,500 watts	
Ecomonic Development Office	Packaged Heat Pump (RTU)	Electric	Rheem	RQKA-A030JK 000	2003	2.5-tons cooling, 29,600 BTU/hour heating with **7.2 kW backup heating estimated**	10 SEER, 3.12 COP, 6.8 HSPF
	Domestic Water Heater	Electric	Rheem	81V52D C	1998	50-gallons, 4,500 watts	
Economic Development Office - Unoccupied Space	Packaged Heat Pump (RTU)	Electric	Ruud	UQKA-A024JK 000	2003	2-tons cooling, 23,400 BTU/hour heating, with **7.2 kW backup heating estimated**	10 SEER, 3.1 COP, 6.8 HSPF
	Domestic Water Heater	Electric	Richmond	F1VP6-1	1991	6-gallon, 1,200 watts	
Ecomonic Development Office - Post Office	Central Furnace/Air Handler	Electric	Armstrong Air	EFC12BCP-1A	**2011**	36,000 BTU/hour heating	
	Room Air Conditioner	Electric	--	--	--	12,000 BTU/hour cooling estimated	10 SEER estimated
Benewah Auto	Packaged Air-Conditioner/Electric Furnace	Electric	Carrier	--	1986	Estimated 2-tons cooling, 15 kW heating	
	Packaged Air-Conditioner/Electric Furnace	Electric	Carrier	--	1986	Estimated 4-tons cooling, 20 kW heating	
	Wall Heater	Electric	Cadet	--	--	1,500-watts	
	Unit Heaters(x3)	Electric	Brasch	BTU-10.20838	1987	10 kW heating	
	Domestic Water Heater	Electric	A.O. Smith	EI_JF 15 910	1986	15 gallons, 1,500 watts	
Benewah Market	Domestic Water Heater	Electric	A.O. Smith	80-917	2003	80-gallons, 4,000 watts	Circ. Pump, no timer
Tribal Casino Conoco Service Station	Packaged Heat Pump (RTU)	Electric	Carrier	50TCQD08A2A5A0A0A0	2009	7.5-tons cooling, 85,000 BTU/hour heating, 25 kW auxiliary heating estimated	11.2 EER, 3.3 COP
	Packaged Heat Pump (RTU)	Electric	Carrier	50TCQA04A2A5A0A0A0	2010	3-tons cooling, 35,600 BTU/hour heating, 15 kW auxiliary heating estimated	13.4 SEER, 7.7 HSPF
	Freezer Condenser	Electric	Bohn-Heatcraft	8ZT055M8C	2010	--	
	Refrgerator Condenser	Electric	Bohn-Heatcraft	BZT035L6CF	2010	--	Icing noted at expansion valve
	Domestic Water Heater	Electric	Bradford-White	LD50L33B090	2010	47-gallons, 4,500 watts	Circ pump, pipe insulation, no timer
Echelon Plummer	Unit Heaters (x6)	Propane	Modine	PDP400AE0185	2006	320,000 BTU/hour heating	80% combustion efficiency
	A/C Condenser	Electric	Tempstar	T4A324GKA200	2008	2-tons cooling	13 SEER
	A/C Air Handler	Electric	Tempstar	EDD4X36BA2	2007	--	
	Mini-Split Air Heat Pump	Electric	LG	LSU120HE	--	11,500 BTU/hour heating, 11,500 BTU/hour cooling	20 SEER
Tribal Police Headquarters	Packaged Air-Conditioner/Gas Furnace (RTU)	Electric/Propane	Bryant	580DJV060115AAAA	1995	5-tons cooling, 115,000 BTU/hour heating	10 SEER, 80% AFUE
	A/C Condenser	Electric	Bryant	593CJX018000ABAA	1992	1.5-tons cooling	12 SEER
	Gas Furnace/Air Handler x2	Electric/Propane	Bryant Plus 80	376CAV024050AEJA	1994	37000 BTU/hour heating	80.2% AFUE
	Domestic Water Heater	Electric	US/Craftmaster	E1F12US015V	2004	12 gallons, 1,500 watts	

Facility	Equipment Type	Fuel	Make	Model	Year of Manufacture	Capacity	Additional Information
Old Benewah Medical Center	Split system heat pump HP-1	Electric	Carrier	25HCB660A300	2010	5-tons	16 SEER
	Split system heat pump HP-2	Electric	Carrier	25HCB660A300	2010	5-tons	16 SEER
	Split system heat pump HP-3	Electric	Carrier	25HCB660A300	2010	5-tons	16 SEER
	Split system heat pump HP-4	Electric	Carrier	25HCB648A300	2010	4-tons	16 SEER
	Split system heat pump HP-5	Electric	Carrier	25HCB636A300	2010	3-tons	16 SEER
	Split system heat pump HP-6	Electric	Carrier	25HCB636A300	2010	3-tons	16 SEER
	Split system heat pump HP-7	Electric	Carrier	25HCB660A300	2010	5-tons	16 SEER
	Split system heat pump HP-8	Electric	Carrier	25HCB660A300	2010	5-tons	16 SEER
	Split system heat pump HP-9	Electric	Carrier	25HCB660A300	2010	5-tons	16 SEER
	Split system heat pump HP-10	Electric	Carrier	25HBC342A5	2010	3.5-tons	13 SEER
	Air Handler FC-1 AD-5	Electric	Carrier	FV4CNB006	2010		
	Air Handler FC-2 AD-6	Electric	Carrier	FV4CNF006	2010		
	Air Handler FC-3 AD-7	Electric	Carrier	FV4CNF006	2010		
	Air Handler FC-4 AD-8	Electric	Carrier	FVCNF005	2010		
	Air Handler FC-5 AD-9	Electric	Carrier	FV4CNF005	2010		
	Air Handler FC-6 AD-10	Electric	Carrier	FV4CNF006	2010		
	Air Handler FC-7 AD-11	Electric	Carrier	FV4CNF006	2010		
	Air Handler FC-8 AD-12	Electric	Carrier	FV4CNF006	2010		
	Air Handler FC-9 AD-13	Electric	Carrier	FV4CNF006	2010		
	Air Handler FC-10 AD-14	Electric	Carrier	FV4CNF006	2010		
	Air Handler FC-11 AD-15	Electric	Carrier	FH4CNF002	2010		Basement heating only, no cooling
	Mini-split ductless heat pump	Electric	Fujitsu	AUO36RLX	2010	3-tons	14 SEER
	Mini-split ductless heat pump	Electric	Fujitsu	AUO18RLX	2011	3-tons	12 SEER
	Packaged heat pump RTU-1	Electric	Carrier	50ES-A24---50	2010	2-tons	13.5 SEER
	Packaged heat pump RTU-2	Electric	Carrier	50ES-A30---50	2010	2.5-tons	13.2 SEER
	Packaged A/C heat pump	Electric	Liebert	ER0607RYE0T2057	2010	3-tons	Non AHRI equipment, not rated
	Packaged A/C heat pump	Electric	Liebert	ER0607RYE0T2058	2011	3-tons	Non AHRI equipment, not rated
	Water heater	Electric	Ruud	KER80-2	1997	80-gallon, 4500 watt heating elements	
	Water heater	Electric	American	E61-50R045D	2009	50-gallon, 4500 watt heating elements	
	Unit heater	Electric			2010	2 kW	

Facility	Equipment Type	Fuel	Make	Model	Year of Manufacture	Capacity	Additional Information
Youth Shelter	A/C Condenser	Electric	York	H2CB060A0C6	1990	5-tons cooling	9 SEER
	Air Handler/Furnace	Electric	Goodman Company	MBR200AA-1AB	2011	Estimated 15 kW heating	
	Domestic Water Heater	Electric	US/Craftmaster	E2F50HD045V	2011	50 gallons, 4,500 watts	
City Link Bus Garage	Heat Pump Condenser	Electric	Carrier	25HCB336A300	2011	3-tons cooling, 35,400 BTU/hour heating	13 SEER, 7.7 HSPF
	Furnace/Air Handler	Propane	Carrier	58HDV080	2011	80,000 BTU/hour	95% AFUE, Energy Star Rated
	Wall Heater	Electric	--	--	--	Estimated 1,500 watts	
	Infrared Tube Heaters (x4)	Propane	Re-Verber-Ray	--	2011	100,000 BTU/hour	
	Unit Heater	Propane	Modine/Hot Dawg	--	2011	100,000 BTU/hour	
	Central Furnace	Propane	--	--	2011	Estimated 80,000 BTU/hour	
	Domestic Water Heater	Electric	Bradford-White	M280R6DS-1NCWW	2011	4,500-watts	
Tribal Housing Authority	Heat Pump Condenser	Electric	Carrier	25HCA336A0030010	2006	3-tons cooling, 34,600 BTU/hour heating	13 SEER, 8.1 HSPF
	Furnace/Air Handler	Electric	Carrier	FV4BNF002	2006	Estimated 10 kW auxiliary heating	
	Heat Pump Condenser	Electric	Carrier	25HCA348A0030010	2006	4-tons cooling, 41,000 BTU/hour heating	13 SEER, 8.1 HSPF
	Furnace/Air Handler	Electric	Carrier	FY4ANF048	2006	Estimated 20 kW auxiliary heating	
	A/C Condenser	Electric	Rheem	13AJL36A01	2009	3-tons cooling	13 SEER
	Furnace/Air Handler	Electric	Rheem	RHSL-HM2417JA	2009	2-tons fan capacity (15 kW heating)	
	Domestic Water Heater	Electric	General Electric	GE30S06AAG	2005	30-gallons, 4,500 watts	
Tribal Housing Authority Shop	Unit Heater	Electric	TPI Corporation	H1HUH05003	--	5,000 watts	
Tribal Wellness Center	Packaged Heat Pump RTU	Electric	York	XP060E15U4AAA2A	2012	5-tons, 13.6 kW aux heat strip	13 SEER
	Packaged Heat Pump RTU	Electric	York	XP048C00P4AAA1B	2012	4-tons, estmimated 10kW heat strip	13 SEER
	Packaged Heat Pump RTU	Electric	York	B3CH120A46A	1997	10-tons, no heat strip	COP =2; EER = 9
	Packaged Heat Pump RTU	Electric	York	XP090E18P4AAA5A	2012	7.5-tons, 18 kW aux heat strip	11 EER
	Packaged Heat Pump RTU	Electric	York	XP060E15U4AAA2A	2012	5-tons, 13.6 kW aux heat strip	13 SEER
	Packaged Heat Pump RTU	Electric	York	XP036C00P4AAA1B	2009	3-tons, estimated 10 kW heat strip	13 SEER
	Packaged Heat Pump RTU	Electric	York	B3CH036A46C	1997	3-tons, estimated 10 kW heat strip	10 SEER
	Packaged Heat Pump RTU	Electric	York	B3CH036A46C	1998	3-tons, estimated 10 kW heat strip	11 SEER
	Packaged Heat Pump RTU	Electric	York	B3CH090A46A	1997	7.5 tons, no heat strip	10 SEER
	Packaged Heat Pump RTU	Electric	York	B3CH090A46A	1997	7.5 tons, no heat strip	10 SEER
	Split system heat pump	Electric	York	E1FD030S0D	1997	2.5 tons	10 SEER
	Air handler/furnace	Electric	York	M-AHB1206A	1997	7.5 kW aux heat strip	
	Dehumidification System	Electric	Dectron	RS-040-43	1997	20 kW duct heater; 3300 cfm air flow	576 sf pool area
	Dehumidification System	Electric	Dectron	RS-W-120-023 DE	1997	45 kW duct heater; 11,000 cfm air flow	2853 sf pool area
	Air cooled condenser	Electric	Dectron	CLD030-5	1997		
	Air cooled condenser	Electric	Dectron	CLD060-5	1997		
	Domestic Water Heater	Electric	Rheem/Ruud	RR 0198E00021	1998	119-gallons, 24 kW	
	Domestic Water Heater	Electric	Rheem/Ruud	RR 0198E00322	1998	119-gallons, 24 kW	
	Domestic Water Heater	Electric	Rheem	RH 0298312508	1998	6-gallons, 2000 watts	
	Domestic Water Heater	Electric	Rheem	XXXX	1998	6-gallons, 2000 watts	
	Pool and Spa Heater	Electric	Coates	34845PHS	1997	45 kW	lap pool
	Pool and Spa Heater	Electric	Coates	34845PHS	1997	45 kW	lap pool
	Pool and Spa Heater	Electric	Coates	34836PHS-3	1997	36 kW	therapy pool
	Pool and Spa Heater	Electric	Coates	34836PHS-3	1997	36 kW	spa
	Pool and Spa Heater	Electric	Coates	34824PHS	1997	24 kW	wading pool
	Pump	Electric	Emerson	BU83 DJ7P1-AZ	1997	7.5 hp	lap pool

Facility	Equipment Type	Fuel	Make	Model	Year of Manufacture	Capacity	Additional Information
Technology Center	Heat Pump Condensers (x5)	Electric	York	HP060X1221G	2004	5-tons cooling, 59,000 BTU/hour heating	12 SEER, 7.7 HSPF
	Furnace/Air Handlers	Electric	York	F2FP060H06G	2004	20-kW auxiliary heating	
	Ductless Mini-split A/C	Electric	Fujitsu	AOU36CLX/ASU36CLX	2007	3-tons cooling	15 SEER
	Domestic Water Heater	Electric	Bradford-White	M250T6DS-1NCWW	2009	50-gallons, 3,500 watts	
Tribal Tribal Court Services	Split system heat pump	Electric	Trane	TWA090A300A	2001	7.5-tons	10.1 EER
	Split system heat pump	Electric	Lennox	nameplate illegible	nameplate illegible	nameplate illegible	nameplate illegible
	Split DX air conditioner	Electric	Ruud	UPKB-036JAZ	2005	3-tons, 14 kW aux heat strip	10 SEER
	Split DX air conditioner	Electric	Ruud	UPKB-036JAZ	2005	3-tons, 14 kW aux heat strip	10 SEER
	Air handler	Electric	Raywall	nameplate inaccessible	nameplate inaccessible	nameplate inaccessible	nameplate inaccessible
	Air handler/furnace	Electric	Ruud	UBHC-17J14SFA	2004		
	Air handler/furnace	Electric	Ruud	UBHC-17J14SFA	2005		
	Air handler	Electric	Rheem	RHGE-100ZK		2005	No aux heat strip
	Water heater	Electric	Craftmaster	E2E40RD045V	1997	40 gallon, 3380 heating element	
	Aeration compressor pump	Electric	Koenders Windmills	EL2	1995	1/4 hp	runs 24/7 aerating trout pond

APPENDIX B – ENERGY EFFICIENCY PRODUCT INFORMATION

CATALYST

Efficiency Enhancing Controller

Patent Pending

Technology Overview

transformative wave
TECHNOLOGIES

A subsidiary of the Performance Mechanical Group
1012 Central Ave S | Kent, WA 98032

CatalystEEC.com

Introduction

We want to thank you for the opportunity to introduce the CATALYST: Efficiency Enhancing Controller. This patent-pending retrofit technology adds dynamic control to constant volume HVAC systems and produces dramatically more efficient operation. It represents a new, unprecedented frontier of energy savings opportunities. It is the result of classic ingenuity combined with the capabilities of some of the world's leading manufacturing firms.

Exclusive distribution rights for the CATALYST are held by Transformative Wave Technologies (TWT), a wholly owned subsidiary of the Performance Mechanical Group. TWT developed the technology in-house, has proven the savings potential in the field, and brought the technology to the marketplace. In 2009, Yaskawa America was selected as the manufacturer for the CATALYST controller.

The CATALYST technology is built on proven hardware that has been utilized in industrial and commercial sectors for decades. At the same time it makes use of the latest technological advances in HVAC system control. The CATALYST controller has a small footprint which enables it to be easily installed inside the HVAC equipment cabinet. It integrates readily with existing thermostats or building management systems. The technology combines several well-practiced efficiency measures with our proprietary ***Opti-Run*** fan control logic to create a highly intelligent system. This custom microprocessor-embedded program effectively manages the system's operation without compromising comfort or indoor air quality.

The CATALYST has an extraordinary return on investment (ROI), especially when combined with utility funding. Virtually any existing HVAC unit can be retrofitted with the CATALYST to achieve dramatic energy savings. Options for improving the efficiency of older existing HVAC equipment have historically been limited or economically unfeasible. The CATALYST will make a major contribution toward the energy conservation goals of utilities, business operators, and public entities.

Current Landscape

There is currently a very visible focus on the need to reduce energy consumption. The federal government is devoting billions of dollars toward energy efficiency upgrades to public buildings. The private sector is also recognizing the financial benefits of projects that reduce energy costs and improve the financial bottom line. Furthermore, utilities are subsidizing sensible efficiency projects all across the country.

Heating, Ventilation, and Air Conditioning (HVAC) typically accounts for about 30% - 50% of the energy consumed in a commercial building. A small decrease in energy use by HVAC systems can have a large impact on the overall energy and greenhouse gas profile of a building. Increasing a building's energy efficiency is one of the most effective ways for organizations to simultaneously meet their carbon reduction goals and reduce operating costs.

> "Small packaged heating, ventilation, and air-conditioning (HVAC) systems are among the most common HVAC systems for small commercial buildings. These systems, however, are notorious for a host of problems requiring 25 to 35 percent more energy than is necessary to heat, cool, and ventilate ... buildings."
>
> *Source: California Energy Commission's Public Energy Research Program*

Over 50% of the commercial floor space in the United States is reportedly served by rooftop-packaged HVAC units. These simple, constant volume systems are often equipped with airside economizers. An economizer allows the HVAC equipment to use outside air to satisfy cooling needs when conditions permit. This free cooling cycle meets the comfort needs of the space without using electrically powered compressors. A properly functioning economizer is indispensable to an efficiently operated HVAC system in most climate zones.

Unfortunately, the vast majority of economizers are not operating correctly. Most facility operators are not receiving the full benefit of these energy-saving devices due to common failures. With recent changes in the energy codes across the country, we are now starting to see split system HVAC units equipped with economizers. This increases the total number of economizers nation-wide and creates an additional opportunity to capture savings in split systems, provided that they are functional and operated properly.

The HVAC equipment's role is not just to provide comfort. It is also responsible for ensuring proper fresh air ventilation rates. Current practice is to set ventilation levels based upon the maximum occupancy of the space served. Since a typical space is rarely at full occupancy, this means that most spaces are over-ventilated the majority of the time. An energy penalty occurs when the HVAC equipment unnecessarily conditions large amounts of fresh air. Current standards allow for the amount of fresh air to vary based upon actual occupancy levels rather than the maximum anticipated occupancy rating of the space. However, this practice is rarely applied to existing equipment as a retrofit strategy due to cost barriers, especially on constant volume equipment.

In any economy, efficiency makes financial sense. Investing in energy efficiency reduces operating expenses and can lead to increased profitability. It is the rare capital improvement to a facility that will produce a return on investment. In the current economic climate, it is even more important to focus on strategies that reduce operating costs, save energy, and lower maintenance costs. A reduction in energy expenses can help absorb some of the economic burden of a slow economy and support the profitability of the overall enterprise.

Catalyst Overview

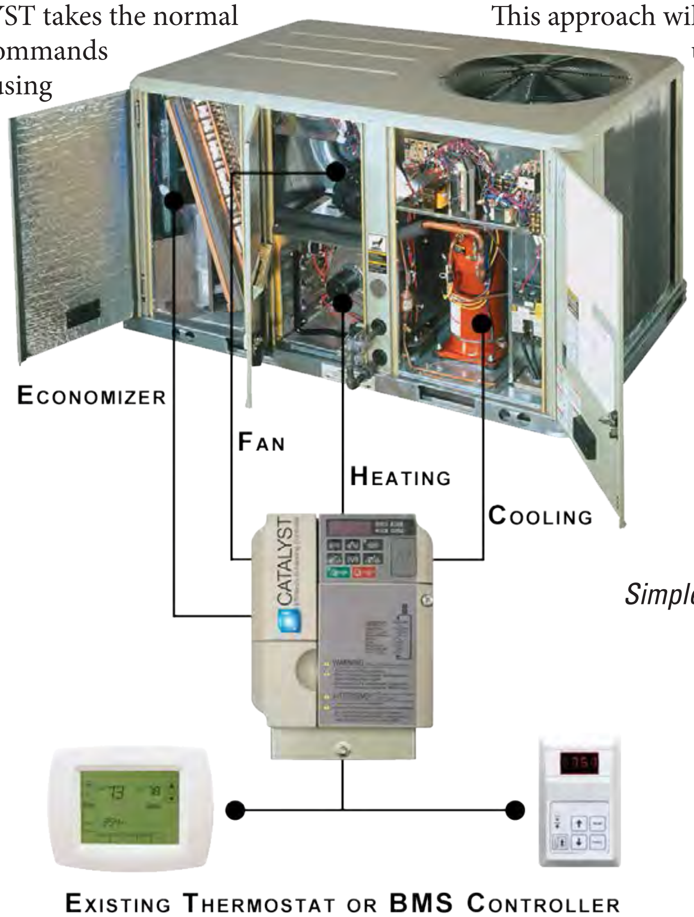
The CATALYST is a retrofit technology for constant volume rooftop HVAC systems. This patent-pending retrofit process and technology is a multi-faceted improvement that will typically reduce energy consumption in these systems by 30-40%.

The core of the CATALYST is a controller with our proprietary ***Opti-Run*** fan control logic. We are able to embed this custom logic, along with several additional energy saving functions, into the controller. This reduces the number of components and installation time, which allows us to provide a more attractive financial payback for clients. Once installed, the CATALYST device optimizes the heating, cooling, economizer, and ventilation functions of the HVAC equipment in response to input from the existing thermostat or building management system.

The installation of this technology does not undermine the integrity or performance of the unit. The device is installed between the thermostat (or BMS controller) and the control terminals on the HVAC unit. The CATALYST takes the normal thermostatic controller commands and adds intelligence by using proprietary logic, which enables the HVAC unit to make better decisions regarding its operation. This approach to system integration allows us to interface with a variety of systems in the same consistent manner. The CATALYST technology also includes the installation of additional sensors designed to provide critical information to the controller. This allows the technology to optimize the performance of the unit and provide feedback on the system's operation and energy performance.

The CATALYST also reduces maintenance and service costs associated with each piece of equipment. The fan speed control feature reduces wear and tear on the fan motors by providing soft-start capability. By improving the control strategies, compressor runtimes are reduced and life spans are increased.

The logic for all of these strategies is embedded in the onboard programmable logic controller by CATALYST manufacturer Yaskawa and cannot be changed in the field except by authorized personnel with specific programming tools. Yaskawa also factory-installs the external wiring harnesses to minimize installation error and access to the internal controller terminals. This approach will reduce the potential for unauthorized field changes that may undermine the anticipated energy savings and creates a process that will produce reliable and repeatable energy savings.



Simple Catalyst EEC schematic.

Energy Saving Strategies

The CATALYST technology equips the HVAC system with a number of advanced energy saving strategies not commonly applied to constant volume rooftop packaged equipment. These include:

Opti-Run **Fan Control** – The CATALYST will modulate the speed of the system fan according to a unique logic sequence based on space needs and input from the new sensors. This allows us to achieve significant fan energy savings while operating the unit within the manufacturer's rated design parameters. The CATALYST monitors key system variables and adjusts as needed to ensure proper equipment operation. These combined capabilities go beyond the abilities of a typical variable frequency drive (VFD) installation.

Integrated Economizer – The CATALYST will control the economizer to allow for the simultaneous use of mechanical cooling and "free" outside air to satisfy a space. Most economizers on rooftop packaged units operate on an "either/or" basis, leaving considerable energy savings unrealized.

Advanced Economizer Changeover – The CATALYST introduces the ability to sense and compare outside air and return air based on dry bulb temperature for non-humid markets and a combination of temperature and dew point for humid markets. Differential changeover will select the preferred source of air for mechanical cooling operation.

Unoccupied Damper Control – During calls for heating or cooling when the space is unoccupied the outside air damper will remain closed. This will lower heating and cooling costs because the system will not treat outside air during periods when ventilation air is not required.

Demand Control Ventilation – Demand Control Ventilation (DCV) uses a CO^2 sensor to establish occupancy levels and match the amount of ventilation air delivered to the space to the occupancy level. By only bringing in the amount of ventilation air that is actually needed, we reduce the amount of heating and cooling required for treating this air. DCV is a well-established energy efficiency strategy that assures indoor air quality while reducing energy use.

This strategy is documented in ANSI/ASHRAE Standard 62, *Ventilation for Acceptable Indoor Air Quality*.

Demand Charge Reduction - To provide an additional energy savings benefit, the CATALYST also contains features to reduce the facility's energy "demand", which is the rate of energy use. In a commercial building, demand charges can account for 10-20% of the total energy bill. Reducing demand saves money and reduces overall energy costs. The CATALYST reduces demand charges by decreasing the maximum consumption of each HVAC unit. It can also be set to limit demand based on overall building consumption, or it is capable of receiving a "load-shed" signal from the local utility.

^{e}IQ *Energy Intelligence Platform*

CATALYST controllers can operate as stand-alone units or wirelessly networked together using the ^{e}**IQ**: Energy Intelligence Platform. The ^{e}**IQ** Platform can then be integrated with an existing Building Management System for a total facility solution.

The ^{e}**IQ** Platform adds remote access, fault detection, diagnostic capability, and a host of other features to the CATALYST installation. This communicating version will automatically notify operators of any equipment performance issues or compromised efficiency, allowing for the quick remedy of problems before occupant comfort suffers, and energy costs skyrocket. It also provides assurance that the anticipated savings are being achieved and sustained.

The features of the ^{e}**IQ** Platform include:

Web-Based Access – The system can be accessed anytime, anywhere by an authorized user on any computer with an Internet connection.

Real-time Energy Consumption Monitoring – This provides clients with the capability to capture and document the actual energy savings of the CATALYST-equipped systems, or the entire building.

Demand Limiting – The system can either use preset demand parameters or monitor an automated signal from the local utility (where available) to limit the consumption of the unit and demand levels.

Fault Detection and Diagnostics – We have developed several proprietary diagnostic functions to actively monitor the energy consumption and performance of the equipment. This includes the addition of several sensors to verify the status of key conditions including airflow, discharge air temperature, and compressor status. These additional points of information are recorded and then normalized based on outside air conditions and time of day. The system is then monitored for any performance abnormalities, which will trigger an alert.

Remote Notification – Through remote access the system can send e-mail notifications to any contact of choice based on system performance, component integrity, or comfort related issues. Often times the system will trigger a warning before occupant comfort starts to suffer. Each site is monitored to verify that the system is operational.

Building Management Controls – The system can be integrated with most Building Management Systems. The CATALYST with the ^{e}**IQ** Platform can also serve as a open-protocol Building Management System for very little additional cost. It is capable of controlling lighting, HVAC, schedules, space temperatures, keycard access, total building energy usage, and more.

*Monitor your HVAC systems from anywhere through the ^{e}**IQ** Energy Intelligence Platform*

Preventative Maintenance Cost Avoidance – The CATALYST is able to monitor filter performance and operating conditions of the equipment. Preventative maintenance programs are often based on the assumption that air filters need to be replaced quarterly. By actual monitoring of the filter performance it may be possible to schedule filter changes and PM visits on an "as-needed" basis, resulting in reduced overall maintenance costs.

Warranty – The CATALYST hardware is warranted for 5 years to provide confidence that the technology will provide long-lasting savings and performance.

The ^{e}**IQ** Platform is a subscription-based service. The cost of the subscription is easily offset by the avoided energy costs, which result from the advanced diagnostics and fault detection.

Cost Effectiveness & Implementation

As capital budgets continue to shrink and operating costs continue to rise, it is important that the economics of the CATALYST opportunity make sense and are attractive to all involved. In a typical application, the CATALYST will reduce HVAC energy consumption by 25-40%. When the CATALYST includes the eIQ Platform, the operational savings achieved during the initial installation can be maintained for the life of the equipment. This avoided electrical expense is sometimes as much as 10% of the annual utility cost. The CATALYST will also reduce the demand at each site, which can lower the overall utility expense by another 2-3%.

A system equipped with the CATALYST technology can demonstrate its proper operation in a manner of minutes. This makes verification of the measure simple. As long as the technology remains in place, and in working order, the energy savings will be reliable and consistent. When coupled with the eIQ Platform, we are able to guarantee the savings for the life of the product.

The installation of the CATALYST technology provides an opportunity to identify and address operational and service related deficiencies. Under no circumstances will the technology be applied in systems that are not properly repaired or controlled.

COST DISCUSSION

We have several strategies for the implementation and funding of a CATALYST upgrade. On a capital purchase program our target is to meet a total installed cost to the client that produces a 2-3 year payback, after utility rebates. This is considered to be very attractive by most clients. Utility funding will vary from market to market. We are working with a number of utilities to obtain a general funding commitment that we can count on. A specific equipment list for a proposed site allows us to develop a preliminary installation cost and savings estimate for presentation to the local utility. This will allow them to respond with a firm funding commitment and allow us to produce a final Payback/ROI Analysis for the client.

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With SnackMiser, your current snack venders can achieve maximum energy savings resulting in a reduction in both operating costs and greenhouse gas emissions. Compatible with non-refrigerated snack vending machines, SnackMiser incorporates innovative, energy-saving technology into a small, plug-and-play unit that installs in minutes.

A Practical approach to power

SnackMiser uses a Passive Infrared Sensor (PIR) to determine if there is anyone within 25 feet of the machine. It waits for 15 minutes of vacancy, then powers down the machine. If a customer approaches the machine while powered down, SnackMiser will sense the presence and power up immediately. In addition to reducing energy costs, this practical power play lengthens the expected lifetime of your machine and reduces its exposure to power line spikes.

On average, SnackMiser reduces energy consumption annually per machine by $50 and CO2 emissions by 470 lbs. and 770 grams of NOx, based on occupancy and the Energy Information Administration's national average of greenhouse gas emissions and electricity generation.

This Miser runs the bank

For a bank of machines, SnackMiser can use its embedded Sensor Repeater, which allows it to be controlled from the PIR sensor of any other Miser in the bank. SnackMiser can stand alone or be an ideal partner for VendingMiser®.

SnackMiser offers...

- A quick, inexpensive solution to energy savings and conservation
- Longer machine lifespan
- Environmental benefits
- Early return on investment

SnackMiser Technical Specifications
Electrical Specifications
Input Voltage: 115 Volts
Input Frequency: 50/60 Hz
Maximum Load: 1050 Watts (Steady-State)
Power Consumption: Less than 1 Watt (Standby)

Environmental Specifications
Operating Temp: 0°C to 50°C
Storage Temp: -20°C to 60°C
Relative Humidity: 95% Maximum (Non-Condensing)

Compatibility
Snack Vending Machines: Any type, as long as SnackMiser's maximum power rating is not exceeded

Inactivity Timeouts
Occupancy Timeout: 15 minutes

Dimensions
Size: 4.5"W x 1.75"H x 3.25"D
Weight: 2 lbs. (includes power cable)

Regulatory Approvals
Safety: UL/C-UL Listed
Information Technology Equipment (ITE) 9T79

Other energy-saving products offered by USA Technologies include VendingMiser®, VM2IQ™, CoolerMiser™ and PlugMiser™.

GSA Schedule
Contract GS-35F-0031R

ENERGY STAR PARTNER

USA TECHNOLOGIES

Frequently Asked Questions

How Does SnackMiser™ Work?

SnackMiser™ uses a PIR sensor to determine if there is anyone within 25 feet of the machine. SnackMiser™ waits for 15 minutes of vacancy and then powers off the snack machine. If a customer approaches the snack machine while powered down, SnackMiser™ will sense the person's presence and power up immediately.

Will SnackMiser™ affect the lifetime of the lights in my machine?

The replacement frequency of the fluorescent lamps will be reduced. While it is true that power cycling fluorescent lamps will shorten their life, the hours that the machine is powered down greatly exceeds this reduction in burn hours. The net effect is that the lamps will need replacement less often.

Are there any locations not appropriate for SnackMiser™?

A machine in a location that is occupied 24-hours, 7 days a week will likely generate little savings.

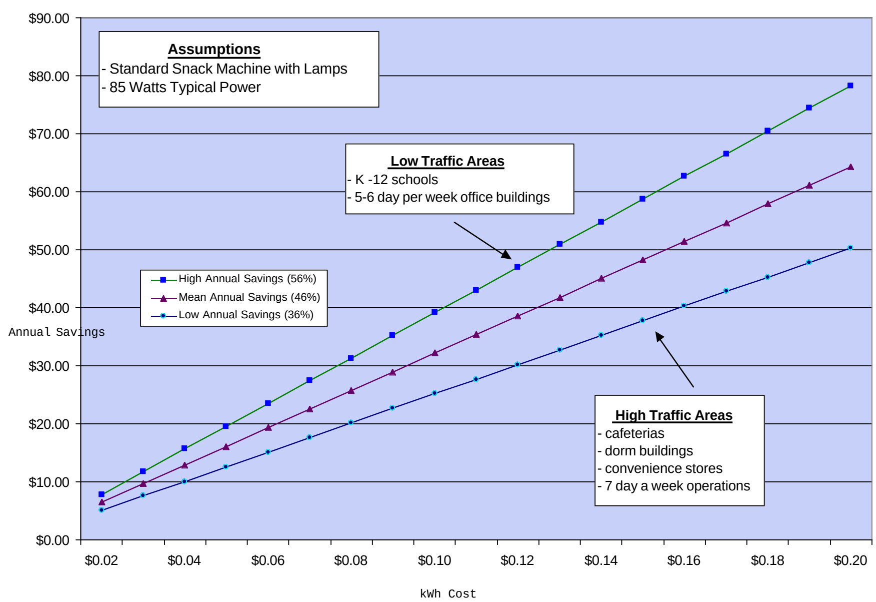
Is the SnackMiser™ easy to install?

Yes. The SnackMiser™ can be installed on the wall with the supplied bracket holder or it can be attached to the snack machine using the new Easy-Install system. Because many SnackMisers™ are installed with a VendingMiser®, sensor installation might not even be needed.

Technical Specifications

ELECTRICAL SPECIFICATIONS	
Input Voltage:	115 Volts (230 Volts available)
Input Frequency:	50/60 Hz
Maximum Load:	1050 Watts (Steady-State)
Power Consumption:	Less than 1 Watt (Standby)
ENVIRONMENTAL SPECIFICATIONS	
Operating Temp:	0°C to 50°C
Storage Temp:	-20°C to 60°C
Relative Humidity:	80% Maximum (Non-Condensing)
COMPATIBILITY	
Snack Machines:	Any type, as long as SnackMiser's maximum power rating is not exceeded
INACTIVITY TIMEOUTS	
Timeout Period:	15 minutes
DIMENSIONS	
Size:	4.5"W x 1.75"H x 3.25"D
Weight:	2 lb. (incl. power cable)
REGULATORY APPROVALS	
Safety:	UL/C-UL Listed Information Technology Equipment (ITE) 9T79

Typical Saving Generated with SnackMiser™



SnackMiser™ Products

SM150	SnackMiser with PIR Sensor
SM151	SnackMiser only
SM170	Easy-Install SnackMiser with PIR Sensor
SM171	Easy-Install SnackMiser only

For more information about SnackMiser by USA Technologies
888.521.6982 • www.usatech.com

VendingMiser®

ENERGY MANAGEMENT SYSTEM
For Refrigerated Vending Machines

Improve the profitability of your existing cold drink machines. Vending Miser® puts you on a cost-effective refresher course for energy savings and conservation.

VendingMiser cuts energy costs down to size

VendingMiser incorporates its innovative energy-saving technology into a small, plug-and-play powerhouse that installs in minutes either on the wall or on the vending machine. It's that easy.

With VendingMiser there's no need to have new machines to achieve maximum energy savings resulting in a reduction in operating costs and greenhouse gas emissions. When equipped with the VendingMiser, refrigerated beverage vending machines use less energy and are comparable in daily energy performance to new ENERGY STAR® qualified machines.

Power play

Compatible with all types of cold drink vending machines, the VendingMiser uses a Passive Infrared Sensor (PIR) to power down the machine when the area surrounding it is vacant. Then it monitors the room's temperature and automatically re-powers the cooling system at one- to three-hour intervals, independent of sales, to ensure that the product stays cold.

This Miser runs the bank

For a series of up to four machines, VendingMiser can use its embedded Sensor Repeater, which allows it to be controlled from the PIR sensor of any other Miser in the bank.

Refresher course

VendingMiser's microcontroller will never power down the machine while the compressor is running, eliminating compressor short-cycling. In addition, when the machine is powered up, the cooling cycle is allowed to finish before again powering down. This reduces the wear and tear on your machines, extending the lifespan and prolonging your profitability. Maintenance savings is generated through reduced running time of vendor components – estimated at $40 - $80 per year, per machine. The VendingMiser has been tested and accepted for use by major bottlers.

VendingMiser reduces energy consumption an average of 46%—typically $150 per machine.

Vending Miser offers...

- A quick, inexpensive solution to energy savings and conservation
- Longer machine lifespan
- Early return on investment
- Environmental benefits

VendingMiser can also control other cooled product vending machines, such as refrigerated candy machines.

VendingMiser Technical Specifications
Electrical Specifications
Input Voltage: 115 Volts
Input Frequency: 50/60 Hz
Maximum Load: 12 Amps (Steady-State)
Power Consumption: Less than 1 Watt (Standby)

Environmental Specifications
Operating Temp: -15°C to 75°C
Storage Temp: -40°C to 85°C
Relative Humidity: 95% Maximum (Non-Condensing)

Compatibility
Vending Machines: Any machine, except those containing perishable goods such as dairy products

Inactivity Timeouts
Occupancy Timeout: 15 minutes
Auto Re-power: One to three hours, dynamically adjusted, based on ambient temperature

Dimensions
Size: 4.5"W x 1.75"H x 3.25"D
Weight: 2.2 lbs. (includes power cable)

Regulatory Approvals
Safety: UL/C-UL Listed
Information Technology Equipment (ITE) 9T79

Other energy-saving products offered by USA Technologies include VM2IQ™, CoolerMiser™, SnackMiser™ and PlugMiser™.

GSA Schedule
Contract GS-35F-0031R

ENERGY STAR PARTNER

USA TECHNOLOGIES

Frequently Asked Questions

Will VendingMiser® keep my drinks cold?
Absolutely - VendingMiser® has been tested and accepted for use by both major bottlers.

Is the VendingMiser® easy to install?
Yes! VendingMiser® is a simple external plug-and-play product. The VendingMiser® can be installed on the wall with simple hand tools or it can be attached to the vending machine without tools using the new Easy-Install system. The Easy-Install System allows quick installation in 5 minutes.

Is VendingMiser® safe for all machines?
Yes! VendingMiser® is compatible with all types of cold drink vending machines. In fact, by reducing run time of the machines, VendingMiser® reduces maintenance costs.

Has VendingMiser® been field tested?
Tens of thousands of VendingMisers® are operational in the field. Typical energy savings have been independently documented to be between 35% and 45%. Measurement and verification test results as well as testimonials are available on the website.

Are there any locations not appropriate for VendingMiser®?
VendingMiser's® savings are generated as a result of location vacancy. Therefore, a machine in a location that is occupied 24-hours, 7 days a week will likely generate little savings. Our VM2IQ is more appropriate for this type of location and will typically save up to 35% energy use.

Technical Specifications

ELECTRICAL SPECIFICATIONS

Input Voltage:	115 Volts (230 Volts available)
Input Frequency:	50/60 Hz
Maximum Load:	12 Amps (Steady-State)
Power Consumption:	Less than 1 Watt (Standby)

ENVIRONMENTAL SPECIFICATIONS

Operating Temp:	-15°C to 75°C
Storage Temp:	-40°C to 85°C
Relative Humidity:	95% Maximum (Non-Condensing)

COMPATIBILITY

Vending Machines:	Any machine, except those containing perishable goods such as dairy products.

INACTIVITY TIMEOUTS

Occupancy Timeout:	15 minutes
Auto Repower:	One to three hours, dynamically adjusted, based on ambient temperature

DIMENSIONS

Size:	4.5"W x 1.75"H x 3.25"D
Weight:	2.2 lb. (incl. power cable)

REGULATORY APPROVALS

Safety:	UL/C-UL Listed Information Technology Equipment (ITE) 9T79

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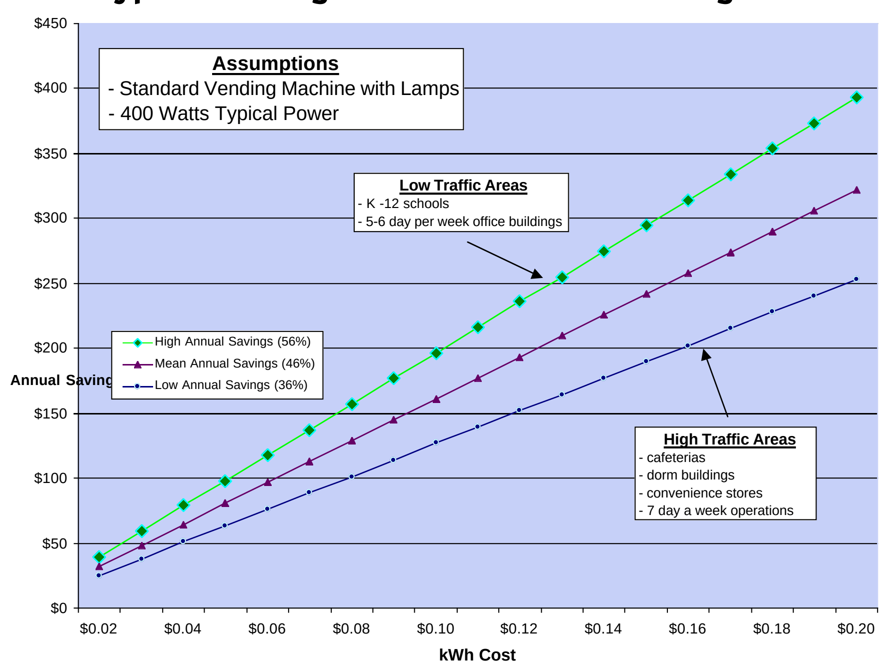
Typical Saving Generated with VendingMiser®



VendingMiser® Products

VM150	VendingMiser® with PIR Sensor
VM151	VendingMiser® only
VM160	Weatherproof VendingMiser® with PIR Sensor
VM161	Weatherproof VendingMiser® only
VM170	Easy-Install VendingMiser® with PIR Sensor
VM171	Easy-Install VendingMiser® only
VM180	Weatherproof Easy-Install VendingMiser w/PIR sensor
VM181	Weatherproof Easy-Install VendingMiser only

APPENDIX C – ECM PRIORITIZATION REPORT – ECONOMIC ANALYSES

Coeur d'Alene Tribe
Energy Conservation Measure
Economic Analysis Summary

Facility	Measure	Number of Units	Estimated Unit Cost	Estimated Incremental Cost	Potential Rebate ($)	Net Incremental Cost ($)	Annual Energy Savings (kWh)	Annual Energy Savings (propane Btu)	Annual Energy Savings (kBtu)	Estimated Energy Savings (%)	Annual Energy Savings ($)	Simple Payback (years)	NPV	IRR
Tribal Facilities	Program thermostats to reflect actual occupancy and energy efficient setpoints	3	$50	$150		$150	3075		10,495	4.6%	$246	0.61	$3,756	166.6%
	Install Bay-Door Interlocks, Change Thermostats - Shop	2	$750	$1,500		$1,500	7688		26,237	11.4%	$615	2.44	$8,297	42.3%
	New bay door weather seals	2	$300	$600		$600	7688		26,237	11.4%	$616	0.97	$9,187	104.6%
	Install Occupancy Sensors in Office Area	1	$120	$120		$120	513		1,749	0.8%	$41	2.93	$533	35.3%
	Install Occupancy Sensors in Shop Area	1	$120	$120		$120	313		1,067	0.5%	$25	4.81	$279	21.4%
	Pipe insulation	1	$150	$150		$150	1170		3,993	1.7%	$94	1.60	$1,339	64.0%
	Totals			$2,640		$2,640	***20445***		69,779	***30.3%***	***$ 1,637***	1.61	$23,391	63.6%
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Facility	Measure	Number of Units	Unit Cost	Incremental Cost	Rebate ($)	Net Incremental Cost ($)	Annual Energy Savings (kWh)	Annual Energy Savings (propane Btu)	Annual Energy Savings (kBtu)	Estimated Energy Savings (%)	Annual Energy Savings ($)	Simple Payback (years)	NPV	IRR
Tribal Headquarters	Install mini-split heat pumps in all basement offices and program thermostats to actual occupancy and energy efficient set points	12	$2,600	$31,200		$31,200	20745		70,803	*22.0%*	1452.15	21.49	-$7,261	0.3%
	Replace existing DX AC electric furnaces with heat pumps and program thermostats to actual occupancy and energy efficient set points	7	$3,800	$26,600		$26,600	37562		128,199	*39.9%*	2629.34	10.12	$15,874	8.6%
	Install pipe insulation	4	$150	$600		$600	4680		15,973	*5.0%*	$375	1.60	$5,365	64.1%
	Totals		***$6,550***	$58,400		$58,400	***62987***		214,975	***66.9%***	***$4,457***	13.10	$13,978	5.4%
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Facility	Measure	Number of Units	Unit Cost	Incremental Cost	Rebate ($)	Net Incremental Cost ($)	Annual Energy Savings (kWh)	Annual Energy Savings (propane Btu)	Annual Energy Savings (kBtu)	Estimated Energy Savings (%)	Annual Energy Savings ($)	Simple Payback (years)	NPV	IRR
Career Renewal & Child Services	Program thermostats to reflect actual occupancy and energy efficient setpoints	2	$50	$100		$100	5400		18,430	14.7%	$432	0.23	$6,754	437.2%
	Upgrade 4', 4-Lamp, T12 Lighting to 4-Lamp, HP T8 Lighting (32W) and HP Electronic Ballast	20	$139	$2,778	$1,000	$1,778	4233		14,447	11.5%	$339	5.25	$3,644	19.5%
	Replace Weatherstripping on Exterior Doors	4	$13	$50		$50	313		1,067	0.8%	$25	2.00	$348	51.4%
	Pipe insulation	1	$150	$150		$150	1170		3,993	3.2%	$94	1.60	$1,339	64.0%
	Totals			$3,078	***$1,000***	$2,078	***11116***		37,937	***30.2%***	***$796***	2.61	$10,600	39.6%
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Social Services	Program thermostats to reflect actual occupancy and energy efficient set points	1	$50	$50		$50	14162.5		48,337	19.3%	$1,133	0.04	$17,920	2289.0%
	Upgrade 4', 2-Lamp, T12 Lighting to 2-Lamp, HP T8 Lighting (32W) and HP Electronic Ballast	29	$132	$3,822	$1,450	$2,372	2960		10,102	4.0%	$237	10.02	$1,453	8.8%
	Replace Outdoor 60W Incandescents with 23W CFL	8	$4	$32	$24	$8	1049		3,580	1.4%	$84	0.10	$1,323	1060.1%
	Pipe insulation	1	$150	$150		$150	1170		3,993	1.6%	$94	1.60	$1,339	64.0%
	Totals		***$185***	$4,054	***$1,474***	$2,580	***18172***		62,019	24.8%	***$1,454***	1.77	$20,550	57.9%
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Coeur d'Alene Tribe
Energy Conservation Measure
Economic Analysis Summary

Facility	Measure	Number of Units	Unit Cost	Incremental Cost	Rebate ($)	Net Incremental Cost ($)	Annual Energy Savings (kWh)	Annual Energy Savings (propane Btu)	Annual Energy Savings (kBtu)	Estimated Energy Savings (%)	Annual Energy Savings ($)	Simple Payback (years)	NPV	IRR
Veteran's Center	Relocate and program thermostat to reflect actual occupancy and energy efficient set points	1	$50	$50		$50	11200		38,226	19.4%	$896	0.06	$14,161	1810.4%
	Weatherstrip Exterior Doors and Seal Windows	6	$13	$75		$75	862.5		2,944	1.5%	$69	1.09	$1,021	93.9%
	Replace Outdoor 60W Incandescents with 13W CFL	4	$4	$16	$12	$4	524		1,788	0.9%	$9	0.44	$139	228.2%
	Pipe insulation	1	$150	$150		$150	1170		3,993	2.0%	$94	1.60	$1,339	64.0%
	Totals			$291	***$12***	$279	***13756.5***		46,951	23.8%	***$974***	0.29	$15,176	353.5%
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Facility	Measure	Number of Units	Unit Cost	Incremental Cost	Rebate ($)	Net Incremental Cost ($)	Annual Energy Savings (kWh)	Annual Energy Savings (propane Btu)	Annual Energy Savings (kBtu)	Estimated Energy Savings (%)	Annual Energy Savings ($)	Simple Payback (years)	NPV	IRR
BIA	Change thermostats to reflect actual occupancy	2	$50	$100		$100	639		2,182	8.7%	$77	1.30	$1,119	78.4%
	Upgrade 4', 2-Lamp, T12 Lighting to 2-Lamp, HP T8 Lighting (32W) and HP Electronic Ballast	12	$132	$1,581	$600	$981	283		966	3.9%	$34	28.90	-$414	-2.3%
	Upgrade 60W Incandescent to 13W CFL in restrooms	4	$4	$16	$12	$4	32		109	0.4%	$4	1.04	$57	97.9%
	Pipe insulation	1	$150	$150		$150	1170		3,993	15.9%	$94	1.60	$1,339	64.0%
	Totals			$1,847	***$612***	$1,235	***2124***		7,250	28.9%	***$115***	10.79	$617	7.8%
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Facility	Measure	Number of Units	Unit Cost	Incremental Cost	Rebate ($)	Net Incremental Cost ($)	Annual Energy Savings (kWh)	Annual Energy Savings (propane Btu)	Annual Energy Savings (kBtu)	Estimated Energy Savings (%)	Annual Energy Savings ($)	Simple Payback (years)	NPV	IRR
Department of Education	Program thermostats to reflect actual occupancy and energy efficient setpoints	2	$50	$100		$100	13533		46,189	14.3%	$974	0.10	$15,356	984.8%
	Weatherstrip exterior doors, seal windows	15	$13	$195		$195	950		3,242	1.0%	$68	2.85	$895	36.3%
	Upgrade 4', 2-Lamp, T12 lighting to 2-lamp, HP T8 lighting (32W) and HP electronic ballast	43	$132	$5,667	$2,150	$3,517	4390		14,983	4.7%	$278	12.63	$1,000	5.9%
	Replace 60W Incandescent with 13W CFL	1	$4	$4	$3	$1	185		632	0.2%	$11	0.09	$175	1122.9%
	Pipe insulation	1	$150	$150		$150	1170		3,993	1.2%	$94	1.60	$1,339	64.0%
	Totals			$6,116	***$2,153***	$3,963	***20229***		69,040	21.4%	***$1,332***	2.97	$17,281	34.8%
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Facility	Measure	Number of Units	Unit Cost	Incremental Cost	Rebate ($)	Net Incremental Cost ($)	Annual Energy Savings (kWh)	Annual Energy Savings (propane Btu)	Annual Energy Savings (kBtu)	Estimated Energy Savings (%)	Annual Energy Savings ($)	Simple Payback (years)	NPV	IRR
Finance Department	Change thermostats to reflect actual occupancy	3	$50	$150		$150	8422		28,745	18.5%	$758	0.20	$11,876	511.2%
	Replace weatherstripping on exterior doors	4	$13.00	$52		$52	1011		3,451	2.2%	$91	0.57	$1,393	177.7%
	Complete maintenance on heat pumps	4	$125.00	$500		$500	789		2,692	1.7%	$71	7.04	$641	14.1%
	Upgrade 4', 2-Lamp, T12 lighting to 2-Lamp, HP T8 lighting (32W) and HP electronic ballast	19	$132	$2,504	$950	$1,554	1940		6,621	4.3%	$173	9.00	$1,230	10.3%
	Upgrade 60W incandescents to 13W CFLs in restrooms	2	$4.00	$8	$6	$2	35		119	0.1%	$3	0.64	$47	158.2%
	Discontinue use of coffee burner, switch to carafe style	1	$65.00	$65		$65	1456		4,968	3.2%	$131	0.50	$2,014	204.5%
	Pipe insulation	1	$150	$150		$150	1170		3,993	2.6%	$94	1.60	$1,339	64.0%
	Totals			$3,429	***$956***	$2,473	***14823***		50,590	32.6%	***$1,227***	2.02	$17,055	51.0%
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Coeur d'Alene Tribe
Energy Conservation Measure
Economic Analysis Summary

Facility	Measure	Number of Units	Unit Cost	Incremental Cost	Rebate ($)	Net Incremental Cost ($)	Annual Energy Savings (kWh)	Annual Energy Savings (propane Btu)	Annual Energy Savings (kBtu)	Estimated Energy Savings (%)	Annual Energy Savings ($)	Simple Payback (years)	NPV	IRR
Food Distribution Warehouse	Install programmable thermostats and program to reflect actual occupancy and energy efficient set points	2	$65.00	$130		$130	9338		31,869	7.9%	$747	0.17	$11,721	581.2%
	Air seal and insulate walls and ceiling	9472	$2.00	$18,944		$18,944	24200		82,595	20.5%	$1,936	9.79	$12,311	9.1%
	Replace electric furnaces with air source heat pumps	2	$5,705.00	$11,410		$11,410	35350		120,650	30.0%	$2,828	4.03	$33,772	25.7%
	Replace shaded pole motors with ECMs in walk-in coolers	8	$170.00	$1,360	1120	$240	9543		32,570	8.1%	$763	0.31	$11,874	322.2%
	Upgrade warehouse lighting From 8', T12 to High Bay T5 w/program start ballast	6	$222.48	$1,335	$300	$1,035	895		3,055	0.8%	$73	14.10	$159	4.6%
	Upgrade office 4', 2-Lamp, T12 Lighting to 2-Lamp, HP T8 Lighting (32W) and HP Electronic Ballast	6	$132	$791	$300	$491	443		1,512	0.4%	$35	13.85	$86	4.8%
	Upgrade exterior mercury vapor lighting to new LED fixture (70W)	1	$453.06	$453		$453	1513		5,162	1.3%	$121	3.74	$1,479	27.7%
	Pipe insulation	1	$150	$150		$150	1170		3,993	1.0%	$94	1.60	$1,339	64.0%
	Totals			$34,573	***$1,720***	$32,853	***82451***		281,405	70.0%	***$6,504***	5.05	$71,256	20.4%
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Facility	Measure	Number of Units	Unit Cost	Incremental Cost	Rebate ($)	Net Incremental Cost ($)	Annual Energy Savings (kWh)	Annual Energy Savings (propane Btu)	Annual Energy Savings (kBtu)	Estimated Energy Savings (%)	Annual Energy Savings ($)	Simple Payback (years)	NPV	IRR
Early Childhood Learning Center	Change thermostats to reflect actual occupancy - Phase I	6	$50	$300		$300	23857		81,424	7.1%	$1,670	0.18	$26,193	563.0%
	Change thermostats to reflect actual occupancy - Phase II	6	$50	$300		$300	21600		73,721	6.5%	$1,512	0.20	$23,688	509.9%
	Install timer on domestic water heater pump	1	$175.00	$175		$175	2114		7,215	0.6%	$148	1.18	$2,177	86.4%
	Replace upright freezer with Energy Star equivalent	1	$850.00	$850		$850	1714		5,851	0.5%	$120	7.08	$1,078	14.0%
	Replace Phase I heating and cooling systems	6	$4,500.00	$27,000		$27,000	25585		87,322	7.7%	$1,791	15.08	$2,189	3.9%
	Retrofitting fluorescent lighting with incandescent lighting in classrooms	50	$50.00	$2,500		$2,500	(23,657)		(80,741)	-7.1%	-$1,656	N/A	-$28,690	NA
	Pipe insulation	2	$150	$300		$300	2340		7,986	0.7%	$187	1.60	$2,678	64.0%
	Totals			$31,425		$31,425	***77210***		263,519	23.1%	***$3,450***	9.11	$24,204	10.1%
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Facility	Measure	Number of Units	Unit Cost	Incremental Cost	Rebate ($)	Net Incremental Cost ($)	Annual Energy Savings (kWh)	Annual Energy Savings (propane Btu)	Annual Energy Savings (kBtu)	Estimated Energy Savings (%)	Annual Energy Savings ($)	Simple Payback (years)	NPV	IRR
Rose Creek Longhouse	Replace Weatherstripping on Exterior Doors	4	$13.00	$52		$52	1304		4,451	1.6%	$104	0.50	$1,604	203.5%
	Upgrade 60W wall sconces to 13W CFL	20	$4	$80	60	$20	554		1,891	0.3%	$44	0.45	$683	224.7%
	Turn off gas to commercial oven when not needed	10	$35	$350		$350		60,000,000	60,000	8.5%	$1,508	0.23	$23,579	436.1%
	Reprogram thermostats to reflect actual occupancy	2	$50	$100		$100	22075		75,342	10.7%	$2,649	0.04	$41,914	2675.7%
	Turn off reach-in refrigerator and ice maker when not needed	2	$35	$70		$70	2617		8,931	1.3%	$314	0.22	$4,912	453.9%
	Pipe insulation	1	$150	$150		$150	1170		3,993	0.6%	$94	1.60	$1,339	64.0%
	Totals		***$39***	$802		$802	***26416***		150,157	21.3%	***$1,553***	0.52	$23,843	196.4%
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Coeur d'Alene Tribe
Energy Conservation Measure
Economic Analysis Summary

Facility	Measure	Number of Units	Unit Cost	Incremental Cost	Rebate ($)	Net Incremental Cost ($)	Annual Energy Savings (kWh)	Annual Energy Savings (propane Btu)	Annual Energy Savings (kBtu)	Estimated Energy Savings (%)	Annual Energy Savings ($)	Simple Payback (years)	NPV	IRR
DeSmet Longhouse	Program thermostats to reflect actual occupancy	2	$50	$100		$100	22075		75,342	15.8%	$2,649	0.04	$41,914	2675.7%
	Service call to repair damaged fins on 20-ton heat pump	1	$750.00	$750		$750	3633		12,401	2.6%	$436.00	1.72	$6,186	59.7%
	Turn off reach-in refrigerator and ice maker when not needed	12	35	$420		$420	2617		8,931	1.9%	$314.00	1.34	$4,572	76.5%
	Turn off propane to commercial oven when not needed	12	35	$420		$420		72,000,000	72,000	15.1%	$1,810	0.23	$28,295	436.1%
	Pipe insulation	1	$150	$150		$150	1170		3,993	0.8%	$140	1.07	$2,081	95.5%
	Totals			$1,840		$1,840	***29495***		100,666	21.1%	***$5,209***	0.35	$80,821	286.8%
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Facility	Measure	Number of Units	Unit Cost	Incremental Cost	Rebate ($)	Net Incremental Cost ($)	Annual Energy Savings (kWh)	Annual Energy Savings (propane Btu)	Annual Energy Savings (kBtu)	Estimated Energy Savings (%)	Annual Energy Savings ($)	Simple Payback (years)	NPV	IRR
Old Roads Maintenance Shop	Upgrade 4', 2-Lamp, 8', T12 Lighting to 4', 2-Lamp, HP T8 Lighting and HP Electronic Ballast	6	$75.00	$450	$120	$330	911		3,109	2.8%	$81	4.07	$965	25.5%
	Upgrade exterior 250W metal halide Fixture to LED Fixture (90W)	1	$425.00	$425	$50	$375	517		1,765	1.6%	$46	8.15	$366	11.7%
	Pipe insulation	1	$150	$150		$150	1170		3,993	3.6%	$94	1.60	$1,339	64.0%
	Totals			$1,025	***$170***	$855	***2598***		8,867	7.9%	***$127***	6.73	$1,185	14.8%
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New Roads Maintenance Shop	Replace 100W incandescent exterior lighting with 23W CFL	4	$4.00	$16	$12	$4	1256.0		4,287	Unknown	$112	0.04	$1,769	2822.7%
	Replace 100 W incandescent flood lamps with 23W CFL equivalent and repair photocell controls	8	$4.00	$32	$24	$8	2512		8,573	Unknown	$224	0.04	$3,538	2822.7%
	Install Bay-Door Interlocks	1	$750.00	$750		$750		18,116,204	18,116	Unknown	$455	1.65	$6,494	62.3%
	Pipe insulation	1	$150	$150		$150	1170		3,993	1.7%	$94	1.60	$1,339	64.0%
	Totals			$948	***$36***	$912	***4938.0***		16,853		***$791***	1.15	$11,655	88.5%
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Facility	Measure	Number of Units	Unit Cost	Incremental Cost	Rebate ($)	Net Incremental Cost ($)	Annual Energy Savings (kWh)	Annual Energy Savings (propane Btu)	Annual Energy Savings (kBtu)	Estimated Energy Savings (%)	Annual Energy Savings ($)	Simple Payback (years)	NPV	IRR
Fire Warehouse and Shop	New bay door weather seals	2	$300	$600		$600	3320		11,331	4.9%	$266	2.26	$3,630	45.6%
	Weatherstrip Exterior Doors, Seal Windows	12	$13	$156		$156	950		3,242	1.0%	$76	2.05	$1,054	50.1%
	Upgrade Office to Mini-Split Heat Pumps	2	$2,600	$5,200		$5,200	7241		24,714	7.7%	$579	8.98	$4,138	10.3%
	Install programmable thermostats and set as recommended	4	$75	$300		$300	12090		41,263	12.8%	$967	0.31	$15,048	326.5%
	Upgrade T12 Lighting in Shop and high-bay Garage to high- bay T5 Lighting	16	$135.00	$2,160	$800	$1,360	3785		12,918	4.0%	$303	4.49	$3,482	23.0%
	Upgrade 4', 2-Lamp, 8', T12 Lighting to 4', 2-Lamp, HP T8 Lighting and HP Electronic Ballast	20	$75	$1,500	$1,000	$500	4125		14,079	4.4%	$330	1.52	$4,748	67.6%
	Pipe insulation	1	$150	$150		$150	1170		3,993	1.7%	$94	1.60	$1,339	64.0%
	Eliminate redundant refrigeration capacity	3	$0	$0	$0	$0	1243		4,242	1.8%	$99	0.00	$1,577	NA
	Replace main existing refrigerator with Energy Star equivalent	1	$1,200	$1,200	$300	$900	300		1,024	0.4%	$24	37.50	-$493	-4.4%
	Totals			$11,266	$2,100	$9,166	34224		116,807	38.8%	$2,738	3.35	$34,522	31.0%
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Department of Natural Resources	Pipe insulation	1	$150	$150		$150	1170		3,993	Unknown	$94	1.60	$1,339	64.0%
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Coeur d'Alene Tribe
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Facility	Measure	Number of Units	Unit Cost	Incremental Cost	Rebate ($)	Net Incremental Cost ($)	Annual Energy Savings (kWh)	Annual Energy Savings (propane Btu)	Annual Energy Savings (kBtu)	Estimated Energy Savings (%)	Annual Energy Savings ($)	Simple Payback (years)	NPV	IRR
Felix Aripa Building	Program thermostats to reflect actual occupancy and energy efficient set points	6	$50.00	$300		$300	13075		44,625	11.3%	$1,046	0.29	$16,297	353.0%
	Insulate exterior refrigerant lines on heat pumps	5	$25.00	$125		$125	1325		4,522	1.1%	$106	1.18	$1,560	86.6%
	Complete duct testing and sealing	1	$500.00	$500		$500	3350		11,434	2.9%	$268	1.87	$3,765	55.1%
	Install insulated blinds on north facing windows in reception	1	$1,400.00	$1,400		$1,400	813		2,773	0.7%	$65	21.54	-$328	0.3%
	Pipe insulation	1	$150	$150		$150	1170		3,993	1.0%	$94	1.60	$1,339	64.0%
	Totals			$2,475		$2,475	***19733***		67,347	17.1%	***$1,485***	1.67	$21,148	61.5%
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Facility	Measure	Number of Units	Unit Cost	Incremental Cost	Rebate ($)	Net Incremental Cost ($)	Annual Energy Savings (kWh)	Annual Energy Savings (propane Btu)	Annual Energy Savings (kBtu)	Estimated Energy Savings (%)	Annual Energy Savings ($)	Simple Payback (years)	NPV	IRR
Tribal Police Headquarters	Replace weatherstripping on exterior doors	2	$13.00	$26		$26	575		1,962	0.7%	$46	0.57	$704	179.6%
	Replace 2 existing AC units with heat pumps, relocate to ground level	2	$2,500.00	$5,000		$5,000		40,747,807	40,748	17.9%	$1,024	4.88	$11,390	21.1%
	Remove existing rooftop packaged unit (excess capacity)	1	$500.00	$500		$500	(inclusive)					#DIV/0!	-$485	NA
	Complete duct testing and sealing	1	$1,000.00	$1,000		$1,000	(inclusive)					#DIV/0!	-$971	NA
	Add ductless air conditioner in server room	1	$2,500.00	$2,500		$2,500	(inclusive)					#DIV/0!	-$2,427	NA
	Replumb exterior hose bib so that it provide cold water. Address leaks in exterior hose bib.	1	$200.00	$200		$200	5475		18,686	8.2%	$273.75	0.73	$4,147	139.2%
	Pipe insulation	1	$150	$150		$150	1170		3,993	1.7%	$94	1.60	$1,339	64.0%
	Totals		***$ 6,700***	$9,376		$9,376	***6645***	***40,747,807***	63,427	***26.2%***	***1298.011815***	7.22	$11,482	13.6%
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Facility	Measure	Number of Units	Unit Cost	Incremental Cost	Rebate ($)	Net Incremental Cost ($)	Annual Energy Savings (kWh)	Annual Energy Savings (propane	Annual Energy Savings (kBtu)	Estimated Energy Savings (%)	Annual Energy Savings ($)	Simple Payback (years)	NPV	IRR
Youth Shelter	Install new separate split system heat pump for upstairs zone; install programmable thermostats	1	$5,705	$5,705		$5,705	-4197		(14,323)	-12.8%	-$357	-15.99	-$11,196	NA
	Replace existing DX AC unit with heat pump sized for ground floor only; install programmable thermostats	1	$2,500	$2,500		$2,500	-4197		(14,323)	-12.8%	-$357	-7.01	-$8,084	NA
	Replace failing metal-framed windows with dual pane vinyl units	15	$300	$4,500		$4,500	814		2,778	2.5%	$69	65.04	-$3,272	-8.4%
	Pipe insulation	1	$150	$150		$150	1170		3,993	3.6%	$94	1.60	$1,339	64.0%
	Totals		***$8,505***	$12,855		$12,855	***-6409***		(21,874)	-19.5%	***-$713***	-18.02	-$23,795	NA
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Facility	Measure	Number of Units	Unit Cost	Incremental Cost	Rebate ($)	Net Incremental Cost ($)	Annual Energy Savings (kWh)	Annual Energy Savings (propane Btu)	Annual Energy Savings (kBtu)	Estimated Energy Savings (%)	Annual Energy Savings ($)	Simple Payback (years)	NPV	IRR
Technology Center	Program thermostats to reflect actual occupancy and energy efficient set points	6	$50.00	$300		$300	16488		56,272	3.4%	$1,319	0.23	$20,627	444.9%
	Replace weatherstripping on exterior doors	4	$25.00	$100		$100	813		2,773	0.2%	$65	1.54	$934	66.6%
	Replace exterior metal halides with LED equivalent (90W)	4	$453.06	$1,812	$200	$1,612	2338		7,978	0.5%	$187	8.62	$1,400	10.9%
	Pipe insulation	1	$150	$150		$150	1170		3,993	0.2%	$94	1.60	$1,339	64.0%
	Totals			$2,362	***$200***	$2,162	***20808***		71,016	4.3%	***$1,571***	1.38	$22,815	74.3%
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Facility	Measure	Number of Units	Unit Cost	Incremental Cost	Rebate ($)	Net Incremental Cost ($)	Annual Energy Savings (kWh)	Annual Energy Savings (propane Btu)	Annual Energy Savings (kBtu)	Estimated Energy Savings (%)	Annual Energy Savings ($)	Simple Payback (years)	NPV	IRR
Tribal Court Services	Change thermostats to reflect actual occupancy	4	$50.00	$200		$200	24167		82,481	20.4%	$1,450	0.14	$22,802	733.0%
	Replace weatherstripping on exterior doors and seal windows	24	$16.00	$384		$384	7333		25,029	6.2%	$440	0.87	$6,605	116.7%
	Upgrade 4', T12 Lighting in Court Room to T8 equivalent	3	$156.00	$468	$150	$318	900		3,072	0.8%	$54	5.89	$548	17.3%
	Upgrade 100W Incandescent to 23W CFL	12	$4.00	$48	$36	$12	2883		9,841	2.4%	$173	0.07	$2,732	1456.6%
	Install Lighting Occupancy Sensors in Offices, Restrooms, Meeting Rooms	13	$79.66	$1,036	$455	$581	2583		8,817	2.2%	$155	3.75	$1,894	27.7%
	Pipe insulation	1	$150	$150		$150	1170		3,993	1.0%	$94	1.60	$1,339	64.0%
	Totals			$2,286	***$641***	$1,645	***39037***		133,232	32.9%	***$2,272***	0.72	$34,435	140.5%
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Facility	Measure	Number of Units	Unit Cost	Incremental Cost	Rebate ($)	Net Incremental Cost ($)	Annual Energy Savings (kWh)	Annual Energy Savings (propane Btu)	Annual Energy Savings (kBtu)	Estimated Energy Savings (%)	Annual Energy Savings ($)	Simple Payback (years)	NPV	IRR
Casino Daycare	Upgrade 4', 2-Lamp, T12 Lighting to 2-Lamp, HP T8 Lighting (32W) and HP Electronic Ballast	22	$131.78	$2,899	$1,100	$1,799	9257		31,594	27.6%	$741	2.43	$9,998	42.5%
	Pipe insulation	1	$150	$150		$150	1170		3,993	3.5%	$94	1.60	$1,339	64.0%
	Totals			$3,049	$1,100	$1,949	10427		35,587	31.1%	***$834***	2.34	$11,337	44.1%
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Facility	Measure	Number of Units	Unit Cost	Incremental Cost	Rebate ($)	Net Incremental Cost ($)	Annual Energy Savings (kWh)	Annual Energy Savings (propane Btu)	Annual Energy Savings (kBtu)	Estimated Energy Savings (%)	Annual Energy Savings ($)	Simple Payback (years)	NPV	IRR
Circling Raven Golf Course Pro Shop	Upgrade 100W recessed Incandescents to 23W CFL equivalent	30	$4	$120	$90	$30	5651		19,287	1.3%	$311	0.10	$4,900	1047.0%
	Upgrade 50W MR16 lighting in showroom to 8W LED equivalent	22	$40	$880	$880	$0	1349		4,604	0.3%	$74	0.00	$1,177	NA
	Upgrade shaded pole motor to ECM	1	$170	$170	$140	$30	1193		4,072	0.3%	$66	0.46	$1,011	221.8%
	Upgrade T12 lighting in reach-in refrigerator to LED	6	$32	$192	$150	$42	924		3,154	0.2%	$51	0.83	$765	123.1%
	Install floating head controls on LT compressor unit	7	$157	$1,099	$420	$679	5229		17,847	1.2%	$288	2.36	$3,902	43.7%
	Install floating head controls on MT compressor unit	15	$207	$3,105	$900	$2,205	7740		26,417	1.8%	$426	5.18	$4,610	19.8%
	Catalyst technology on packaged units (rebate potential $250/ton)*	4	$4,500	$18,000	$4,250	$13,750	48351		165,022	11.0%	$2,659	5.17	$28,825	19.9%
	Pipe insulation	2	$150	$300		$300	2340		7,986	0.5%	$129	2.33	$1,750	44.3%
	Totals			$23,866	***$6,830***	$17,036	***72777***		248,388	16.5%	***$5,671***	3.00	$73,398	34.5%
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Facility	Measure	Number of Units	Unit Cost	Incremental Cost	Rebate ($)	Net Incremental Cost ($)	Annual Energy Savings (kWh)	Annual Energy Savings (propane Btu)	Annual Energy Savings (kBtu)	Estimated Energy Savings (%)	Annual Energy Savings ($)	Simple Payback (years)	NPV	IRR
Golf Course Pavilion	Install 4 mini-split heat pumps to offset resistance heating and provide necessary cooling; install programmable thermostats as part of this upgrade	4	$2,500	$10,000		$10,000	5389		18,393	32.3%	$431	23.20	-$2,872	-0.4%
	Turn off commercial refrigerator when not needed	1	$35	$35		$35	1204		4,109	7.2%	$144.48	0.24	$2,257	417.8%
	Pipe insulation	2	$150	$300		$300	840		2,867	5.0%	$67	4.46	$774	23.2%
	Totals		***$2,500***	$10,335		$10,335	***7433***		25,369	44.6%	***$643***	16.08	$160	3.2%
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Coeur d'Alene Tribe
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Facility	Measure	Number of Units	Unit Cost	Incremental Cost	Rebate ($)	Net Incremental Cost ($)	Annual Energy Savings (kWh)	Annual Energy Savings (propane Btu)	Annual Energy Savings (kBtu)	Estimated Energy Savings (%)	Annual Energy Savings ($)	Simple Payback (years)	NPV	IRR
Casino Conoco Gas Station	Upgrade 150W metal halide wall packs to 40W LED equivalent	4	$453.06	$1,812	$200	$1,612	1213		4,140	0.4%	$85	18.99	-$219	1.5%
	Upgrade 400W metal halide parking lot lighting to 70W LED fixture	4	$1,203.84	$4,815	$920	$3,895	3464		11,823	1.3%	$242	16.06	$64	3.2%
	Install anti-sweat heat controls MT walk-in and reach-in	32.5	$40.00	$1,300	$1,300	$0	11485		39,198	4.2%	$804	0.00	$12,750	NA
	Install anti-sweat heat controls LT walk-in and reach-in	7.5	$40.00	$300	$300	$0	3550		12,116	1.3%	$249	0.00	$3,941	NA
	Upgrade T8 lighting in walk-in and reach-in doors to LED	114	$32.00	$3,648	$2,280	$1,368	12996		44,355	4.7%	$910	1.50	$13,099	68.1%
	Install floating head controls on LT compressor unit	15	$157.00	$2,355	$900	$1,455	11205		38,243	4.1%	$784	1.86	$11,026	55.4%
	Install floating head controls on MT compressor unit	30	$207.00	$6,210	$1,800	$4,410	15480		52,833	5.6%	$1,084	4.07	$12,903	25.5%
	$250/ton)*	2	$4,500	$9,000	$2,625	$6,375	30471		103,999	11.0%	$2,133	2.99	$27,638	34.6%
	Install lighting occupancy sensors in restrooms	2	$80	$159	$70	$89	962		3,283	0.3%	$67	1.33	$981	77.1%
	Totals			$29,600	***$10,395***	$19,205	***90826***		309,991	32.9%	***$6,358***	3.02	$82,184	34.3%
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Facility	Measure	Number of Units	Unit Cost	Incremental Cost	Rebate ($)	Net Incremental Cost ($)	Annual Energy Savings (kWh)	Annual Energy Savings (propane Btu)	Annual Energy Savings (kBtu)	Estimated Energy Savings (%)	Annual Energy Savings ($)	Simple Payback (years)	NPV	IRR
City Link Bus Garage	Replace exterior 175W metal halide wall packs with 40W LED fixtures	8	$453	$3,624	$400	$3,224	2870		9,795	5.6%	$230	14.04	$511	4.6%
	Install lighting occupancy sensors in offices	4	$80	$319	$140	$179	652		2,225	1.3%	$52	3.42	$654	30.3%
	Discontinue use of coffee burner, switch to carafe style	1	$65	$65		$65	1650		5,631	3.2%	$132	0.49	$2,030	206.0%
	Pipe insulation	1	$150	$150		$150	1170		3,993	2.3%	$94	1.60	$1,339	64.0%
	Totals			$4,158	***$540***	$3,618	***6342***		21,645	12.3%	***$414***	8.74	$3,049	10.7%
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Facility	Measure	Number of Units	Unit Cost	Incremental Cost	Rebate ($)	Net Incremental Cost ($)	Annual Energy Savings (kWh)	Annual Energy Savings (propane Btu)	Annual Energy Savings (kBtu)	Estimated Energy Savings (%)	Annual Energy Savings ($)	Simple Payback (years)	NPV	IRR
CDA Casino Resort and Hotel	Upgrade parking lot lighting fixtures from 400W HPS to 70W LED	320	$1,000	$320,000	$16,000	$304,000	479,457		1,636,387	2.2%	$38,357	7.93	$313,155	12.2%
	Upgrade "Entrance Foyer" lighting from 100W incandescent spots to 23W CFL	120	$4	$480	$360	$120	38,998		133,100	0.2%	$3,120	0.04	$49,361	2626.1%
	Upgrade MR16 halogen lamps in bars and buffets to LED equivalent lamps	150	$40	$6,000	$2,160	$3,840	20,968		71,564	0.1%	$1,677	2.29	$22,875	45.0%
	Upgrade recessed 100W incandescent lamps in buffet area to 23W CFL equivalent	150	$4	$600	$450	$150	48,748		166,377	0.2%	$3,900	0.04	$61,702	2626.1%
	Reduce run time of 400,000 BTU/hour "fire feature " from 12 hpd to 6 hpd	1	$0	$0		$0		876,000,000	876,000	1.2%	$22,020	0.00	$349,212	NA
	Reduce run time of two 150,000 BTU/hour fireplaces from 12 hpd to 6 hpd	1	$0	$0		$0		328,500,000	328,500	0.5%	$8,257	0.00	$130,955	NA
	Chinook Steakhouse - Install floating head controls on LT compressor(s)	7	$157	$1,099	$420	$679	5,229		17,847	0.02%	$418	1.62	$5,975	63.2%
	Chinook Steakhouse - Install floating head controls on MT compressor(s)	15	$207	$3,105	$900	$2,205	7,740		26,417	0.04%	$619	3.56	$7,679	29.1%
	Sweetgrass Restaurant -Upgrade shaded pole evaporator motors to ECM	18	$170	$3,060	$2,520	$540	21,472		73,284	0.10%	$1,718	0.31	$26,718	322.2%
	Sweetgrass Restaurant - Install gaskets on LT walk-in doors	1	$119	$119	$70	$49	722		2,465	0.003%	$58	0.85	$869	120.0%
	Sweetgrass Restaurant - Install gaskets on MT walk-in doors	2	$85	$170	$70	$100	788		2,688	0.004%	$63	1.59	$902	64.6%
	Sweetgrass Restaurant - Install floating head controls on LT compressor(s)	15	$157	$2,355	$900	$1,455	11,205		38,243	0.1%	$896	1.62	$12,803	63.2%
	Sweetgrass Restaurant - Install floating head controls on MT compressor(s)	15	$207	$3,105	$900	$2,205	7740		26,417	0.04%	$619	3.56	$7,679	29.1%
	Deli Food Court - Upgrade shaded pole evaporator motors to ECM	2	$170	$340	$280	$60	2386		8,143	0.01%	$191	0.31	$2,969	322.2%
	Deli Food Court - Upgrade T12 lighting in reach-in doors to LED	12	$32	$384	$300	$84	1848		6,307	0.01%	$148	0.57	$2,263	178.7%
	Deli Food Court - Install floating head controls on MT compressor(s)	22	$207	$4,554	$1,320	$3,234	11352		38,744	0.1%	$908	3.56	$11,263	29.1%
	Nighthawk Lounge - Upgrade shaded pole evaporator motors to ECM	3	$170	$510	$420	$90	3579		12,215	0.02%	$286	0.31	$4,453	322.2%
	Nighthawk Lounge - Install floating head controls on MT compressor(s)	15	$207	$3,105	$900	$2,205	7740		26,417	0.04%	$619	3.56	$7,679	29.1%
	Red Tail Bar and Grill - Install ECM for compressor head fans	1	$62	$62	$62	$0	835.1		2,850	0.004%	$67	0.00	$1,060	NA
	Red Tail Bar and Grill - Install floating head controls for LT compressor(s)	7	$157	$1,099	$420	$679	5229		17,847	0.02%	$418	1.62	$5,975	63.2%
	Red Tail Bar and Grill - Install floating head controls for MT compressor(s)	15	$207	$3,105	$900	$2,205	7740		26,417	0.04%	$619	3.56	$7,679	29.1%
	Room Service Bakery - Install floating head controls for LT compressor(s)	7	$157	$1,099	$420	$679	5229		17,847	0.0%	$418	1.62	$5,975	63.2%
	Room Service Bakery - Install floating head controls for MT compressor(s)	7	$207	$1,449	$420	$1,029	3612		12,328	0.0%	$289	3.56	$3,584	29.1%
	Totals			$355,800	***$30,192***	$325,608	***692616.8***		3,568,401	4.9%	***$85,686***	3.80	$1,042,785	27.3%
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Coeur d'Alene Tribe
Energy Conservation Measure
Economic Analysis Summary

Facility	Measure	Number of Units	Unit Cost	Incremental Cost	Rebate ($)	Net Incremental Cost ($)	Annual Energy Savings (kWh)	Annual Energy Savings (propane Btu)	Annual Energy Savings (kBtu)	Estimated Energy Savings (%)	Annual Energy Savings ($)	Simple Payback (years)	NPV	IRR
Tribal Housing Authority	Change thermostats to reflect actual occupancy	3	50	$150		$150	12300		41,980	14.6%	$984	0.15	$15,460	663.3%
	Repair and re-install fiberglass batt insulation in attic area	400	$2.50	$1,000		$1,000	562.5		1,920	0.7%	$45	22.22	-$257	0.0%
	Replace weatherstripping on exterior doors	4	$13.00	$52		$52	1100		3,754	1.3%	$88	0.59	$1,345	171.8%
	Upgrade 4', 4-lamp, T12 lighting to 4-Lamp, HP T8 lighting (32W) and HP electronic ballasts	11	$138.92	$1,528	$550	$978	3660		12,492	4.4%	$293	3.34	$3,694	31.0%
	Upgrade 4', 2-lamp, T12 lighting to 2-Lamp, HP T8 lighting (32W) and HP electronic ballasts	11	$131.78	$1,450	$550	$900	1776		6,061	2.1%	$142	6.33	$1,380	15.9%
	Upgrade 4', 1-lamp, T12 lighting to 1-Lamp, HP T8 lighting (32W) and HP electronic ballasts	2	$131.78	$264	$50	$214	176		601	0.2%	$14	15.17	$16	3.8%
	Upgrade 60W incandescent flood lamps to 13W CFL equivalent	6	$4.00	$24	$18	$6	1380		4,710	1.6%	$110	0.05	$1,745	1858.8%
	Occupancy sensors in office areas	5	$125.00	$625	$175	$450	512.5		1,749	0.6%	$41	10.98	$213	7.6%
	Occupancy sensors in restrooms	1	$125.00	$125	$35	$90	210		717	0.2%	$17	5.36	$179	19.1%
	Install Vending Miser on vending machine	1	$125.00	$125	$125	$0	450		1,536	0.5%	$36	0.00	$571	NA
	Pipe insulation	1	$150	$150		$150	1170		3,993	1.4%	$94	1.60	$1,339	64.0%
	Totals			$5,492	***$1,503***	$3,989	***23297***		79,513	27.7%	***$1,734***	2.30	$23,629	44.8%
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Tribal Housing Authority Shop	Upgrade 4', 2-Lamp, T12 Lighting to 2-Lamp, T8 Lighting	10	$131.78	$1,318	$500	$818	1251		4,270	7.0%	$100	8.17	$793	11.7%
	Install timer switch for electric resistance heater	1	$85.00	$85		$85	1825		6,229	10.2%	$146	0.58	$2,233	174.4%
	Totals			$1,403	***$500***	$903	***3076***		10,498	17.2%	***$246***	3.67	$3,026	28.3%
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Facility	Measure	Number of Units	Unit Cost	Incremental Cost	Rebate ($)	Net Incremental Cost ($)	Annual Energy Savings (kWh)	Annual Energy Savings (propane Btu)	Annual Energy Savings (kBtu)	Estimated Energy Savings (%)	Annual Energy Savings ($)	Simple Payback (years)	NPV	IRR
Senior Housing Complex	Replace 100W incandescent spot lighting with 23W CFL equivalent	40	$4.00	$160	$120	$40	13490		46,041	8.7%	$1,079	0.04	$17,076	2725.1%
	Replace 60W incandescent lighting in restrooms to 13W CFL equivalent	8	$4.00	$32	$24	$8	171.55		586	0.1%	$14	0.58	$210	174.2%
	Upgrade 4', 2-Lamp T12 Lighting in Hallways to 4', 2-Lamp T8	14	$131.78	$1,845	$700	$1,145	1475		5,034	0.9%	$118	9.70	$760	9.2%
	Repair/reconfigure 250W metal halide exterior lighting to operate only after dark	12	$20.00	$240		$240	1095		3,737	0.7%	$88	2.74	$1,156	37.8%
	Replace existing propane-fired water heater with a high efficiency condensing unit	1	$4,500.00	$4,500		$4,500		32,628,280	32,628	6.1%	$820	5.49	$8,638	18.6%
	Install Vending Miser on vending machine	1	$125.00	$125	$125	$0	450		1,536	0.3%	$36	0.00	$571	NA
	Pipe insulation	1	$150	$150		$150	1170		3,993	0.8%	$94	1.60	$1,339	64.0%
	Totals			$7,052	***$969***	$6,083	***17852***		60,927	17.6%	***$2,155***	2.82	$28,266	36.7%
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Facility	Measure	Number of Units	Unit Cost	Incremental Cost	Rebate ($)	Net Incremental Cost ($)	Annual Energy Savings (kWh)	Annual Energy Savings (propane Btu)	Annual Energy Savings (kBtu)	Estimated Energy Savings (%)	Annual Energy Savings ($)	Simple Payback (years)	NPV	IRR
New Tribal School	Replace existing boiler with 2 staged tankless on demand water heaters	2	$3,000	$6,000		$6,000		85,735,500	85,736	3.8%	$2,155	2.78	$28,353	37.2%
	Totals		***$3,000***	$6,000		$6,000	0	85,735,500	85,736	***3.8%***	***$2,155***	2.78	$28,353	37.2%
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Coeur d'Alene Tribe
Energy Conservation Measure
Economic Analysis Summary

Facility	Measure	Number of Units	Unit Cost	Incremental Cost	Rebate ($)	Net Incremental Cost ($)	Annual Energy Savings (kWh)	Annual Energy Savings (propane Btu)	Annual Energy Savings (kBtu)	Estimated Energy Savings (%)	Annual Energy Savings ($)	Simple Payback (years)	NPV	IRR
Tribal School - New Bus Garage	Install timer on 10kW unit heater (model assumes heater is left on 10 days per year)	1	$150.00	$150		$150	2400		8,191	8.7%	$192	0.78	$2,899	130.2%
	Install timer on 800W unit heater in restroom (model assumes heater is left on 10 days per year)	1	$100.00	$100		$100	192		655	0.7%	$15	6.51	$147	15.4%
	Install lighting occupancy sensors in restrooms and common area	2	$125	$250		$250	625		2,133	2.3%	$50	5.00	$550	20.6%
	Replace photocell on exterior 100W high pressure sodium fixtures	5	$30	$150		$150	1637.5		5,589	6.0%	$131	1.15	$1,932	89.2%
	Pipe insulation	1	$150	$150		$150	1170		3,993	4.3%	$94	1.60	$1,339	64.0%
	Totals			$800		$800	***6024.5***		20,562	21.9%	***$388***	2.06	$5,382	50.0%
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Facility	Measure	Number of Units	Unit Cost	Incremental Cost	Rebate ($)	Net Incremental Cost ($)	Annual Energy Savings (kWh)	Annual Energy Savings (propane Btu)	Annual Energy Savings (kBtu)	Estimated Energy Savings (%)	Annual Energy Savings ($)	Simple Payback (years)	NPV	IRR
Benewah Auto	Replace existing packaged RTU electric resistance heater, DX air-conditioners with high efficiency heat pumps; relocate all ducting to within conditioned space; program thermostats	2	5705	$11,410		$11,410	14500		49,489	4.8%	$725.00	15.74	$420	3.4%
	Replace existing 10 kW unit heaters with occupancy-sensor equipped 2kW radiant heaters above workstations	6	700	$4,200		$4,200	13200		45,052	4.3%	$660.00	6.36	$6,389	15.8%
	Upgrade 8', 2-Lamp, T12 lighting to 2-lamp, HP T8 lighting with HP electronic ballasts	40	$135.00	$5,400	$3,200	$2,200	22016		75,141	7.3%	$1,761.28	1.25	$25,796	81.8%
	Pipe insulation	1	$150	$150		$150	1170		3,993	0.4%	$94	1.60	$1,339	64.0%
	Totals		***$6,540***	***$21,160***	***$3,200***	$17,960	***50,886***		173,674	16.8%	***$3,239.88***	5.54	$33,945	18.4%
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Facility	Measure	Number of Units	Unit Cost	Incremental Cost	Rebate ($)	Net Incremental Cost ($)	Annual Energy Savings (kWh)	Annual Energy Savings (propane Btu)	Annual Energy Savings (kBtu)	Estimated Energy Savings (%)	Annual Energy Savings ($)	Simple Payback (years)	NPV	IRR
Echelon Plummer	Install occupancy sensors in restrooms, offices, break room and meeting room	10	$110	$1,100		$1,100	6130		20,922	0.7%	$362	3.04	$4,668	34.1%
	Install Vending Miser on Vending Machine	1	$125	$125	125	$0	450		1,536	0.1%	$36	0.00	$571	NA
	Pipe insulation	1	$150	$150		$150	1170		3,993	0.1%	$94	1.60	$1,339	64.0%
	Totals			$1,375		$1,375	***7750***		26,451	0.9%	***$398***	3.46	$4,972	30.0%
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Facility	Measure	Number of Units	Unit Cost	Incremental Cost	Rebate ($)	Net Incremental Cost ($)	Annual Energy Savings (kWh)	Annual Energy Savings (propane Btu)	Annual Energy Savings (kBtu)	Estimated Energy Savings (%)	Annual Energy Savings ($)	Simple Payback (years)	NPV	IRR
Benewah Market	Complete Refrigeration System Upgrades - See Description*	1	$676,000	$676,000	$78,910	$597,090	394551		1,346,603	30.8%	$16,065	37.17	-$324,922	-4.4%
	Upgrade 4', 2-lamp T12 lighting in stock room to 4', 2-lamp T8	8	$75	$600	$400	$200	2140		7,304	0.2%	$86	2.34	$1,163	44.2%
	Install Vending Miser on Vending Machine	1	$125	$125	$125	$0	450		1,536	0.0%	$18	0.00	$285	NA
	Pipe insulation	1	$150	$150		$150	1170		3,993	0.1%	$47	3.21	$597	32.3%
	Totals			$676,875	***$79,435***	$597,440	***398311***		1,359,435	31.1%	***$16,215***	36.84	-$322,877	-4.3%
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Facility	Measure	Number of Units	Unit Cost	Incremental Cost	Rebate ($)	Net Incremental Cost ($)	Annual Energy Savings (kWh)	Annual Energy Savings (propane Btu)	Annual Energy Savings (kBtu)	Estimated Energy Savings (%)	Annual Energy Savings ($)	Simple Payback (years)	NPV	IRR
Tribal Wellness Center	Upgrade recessed 60W incandescent floods to 13W CFL equivalent	36	$4	$144	108	$36	9449		32,249	0.6%	$756	0.05	$11,953	2121.1%
	Upgrade 250W MH uplights in entry rotunda to 70W LED fixtures	7	$453	$3,171	350	$2,821	7779		26,550	0.5%	$622	4.53	$7,130	22.8%
	Upgrade 250W MH exterior wall packs to 70W LED fixtures	12	$453	$5,437	600	$4,837	8716		29,748	0.6%	$697	6.94	$6,362	14.3%
	Turn off basketball court lighting when not in use	12	$0	$0			4380		14,949	0.3%	$350	0.00	$5,557	NA
	Install pipe insulation	3	$150	$450		$450	3510		11,980	0.2%	$281	1.60	$4,016	64.0%
	Energy management of sound systems	1	$0	$0	0	0	2336		7,973	0.2%	$187	0.00	$2,964	NA
	Totals		***$1,060***	$9,202	***1058***	$8,144	***36170***		123,448	***2.4%***	***$2,894***	2.81	$37,983	36.8%

APPENDIX D – LIGHTING UPGRADE RECOMMENDATIONS

Coeur d'Alene Tribe

Energy Conservation Measure Prioritization - Proposed Lighting Measure Details

Lighting Type	Manufacturer	Model Number	Ballast Type	Approximate Installed Cost ($)	Notes
4', 1 Lamp T8 Relight Retrofit (32 max watt lamps)	Lithonia			$ 131.78	
4', 2 Lamp T8 Relight Retrofit (32 max watt lamps)	Lithonia	2RT8R	BINP	$ 131.78	3100 Lumen Lamps
4', 3 Lamp T8 Relight Retrofit (32 max watt lamps)	Lithonia	3RT8R	BINP	$ 132.98	3100 Lumen Lamps
4', 4 Lamp T8 Relight Retrofit (32 max watt lamps)	Lithonia	4RT8R	BIHP	$ 138.92	3100 Lumen Lamps
4', 2 Lamp Industrial Strip Fluorescent	Lithonia	L232MV		$ 97.40	3100 Lumen Lamps
Retrofit existing strip light new ballast / lamps				$ 58.03	3100 Lumen Lamps
4', 6 Lamp High Bay Lighting	Lithonia	IBZ 654		$ 222.48	
Security Lighting	Lithonia	TDD LED 1 40K 120 DNA M2		$ 179.70	
Occupancy Sensor (Infrared)				$ 57.70	
Occupancy Sensor (Ultrasonic)				$ 79.66	
MR16 LED Lamp	Acculamp	ALSMR16		$ 40.00	
LED Wall Pack	Lithonia	TWH LED - 20 LED count		$ 453.06	
LED Parking Lot Lighting	Lithonia	DSX1 LED		$ 1,203.84	

APPENDIX E – BPA ENERGY EFFICIENCY IMPLEMENTATION MANUAL

BONNEVILLE POWER ADMINISTRATION

ENERGY EFFICIENCY
Implementation Manual

October 1, 2014

This document is available online at http://www.bpa.gov/EE/Policy/IManual/Pages/default.aspx.

Table of Contents

October 2014 Changes and Corrections Summary

This summary includes corrections and new changes only.
It does not include interim updates/revisions or changes from a previously announced notice.

Changes that will take effect in six months (or later) are shaded.

Description	Rationale (e.g., business, policy or research changes)	Change or Correction?	Page Number
General			
There are no changes.			
Introduction			
In Section 1.2, Payment Strategies and Levels, the deemed and custom payment types were removed.	The previous language specifically called out custom projects and deemed measures, not accounting for other activity that may receive payment.	Correction	3
Funding			
Language on BPA's obligation to pay in excess of the Implementation Budget has been clarified to "Pursuant to Section 4(c) of the ECA, BPA shall not pay amounts in excess of the implementation budget in Exhibit A."	The previous language specifically called out custom projects and deemed measures, not accounting for other activity that may be submitted on an invoice.	Correction	5
The distribution process for Unassigned Account funds has changed. This process is reflected on the Unassigned Account Request form, which now states the following: Funds in the Unassigned Account will be allocated on a TOCA weighted basis that reflects the pool of customers requesting additional funds (with no levels of priority). BPA will allocate funds by normalizing the TOCAs (i.e., adjusting to sum to 1.0) of those customers requesting funds (BPA will use the TOCAs from BPA's final proposal and net requirements process for the first year of the rate period). Thus, a given customer's allocation is a function of its TOCA relative to all others requesting Unassigned Account funding.	These changes were prompted by the Post-2011 process.	Change	6
The process for requesting Large Project Funds has been revised to indicate that the request comes through the COTR Request and Acknowledgment Procedure rather than through the custom project proposal.	The custom project proposal is not equipped to handle this request.	Correction	6

Description	Rationale (e.g., business, policy or research changes)	Change or Correction?	Page Number
The applicable applications in the Funding Sources and Savings Allocation table have been revised to be more inclusive of savings deriving from any allowed manner, not just deemed measures or custom projects.	The previous language specifically called out custom projects and deemed measures, not accounting for other activity that may be reported to BPA.	Correction	9
General Requirements			
Section 3.1 has been corrected to indicate that files may be kept electronically.	The Manual was previously silent on this issue, and the explicit addition clarifies the existing rules.	Correction	10
Custom Program calculator was added to the list of invoice package documents under section 3.2.	This calculator was inadvertently omitted.	Correction	11
Custom Projects			
Effective April 1, 2015, customers must use Custom Project Calculator Version 2.0 or later for new custom projects. BPA will no longer accept Custom Project Calculator Version 1 unless it is for a completion report on a project started prior to April 1, 2015.	BPA has updated the custom project calculator.	Change	13
Clarification was added to the section on deemed measures and other project types within custom projects to indicate that deemed measures and calculated projects may be included in custom projects on their own or in a project with other components.	The previous language was ambiguous regarding the ability to submit a deemed measure or calculated project, alone, as a custom project.	Correction	16
Custom Programs			
Clarification was added to the section on deemed measures and other measure types within custom programs to indicate that deemed measures and calculated projects may be included in custom programs on their own or in a program with other components.	The previous language was ambiguous regarding the ability to submit a deemed measure or calculated project, alone, as a custom program.	Correction	20

Agricultural Sector			
In the Irrigation System Upgrades, payment section's Sprinkler Equipment table, footnote references were added to indicate that lateral moves are also included to the following measures: • New multiple configuration nozzles for low-pressure pivot sprinklers • New goose-neck elbow for new drop tubes (to convert existing sprinkler equipment mounted on top of the pivot to low-pressure sprinkler package) Also the phrase "Cut and pipe press repair of leaking hand lines, wheel-lines and portable mainline" was changed to "Pipe repair of leaking hand lines, wheel-lines and portable mainline."	These edits clarify and simplify some of the measure descriptions for sprinkler equipment.	Correction	26
In the Variable Frequency Drives in Agricultural Turbine Pump Applications section, custom project criteria has been removed.	This policy change (allowing any measure or calculated project to be submitted as custom) was made in April but not fully described or represented in the Manual until now.	Correction	
In the Transformer De-energization section, the reference to custom project documentation requirements was removed from the documentation requirements section.	Previously, this measure was submitted as a custom project, and this reference was inadvertently left in place after conversion to a deemed measure.	Correction	29
Commercial Sector			
In the commercial custom projects section, the restriction that custom projects not include deemed measures was removed to reflect the custom project policy change that custom projects can be deemed measures.	This policy change (allowing any measure or calculated project to be submitted as custom) was made in April but not fully described or represented in the Manual until now.	Correction	33
In the Unitary Air Conditioning Equipment in Commercial Buildings section, the custom project submittal requirements were removed.	This policy change (allowing any measure or calculated project to be submitted as custom) was made in April but not fully described or represented in the Manual until now.	Correction	34
In the Heat Pump Equipment Conversion and Upgrade in Commercial Buildings section, the custom project submittal requirements were removed.	This policy change (allowing any measure or calculated project to be submitted as custom) was made in April but not fully described or represented in the Manual until now.	Correction	37

Commercial shell insulation measures were added.	These measures were made available through the RTF and BPA Qualified paths.	Change	39
Effective April 1, 2015, numerous changes to the deemed refrigeration measures will take effect.	RTF changes prompted numerous expirations, re-introductions, and revisions to the deemed refrigeration measures.	Change	43-44
The requirements for deemed refrigeration measures will now be housed solely in the Interim Reference Deemed Measure list (in the Document Library) rather than in the Deemed Refrigeration Retrofit Measures – Payment summary (which has been removed from the document library).	This change removes unnecessary redundancy.	Correction	
Effective April 1, 2015, delivery mechanisms for Pre-rinse Spray Wash Valves will be consolidated to Direct Install only. Documentation requirements capturing end user request, mailing documentation, site address and water heater fuel do not change.	BPA has consolidated measure delivery mechanisms for simplification.	Change	49
Effective April 1, 2015, delivery mechanisms for Showerheads will be consolidated to Direct Install and By Request (includes Mail by Request, Over the Counter and Other Distribution Methods). Documentation requirements capturing end user request, mailing documentation, site address and water heater fuel do not change.	BPA has consolidated measure delivery mechanisms for simplification.	Change	51
Federal Sector			
The reference to deemed and custom projects as the only sources of savings was removed.		Correction	
Industrial Sector			
Effective April 1, 2015, customers participating in the Energy Smart Industrial Energy Management pilot must upload documents to the ESI SharePoint site and submit links to that documentation by e-mail to eedocs@bpa.gov. Until then, submitting the link is optional.	BPA will require links be shared for Energy Management data, program files and other project-specific information. This change increases information protection and brings greater efficiencies to the process of review and approval by BPA.	Change	58
BPA review of Track and Tune Performance Tracking System Design Proposals is optional.	This eliminates customer submission without savings or payment. Customers have the option for BPA review as implemented in the Track and Tune Calculator.	Change	61

The High Performance Energy Management and Track and Tune Projects sections (optional energy management pilot components) were consolidated, and the completion report and supporting invoices were added to the documentation requirements table.	This consolidation simplifies the requirements and allows a comparison across components.	Correction	65
In the Variable Frequency Drives for Fans in Spud and Onion Storage Facilities section, the custom project submittal requirements were removed.	This policy change (allowing any measure or calculated project to be submitted as custom) was made in April but not fully described or represented in the Manual until now.	Correction	69
Effective April 1, 2015, savings will increase for Variable Frequency Drives for Fans in Spud and Onion Storage Facilities.	These changes were recommended by the RTF and accepted by BPA.	Change	69
Residential Sector			
Effective April 1, 2015, current CFL lighting measures will be expired and replaced.	These measures were updated and consolidated by the RTF. BPA has accepted the RTF recommendations.	Change	73
Effective April 1, 2015, delivery mechanisms for CFL bulb and fixture measures will be consolidated and reduced to four categories: Retail, Direct Install, By Request (includes Mail by Request, Over the Counter and Other Distribution Methods) and Mailed Non-Request (bulbs only). CFL measures being consolidated into the "By Request" category have the same savings and payment amounts. Documentation requirements capturing end user request, mailing documentation and/or limits to number of Mailed Non-Request bulbs do not change.	BPA has consolidated measure delivery mechanisms for simplification.	Change	73
Effective April 1, 2015, the BPA payment for CFL general purpose bulbs will be reduced (and the name will change from “standard twister” to “general purpose bulb.”)	Measure implementation costs have decreased, and payment has been adjusted accordingly. The change in name reflects an update in RTF measure taxonomy.	Change	74
Effective April 1, 2015, current LED lighting measures will be expired and replaced.	These measures were updated and consolidated by the RTF. BPA has accepted the RTF recommendations.	Change	74

Effective April 1, 2015, delivery mechanisms for LED bulbs will be consolidated and reduced to four categories: Retail, Direct Install, By Request (includes Mail by Request, Over the Counter and Other Distribution Methods) and Mailed Non-Request (bulbs only). LED bulb measures being consolidated into the "By Request" category have the same savings and payment amounts. Documentation requirements capturing end user request, mailing documentation and/or limits to number of Mailed Non-Request bulbs do not change.	BPA has consolidated measure delivery mechanisms for simplification.	Change	74
Effective April 1, 2015, delivery mechanisms for Showerheads will be consolidated and reduced to three categories: Retail, Direct Install, and By Request (includes Mail by Request, Over the Counter and Other Distribution Methods). Showerhead measures being consolidated into the "By Request" category have the same savings and payment amounts. Documentation requirements capturing end user request, mailing documentation, site address and water heater fuel do not change.	BPA has consolidated measure delivery mechanisms for simplification.	Change	75
In the Simple Steps section, corrections were made to direct customers to the BPA Residential Lighting Web site for additional information rather than Ryan Crews; to the documentation requirements to indicate that the release form, if used, must be submitted to eedocs@bpa.gov; and to the contractor name, changing from Fluid to a generic "contractor."	This will allow contact information to be updated as needed to ensure access for all customers.	Correction	76
The description of Simple Steps was corrected to include bulk purchase, direct mail and direct install delivery options.	The Simple Steps contract allows customers to select different measures and delivery mechanisms.	Correction	76
Effective April 1, 2015, a new documentation requirement was added to the Simple Steps section: customers must now retain the Simple Steps invoice.	This documentation requirement was requested by COTRs to assist in their oversight role.	Change	77
Effective April 1, 2015, delivery mechanisms for Advanced Power Strips will be consolidated to three categories: Retail, Direct Install and By Request (includes Mail by Request, Over the Counter and Other Distribution Methods). Advanced Power Strip measures being consolidated into the "By Request" category have the same savings and payment amounts. Documentation requirements capturing end user request and mailing documentation do not change.	BPA has consolidated measure delivery mechanisms for simplification.	Change	78

Advanced Power Strips distributed "Over-the-Counter" may be reported using the Mail by Request reference number until April 1, 2015, at which point customers must use the "By Request" reference number.	This provides temporary guidance until the new measure distribution methods are available.	Change	78
Effective April 1, 2015, the Advanced Power Strip measure will include a requirement for customers to send and collect a short survey (mailed or emailed) to all end users who received an Advanced Power Strip.	This measure was deemed a Planning measure by the RTF, requiring additional research to verify the savings for this measure.	Change	78
The following was removed from the clothes washer requirements: "Clothes Washers must have a Modified Energy Factor (MEF) of 2.0 or greater and a Water Factor of 6.0 or lower."	The current Requirements and Specifications require Clothes Washers to be ENERGY STAR qualified. The ENERGY STAR specification for Clothes Washers has been updated.	Correction	
In the Heat Pump Water Heaters section, customers who report Tier 2 HPWHs in heating zones 2 and 3 will not be contacted by BPA (as previously stated) about a field study to validate savings for ducted heat pump water heaters.	NEEA is working on review in lieu of BPA.	Change	80
Effective April 1, 2015, BPA will no longer provide payment for AirGenerate and Electrolux Heat Pump Water Heaters which were removed from the HPWH Qualified Product list.	BPA requires HPWHs to be listed on the HPWH Qualified Product list but has decided to make an exception in this instance and allow these two products that have already been removed from the list, until April 1, 2015.	Change	80
In the HVAC Measures - Ductless Heat Pumps section, the custom project criteria was removed.	This policy change (allowing any measure or calculated project to be submitted as custom) was made in April but not fully described or represented in the Manual until now.	Correction	82
A new measure was added for Ductless Heat Pumps – Manufactured Homes with Zonal electric heat for both standard and low income.	This measure is now available to customers.	Change	82
In the Ductless Heat Pumps section, the following sentence has been added: Homes where plug-in electric space heaters are the primary heating system in the home qualify for BPA DHP payment.	Savings from homes with plug-in electric space heaters as a primary heating system is consistent with savings for homes with zonal electric heat.	Change	83

Effective April 1, 2015, PTCS heat pump measures with “ducts required” or “with duct sealing” will no longer be available. PTCS heat pump measures with “ducts required” have been renamed to heat pumps “with duct sealing.”	Heat pump and duct sealing measures are now offered as individual measures and duct sealing is now optional. These measures were not noticed previously, and expiring them represents a change in payment.	Change	83
Effective April 1, 2015, PTCS Commissioning, Controls and Sizing measures will be combined, eliminating the differentiation between new single-family homes and existing single-family homes. The measures currently labeled in the Interim Reference Deemed Measure List as “Commissioning Controls Sizing New Single-family Home Heat Pump – HSPF/SEER <9.0/14” and “Commissioning Controls Sizing Existing Single-family Home Heat Pump – HSPF/SEER <9.0/14” will be expired and replaced with new measures.	These measures for “new” and “existing” single-family homes are identical in savings and payment. The additional measures provide no value and are being eliminated.	Change	83
Effective April 1, 2015, the current low income PTCS duct sealing measures for manufactured homes will no longer be available. New low income PTCS duct sealing measures will be available October 1, 2014.	The measures being expired were out of sync with the standard income PTCS duct sealing measures updated by the RTF.	Change	83
HVAC technicians may now install PTCS measures if they are certified in an approved PTCS alternative as listed in the PTCS Program Requirements.	The PTCS Program Requirements were updated to accept additional HVAC technical certifications.	Change	84
In the Ducted Systems with PTCS section, both air source and variable speed heat pumps must be installed according to the PTCS Air Source Heat Pump Installation Specification.	Variable speed heat pumps are considered the equivalent of air source heat pumps under PTCS requirements.	Correction	84
In the Ducted Systems with PTCS section, a correction was made to indicate that heat pump upgrades include replacing an existing heat pump.	This language was removed in error and has been corrected.	Correction	85
This sentence was added to the PTCS duct sealing section: “New and existing single-family homes and existing manufactured homes are eligible for PTCS duct sealing provided the ducts are connected to electric heat.”	This requirement was previously contained in the requirements and specifications introductory section, and it was been moved to this new section to provide clarity.	Correction	85

In the Ducted Systems with PTCS Heat Pump Upgrades and Conversions section, the following sentence was deleted: When more than 50% of the heating ducts run through unconditioned space, ducts must be sealed and PTCS certified unless the ducts were previously certified or a PTCS duct leakage test indicates that the pre-existing duct leakage is too low to qualify for the PTCS duct sealing reimbursement.	PTCS heat pump and duct sealing measures have been decoupled. Duct sealing is no longer required.	Change	
In the Ducted Systems with PTCS section, the following sentence was deleted: "Hydronically heated homes are considered to have "ducts not required" for payment purposes, as no ducts exist, and new ducts are not eligible in existing homes.	This revision removed unnecessary information, as ducts are no longer required.	Correction	
In the Ducted Systems with PTCS section, a change was made to clarify primary heating system eligibility by application by providing specific guidance in the PTCS measure table.	PTCS measures have specific HVAC baseline requirements. This information has been clarified.	Correction	85
Prescriptive duct sealing measures were added to Ducted Systems.	These measures are now available.	Change	86
Clarifications were made to the Ducted Systems with PTCS payment information.	The payment table was revised because duct sealing requirements changed. Though notice was provided that Air Source Heat Pumps will be eligible as stand-alone measures without duct testing or previous certification of the duct system, there was not clear information on how payments would change. These changes clarify payment changes.	Correction	86
In the HVAC Measures – Ducted Systems, Commissioning and Controls section, the technician instructions were removed because these are contained in the specifications announced in April to be effective October 1, 2014.	This statement was redundant and inconsistent with the specifications.	Correction	
Effective April 1, 2015, All New ENERGY STAR/Built Green Single-family homes measures, Washington Only, will be expired and no longer available.	The Washington State Energy Code changed on January 1, 2014 and NEEA is in the process of changing the way New ENERGY STAR homes are certified to reflect that change. New measures are being developed by NEEA and the RTF.	Change	88

Weatherization eligibility requirement for electrically heated homes was corrected. The announcement expanding the definition of electrically heated homes inadvertently removed the definition for electrically heated homes with an electric heating system as the primary system.	This omission has been corrected.	Correction	91-92
The open cavity wall insulation minimum requirement is reduced from R-15 to R-13.	In many parts of the Northwest, R-15 insulation is not available.	Change	92
Effective April 1, 2015, new insulation documentation requirement has been added. A description of home (single-family, multifamily or manufactured) is required.	Savings and payment are specific to housing type. This information must be maintained in the customer file.	Change	93
In the Prime Window and Patio Door section, the documentation requirements were revised to indicate that the original window or patio door and frame must be included in the audit/field notes rather than contained solely in a description.	These revisions were undertaken to make field notes on existing condition more consistent across all Weatherization measures.	Correction	93
Effective April 1, 2015, new documentation requirement was added to the Whole House Air Sealing and Testing section: customers must retain audit or field notes detailing the age and description of home (single family/manufactured).	These additional documentation requirements will assist in collection of critical data needed to maintain the savings for these measures.	Change	95
An exception for the Whole-House Air Sealing house age limit was added. Whole-House Air Sealing is limited to homes built before 1982 unless a pre-test measures the house leakage at greater than nine air changes per hour at 50 Pascals.	This exception expands eligibility.	Change	95
A new measure was added for Prescriptive Air Sealing.	This measure is now available.	Change	96
Low-income measures must follow the Specification, Requirements and Documentation requirements as listed under the corresponding standard sections (i.e., non low-income versions).	New language was added to clarify these requirements.	Correction	96
A new measure has been added for Prescriptive Air Sealing for Low Income single-family homes.	This measure is now available.	Change	97
A new measure has been added for Prescriptive Duct Sealing for Low Income single-family homes.	This measure is now available.	Change	97
A new measure has been added for Ductless Heat Pumps for Low Income Manufactured Homes with zonal electric heat.	This measure is now available.	Change	97

Effective April 1, 2015, documentation requirements will be put in place for income status of households eligible for Low-income measures. Income documentation must be verifiable.	Acceptable documentation of income was not identified and has been clarified.	Change	98
Utility Distribution Sector			
There are no changes.			
Multi-Sector			
Effective April 1, 2015, Measure Distribution Processes will be consolidated and reduced to: Retail Markdown, Direct Install, By Request (includes Mail by Request, Over the Counter and Other Distribution Methods), and Mailed Non-Request (CFL bulbs only). Documentation requirements do not change. New forms are available in the Document Library for both Commercial and Residential Measure Distribution processes.	BPA has consolidated measure delivery mechanisms for simplification.	Change	104
Revisions were made to clarify details about the Green Motors Rewind Initiative.	These revisions were made as a result of customer inquiries throughout the last year.	Correction	107
The Non-residential Lighting Program has introduced program promotions.	This was requested by several customers.	Change	110
In the Non-residential Lighting Program, the custom project submittal requirements were removed.	This policy change (allowing any measure or calculated project to be submitted as custom) was made in April but not fully described or represented in the Manual until now.	Correction	
Several commercial measures were added to the Multi-Sector, Multifamily measures table: Heat Pump Water Heaters, Commercial Insulation and Heat Pump Equipment Conversion and Upgrade in Commercial Buildings.	These measures were inadvertently omitted from the table.	Correction	115

Implementation Manual Revision Timeline

Action	Personnel on Point	Static Due Date	April 2015 Due Date[1]
Prepare Manual for publishing, and send out for first round of revisions.	BPA Energy Efficiency Implementation Manual Coordinator	15 weeks before Manual publication date	December 16, 2014
Complete first round of revisions, and return to BPA Energy Efficiency Implementation Manual Coordinator.	BPA Energy Efficiency Staff (Sector Leads, Contracts Manager, Programs Manager)	11 weeks before Manual publication date	January 13, 2015
Incorporate first round of revisions, and meet with Implementation Manual Change Review Board.	BPA Energy Efficiency Implementation Manual Coordinator	9 weeks before Manual publication date	January 27, 2015
Incorporate Implementation Manual Change Review Board edits, and meet with management to review.	BPA Energy Efficiency Implementation Manual Coordinator	8 weeks before Manual publication date	February 3, 2015
Incorporate management edits, and send to BPA Energy Efficiency staff/Utility Sounding Board for second round of revisions.	BPA Energy Efficiency Implementation Manual Coordinator	7 weeks before Manual publication	February 10, 2015
Complete second round of revisions, and return to BPA Energy Efficiency Implementation Manual Coordinator.	BPA Energy Efficiency staff, Utility Sounding Board Members	5 weeks before Manual publication date	February 24, 2015
Incorporate second round of revisions, and meet with Implementation Manual Change Review Board.	BPA Energy Efficiency Implementation Manual Coordinator	4 weeks before Manual publication date	March 3, 2015
Incorporate Implementation Manual Change Review Board edits, and meet with management to review.	BPA Energy Efficiency Implementation Manual Coordinator	3 weeks before Manual publication date	March 10, 2015
Incorporate management edits.	BPA Energy Efficiency Implementation Manual Coordinator	2 week before Manual publication date	March 18, 2015
Work with marketing to finalize Manual for publication.	BPA Energy Efficiency Implementation Manual Coordinator	3-5 days before Manual publication date	March 26, 2015
Submit Manual print requests to Implementation Manual Coordinator.	BPA Energy Efficiency staff and other interested parties (e.g. customers)	15th day of month after Manual publication date	April 15, 2015

[1] This column will be updated every six months to reflect the dates of the upcoming publication. If the static due date falls on a weekend or holiday, the actual due date will be the following business day.

Definitions

AHRI	Air-Conditioning Heating and Refrigeration Institute
aMW	Average megawatt of electricity or the average measure of the total energy delivered in one year - 8,760,000 kilowatt-hours per year
B/C	Total resource cost benefit/cost ratio
Bilateral Funding	A form of BPA energy efficiency funding; “Implementation Budget” as used in the Energy Conservation Agreement; Energy Efficiency Incentive
Bilateral Transfer	The transfer of implementation budget between customers
BPA	Bonneville Power Administration
BPA Qualified	A non-RTF approved measure that BPA is collecting data and performing analysis on, with the eventual goal of securing RTF approval.
BTU	Unit of energy equal to about 1055 joules; the amount of energy needed to cool or heat one pound of water by one degree Fahrenheit
Busbar energy savings	Generally 9.056% above the site energy savings
CEE	Consortium for Energy Efficiency
CFL	Compact fluorescent lamp/light bulb
Completed Unit	As used in the Energy Conservation Agreement describes properly installed measures, operating and, when applicable, commissioned in accordance with the manufacturer’s requirements and specifications for normal operations and, as applicable, having met specifications and requirements set forth in this Manual and the BPA Energy Efficiency reporting system and supporting documents
Completion Report	A document submitted at the completion of a custom project (under Custom Project Process, Option 1) that includes information on project costs, verified energy savings and information on changes to the approved M&V plan
Conditioned space (residential)	Any residential building cavity or space that is directly heated by a register or duct that provides conditioned air, typically a space inside the thermal shell of the residence
Conservation	Any reduction in electric energy consumption resulting from an increase in the efficiency of electric energy use, production or distribution
COTR	Contracting Officer’s Technical Representative
Customer	A utility or other regional entity that purchases power from BPA
Custom Program	Energy savings work performed under the Manual’s custom program section
Custom Project	Energy savings work performed under the Manual’s custom project section
Custom Project Proposal	A proposal for energy savings work made under the Manual’s custom project section (under Custom Project Process, Option 1)
Deemed Measure	A measure with estimated energy savings per unit based on a history of measured results and an ability to replicate energy savings; Unit Energy Savings
DHP	Ductless Heat Pump
ECA	Energy Conservation Agreement
EEI	Energy Efficiency Incentive; the basis of the implementation budget that funds energy efficiency activities
EER	Energy Efficiency Representative
EM&V	Evaluation, measurement and verification
End user	Ultimate consumer of product
Energy Savings	Conservation in first year kilowatt-hours attributable to completed units; site energy savings, which include busbar energy savings
ENERGY STAR®	The registered name for a joint national energy efficiency program of the U.S. Environmental Protection Agency and the U.S. Department of Energy
Evaluation	The testing of the assumptions made in planning when measures are installed by real people and used by real people (generally not part of oversight, does not affect payments and is used to refine or confirm the planning assumptions for future use)

Fiscal Year (FY)	For BPA, from October 1 through September 30
Fuel Switching	As determined by BPA, the switching of one type of energy consumption to another (e.g., switching from electric heating to natural gas heating)
GPM	Gallons per minute, as in the flow-rate of showerheads
HPWH	Heat pump water heater; a water heater manufactured with an integrated heat pump that heats water by transferring heat from ambient air via a refrigeration cycle; does not include add-on units that modify an existing water heater.
HVAC	Heating, ventilation and air conditioning
HZ	Heating zone
Implementation Budget	The amount of money BPA makes available to a customer (through its Energy Conservation Agreement) to expend on implementation costs during the implementation period
Implementation Period	The period of time covered by a customer's Energy Conservation Agreement
Incremental cost	Energy efficiency costs for work beyond that required by standard practice or code (may be the full cost of measures, especially in retrofit situations); "implementation cost" as used in the Energy Conservation Agreement
Invoice	A report of measures claimed and/or savings achieved under the Manual (may or may not include a request for payment)
kW	Kilowatt – one thousand watts (units of electric power)
kWh	Kilowatt-hour – one kilowatt over the period of one hour (unit of energy)
Large Project Fund	The money reserved for certain BPA-approved custom projects with payment amounts that exceed 50% of the customer's original implementation budget (i.e., budget at start of rate period)
LED	Light-emitting diode
Low-income	As defined in the Federal Weatherization Assistance Program, 200% of the poverty income levels (Approved statewide definitions substitute for federal low-income weatherization programs in the corresponding states.)
M&V	Measurement and Verification
Major Renovation	A renovation to an existing structure that requires a building permit and in which multiple systems are impacted while the structure is repurposed, expanded or repositioned
Manufactured Home	A dwelling that is transportable in one or more sections, built on a permanent chassis, with or without a permanent foundation, with wheels removed when set up on site (not including travel trailers or park models) (Homes manufactured after 1983 must be constructed to the U.S. Department of Housing and Urban Development code.)
Measure	Materials, equipment or activities that achieve energy efficiency
Measurement	Readings taken to establish energy use or improvements in energy use, such as testing duct leakage or measuring loading factors and run time in factories (It usually involves post and/or pre-post measurement. Large end users often measure to make sure that they are getting what they pay for or to better understand their system operations. The prevalence of required measurement for audits or for payment has varied in the field of energy efficiency, but the general rule is the more uncertainty, the greater the risk of performance, the greater the need for actual measurement. BPA requires some level of measurement and verification for projects for which the payment is established by the energy savings achieved.)
Modular Home	Sectional, factory-built dwelling in the single-family home category designed to be transported to the building site, affixed to a permanent foundation, with no chassis
Multifamily (Commercial)	Five or more dwelling units within the same structure and more than three stories
Multifamily (Residential)	Five or more dwelling units within the same structure and no more than three stories
MW	Megawatt – one million watts (units of electric power)
MWh	Megawatt-hour – one megawatt over the period of one hour
NEEA	Northwest Energy Efficiency Alliance
NFRC	National Fenestration Rating Council

Oversight	A contract management activity, designed to assure the government that it is getting what it pays for with some level of certainty
Payment	A term representing monetary incentive levels for the installation of energy efficiency measures
Performance Payment	Application of funds to cover internal customer administrative costs incurred in support of energy savings activities described in this Manual
Primary Residential Heating System	A heating system that serves 50% or more of the conditioned living area of a residence
PTCS™	Performance Tested Comfort Systems (certification for duct sealing and heat pump commissioning)
Rate Period	Period of time during which a specific set of rates established by BPA pursuant to a rate process is in effect (currently two-year periods, with the current rate period covering FY14-15)
Regional Technical Forum (RTF)	An advisory committee established in 1999 to develop standards to verify and evaluate energy conservation (Committee members are experienced in conservation program planning, implementation and evaluation and are appointed by the Northwest Power and Conservation Council.)
Single-family	Fewer than five dwelling units within the same structure (including accessory dwelling units and modular homes)
Site energy savings	The ascribed, deemed, calculated, estimated, evaluated or verified conservation in first year kilowatt-hours attributable to completed units
Tier One Cost Allocator (TOCA)	Per the Tiered Rate Methodology, a billing determinant for applicable customer charges, annually based on the lesser of the customer's rate period high water mark (RHWM) or the customer's forecast net requirement, calculated as a percentage of the total of RHWMs for all customers
TSP	Technical Service Provider
Unassigned Account	The grouping of unclaimed and returned Energy Efficiency Incentive funds
Unconditioned space (residential)	Any residential building cavity or space that is intentionally vented to the outside or is not heated directly by a register or duct
Unheated buffer space (residential)	Any residential building cavity or space that is adjacent to the thermal boundary of the house and that has no positive heat supply under thermostatic control (e.g., garages and basements)
Utility	A public customer that purchases power from BPA
Variable speed heat pump	A ducted heat pump manufactured with an inverter driven motor that is capable of adjusting its output to meet the requested heating load (with performance similar to a DHP)
Verification	A process or procedure designed to produce evidence confirming accuracy or truth of claims made to BPA, which may minimally involve obtaining and retaining documentation or may require site inspection(s) of the measure(s)
VFD	Variable Frequency Drive
Whole Building Cost	As-built contracted cost including labor, design and measurement and verification, excluding land costs
Working day	Monday, Tuesday, Wednesday, Thursday and Friday, excluding federal holidays or other days federally deemed to be non-working days
Zonal electric heating system	Non-ducted electric heating systems utilizing thermostats to control individual heating units or groups of heaters (e.g., "zones"), including radiant ceiling cable, fan-forced electric resistance (wall, toe-kick, ceiling, and exhaust fan combinations), electric baseboard, and electric boiler/hot water (e.g., "hydronic") radiant systems

1. Introduction

The Bonneville Power Administration (BPA) Energy Efficiency Implementation Manual (Manual) is based on the BPA Energy Efficiency Post-2011 Implementation Program. For additional guidance on Post-2011, see the BPA Web site. The Manual, together with the customer's Energy Conservation Agreement (ECA) and specifications in BPA's energy efficiency reporting system, incorporated herein, provides the implementation requirements for projects reported to BPA.

1.1 How Measures Become Eligible for BPA Payment

Energy efficiency measures are eligible for payment if (1) they are recommended by the Regional Technical Forum (RTF) and accepted by BPA or (2) they are BPA Qualified.

1.1.1 RTF Recommendations

The RTF is independent from BPA and makes recommendations regarding the following:

- Cost-effective conservation and estimated energy savings and costs of deemed measures
- Standard practices
- Protocols for estimating the energy savings and system value of measures/programs not on the RTF recommended list
- Protocols for measurement and evaluation of energy savings or production

Customers may write the RTF chair to propose new/changed measures. Customers should verify RTF proposal requirements, but depending upon the proposal type, certain items should be included.

- If a new measure is proposed, the proposal should cite the RTF criteria under which the measure qualifies for inclusion in the RTF list.
- If a change in evaluation methodology is proposed, the proposal should include the rationale for the change (e.g., a proposed change in protocol should explain why the change improves the protocol's analytical quality).
- If a changed assumption is proposed, the proposal should present evidence that the change more closely aligns the change with reality.

Organization of the Manual

Section 1 contains general information about the Manual.

Section 2 contains information specific to funding.

Section 3 contains general requirements for customers using BPA funding.

Section 4 contains information on the custom project process.

Section 5 contains information on the custom program process.

Sections 6 through 12 contain information about specific sectors (Agricultural, Commercial, Federal, Industrial, Residential, Utility Distribution and Multi-Sector).

Section 13 contains updates and revisions made outside publications in October and April.

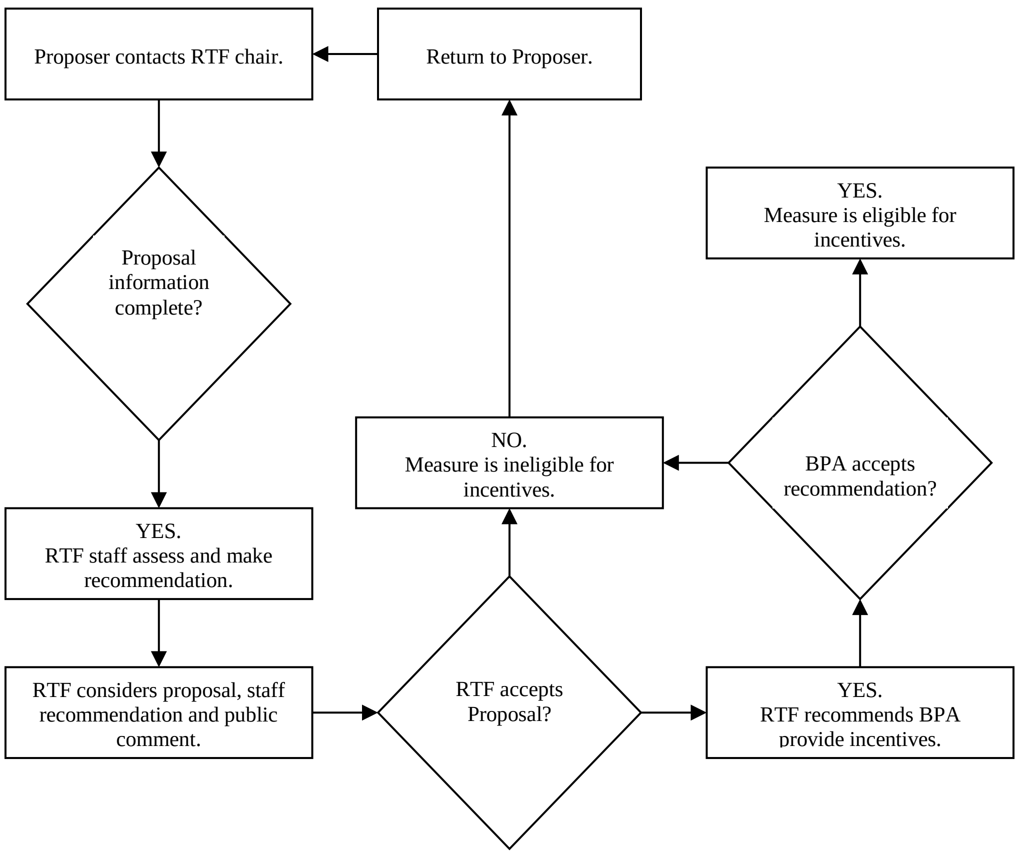
RTF staff will place completed proposals on either the (1) RTF discussion agenda or (2) the RTF consent agenda for rejection. If any RTF member disagrees with consent agenda assignment, the proposal will be put on the discussion agenda.

Proposing parties may present directly to the RTF and/or contact individual RTF members prior to the meeting. Members must disclose contacts when the proposal is under consideration. The RTF shall consider the staff's recommendation and any public comment and accept or reject the proposal by majority vote, usually within 90 days of proposal receipt.

The RTF will recommend accepted proposals to BPA. These recommendations are advisory only, and BPA will generally decide within 30 days whether to accept, reject, modify or request more information regarding the RTF recommendation.

The figure below depicts the RTF process.

RTF Process Flow Chart



1.1.2 BPA Qualified Measures

BPA Qualified is a measure approval status that allows installation of non-RTF approved measures. Through these measures, BPA collects data and performs analysis, with the eventual goal of securing RTF approval. Measures are more likely to be BPA Qualified if they fit within the following criteria:

- The measure's estimated achieved savings is less than 1 aMW of annual savings.
- The RTF rejected the measure because of a lack of data.

- The measure has estimates and reliable sources of per-unit savings, incremental costs and lifetime.
- The measure is expected to have a B/C ratio greater than 1.
- A thorough plan for data collection and evaluation has been established.

For BPA Qualified measures, BPA assesses preliminary cost-effectiveness, develops an M&V plan and generally evaluates the measure for BPA Qualified status. After evaluation, if BPA decides to proceed with the measure, BPA develops the measure design and presents evaluation results to the RTF for review. The RTF is expected to complete its review within two RTF meetings.

Once BPA Qualified, BPA offers the measure to customers for claiming measure savings in order to ensure information is available for research and evaluation. In some instances, the customer may need to submit additional information in order to claim the measure (typically research data). If additional information is required, it will be noted in the Manual and/or BPA's energy efficiency reporting system.

During implementation, BPA counts planned savings toward its conservation target and after evaluation, adjusts savings for BPA historic tracking and decides whether and how to continue the measure. In the event of minimal uptake, BPA may forego evaluation and count no savings toward the measure. Individual customer accomplishments are not adjusted.

1.2 Payment Strategies and Levels

BPA strives to acquire conservation at the lowest possible cost and bases payment levels on (1) busbar energy savings, which are generally 9.056% above the site energy savings and (2) estimated or verified energy savings that persist over the life of the measure (as derived from program evaluations and research projects).

1.3 Policy for Measure Changes/Additions

BPA reserves the right to make changes to policies, procedures, measure eligibility, specifications and requirements. In general, such changes occur every six months, on October 1 and April 1, and notice is provided per the terms of the table, below.

Note, however, that changes are different from corrections. Corrections are introduced to fix ambiguous or incorrect language or to align conflicting terms between BPA's rules (e.g., Implementation Manual, standards of conduct, spreadsheets, calculators, outside specifications and the BPA Energy Efficiency reporting system). Corrections may be implemented at anytime in order to provide immediate clarification, alignment and relief to customers and BPA.

Minimum of Six Months of Notice Required	No Notice Required
Savings change up or down	New measure
Payment amount change, up or down	Optional lighting calculators
Adding or substituting a requirement	Removing a requirement

1.4 Official Interpretations

Only the BPA Contract Administration Manager or Director of Energy Services may issue interpretations, determinations and findings related to the Manual unless delegated to other BPA staff (e.g., Contracting Officer's Technical Representative (COTR)). Such interpretations, determinations and findings will be provided to the customer in writing. Only written statements (including e-mail) by BPA officials acting within the scope of their authority are official BPA statements.

2. Funding

2.1 BPA Funding

Pursuant to section 3(a) of the Energy Conservation Agreement (ECA), BPA Energy Efficiency will pay customers for the costs of energy savings from in-region projects.[2]

This section discusses (1) bilateral funding, (2) pooling organizations and (3) performance payments.

2.1.1 Bilateral Funding

Bilateral funds may be used for all BPA-funded measures, unless otherwise specified in the Manual. Bilateral funding is administered through the customer's ECA (Exhibit A) and is referred to as the implementation budget (or in certain instances through a supplemental Large Project Fund budget in a separate exhibit).

Customers may request an ECA[3] by writing to their Energy Efficiency Representative (EER). BPA shall review the request and, if accepted, develop a draft ECA, generally providing an opportunity for customer review. Once the ECA is final, two originals (signed by BPA) will be sent to the customer with a request that both be signed and one returned to BPA.

Customer rate period implementation budgets (contained in ECA Exhibit A) are based on customer Tier One Cost Allocators (TOCA). Customers may pursue budget changes under the ECA, per the terms of that agreement according to the parameters detailed below for budget redistribution, reduction and increase (from the Unassigned Account and Large Project Fund). Pursuant to Section 4(c) of the ECA, BPA shall not pay amounts in excess of the implementation budget in Exhibit A.

The following section discusses (1) Energy Efficiency Incentive (EEI) allocation, (2) EEI redistribution, (3) EEI increase from the Unassigned Account and (4) the Large Project Fund.

1. EEI Allocation

   After the rate case Final Proposal is published, BPA will calculate the EEI allocation for each customer and deliver this information in a letter or similar document. BPA will revise the customer's ECA implementation budget to reflect the allocated funds, effective the first day of each rate period (i.e., October 1), unless the customer indicates a different funding amount (not to exceed the EEI allocation) through the COTR Request and Acknowledgement Procedure. If the customer does not request a different funding amount, it commits to use or transfer its full EEI allocation for the acquisition of energy efficiency, per the requirements of the Manual. Returned EEI funds will be added to the Unassigned Account, an account which will capture unclaimed EEI funds.

2. ECA Implementation Budget Redistribution (Bilateral Transfers and Pooling Organizations)

   Customers may redistribute EEI funds among each other by forming a pooling organization or by sending a completed Bilateral Transfer Request and Attestation

[2] BPA will not pay for projects that have been or will be funded in part/full by another BPA funding source.

[3] Occasionally, BPA may negotiate a non-standard agreement with a customer that contains variations from Manual requirements, but only when there is a benefit to BPA (e.g., a reduction in the payment or staff time spent administering the agreement).

Form (available in the Document Library) to BPA (e-mail eedocs@bpa.gov or fax 1-866-535-7955). Approved bilateral transfers will result in ECA implementation budget revisions.

3. ECA Implementation Budget Reduction

   Customers may reduce their implementation budget at anytime by submitting a request through the COTR Request and Acknowledgement Procedure. BPA will revise the customer's ECA implementation budget to reflect the reduction, and the unallocated funds will be added to the Unassigned Account.

4. ECA Implementation Budget Increase from the Unassigned Account

   BPA may increase customer implementation budgets (1) at months 6, 12 and 18 of the rate period and (2) on a monthly basis, beginning the 19th month of the rate period by distributing available EEI funds from the Unassigned Account. Customers will have 10 working days to request an implementation budget increase after BPA provides an accounting of available funds. If a customer's request is approved, funds will be allocated via a revision to the customer's ECA implementation budget.

   To request an implementation budget increase from funds in the Unassigned Account, customers must submit to BPA (e-mail eedocs@bpa.gov or fax 1-866-535-7955) the Unassigned Account Funding Request Template (available in the Document Library).

   Customers who reduce their implementation budgets within the first 12 months of a rate period receive second priority access (behind BPA, which has first priority for Large Project Fund allocations, if applicable) to the unassigned funds up to the amount reduced. Priority is based on the date the funds were released and carries through that rate period and the one immediately following. Once the customer has recovered all the reduced funds, priority access is removed.

5. Large Project Fund Budget

   Customers may receive a supplemental Large Project Fund budget in a separate ECA exhibit to support qualifying custom projects. Per the terms of that exhibit, BPA will lock large project funding equal to the projected payment, less either 1/3 of the customer's start-of-rate-period EEI allocation or 1/3 of the estimated payment (customer must choose one). The difference provides the BPA payment cap, but the actual payment is based on savings achieved as documented in the custom project completion report. The Large Project Fund is capped at $10 million per rate period, and BPA will allocate funds on a first-come, first-served basis according to the date of the submitted custom project proposal requesting Large Project Funds.[4] A customer must request Large Project Fund budget by using the COTR Request and Acknowledgement Procedure and requesting such funds in the custom project calculator.[5] [6] The request must indicate (1) the rate period in which the Large Project Fund allocation will be disbursed to the customer (by estimating the project completion date) and (2) project milestones and a proposed schedule of completion.

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[4] To ensure initial equitable access to the Large Project Fund, BPA will open a window for fund requests, and will consider all requests received during that window to have the same submission date and time. Funds will be allocated to qualifying projects submitted during the window on a pro-rata basis, if necessary.

[5] Only projects initiated post-2011 may qualify for the Large Project Fund.

[6] Customers using Custom Project Process, Option 2 must use Custom Project Process, Option 1 for projects using Large Project Funds.

In order to qualify for the Large Project Fund, the requirements below must be met:

- The custom project's payment meets or exceeds 50% of the customer's rate period implementation budget.[7]
- The customer must pass through to the end user, at a minimum, the lesser of the estimated payment as documented in the proposal or the actual total available payment as documented in the completion report (including BPA and customer shares).
- If a project is not completed within the projected rate period stipulated in the custom project proposal, the funding lock will be revoked, and the customer must reapply for large project funding using the COTR Request and Acknowledgement Procedure. The request must include the revised projected completion date, payment amount and documentation of the Large Project Fund requirements.
- The customer must repay BPA for the large project funding received through (1) reductions to the customer's implementation budget, (2) reductions to two start-of-rate-period EEI allocations or (3) by the customer using its own funds.

If the customer is a member of a pooling organization, all calculations are based on the customer's individual, uncombined budgets.

2.1.2 Rules for Pooling Organization

A pooling organization is two or more customers combining BPA funds to implement cost-effective conservation. A customer may put all or a portion of its BPA funding toward a pool and withdraw under terms and conditions agreed to by the pool. Pool membership can expand or contract as determined by the pool, but pooling organizations must provide written notice to BPA at least 30 days prior to membership formation, changes or dissolution.

A pooling organization must appoint a legally authorized representative (i.e., customer or separate entity) to assume non-transferable liability for the organization. BPA will fund a pooling organization only after it has reviewed and approved documentation of pool status (e.g., pooling organization agreement, by-laws, articles of incorporation) submitted by requesting customers. If the authorized representative is not a BPA customer with an existing ECA, BPA will offer an ECA for signature. Savings must be allocated to the individual customer where the savings are located.

[7] For customers in a pooling organization, this requirement is calculated using the customer's individual, uncombined rate period implementation budget.

2.1.3 Performance Payments

Performance payments come out of the customer's ECA implementation budget and are based on savings achieved. The payment rate and cap depend on the customer's classification as "small," "rural" or "residential" (SRR) or none of these (non-SRR) (as defined in the chart below).[8]

SRR Status	Definition	Payment Rate *$/kWh*
Small	The customer's forecast net requirement is less than 10 aMW.	$0.08
Rural	The customer has fewer than 10 customers per line mile according to the Low Density Discount calculation.	$0.08
Residential	The customer's load is greater than 66% residential, according to U.S. Energy Information Administration data.[9]	$0.08
Non-SRR	The customer is not small, rural or residential.	$0.04

Customers may claim payment at a rate up to the rate in the table above, and the payment amount must be included in each invoice. If the performance payment is not claimed in an invoice or claimed only in part (e.g., at a rate less than the payment rate in the table above), there is no opportunity to later collect money for the unclaimed payment. (Note, however, that the process for requesting payment for EnergySmart Grocer (ESG) savings is different; to request a performance payment on ESG savings, customers must e-mail their Energy Efficiency Representative and request a report of eligible savings and the ESG Performance Payment Form.)

The total of all performance payments is capped at 30% of the implementation budget for SRR customers and at 20% of the implementation budget for non-SRR customers.[10]

Pooling organizations may claim performance payments up to the aggregate of each pool participant's allowance.

When funds are redistributed among customers, BPA may restrict the performance payment claimable on the transferred funds.[11]

BPA highly recommends that customers use performance payments to support implementation costs in support of the Manual's activities. Implementation costs may include (1) staff (direct labor and indirect overhead for the implementation and management of conservation activities); (2) marketing (market research, advertising and promotional material production and distribution); and (3) other operating costs (equipment (e.g., metering equipment, computer software/hardware), training, travel and program development).

[8] BPA will notify customers of their rate-period classification in the EEI eligibility letter.

[9] BPA reserves the right to request additional documentation (e.g., an annual report) to verify a customer's load.

[10] The implementation budget does not include Large Project Funds.

[11] This restriction reduces the risk that BPA will overpay because performance payments are paid on a $/kWh basis, independent of payment amount (i.e., a customer could max out its performance payment, receiving little payment and then transfer its remaining implementation budget to another customer that similarly maxes out the performance payment).

2.2 Funding Sources and Savings Allocation

When reporting savings to BPA, customers must select one or more of the following funding sources.

Funding Source	BPA Energy Efficiency Reporting System Title	Description
Implementation Budget	EEI	BPA payment in the form of EEI funding; ECA funded activities that are accepted by BPA
Large Project Fund Budget	LPF	BPA payment in the form of EEI funding; ECA Large Project Funded activities that are accepted by BPA
BPA-accepted, Non-BPA Funds	Self-funding	Non BPA-funded activities that *are accepted* by BPA
Not-BPA-accepted, Non-BPA Funds[12]	Non-reportable	Non BPA-funded activities that *are not accepted* by BPA

Customers are credited for all savings (except non-reportable) achieved in their service territory. Savings may be allocated to either the EEI or the customer depending on the amount of BPA payment requested by the customer.

BPA Payment Amount Requested	Available Applications	Savings Allocated to EEI	Savings Allocated to Customer
All	All	100%	0%
None	All	0%	100%
Partial	Custom projects	See tables, below.	See tables, below.

Partial BPA Payment Requests – Savings Allocation

EEI	$\frac{\textit{Amount of BPA Payment Requested}*}{\textit{Amount Paid to the End User}**}$ *X Total Reported Savings*
Customer	$\frac{(\textit{Amount Paid to the End User}**) - (\textit{Amount of BPA Payment Requested}*)}{\textit{Amount Paid to the End User}**}$ *X Total Reported Savings*

***Use the amount paid to the end user if less than the amount of BPA payment requested.**

****This amount may not exceed the total available BPA payment.**

[12] Customers are allowed, but not required, to include non-reportable savings to BPA. BPA will not review the non-reportable data. Customers will not be credited for the energy savings reported to BPA for non-reportable activities.

3. General Requirements

3.1 Documentation Requirements

Each measure contains documentation requirements. All documentation must be retained in the customer's file (which may be in hard copy or electronic form), and certain documentation must be submitted to BPA (e-mail eedocs@bpa.gov or fax 1-866-535-7955) or sent through BPA's energy efficiency reporting system.

Customers must retain required information for no less than three years after the term of the ECA or through September 30, 2017, whichever is later. Information must be available to BPA upon request.

If a customer agent or contractor was used for some or all of the measure development, implementation or verification, the customer must also retain a subcontract that documents Manual requirements and contains information required by the ECA.

3.2 Reporting Requirements

Reports must include supporting documentation required by the Manual, and documentation must prove that measures were available for implementation during the claimed period and properly installed and operating. BPA may reject measures that do not meet these requirements.

Should there be a disagreement regarding a report, BPA will work with the customer to correct errors and make agreed-upon revisions.

For each submitted report, customers must establish and maintain files and supporting documentation. The files must clearly identify the corresponding invoice and meet the documentation requirements of the Manual.

Until BPA Energy Efficiency procures a long-term reporting system, customers must use Interim Solution 2.0 (IS2.0) (available through BPA Customer Portal) to report energy efficiency achievements to BPA (with and without requests for payment). Customers may report energy savings, at any time, as long as the completion dates are in the current or previous rate period.

The following describes the reporting steps. All referenced documents are available in the Document Library.

1. Gather invoice package documents which may include, but are not limited to, the following:

    - Deemed Measure Upload Template (Note that customers may report measures labeled "any" and/or "all" at any time. Customers may report these measures alone or in conjunction with other, more detailed measures from the same measure Technology/Activity/Practice.)
    - Performance Payment Form (only if requesting less than the total available performance payment on an invoice)
    - Progress Payment Request Form (only if requesting custom project progress payments)
    - Calculators
        - Option 1 Custom Project Calculator (after COTR approval of project completion report, one calculator file for each COTR-approved completed project)

- Option 2 Custom Project Calculator (completed projects only, bulk reporting of multiple projects in one or more calculator files)
- RTF-approved Small Compressed Air Calculator
- Energy Management Calculators (Energy Project Manager, Track and Tune and High Performance Energy Management)
- Lighting Calculators
- Custom Program Calculators

2. Use the File Naming Convention Tool to name all invoice package documents. Improperly named documents will not be processed by the system and may result in the customer having to resubmit the entire invoice package.
3. Use the Summarizer (optional) to estimate the totaled invoice package payment and savings.
4. Upload invoice package documents (named using the File Naming Convention Tool) to the BPA Energy Efficiency reporting system.

BPA will review the submitted documents and create an invoice report showing the amount to be paid. BPA will work with the customer to resolve any errors in the invoice package and will determine the acceptability for payment for measures reported.

3.3 Oversight Review Process

As a part of the oversight review process, BPA shall (1) perform end-user site and record reviews and (2) make program evaluations.

1. Site and Record Reviews

   BPA may conduct oversight inspections of all measures, contact end users to verify reported measures, monitor or review the customer's procedures and records and conduct site visits to verify claimed energy savings and oversee implementation. The number, timing and extent of inspections is decided by BPA and coordinated with the customer. BPA shall normally provide written notice not less than 30 days prior to an inspection and inspections will occur at BPA expense. BPA may contact appropriate federal, state or local jurisdictions regarding health, safety or environmental matters related to any activity under this Manual.

   If, at any time, BPA finds noncompliance with the requirements of the Manual or the customer's ECA, it may make adjustments to the customer's invoices and/or payments to achieve compliance.

2. Program Evaluations

   a. BPA may evaluate measures to assess the amount, cost-effectiveness and reliability of conservation. BPA will determine the timing, frequency and type of evaluations in consultation with the customer.

   b. BPA may require customers to provide billing data and contact information for participants. If so, billing data must be linked to the reported measure (e.g., through a unique identification) to allow BPA to assess savings by measure.

   c. BPA and/or regional participants will pay for evaluations initiated by BPA. In some cases, another party will manage the evaluation on behalf of BPA. BPA recognizes that customers participating in the evaluation provide some resource/cost, but the cost is not eligible for BPA payment.

3.4 Third-Party Operated Program Requirements

It is unlikely, but possible that unforeseeable contract circumstances may result in the termination or change of third-party operated programs, without prior notice. If BPA is forced to change a third-party operated program, BPA will strive to minimize disruptions to delivery of program services through an alternate third-party provider or with BPA's own staff resources. BPA will give customers as much notice as possible of such terminations or changes or of potential terminations or changes and will work with customers to wrap-up and/or transition any work in progress.

The following programs are operated by third-parties: ESG, Energy Smart Industrial, Northwest Trade Ally Network, Technical Service Providers, BPA Simple Steps, Smart Savings Retail Promotion and the Green Motors Rewind Initiative.

3.5 Other Requirements

1. The customer must comply fully with all laws and regulations.
2. If the customer is non-compliant with a requirement of this Manual or there is a significant environmental, health or safety threat, BPA shall notify the customer in writing of the specific noncompliance and suspend implementation.
    a. The customer shall have a number of days, as agreed to in writing by BPA, to correct (at its own cost) the noncompliance.
    b. BPA shall not accept claims with suspended activity, and if the customer does not complete the required corrective actions, BPA may terminate all funding.
    c. BPA shall review completed corrective actions and reassess the suspension. If BPA lifts the suspension, the customer may begin implementation of the activity with the changes required by BPA.
3. If BPA determines a customer reported measures with false information, BPA may prohibit the customer from reporting measures to BPA. If the measure that contains false information was implemented with the assistance of a contractor, BPA may prohibit all customers from reporting measures implemented with the assistance of that contractor.[13]

3.6 Liability Requirements

1. Except for Direct Acquisition initiatives, BPA and the customer assert that neither is the agent or principal for the other; nor are they partners or joint venturers, and BPA and the customer agree that they shall not represent to any other party that they act in the capacity of agent or principal for the other.
2. In no event will either BPA or the customer be liable to each other for any special, punitive, exemplary, consequential, incidental or indirect losses/damages from any failure of performance howsoever caused, whether or not arising from a party's sole, joint or concurrent negligence.
3. The reference to specific products or manufacturers does not represent a BPA endorsement or warranty, and BPA is not liable for any damages that may result from the installation or use of such products.

[13] BPA does not accept claims implemented in conjunction with AutoCell Electronics, Inc.

4. Custom Projects

4.1 Custom Projects Payment Rate

Effective April 1, 2015, customers must use Custom Project Calculator Version 2.0 or later for new custom projects. BPA will no longer accept Custom Project Calculator Version 1 unless it is for a completion report on a project started prior to April 1, 2015.

The total available BPA payment for a custom project is equal to the lesser of (1) the BPA payment rate ($/kWh) or (2) the project cost cap.

The applicable BPA payment rate ($/kWh) is the rate in place at the time of project start date. BPA payment rate is calculated according to the table below:

Project Type	Measure Life (Years)	Sector	Payment Rate (*$/kWh*)
ESG	1	Commercial	$0.025
	2-3	Commercial	$0.05
	4+	Commercial	$0.17
Non-Residential Lighting	All	Agricultural Commercial Industrial	$0.18
Retrofit Construction (excluding ESG and Non-Residential Lighting)	1	All	$0.025
	2-3	All	$0.05
	4-19	Agricultural Industrial Utility Distribution	$0.25
		Commercial Residential	$0.20
	20+	All	$0.35
New Construction and Major Renovation (excluding ESG and Non-Residential Lighting)	1	All	$0.025
	2-3	All	$0.05
	4-19	Agricultural Residential Commercial	$0.27
		Industrial Utility Distribution	$0.25
	20+	Agricultural Commercial Industrial	$0.35
		Utility Distribution	$0.25

Project cost cap: Payment for all sectors is capped at 70% of the incremental project cost. If incremental cost data is not available for commercial new construction projects, incremental cost may be calculated as 2.86% of the whole building.

Customers may request less than the available BPA payment. This option applies to all projects, regardless of the approval date. To make this request, the customer must enter the percentage of available payment requested in the Custom Project Calculator.

Customers must pass through the entire BPA payment received to their end users if such payment is for a progress payment or funded by large project funds.

Customers seeking partial self-funded credit on a project must (a) request a payment lower than the available BPA payment, (b) pay a portion of the available BPA payment with utility funds (self-funding), (c) enter the actual end-user payment amount in the custom project calculator and (d) retain proof of actual end-user payment to substantiate the self-funding portion.

4.2 Custom Projects Progress Payments

Only Option 1 custom projects are eligible for progress payments.[14] The customer must request progress payments in the proposal, and the request must include a schedule with estimated progress payments that coincide with incurred costs and measureable milestones.

Progress payments will be made after project milestones are achieved and verified in accordance with the BPA approved custom project proposal. The customer must document project milestone achievement (e.g., ordered, delivered or installed equipment) prior to receiving a progress payment.

The full progress payment amount paid by BPA must be passed through to the end user, and the customer must retain proof of payment. Customers will be required to repay BPA if the project is not completed within six months of the expected completion date (the expected completion date may be revised with BPA approval).

In order to qualify for progress payments, the project must have the following attributes:

1. The time period from the BPA custom project proposal approval date to the completion report submittal date meets or exceeds 12 months.
2. The amount of each progress payment is $100,000.00 or greater.
3. The estimated incentive for the project is $250,000.00 or greater.
4. The sum of the progress payments does not exceed the lower of (a) 70% of actual expenditures of the project incurred up to the date of the progress payment invoice to BPA or (b) 50% of the estimated total project incentive.

[14] Option 2 customers may request progress payments for a project only if they use the Option 1 custom project process to secure BPA's approval.

4.3 Custom Projects Documentation Requirements

Documentation Description	Retention/Submittal Locations		
	BPA Energy Efficiency Reporting System	eedocs@bpa.gov or fax 1-866-535-7955	Customer File
Option 1 Custom Projects			
Option 1 Custom Project Calculator (Send to BPA for completion report review with all supporting documentation, including associated lighting calculator being used for estimates if applicable. Submit to BPA Energy Efficiency reporting system after approval of project completion report, when requesting BPA payment or reporting self-funding.)	X	X	X
End-user payment documentation (e.g. canceled check), if progress payments, large project fund or if partial self-funding credit is requested.			X
Option 2 Custom Projects			
Option 2 Custom Project Calculator	X		X
Responsible entity implementing M&V plan, M&V plan, pre and post measurement data, assumptions and any modeled or calculated data used to determine energy savings			X
Project documentation including, at a minimum: basic project information, baseline conditions, efficient measure conditions, description of M&V procedures used for the project (e.g., protocol used for estimating savings, calculations used, metering equipment, sampling) and deviations from planned M&V, M&V report and/or detailed savings model, name of M&V protocol used, verified savings and documentation showing how the projected non-energy benefits and operations and maintenance costs were calculated (if applicable), verified costs, including invoices, and delivery inspection report/date.			X
End-user payment documentation (e.g. canceled check) if progress payments, large project fund or if partial self-funding credit is requested.			X

4.4 Custom Projects Overview

4.4.1 Custom Projects Process Option Overview and Enrollment

There are two paths available for custom projects: Option 1 and Option 2.

Customers, by default, are enrolled in Option 1, but may elect Option 2 by using the COTR Request and Acknowledgement Procedure at the start of each rate period, and must submit/renew their application no later than September 1 preceding the new rate period.

A request to follow the Option 2 path must include the customer's proposed custom project delivery approach including documentation of rules, processes, and staffing capability to meet the custom project requirements. The request must also provide any internal M&V protocols used for custom projects for BPA review. BPA may request additional information before notifying the customer of its approval/non-approval of Option 2 status. Option 2 customers may switch to Option 1 through the COTR Request and Acknowledgement

Procedure (1) for any reason at the start of a new rate period[15] or (2) if customer circumstances change, making Option 2 unworkable.

- Option 1: BPA manages the project performance and cost-effectiveness of the bundle of energy savings from Option 1 custom projects. Option 1 customers may request technical support from BPA or BPA program implementers (i.e. Energy Smart Industrial or ESG) to develop projects and complete M&V regardless of the size of the project or the requirement for review and comment.
- Option 2: Customers manage the project performance and cost effectiveness of the bundle of energy savings from their custom projects. The customer conducts all aspects of M&V and custom project quality control (e.g., project proposal and project completion documentation review) internally. Technical assistance is available in relation to Manual clarifications and consultations regarding M&V methods and protocols as they apply to a single project or the customer's portfolio of projects; project implementation assistance is not available unless provided by third-party implementation contractors as part of a program (e.g., PECI through ESG, Cascade Energy through Energy Smart Industrial or the Northwest Trade Ally Network). Option 2 customers that request special BPA funding such as progress payments or Large Project Fund or those performing Emerging Field Test Demonstration Projects must follow the Option 1 custom project process.

4.4.2 Custom Projects General Requirements

1. The measures must be designed to result in improvements in the energy efficiency of electricity distribution or use and must have a savings life of at least one year.
2. Custom projects are limited to one sector each.
3. Deemed measures and calculated projects may be included in custom projects, on their own or in a project with other measures/projects, but must either (1) be included in the custom project M&V and not use the deemed/calculated savings value or (2) be reported through the deemed/calculated path and netted out from the custom project savings.
4. Option 1 Custom Projects must meet the following B/C ratio requirements:
    a. If the project savings are 200,000 kWh or less, no cost effectiveness screen is applied.
    b. If the project savings are over 200,000 kWh and the project has a BPA-approved proposal, the proposal must demonstrate that the project has a B/C ratio $\geq$ 0.5 based on proposed costs and savings. No additional screen will be applied at the completion report.
    c. If the project savings are over 200,000 kWh and the project does not have a BPA-approved proposal, the completion report must demonstrate that the project has a B/C ratio $\geq$ 0.5.
5. Option 2 custom projects must have a minimum B/C ratio of 1.0 at the invoice level, based on verified costs and savings.
6. The BPA M&V Protocol Selection Tool for custom projects must be used to select an appropriate M&V plan and documented in file. The implemented plan will be either (i)

[15] Customers wishing to return to Option 1 with the start of a new rate period must submit their request no later than September 1 immediately preceding the new rate period.

Engineering Calculations with a Verification Plan or (ii) a Comprehensive M&V Plan. See the Document Library.

a. *Engineering Calculations with a Verification Plan*

Detailed guidance on preparing Engineering Calculations with a Verification Plan is included in the BPA Engineering Calculations with Verification Protocol. As directed in the BPA M&V Protocol Selection Tool, Engineering Calculations with a Verification Plan may be used for projects with an expected annual energy savings less than 200,000 kWh per year that qualify under the BPA Engineering Calculations with Verification Protocol.

b. *Comprehensive M&V Plan*

Detailed guidance on preparing a Comprehensive M&V Plan is in the BPA M&V Protocols and Guidelines and RTF Standard Savings Estimation Protocols.

4.5 Option 1 Custom Projects

4.5.1 Custom Project Proposal

Option 1 custom project proposals (a component of the Option 1 Custom Project Calculator) are not required unless the customer is applying for Large Project Funds or Progress Payments or is performing an Emerging Technology Demonstration Field Test Project.

Customers may, but are not required to, submit proposals to manage (1) energy savings risks (i.e., if BPA approves the M&V plan at the proposal stage and the M&V is carried out as stated in the plan, then BPA will accept the savings.) and (2) cost-effectiveness risks (i.e., customers can secure assurance of project eligibility based on proposed values (rather than the completion report values)). The customer may submit the Option 1 Custom Project Calculator and other supporting materials to BPA by emailing it to eedocs@bpa.gov or faxing to 1-866-535-7955 with the following tabs completed: “Project Information”, “Proposal” and “Measure Input” (all fields labeled “required for proposals”).

When a proposal is approved, BPA will notify the customer and e-mail the approved Option 1 Custom Project Calculator to the customer with the BPA-Assigned Project ID. This file must be saved and used by the customer for submittal of the completion report.

4.5.2 Custom Project Completion Report

Option 1 customers must submit a completion to BPA (e-mail eedocs@bpa.gov or fax 1-866-535-7955) in BPA’s Option 1 Custom Project Calculator with “Project Information”, “Measure Input” and “Completion Report” completed and provide supporting documentation for all custom projects.

When a completion report is approved, BPA shall notify the customer and email the approved Option 1 Custom Project Calculator to the customer. The customer must submit the BPA-approved calculator in the BPA Energy Efficiency Reporting System when requesting payment or reporting self-funding.

Note that Option 1 customers electing to submit non-reportable projects must do so using the Option 2 Custom Project Calculator.

4.5.3 BPA Review

Within 10 business days of receiving an Option 1 custom project proposal or completion report, BPA will review the proposal or completion report and either (1) accept the submittal, return the submittal for modification and resubmittal or (2) reject the submittal. BPA determination of acceptability of a completion report is based on the following criteria:

- Whether the Option 1 Custom Project Calculator and supporting documentation contain all required information
- Whether the project meets all requirements
- Whether verified energy savings are reliable (i.e., M&V was implemented per the approved M&V plan or M&V was appropriate for the project and consistent with BPA M&V Protocols)

For Option 1 projects without BPA-approved proposals and insufficient M&V, BPA will work with customers to adjust completion report savings, where appropriate and feasible. If it is not possible to make appropriate adjustments, the project will be rejected and is ineligible for reporting to BPA.

4.6 Option 2 Custom Projects

For Option 2 projects, BPA does not require or review proposals. Option 2 customers may apply for special BPA funding such as Progress Payments or Large Project Funds using the custom project proposal process for Option 1 custom projects, and if approved for such, the projects are Option 1 projects and must meet all requirements of Option 1 custom projects.

For all Option 2 projects, the customer must review and approve the completion report prior to customer submission of savings into BPA reporting system. The completion report itself does not need to be submitted to BPA but must be retained in the customer file for oversight/evaluation. The completion report should also contain any information on additional quality control conducted on the project. To receive payment for a custom project, the customer must submit the Option 2 Custom Project Calculator through the BPA Energy Efficiency reporting system.

BPA may reject Option 2 projects that do not (1) have a completion report that contains all required information and demonstrates that project is consistent with the custom project requirements and (2) have verified energy savings that are reliable (i.e., M&V was implemented per the approved M&V plan or M&V was appropriate for the project and consistent with BPA M&V Protocols).

5. Custom Programs

Custom programs are a combination of projects, measures and/or end-users that have a similar delivery mechanism whereby gaining BPA approval of the program allows for more customer flexibility and reduced administrative effort associated with multiple custom projects. The scope of a custom program is multiple installations that may include one or more measures, or sectors[16] and may occur at one or more end-user sites.

5.1 Custom Programs Payment Rate

The total available BPA payment for an Evaluated Custom Program or project within a M&V Custom Program is equal to the lesser of (1) the BPA payment rate ($/kWh) or (2) the project cost cap.

The applicable BPA payment rate ($/kWh) is the rate in place at the time of Evaluated Custom Program approval or project start date for a project within a M&V Custom Program. BPA payment rate is calculated according to the table below:

Program Measure Type	Measure Life (Years)	Sector	Payment Rate (*$/kWh)*
Non-Residential Lighting	All	Agricultural Commercial Industrial	$0.18
Retrofit Construction (excluding Non-Residential Lighting)	1	All	$0.025
	2-3	All	$0.05
	4-19	Agricultural Industrial Utility Distribution	$0.25
		Commercial Residential	$0.20
	20+	All	$0.35
New Construction and Major Renovation (excluding Non-Residential Lighting)	1	All	$0.025
	2-3	All	$0.05
	4-19	Agricultural Residential Commercial	$0.27
		Industrial Utility Distribution	$0.25
	20+	Agricultural Commercial Industrial Residential	$0.35
		Utility Distribution	$0.25

Payment for all sectors is capped at 70% of the incremental cost. Eligible costs include measure costs (incremental measure costs, operations and maintenance costs) and program costs (implementation, evaluation and M&V).

Customers may request less than the available BPA payment.

[16] Savings must be reported separately for each sector.

Customers seeking partial self-funded credit on an evaluated program or project within an M&V Custom Program must (a) request a payment lower than the available BPA payment, (b) pay a portion of the available BPA payment with utility funds (self-funding), (c) enter the actual program expenses (implementation, incentives and evaluation) in the custom program calculator and (d) retain proof of actual program expenses (payment to end-user and program costs) to substantiate the self-funding portion.

5.2 Custom Programs Requirements

Both Option 1 and Option 2 customers are eligible for custom programs, and both must meet the same requirements and follow the same process with BPA. Option 2 customers must use the custom program path when the BPA M&V protocols are insufficient to provide direction, including use of an impact evaluation to estimate savings or where the M&V protocols do not cover a specific measure/application/method.

Custom Programs must do the following:

1. Not result in fuel switching
2. Contain only measures with a savings life of one year or more

Deemed measures and calculated projects may be included in custom programs, on their own or in a program with other measures/projects, but must either (1) be included in the custom program M&V or evaluation and not use the deemed/calculated savings value or (2) be reported through the deemed/calculated path and netted out from the custom program savings.

There are two types of custom programs:

1. M&V Custom Program: Savings are estimated for individual sites based on M&V methodologies. M&V methods are based on the BPA M&V Protocols and Guidelines or RTF Standard Savings Estimation Protocols.

   M&V Custom Programs must be TRC cost-effective (TRC>1.0) at a calculator level.

2. Evaluated Custom Program: Savings estimation follows an impact evaluation plan, which may include a census or sample of the participants. Evaluation methods are known and tested for the specific measure/application. Evaluations must be, at a minimum, consistent with RTF Guidelines Section 5 (Impact Evaluation).

   Evaluated Custom Programs must be cost-effective at the program level (impact evaluation level) with TRC of 1.0 or greater based on verified costs and savings at the time of completion report and invoicing.

5.3 Custom Programs Approval and Modification Process

The customer must secure BPA's approval of its custom program or any modifications (including cancelation) thereto (e.g., new measures, measure exclusion, and M&V approach change).

Custom Program proposals must, at a minimum, contain[17] the following information:

1. Basic program information, including:
    a. Program name
    b. Contact information: customer name, proposer contact information
    c. Program summary, existing system and proposed system descriptions
2. Documentation of baseline conditions
3. A site-specific M&V plan or impact evaluation plan
4. Proposed measure costs and savings
5. Proposed program costs
6. Estimated project-level cost effectiveness
7. For M&V Custom Program, completion report submission requirements (e.g., approved reports prior to submission for all projects, some projects, or no projects.

The customer's request for approval must be sent to BPA (e-mail eedocs@bpa.gov or fax 1-866-535-7955) by submitting a Custom Program Calculator (available in the Document Library).

The customer may cease its custom program participation at any time using the COTR Request and Acknowledgment Procedure. BPA shall have no obligation for costs incurred for unreported savings.

Evaluation requirements differ for Evaluated and M&V Custom Programs, *but each evaluation plan must be customer funded unless otherwise directed by BPA*.

BPA may ask the customer clarifying questions during the approval process. Within 10 working days of the receipt of all documents (as listed below), BPA will e-mail the customer with its decision or a time-frame for a decision.

[17] Additional optional fields are included in the Custom Program Calculator.

5.4 Custom Programs Documentation and Reporting Requirements

Documentation Description	Retention/Submittal Locations		
	BPA Energy Efficiency Reporting System	eedocs@bpa.gov or fax 1-866-535-7955	Customer File
Custom Program Calculator	X	X	X
Evaluation Plan		X	X
Evaluation Report for completed evaluated program		X	X
End-user payment documentation (e.g. canceled check), if pass-through is required or for all projects requesting less than the total available BPA payment			X
Completion reports for M&V Custom Program projects, as defined in the proposal		X	X
For M&V Custom Programs, documentation of basic project information, baseline conditions, efficient measure conditions, description of M&V procedures used for the project (e.g., protocol used for estimating savings, calculations used, metering equipment, sampling) and deviations from planned M&V, detailed savings model including calculations and raw data if applicable, verified savings			X

Savings may be reported from projects that were completed prior to proposal approval, as long as those savings meet the savings estimation and reporting requirements.

The reporting requirements differ depending on whether the custom program is (1) M&V or (2) evaluated.

1. <u>M&V Custom Program</u>

   The customer must conduct M&V in accordance with its approved M&V plan and must document the type and quantity of measures installed.

   Completed projects may be submitted for payment using the Custom Program Calculator for each project (including measure-specific results) no later than the reporting period immediately following project completion (i.e., when the project is installed and energy savings measured according to its M&V plan).The calculator will estimate the payment, consistent with the start date of each individual project.

   BPA will define M&V Custom Program completion report requirements at the proposal stage. Prior to customer submission in the BPA reporting system, BPA must approve the completion report to ensure alignment with the requirements given at proposal.

2. <u>Evaluated Custom Program</u>

   Prior to reporting in the BPA reporting system, the customer must submit a completed Custom Program Calculator and an evaluation report consistent with the previously approved evaluation plan.

   Payment is based on evaluated savings per the evaluation report.

   Upon conclusion of the program and approval of the final Custom Program Calculator and evaluation report, the COTR will direct the customer how to report the program savings to BPA.

6. Agricultural Sector

Please check the changes and corrections summary to see if revisions were made to any of the measures in this sector.

The Agricultural Sector includes electrical energy used (1) by a farm or business of which the primary purpose is applying water for food production or vegetation growth (e.g., pumping and irrigation) and (2) by a ranch or aquaculture (aquafarming) business where the primary business is breeding or raising of domestic livestock, poultry, game animals, fish, oysters, etc.

The storage and processing of farm products is not agricultural, and rather it is industrial with the exception of dairies and the storage of milk at the milking facility (note that homogenizing, dehydrating and bottling of milk and its derivatives are industrial). A facility may have a mix of both agricultural and industrial measures at the same location (e.g., winery operation with processing facility where the vineyard irrigation is considered agricultural and the grape processing facility is considered industrial).

Payment Summary*

Program Component or Measure	Payment
Freeze Resistant Stock Water Tanks/Fountains	$140.00-$225.00/tank or fountain
Irrigation-Related Measures	
o *Irrigation System Upgrades*	$0.75-$175.00
o *Scientific Irrigation Scheduling*	$5.20/acre
o *Irrigation Pump Testing and System Analysis*	$50.00-$300.00/test or analysis
Variable Frequency Drives in Agricultural Turbine Pump Applications	$60.00/horsepower
Transformer De-energization	$0.025/kWh or 70% of project incremental cost
New Agricultural Construction	See the custom projects payment table.
Other Agricultural Measures	See the custom projects payment table.
Multi-Sector Opportunities	
o *Green Motors Rewind Initiative*	$2.00/hp
o *Non-Residential Lighting Program*	See the lighting calculators.
o *Engine Block Heaters*	$200.00-$1,500.00/unit
o *Limited Availability Emerging Technology Demonstration Field Test Projects*	See the custom projects payment table.
o *Variable Frequency Drives in Small Compressed Air System*	See the custom projects payment table.

* The payment levels described in this table provide a summary only. Complete details of the payment levels and associated requirements may be found in the corresponding text of the Manual. Please see the Table of Contents for the text location.

Freeze Resistant Stock Water Tanks/Fountains

Requirements and Specifications

Freeze resistant stock water tanks/fountains are available as a measure in heating zones (HZ) 1, 2 and 3. Electric resistance stock water tank heater(s) must be removed or permanently disabled, and the new freeze resistant stock water tanks/fountains must have the following qualifications:

1. New (i.e., not home- or kit- made)
2. Enclosed, fully foam or dead air space insulated with the opening completely sealed in impact-resistance polyurethane
3. Possess elliptical or flap closures that tip easily so animals can drink without resistance
4. Sized in accordance with manufacturer's specifications for the type and number of animals for which it will be used
5. Hard-piped underground and stubbed up into the insulated portion of the fountain
6. Contain no electric heat
7. Possess a minimum five-year manufacturer defect warranty

Documentation Requirements

Documentation Description	Retention/Submittal Locations		
	BPA Energy Efficiency Reporting System	eedocs@bpa.gov or fax 1-866-535-7955	Customer File
End-user identifying information including unique site ID and address			X
Equipment/contractor invoice showing (a) measure requirements have been met (e.g., manufacturer, model number, type, size and quantity of equipment or product installed/used), (b) the order/purchase date and (c) cost			X

Payment

HZ 1: $140.00 per freeze resistant stock water tank/fountain

HZ 2: $165.00 per freeze resistant stock water tank/fountain

HZ 3: $225.00 per freeze resistant stock water tank/fountain

Irrigation-Related Measures

Irrigation System Upgrades

Requirements and Specifications

Energy efficiency upgrades to new or existing irrigation systems and water management must be designed, constructed and verified in compliance with the current specifications as listed in the Interim Reference Deemed Measure List in the Document Library.

Documentation Requirements

Documentation Description	Retention/Submittal Locations		
	BPA Energy Efficiency Reporting System	eedocs@bpa.gov or fax 1-866-535-7955	Customer File
End-user identifying information including unique site ID and address	X		X
Equipment/contractor invoice showing (a) measure requirements have been met (e.g., manufacturer, model number, type, size and quantity of equipment or product installed/used), (b) the order/purchase date and (c) cost			X

Payment

Sprinkler Equipment	Payment
Replace worn nozzle with new flow controlling type nozzle for impact sprinklers	$4.00/nozzle[i]
Replace leaking impact sprinkler with rebuilt or new impact sprinkler	$3.75/sprinkler[i]
New nozzle for impact sprinkler replacing existing worn nozzle of same flow rate or less	$1.50/nozzle[i]
New nozzle for center pivot and lateral moves	$1.00/nozzle
New rotating type sprinklers that replace impact sprinklers	$4.00/sprinkler[i]
Replace leaking pipe section and riser cap gaskets for wheel or hand lines or portable main line gasket with new gasket	$2.75/gasket
New low-pressure regulators	$5.00/regulator[i]
New rotating type sprinklers that replace low-pressure	$4.00/sprinkler[i]
New multiple configuration nozzles for low-pressure pivot[ii] sprinklers	$3.00/sprinkler[i]
New multi-trajectory sprays that replace impact sprinklers	$4.00/sprinkler[i]
New multi-trajectory sprays that replace low-pressure	$1.00/sprinkler[i]
Replace leaking drain gaskets with new gaskets on wheel-lines, hand lines or pivots[ii]	$1.00/drain
New hubs for wheel-lines	$14.50/hub
New goose-neck elbow for new drop tubes (to convert existing sprinkler equipment mounted on top of the pivot[ii] to low-pressure sprinkler package)	$1.65/goose-neck
New drop tube for low-pressure pivot[ii] sprinklers (minimum three feet length)	$3.00/drop tube
Replace leaking center pivot base boot gasket with new gasket	$175.00/pivot
Pipe repair of leaking hand lines, wheel-lines and portable mainline	$10.00/pipe section
Rebuild or replace leaking or malfunctioning leveler with new or rebuilt wheel-line leveler	$0.75/leveler

[i] Rebate is limited to two units per sprinkled acre for solid set sprinklers.

[ii] Lateral moves are also included.

Scientific Irrigation Scheduling

Requirements and Specifications

Scientific Irrigation Scheduling (SIS) applies to agricultural irrigation systems (1) with a pumping capacity beyond that required to meet normal crop needs, as defined by the United States Department of Agriculture, and (2) that irrigate crops that benefit from improved irrigation practices.

Customers must collect and use weekly hydro application data including all water applied, evapo-transpiration needs and soil moisture tables. Energy savings are based on the actual on-farm energy savings determined by the SIS M&V Calculator in the Document Library. Off-farm savings, such as potential savings on other irrigation systems, other utility systems or other irrigation districts cannot be reported, but adjustments of site savings to busbar savings can be claimed.

Documentation Requirements

Documentation Description	Retention/Submittal Locations		
	BPA Energy Efficiency Reporting System	eedocs@bpa.gov or fax 1-866-535-7955	Customer File
End-user identifying information including unique site ID and address	X		X
Equipment/contractor invoice showing (a) measure requirements have been met (e.g., manufacturer, model number, type, size and quantity of equipment or product installed/used), (b) the order/purchase date and (c) cost			X
Completed SIS M&V Calculator and data on measure costs, crop type, acreage and energy savings		X	X

Payment

BPA shall pay customers $5.20 per acre per year.

Irrigation Pump Testing and System Analysis (BPA Qualified)

Requirements and Specifications

- The irrigation pump must be electrically powered, 20 hp or greater and must not have been tested through BPA-sponsored pump testing services within the past five years.
- The irrigation pump must have been in operation for the two previous years.
- The irrigation pump test[18] must be performed by an individual possessing pump testing knowledge and experience.[19]
- Customers and qualified vendors must use the BPA Screening Tool in the Document Library to limit the amount of dry holes (i.e., pump tests that do not result in a BPA-approved custom project).
- The customer may choose from the following tests:
    - Simple System Evaluation: Measure pump discharge pressure and evaluate condition of the sprinkler nozzles.
    - Simple System Irrigation Pump Test (e.g. open discharge): Perform irrigation pump test.
    - Irrigation Pump Test and System Analysis:[20] Perform irrigation pump test and evaluate mainlines and critical sprinklers.
- Customers must deliver printed recommendation reports to the end user.

[18] The test is the process to measure various aspects of the pump's operation including pumping lift, discharge pressure, power input and water flow. The results of the pump test estimate the overall efficiency of the pumping plant under the test conditions.

[19] Pump tests performed by BPA engineers do not qualify for payment.

[20] Irrigation System Analysis: combined with a pump test, the irrigation delivery system is reviewed for potential efficiency improvements including lower flows, reduced pipeline friction and repair of leaks.

Documentation Requirements

Documentation Description	Retention/Submittal Locations		
	BPA Energy Efficiency Reporting System	eedocs@bpa.gov or fax 1-866-535-7955	Customer File
End-user identifying information including unique site ID and address	X		X
Equipment/contractor invoice showing (a) measure requirements have been met (e.g., manufacturer, model number, type, size and quantity of equipment or product installed/used), (b) the order/purchase date and (c) cost			X
Irrigation pump test and recommendation report			X
Completed "Ag Irrigation Pump Testing" tab in the BPA Qualified and Provisionally Deemed Input Sheet (available in the "other documents" section of the Document Library)		X	X

Payment

Test Type	Payment
Simple System Evaluation	$50.00
Simple System Irrigation Pump Test (e.g. open discharge)	$100.00
Irrigation Pump Test and System Analysis, 400 acres or less	$200.00
Irrigation Pump Test and System Analysis, over 400 acres	$300.00
Irrigation Pump Test and System Analysis, Complex Pumping System over 400 acres with multiple operating pumps)	$200.00 per main pump plus $50.00 per booster pump

Variable Frequency Drives in Agricultural Turbine Pump Applications (BPA Qualified)

Requirements and Specifications

This measure applies to pumping operations that deliver, distribute or transport irrigation water with qualifying VFDs from 20 to 500 hp. Eligible installations are limited to turbine pumps with substantial variation in flow rates (20% variation or more) or discharge pressure requirements (10% variation or more). All new VFD installations must meet IEEE 519 standards. This measure provides an annual energy savings of 20% of the average of the previous three operating years' annual energy usage of the pump. Customers must use the Turbine Pump VFD Energy Savings Calculator to estimate savings (available in the Document Library).

Documentation Requirements

Documentation Description	Retention/Submittal Locations		
	BPA Energy Efficiency Reporting System	eedocs@bpa.gov or fax 1-866-535-7955	Customer File
End-user identifying information including unique site ID and address	X		X
Equipment/contractor invoice showing (a) measure requirements have been met (e.g., manufacturer, model number, type, size and quantity of equipment or product installed/used), (b) the order/purchase date and (c) cost			X
Completed Turbine Pump VFD Energy Savings Calculator (available in the Document Library)		X	X

Payment

BPA shall pay $60.00 per installed horsepower.

Transformer De-energization

Requirements and Specifications

Transformer De-energization (TRX-DX) is disconnecting a transformer and downstream loads from the utility power supply during extended periods of agricultural inactivity and reconnecting prior to the irrigation season startup. TRX-DX applies to systems that serve only an agricultural load and must be submitted as deemed projects and have a one-year measure life.

Documentation Requirements

Documentation Description	Retention/Submittal Locations		
	BPA Energy Efficiency Reporting System	eedocs@bpa.gov or fax 1-866-535-7955	Customer File
Documentation of number of transformers de-energized, location of transformers, length of outage period and energy savings associated with each unit			X
Labor and mileage costs			X

Payment

BPA will pay the lesser of $0.025 kWh or 70% of the incremental project cost.

New Agricultural Construction

Requirements and Specifications

New agricultural construction projects must be submitted as custom projects. Standardized M&V protocols must be provided for certain measures prior to project implementation.

Documentation Requirements

See the custom projects documentation requirements.

Payment

See the custom projects payment table.

Other Agricultural Measures

Requirements and Specifications

These measures must be submitted as custom projects.

- Low pressure conversion with associated pump work
- Change to 40 foot spacing on hand and wheel lines to enable conversion
- Turf irrigation applications in landscaping, golf courses, government and municipalities and other areas (including standard sprinkler measures, motor/pumping/VFD controls and weather station driven irrigation scheduling)
- Nursery and greenhouse project improvements in irrigation, air handling, temperature and humidity controls for facilities using less than 1 aMW (If usage is above 1 aMW, projects at the facility are industrial.)

Documentation Requirements

See the custom projects documentation requirements.

Payment

See the custom projects payment table.

Multi-Sector Opportunities

Additional agricultural opportunities are available in the Multi-Sector chapter:

- Processes
- Measures and Initiatives
    1. Green Motors Rewind Initiative
    2. Non-Residential Lighting Program
    3. Engine Block Heaters
    4. Limited Availability Emerging Technology Field Test Projects
    5. Variable Frequency Drives in Small Compressed Air Systems

7. Commercial Sector

Please check the changes and corrections summary to see if revisions were made to any of the measures in this sector.

The Commercial Sector includes electrical energy used in service-providing facilities and equipment of businesses; federal, state, and local governments; and other private and public organizations. The Commercial Sector is generally defined as non-manufacturing business establishments, including hotels, motels, restaurants, wholesale businesses, retail stores and health, social and educational institutions. The Commercial Sector includes multifamily buildings with five or more dwelling units within the same structure, and more than three stories.

Payment Summary*

Program Component or Measure	Payment
Commercial Custom Projects – Existing Buildings	See the custom projects payment table.
Commercial Lighting	See Multi-Sector chapter (except for LED Traffic Signals).
o *LED Traffic Signals*	$25.00-$30.00/traffic signal
Commercial HVAC	
o *Unitary Air Conditioning*	$45.00-$1,500.00/unit
o *Advanced Rooftop Unit Control Retrofit*	$150.00-$225.00/unit
o *Ductless Heat Pumps in Commercial Buildings*	$250.00/ton
o *Heat Pump Equipment Conversion and Upgrade in Commercial Buildings*	$100.00-$250.00/ton
o *Web-Enabled Programmable Thermostats*	$150.00-$800.00/unit
Commercial Shell Measures	
o *Retrofit Windows for Commercial Buildings*	$3.00-$6.00/square foot
o *Commercial Insulation*	$0.25-$1.85/square foot
Electric Water Heating	
o *Heat Pump Water Heating*	$300.00-$500.00/unit
Commercial Refrigeration	
o *BPA ESG Program*	See the PECI ESG Program rebate worksheet.
o *Deemed Refrigeration Retrofit Measures*	See the Document Library.
Commercial Kitchen and Food Service Equipment	
o *Demand Controlled Kitchen Ventilation*	$200.00-$400.00/horsepower
o *Electric Commercial Steamers*	$50.00-$200.00/steamer
o *Hot Food Holding Cabinets*	$75.00-$200.00/cabinet
o *Electric Combination Ovens*	$500.00/oven
o *Electric Convection Ovens*	$300.00/oven
o *Commercial Electric Fryers*	$300.00/installation
o *Pre-rinse Spray Wash Valves*	$100.00/installation
Additional Deemed Offerings	
o *Networked Computer Power Management*	$10.00/workstation
o *ENERGY STAR Commercial Clothes Washers - Laundromats*	$25.00-$125.00/washer
o *Smart Power Strips – Load Sensing*	$15.00/strip
o *Commercial Showerheads*	$8.00-$11.00/showerhead
Commercial New Construction	
o *New Construction/Major Renovation*	See the custom projects payment table.
Multi-Sector Measures	
o *Electric Storage Water Heaters*	$25.00/unit
o *Green Motors Rewind Initiative*	$2.00/hp
o *Non-Residential Lighting Program*	See the lighting calculators.
o *Engine Block Heaters*	$200.00-$1,500.00/unit
o *Limited Availability Emerging Technology Demonstration Field Test Projects*	See the custom projects payment table.
o *Variable Frequency Drives in Small Compressed Air System*	See the custom projects payment table.
o *Commercial Clothes Washers – Multifamily Common Areas*	$25.00-$100.00/unit
o *Multifamily, Multi-Sector Measures*	See the measure specific section.

* The payment levels described in this table provide a summary only. Complete details of the payment levels and associated requirements may be found in the corresponding text of the Manual. Please see the Table of Contents for the text location.

Commercial Custom Projects – Existing Buildings

Many Commercial Sector efficiency opportunities are complex, involve site-specific installations and savings or interaction between energy consuming systems in a building. These opportunities include, but are not limited to, HVAC, shell measures, existing building commissioning, high performance new building design and, in rare circumstances, some lighting projects.

Requirements and Specifications

These measures must be submitted as custom projects.

Documentation Requirements

See the custom projects documentation requirements.

Payment

See the custom projects payment table. The incremental cost for retrofit of existing equipment is the fully installed measure cost. The incremental cost for replacement of burned out/failing/failed equipment is the cost above code or its equivalent (e.g., for HVAC replacement, the incremental cost is the cost of equipment above the federal or state applicable standard for new or replacement equipment).

Commercial Lighting

Refer to the Non-Residential Lighting Program in the Multi-Sector Section for details on the lighting program, and stand-alone lighting measures.

LED Traffic Signals

Requirements and Specifications

LED traffic signals must be installed and replace functioning incandescent signals.

Documentation Requirements

Documentation Description	Retention/Submittal Locations		
	BPA Energy Efficiency Reporting System	eedocs@bpa.gov or fax 1-866-535-7955	Customer File
End-user identifying information including unique site ID and address			X
Equipment/contractor invoice showing (a) measure requirements have been met (e.g., manufacturer, model number, type, size and quantity of equipment or product installed/used), (b) the order/purchase date and (c) cost			X

Payment

Traffic Signal Type	Payment
12-inch Left Turn Bay; 12-inch Thru Lane; Don't Walk	$30.00
8-inch Left Turn Bay; 8-inch Thru Lane	$25.00

Commercial HVAC

Non-deemed HVAC opportunities are available only as custom projects.

Unitary Air Conditioning Equipment in Commercial Buildings (BPA Qualified)

Requirements and Specifications

Unitary air conditioning equipment refers to air-cooled, single cooling-zone, packaged unit, air conditioning equipment for commercial building applications. This equipment can be used in conjunction with gas or electric heating systems. Heat pumps are excluded.

Additional information is also available on the CEE and AHRI Web sites.

Documentation Requirements

Documentation Description	Retention/Submittal Locations		
	BPA Energy Efficiency Reporting System	eedocs@bpa.gov or fax 1-866-535-7955	Customer File
End-user identifying information including unique site ID and address	X		X
Equipment/contractor invoice showing (a) measure requirements have been met (e.g., manufacturer, model number, type, size and quantity of equipment or product installed/used), (b) the order/purchase date and (c) cost			X
Completed Unitary Air Conditioning Business Owner Information Form (available in the Document Library) or other BPA-approved customer form		X	X

Payment

Measure payments by efficiency level and unit size are detailed in the table below. Though payments are the same across all cooling zones, each has a different reference number.

Category by Efficiency Tier and Unit Size Range (Btu/h; Tons)	CEE Tier	Payment ($/unit)
<65,000; <5.4	Tier 1	$45.00
≥65,000 and <135,000; 5.4-11.3	Tier 1	$125.00
≥135,000 and <240,000; 11.3-20.0	Tier 1	$250.00
≥240,000 and <760,000; 20-63.3	Tier 1	$700.00
≥760,000; >63.3	Tier 1	$1,250.00
<65,000; <5.4	Tier 2	$75.00
≥65,000 and <135,000; 5.4-11.3	Tier 2	$200.00
≥135,000 and <240,000; 11.3-20.0	Tier 2	$400.00
≥240,000 and <760,000; 20.0-63.3	Tier 2	$1,200.00
≥760,000; >63.3	Tier 2	$1,500.00

Advanced Rooftop Unit Control (ARC) Retrofit (BPA Qualified)

Requirements and Specifications

Qualifying ARC Retrofit applications must meet the following requirements:

- The existing rooftop unit must have the following qualities:
  - Greater than five tons of cooling capacity
  - An existing economizer
  - Continuous operation during occupied hours serve only a commercial zone
- The ARC Retrofit must have the following qualities:
  - Variable speed, multi-speed or cycling of the supply fan that meets ventilation and space conditioning needs
  - Digital, integrated economizer control

Documentation Requirements

Documentation Description	Retention/Submittal Locations		
	BPA Energy Efficiency Reporting System	eedocs@bpa.gov or fax 1-866-535-7955	Customer File
End-user identifying information including unique site ID and address	X		X
Equipment/contractor invoice showing (a) measure requirements have been met (e.g., manufacturer, model number, type, size and quantity of equipment or product installed/used), (b) the order/purchase date and (c) cost			X
Completed Rooftop Unit Control Retrofit Form (available in the Document Library) or other BPA-approved customer form		X	X

Payment

Measure	Occupied Hours per Year	Payment per ton
Regular	2,000 – 4,000	$150.00
High occupancy	4,001 – 8,760	$225.00

Ductless Heat Pumps in Commercial Buildings (BPA Qualified)

Ductless Heat Pumps (DHPs) are BPA qualified to allow regional installations, sufficient to support data collection, for continued offer research and potential future RTF simplified M&V approval. BPA will request customer billing data from qualified installations for purposes of program evaluation.

Requirements and Specifications

Qualifying applications for DHPs include those installed in commercial areas that meet the following requirements:

- The building (thermally isolated space) conditioned by the DHP has the following characteristics:
  - Less than 20,000 square feet of conditioned floor area
  - A construction date before 2009
- The zone conditioned by the DHP must have the following characteristics:
  - Electric resistance heat
  - Operation hours of at least 40 hours/week
  - No commercial kitchens, commercial refrigeration or process loads (including data or server rooms), where the total connected load is over five watts per square foot
- Installed DHPs must have the following characteristics:
  - An inverter driven outdoor compressor unit and a variable speed fan or indoor blower
  - Fully ductless

Documentation Requirements

Documentation Description	Retention/Submittal Locations		
	BPA Energy Efficiency Reporting System	eedocs@bpa.gov or fax 1-866-535-7955	Customer File
End-user identifying information including unique site ID and address	X		X
Equipment/contractor invoice showing (a) measure requirements have been met (e.g., manufacturer, model number, type, size and quantity of equipment or product installed/used), (b) the order/purchase date and (c) cost			X
Completed Ductless Heat Pump Business Owner Information Form (available in the Document Library) or other BPA-approved customer form		X	X

Payment

Payment is $250.00 per ton of installed outdoor unit heating capacity for each DHP unit serving a qualified indoor space. To determine tonnage, divide installed BTU capacity by 12,000 and round up or down to the nearest tenth.

Heat Pump Equipment Conversion and Upgrade in Commercial Buildings (BPA Qualified)

Requirements and Specifications

The installed equipment must be an air to air heat pump system that meets CEE Tier 1 minimum efficiency level. The building in which the equipment is installed must have the following characteristics:

- An existing building (not new construction)
- 50,000 square feet or less conditioned building area
- Consume less than 600,000 kWh annually
- Electrically heated (buildings with gas heat are excluded)
- Have existing functional HVAC equipment

Documentation Requirements

Documentation Description	Retention/Submittal Locations		
	BPA Energy Efficiency Reporting System	eedocs@bpa.gov or fax 1-866-535-7955	Customer File
End-user identifying information including unique site ID and address	X		X
Equipment/contractor invoice showing (a) measure requirements have been met (e.g., manufacturer, model number, type, size and quantity of equipment or product installed/used), (b) the order/purchase date and (c) cost			X
Heat Pump Tool		X	X
Equipment specification sheet (or BPA-approved alternative)			X

Payment

Measure Category	Payment ($/ton)
Resistance Heating to Tier 1 Premium Efficiency Heat Pump	$250.00
Heat Pump to Tier 1 Premium Efficiency Heat Pump	$100.00

Web-Enabled Programmable Thermostats (BPA Qualified)

Requirements and Specifications

Qualifying applications for Web-Enabled Programmable Thermostats (WEPT) include new and modified, existing WEPTs installed in commercial zones that meet the following requirements:

- Be installed in accordance with the manufacturer's instructions
- Control the primary heating unit in the zone
- Be capable of the following:
  - A limited duration occupied-period override
  - A defined set-back schedule and temperature set-points during unoccupied periods (e.g., evenings, holidays and breaks)
  - Remote, web-based monitoring and programming
- Have battery and memory back-up to retain settings during power or internet losses

Documentation Requirements

Documentation Description	Retention/Submittal Locations		
	BPA Energy Efficiency Reporting System	eedocs@bpa.gov or fax 1-866-535-7955	Customer File
End-user identifying information including unique site ID and address	X		X
Equipment/contractor invoice showing (a) measure requirements have been met (e.g., manufacturer, model number, type, size and quantity of equipment or product installed/used), (b) the order/purchase date and (c) cost			X
Completed Web-enabled Programmable Thermostat Information Form (available in the Document Library) or other BPA-approved customer form		X	X

Payment

WEPT Type	Heating Type	Occupied Hours per Year	Payment
New WEPT	Electric	≤4,000	$800.00
New WEPT	Non-Electric	≤4,000	$700.00
New WEPT	Electric	>4,000	$600.00
New WEPT	Non-Electric	>4,000	$500.00
Modified, existing WEPT	Any	Any	$150.00

Commercial Shell Measures

Commercial Insulation

Requirements and Specifications

Insulation measures include wall and roof insulation in all commercial buildings that are electrically heated with resistance or air source heat pump (ductless heat pumps are included.) Existing insulation values must be R-0. Specific measures are in the Interim Reference Deemed Measure List in the Document Library by building use type, heating type, heating zone, location of insulation, and type of insulation.

Documentation Requirements

Documentation Description	Retention/Submittal Locations		
	BPA Energy Efficiency Reporting System	eedocs@bpa.gov or fax 1-866-535-7955	Customer File
End-user identifying information including unique site ID and address	X		X
Equipment/contractor invoice showing (a) measure requirements have been met (e.g., manufacturer, model number, type, size and quantity of equipment or product installed/used), (b) the order/purchase date and (c) cost			X
Documentation of R-value and square footage of installed insulation			X

Payment

All Commercial (including K-8 Schools)			
	HZ1	**HZ2**	**HZ3**
Attic/Roof Insulation			
R-0 to R-19	$0.40	$0.60	$0.65
R-0 to R-49	$0.60	$0.70	$0.80
Wall Insulation			
R-0 to R-11	$0.25	$0.35	$0.40
R-0 to R-19	$0.40	$0.60	$0.65
K-8 Schools Only			
	HZ1	**HZ2**	**HZ3**
Attic/Roof Insulation			
R-0 to R-30	$0.50	$0.60	$0.65
R-0 to R25 + R11	$1.20	$1.60	$1.85
Wall Insulation			
R-0 to R-9.5	$0.25	$0.35	$0.40

Retrofit Windows for Commercial Buildings (BPA Qualified)

Requirements and Specifications

Window retrofits must be performed in an existing commercial building that has the following characteristics:

- Electrically-heated
- Residential style wood-frame construction
- A total floor area under 5,000 square feet
- Pre-existing windows that are single pane or single pane with storms

The replacement windows must have a National Fenestration Rating Council rated U-value of 0.30 or lower.

Documentation Requirements

Documentation Description	Retention/Submittal Locations		
	BPA Energy Efficiency Reporting System	eedocs@bpa.gov or fax 1-866-535-7955	Customer File
End-user identifying information including unique site ID and address	X		X
Equipment/contractor invoice showing (a) measure requirements have been met (e.g., manufacturer, model number, type, size and quantity of equipment or product installed/used), (b) the order/purchase date and (c) cost			X
Completed Window Retrofit Program Business Owner Information Form (available in the Document Library) or other BPA-approved customer form		X	X
Documentation of U-value (specification sheets, NFRC stickers or other documentation)			X

Payment

Heating Zone	Payment/Square Foot of Window Replaced
1	$3.00
2	$6.00
3	$6.00

Electric Water Heating

BPA will pay customers for heat pump water heaters in some commercial settings. See also Electric Storage Water Heaters in the Multi-Sector chapter.

Heat Pump Water Heater (BPA Qualified)

Requirements and Specifications

Qualifying applications for Heat Pump Water Heaters include those installed in commercial areas that are listed on NEEA's HPWH qualified products list as meeting Tier 1 requirements of the Northern Climate Specification (If a customer believes a product should be on the list, and is not, it should use the COTR Request and Acknowledgement Procedure to request approval to use the product.)

Documentation Requirements

Documentation Description	Retention/Submittal Locations		
	BPA Energy Efficiency Reporting System	eedocs@bpa.gov or fax 1-866-535-7955	Customer File
End-user identifying information including unique site ID and address	X		X
Equipment/contractor invoice showing (a) measure requirements have been met (e.g., manufacturer, model number, type, size and quantity of equipment or product installed/used), (b) the order/purchase date and (c) cost			X
Heat Pump Water Heater Form (available in the Document Library)		X	X

Payment

HPWH Tank Size	Payment
50-75 gallons	$300.00
Greater than 75 gallons	$500.00

Commercial Refrigeration

BPA EnergySmart Grocer (ESG) Program

Requirements and Specifications

The BPA ESG Program implemented by Portland Energy Conservation, Inc. (PECI), installs energy efficiency measures in commercial refrigeration equipped facilities (see EnergySmart). PECI processes and delivers rebate checks to end users, performs post-installation checks as required, manages required back-up documentation and reports installations to BPA.

BPA funds the program delivery contract with PECI. Customers receive credit for savings achieved in their service territory.

Participating customers must (1) sign a participation agreement with PECI and (2) deliver a completed ESG Program Sign-up Form[21] (available in the Document Library) to BPA (e-mail eedocs@bpa.gov or fax 1-866-535-7955). The sign-up form requires selection of the program option, funding amount and program scope. Changes to participation may be made by submitting a revised ESG Program Sign-up Form to BPA.

[21] Customers already enrolled in the ESG Program that wish to continue their participation must immediately complete and submit the ESG Sign-up Form. EERs will outreach to customers to assist enrollment into the ESG program and coordinate with PECI to inform them a Utility Participation Agreement is needed.

By selecting one or more scope add-ons, the customer may work with PECI to implement custom projects in the selected areas. Custom projects completed under the ESG Program must follow the Option 1 requirements in the custom projects chapter, and PECI will act in the role of the customer in approving, reviewing and submitting custom project documentation to BPA.

If customers decrease their funding amount or withdraw from a program component, they must notify PECI at least 60 days in advance to verify that in-process projects have secured rebates. Customers may be able to decrease their funding amount or withdraw from a program component with less advance warning with PECI's consent.

Customers will receive a monthly accounting of the funds spent in their service territories.

If BPA Turnkey Option funds allocated to the program have not been spent on the first day of the final quarter of the rate period, the customer may use the COTR Request and Acknowledgement Procedure to request that BPA (1) add all or a part of unspent funds to the customers' ECA implementation budget, (2) add all or a part of the unspent funds to the Unassigned Account or (3) use all or part of the unspent funds for work under the ESG Program. Requests must be received no later than the 15th day of the first month of the final quarter. If the customer does not make a request, BPA will determine the use of unspent funds. Within the final quarter of the rate period, customers may still submit ESG Sign-up Form to BPA to increase or decrease funds up to the deadlines referenced below.

The following deadlines will be published with the end of the rate period deadlines in 2015:

- Last date to submit a revised ESG Program Sign-up Form to BPA;
- Last date to initiate a Performance Payment request for ESG savings;
- Last date to submit an ESG Performance Payment Form to BPA to claim ESG Performance Payments.

Documentation Requirements

Self-funding customers must retain proof of payment for rebates on their behalf to end users in their service territory.

Payment

Payment rates for deemed measures are in available in PECI's ESG Program rebate worksheet. Payment for custom projects follows the custom projects payment table.

Customers using BPA funds are eligible for a performance payment. To request a performance payment on ESG program, customers must e-mail their Energy Efficiency Representative requesting a report of eligible ESG savings and the ESG Performance Payment Form.

Deemed Refrigeration Retrofit Measures

Requirements and Specifications

Deemed refrigeration retrofit measures include auto-closers (walk-in and reach-in), anti-sweat heat controls, evaporator fan ECM controllers, doors for cases, gaskets, ECM motors, strip curtains, floating head on single compressors and open and reach-in case LEDs and de-lamping. Customers should work with PECI to ensure these measures are incremental to the ESG Program.

Deemed calculated measures remain available exclusively through the ESG Program.

Please refer to the Interim Reference Deemed Measure List (in the Document Library) for requirements and specifications. In the library, it is located within Other Documents – Interim Solution 2.0 Files. To locate additional details about the measures, sort by Sector (commercial) and End Use (refrigeration) in the drop-down menu.

The following measures will be expired, introduced or revised on April 1, 2015:

Reference No.	Description	Savings kWh		Payment		Expiring	New	Revised
		Current	Effective April 1, 2015	Current	Effective April 1, 2015			
CRERI20491	Motors – ECM for Compressor Head Cooling Fan - Shaded Pole motor replaced	NA	835	NA	$62/motor		X	
CRERC20487	Evaporator Fan ECM Motor Controller - Walk-In - Medium Temp - >23 Watt - 1 motor per controller	NA	357	NA	$35/motor		X	
CRERC20488	Evaporator Fan ECM Motor Controller - Walk-In - Medium Temp - >23 Watt - 2 or more motors/controller	NA	357	NA	$35/motor		X	
CRERC20490	Evaporator Fan ECM Motor Controller - Walk-In - Low Temp - >23 Watt - 1 or 2 motors per controller	NA	279	NA	$35/motor		X	
CRERC20489	Evaporator Fan ECM Motor Controller - Walk-In - Low Temp - >23 Watt - 3 or more motors/controller	NA	279	NA	$35/motor		X	
CRERI20316	Motors - Evaporator Motor - ECM - Walk-in - Shaded Pole motor replaced	1193	Expired	$140/ motor	Expired	X		
CRERI20484	Motors - Evaporator Motor - ECM - Walk-in - Shaded Pole motor replaced - > 23 watts	NA	1590	NA	$140/ motor		X	
CRERI20483	Motors - Evaporator Motor - ECM - Walk-in - Shaded Pole motor replaced - ≤23 Watt	NA	646	NA	$140/ motor		X	
CRERI20305	Gasket Replacement - Reach-in - Glass Door - Low Temp-Grocery	447	265	$40/ door	No Change			X
CRERI20306	Gasket Replacement - Reach-in - Glass Door- Medium Temp-Grocery	298	271	$25/ door	No Change			X
CRERI20307	Gasket Replacement - Walk-in - Main Door - Cooler-Grocery	394	222	$25/ door	No Change			X
CRERI20308	Gasket Replacement - Walk-in - Main Door - Freezer-Grocery	722	378	$65/ door	No Change			X
CRERI20290	Case Lighting - LED - T12 replaced - LED power less than 4.5 watts per linear foot - Open Case-Replacement	71	64	$12/Lin Ft LED	$18/Lin Ft LED			X
CRERI20291	Case Lighting - LED- T8 replaced - LED power less than 4.5 watts per linear foot - Open Case-Replacement	41	37	$7/Lin Ft LED	$12/Lin Ft LED			X
CRERI20292	Case Lighting - LED - T12 replaced - LED power between 4.5 and 8.5 watts per linear foot - Open Case-Replacement	145	113	$24/Lin Ft LED	$34/Lin Ft LED			X
CRERI20293	Case Lighting - LED - T8 replaced - LED power between 4.5 and 8.5 watts per linear foot - Open Case-Replacement	88	67	$15/Lin Ft LED	$22/Lin Ft LED			X

CRERI20294	Case Lighting - LED - LED power between 4.5 and 8.5 watts per linear foot - Open Case-New case	68	52	$11.50/Lin Ft LED	No Change			X
CRERI20295	Case Lighting - LED - LED power less than 4.5 watts per linear foot - Open Case-New case	31	27	$5/Lin Ft LED	No Change			X
CRERI20302	Case Lighting Delamping - Delamp T12 - Open Case	110	85	$5/Lin Ft LED	No Change			X
CRERI20303	Case Lighting Delamping - Delamp T8 - Open Case	81	62	$5/Lin Ft LED	No Change			X
CRERI20269	Auto Closers - Cooler - Reach-in	407	Expired	$25/ closer	Expired	X		
CRERI20270	Auto Closers - Freezer - Walk-in	3060	Expired	$150/ closer	Expired	X		
CRERI20271	Auto Closers - Cooler - Walk-in	263	Expired	$25/ closer	Expired	X		
CRERI20268	Auto Closers - Freezer - Reach-in	611	Expired	$30/ closer	Expired	X		
CRERI20322	Strip Curtains – Freezer – Grocery	483	583	$9/ sqft of door way	No Change			X
CRERI20323	Strip Curtains – Cooler – Grocery	113	134	$9/ sqft of door way	No Change			X
CRERI20324	Strip Curtains – Freezer – Convenience Store	33	34	$9/ sqft of door way	No Change			X
CRERI20325	Strip Curtains – Freezer - Restaurant	146	140	$9/ sqft of door way	No Change			X

Documentation Requirements

Documentation Description	Retention/Submittal Locations		
	BPA Energy Efficiency Reporting System	eedocs@bpa.gov or fax 1-866-535-7955	Customer File
End-user identifying information including unique site ID and address	X		X
Equipment/contractor invoice showing (a) measure requirements have been met (e.g., manufacturer, model number, type, size and quantity of equipment or product installed/used), (b) the order/purchase date and (c) cost			X

Payment

Please refer to the Interim Reference Deemed Measure List in the Document Library for payment levels.

Commercial Kitchen and Food Service Equipment

BPA pays for a suite of high-efficiency commercial kitchen and food service electric equipment, including steamers, hot food holding cabinets, combination ovens, convection ovens, fryers and pre-rinse spray wash valves. All equipment must be new.

Demand Controlled Kitchen Ventilation (BPA Qualified)

Requirements and Specifications

Demand Controlled Kitchen Ventilation (DCKV) reduces fan speed during times of low activity or demand. Qualifying applications include new and modified existing exhaust hoods and the associated make-up air units installed in commercial zones that meet the following requirements:

- Installed in zones that contain a kitchen
- Control the primary ventilation and make-up air units in the zone
- Utilize one or more control sensors to modify the fan speeds

Documentation Requirements

Documentation Description	Retention/Submittal Locations		
	BPA Energy Efficiency Reporting System	eedocs@bpa.gov or fax 1-866-535-7955	Customer File
End-user identifying information including unique site ID and address	X		X
Equipment/contractor invoice showing (a) measure requirements have been met (e.g., manufacturer, model number, type, size and quantity of equipment or product installed/used), (b) the order/purchase date and (c) cost			X
Completed Demand Controlled Kitchen Ventilation Information Form (available in the Document Library) or other BPA-approved customer form		X	X

Payment

DCKV	DCKV Control Sensors	Payment/Horsepower of Fan
New or Retrofit	One	$200.00
New or Retrofit	Multiple	$400.00

Electric Commercial Steam Cookers

Requirements and Specifications

Measures must meet ENERGY STAR v1.2 requirements.

Documentation Requirements

Documentation Description	Retention/Submittal Locations		
	BPA Energy Efficiency Reporting System	eedocs@bpa.gov or fax 1-866-535-7955	Customer File
End-user identifying information including unique site ID and address			X
Equipment/contractor invoice showing (a) measure requirements have been met (e.g., manufacturer, model number, type, size and quantity of equipment or product installed/used), (b) the order/purchase date and (c) cost			X

Documentation Description	Retention/Submittal Locations		
	BPA Energy Efficiency Reporting System	eedocs@bpa.gov or fax 1-866-535-7955	Customer File
A copy of the ENERGY STAR product list showing the product or the product information insert or packaging that includes the ENERGY STAR logo (In the event that ENERGY STAR specifications change, BPA will accept pre-existing models that were ENERGY STAR qualified at the time they were manufactured.)			X

Payment

Size	Payment
3 pan, 4 pan, 5 pan, or 6 pan	$50.00
10 pan	$200.00

Hot Food Holding Cabinets

Requirements and Specifications

Measures must meet ENERGY STAR v2.0 requirements.

Documentation Requirements

Documentation Description	Retention/Submittal Locations		
	BPA Energy Efficiency Reporting System	eedocs@bpa.gov or fax 1-866-535-7955	Customer File
End-user identifying information including unique site ID and address			X
Equipment/contractor invoice showing (a) measure requirements have been met (e.g., manufacturer, model number, type, size and quantity of equipment or product installed/used), (b) the order/purchase date and (c) cost			X
A copy of the ENERGY STAR product list showing the product or the product information insert or packaging that includes the ENERGY STAR logo (In the event that ENERGY STAR specifications change, BPA will accept pre-existing models that were ENERGY STAR qualified at the time they were manufactured.)			X

Payment

Size	Payment
Half	$75.00
Full	$200.00

Electric Combination Ovens

Requirements and Specifications

Measures must meet ENERGY STAR v2.0 requirements, and oven capacity must be between 6 and 20 pans.

Documentation Description	Retention/Submittal Locations		
	BPA Energy Efficiency Reporting System	eedocs@bpa.gov or fax 1-866-535-7955	Customer File
End-user identifying information including unique site ID and address			X
Equipment/contractor invoice showing (a) measure requirements have been met (e.g., manufacturer, model number, type, size and quantity of equipment or product installed/used), (b) the order/purchase date and (c) cost			X
A copy of the ENERGY STAR product list showing the product or the product information insert or packaging that includes the ENERGY STAR logo (In the event that ENERGY STAR specifications change, BPA will accept pre-existing models that were ENERGY STAR qualified at the time they were manufactured.)			X

Payment

BPA shall pay $500.00 per oven. Note that there are two measures for Combination Ovens: one for 6–15 pan ovens and one for 16-20 pan ovens.

Electric Convection Ovens

Requirements and Specifications

Measures must meet ENERGY STAR v2.0 requirements.

Documentation Requirements

Documentation Description	Retention/Submittal Locations		
	BPA Energy Efficiency Reporting System	eedocs@bpa.gov or fax 1-866-535-7955	Customer File
End-user identifying information including unique site ID and address			X
Equipment/contractor invoice showing (a) measure requirements have been met (e.g., manufacturer, model number, type, size and quantity of equipment or product installed/used), (b) the order/purchase date and (c) cost			X
A copy of the ENERGY STAR product list showing the product or the product information insert or packaging that includes the ENERGY STAR logo (In the event that ENERGY STAR specifications change, BPA will accept pre-existing models that were ENERGY STAR qualified at the time they were manufactured.)			X

Payment

BPA shall pay $300.00 per oven.

Commercial Electric Fryers (BPA Qualified)

Requirements and Specifications

Measures must meet ENERGY STAR v2.0 requirements and be new.

Documentation Requirements

Documentation Description	Retention/Submittal Locations		
	BPA Energy Efficiency Reporting System	eedocs@bpa.gov or fax 1-866-535-7955	Customer File
End-user identifying information including unique site ID and address			X
Equipment/contractor invoice showing (a) measure requirements have been met (e.g., manufacturer, model number, type, size and quantity of equipment or product installed/used), (b) the order/purchase date and (c) cost			X
Completed "Commercial Electric Fryers" tab in the BPA Qualified and Provisionally Deemed Input Sheet (available in the "other documents" section of the Document Library)		X	X
A copy of the ENERGY STAR product list showing the product or the product information insert or packaging that includes the ENERGY STAR logo (In the event that ENERGY STAR specifications change, BPA will accept pre-existing models that were ENERGY STAR qualified at the time they were manufactured.)			X

Payment

BPA shall pay $300.00 per fryer.

Pre-rinse Spray Wash Valves

Requirements and Specifications

The measure must be installed in a dishwashing facility and covers valves up to one gallon per minute. The existing spray valve must be regularly used every day of business. The spray valve must use hot water heated with an electric water heater. The measure requires direct installation (per the Measure Distribution Processes section in the Multi-Sector chapter) of a new nozzle.

Documentation Requirements

Documentation Description	Retention/Submittal Locations		
	BPA Energy Efficiency Reporting System	eedocs@bpa.gov or fax 1-866-535-7955	Customer File
Equipment/contractor invoice showing (a) measure requirements have been met (e.g., manufacturer, model number, type, size and quantity of equipment or product installed/used), (b) the order/purchase date and (c) cost			X
See the Measure Distribution Processes section in the Multi-Sector chapter.			

Payment

BPA shall pay $100.00 per installation.

Additional Deemed Offerings

BPA pays customers for computer power management solutions and certain efficient commercial appliances and is developing additional deemed measures.

Networked Computer Power Management

Requirements and Specifications

Networked Computer Power Management software must be installed in a commercial setting and must do the following:

1. Give the IT administrator easily-accessible, central control over the power management settings of networked workstations, with the capability to override user settings.
2. Have the capability to (a) cause a workstation's power-energy savings mode to be remotely enabled or disabled for centrally distributed software updates (e.g., wake on LAN capability); (b) monitor disk and central processing unit activity in determining whether a workstation is idle; and (c) apply specific power management policies to network groups.
3. Be compatible with multiple operating systems and hardware configurations in the same network.

Documentation Requirements

Documentation Description	Retention/Submittal Locations		
	BPA Energy Efficiency Reporting System	eedocs@bpa.gov or fax 1-866-535-7955	Customer File
End-user identifying information including unique site ID and address			X
Equipment/contractor invoice showing (a) measure requirements have been met (e.g., manufacturer, model number, type, size and quantity of equipment or product installed/used), (b) the order/purchase date and (c) cost			X
Documentation of software specifications demonstrating software meets requirements			X

Payment

BPA shall pay $10.00 per workstation (i.e., the computer monitor and box).

ENERGY STAR Commercial Clothes Washers - Laundromats

Requirements and Specifications

The clothes washer must be ENERGY STAR and installed in a laundromat.

Documentation Requirements

Documentation Description	Retention/Submittal Locations		
	BPA Energy Efficiency Reporting System	eedocs@bpa.gov or fax 1-866-535-7955	Customer File
End-user identifying information including unique site ID and address			X
Equipment/contractor invoice showing (a) measure requirements have been met (e.g., manufacturer, model number, type, size and quantity of equipment or product installed/used), (b) the order/purchase date and (c) cost			X
A copy of the ENERGY STAR product list showing the product or the product information insert or packaging that includes the ENERGY STAR logo (In the event that ENERGY STAR specifications change, BPA will accept pre-existing models that were ENERGY STAR qualified at the time they were manufactured.)			X

Payment

Measure Name	Payment
Clothes Washers ENERGY STAR Electric Water Heater/Electric Dryer Laundromat	$125.00
Clothes Washers ENERGY STAR Electric Water Heater/Gas Dryer Laundromat	$100.00
Clothes Washers ENERGY STAR Gas Water Heater/Electric Dryer Laundromat	$75.00
Clothes Washers ENERGY STAR Gas Water Heater/Gas Dryer Laundromat	$25.00

Smart Power Strips - Load Sensing

Requirements and Specifications

Smart Power Strips must (1) be installed in a commercial office setting and used in accordance with the manufacturer's instructions, (2) automatically switch off peripheral plug load from the control plug outlet and (3) prohibit false switching by incorporating resistor-capacitor circuit filters or equivalent.

Documentation Requirements

Documentation Description	Retention/Submittal Locations		
	BPA Energy Efficiency Reporting System	eedocs@bpa.gov or fax 1-866-535-7955	Customer File
End-user identifying information including unique site ID and address			X
Equipment/contractor invoice showing (a) measure requirements have been met (e.g., manufacturer, model number, type, size and quantity of equipment or product installed/used), (b) the order/purchase date and (c) cost			X

Payment

BPA shall pay $15.00 per Smart Power Strip.

Commercial Showerheads

Requirements and Specifications

The showerhead must have a rated flow rate at 2.0 gallons (or fewer) per minute and be installed in qualified commercial facilities: hospitality buildings (hotels/motels), health care facilities (including hospitals) and small commercial facilities (including office showers). Showerheads must be distributed via direct install or mail by request per the Measure Distribution Processes section in the Multi-Sector chapter.

Documentation Requirements

Documentation Description	Retention/Submittal Locations		
	BPA Energy Efficiency Reporting System	eedocs@bpa.gov or fax 1-866-535-7955	Customer File
Equipment/contractor invoice showing (a) measure requirements have been met (e.g., manufacturer, model number, type, size and quantity of equipment or product installed/used), (b) the order/purchase date and (c) cost			X
See the Measure Distribution Processes section in the Multi-Sector chapter for additional requirements.			

Payment

Measure Name	Payment
Showerheads, 1.5-2.0 Gallons Per Minute, Mail by Request	$8.00
Showerheads, 1.5-2.0 Gallons Per Minute, Direct Install	$11.00

Commercial New Construction

BPA offers multiple paths to access efficiency opportunities in commercial new construction, including both standardized design packages and custom projects.

New Construction and Major Renovation

Requirements and Specifications

Commercial new construction and major renovation projects must be submitted as custom projects. The following table summarizes recommended M&V strategies.

Project Type	Predicted Savings	M&V Strategy
New Construction	≥ 200,000 kWh/yr	International Performance Measurement and Verification Protocol Option D: Calibrated Model Simulation
	≤ 200,000 kWh/yr	BPA Protocols: Energy Calculations with Verification (ECwV)
Major Renovation	≥ 200,000 kWh/yr	International Performance Measurement and Verification Protocol Option D: Calibrated Model Simulation or The following BPA Protocols: • Energy Modeling • Verification by Energy Use Indexing
	≤ 200,000 kWh/yr	BPA Protocols: • End Use Equipment • Verification by Energy Use Indexing • ECwV
New Equipment	> 200,000 kWh/yr	BPA Protocols: • Equipment in New Construction • End Use Equipment • Verification by Energy Use Indexing
	≤ 200,000 kWh/yr	BPA Protocols: • Equipment in New Construction • End Use Equipment • Verification by Energy Use Indexing • ECwV

The project baseline annual energy usage helps establish the annual energy savings. The baseline for commercial new construction and major renovation is based on the following:

- The baseline is the local energy code, if local energy code applies.
- If there is no local energy code, the baseline is the applicable state energy code.
- If there are no applicable codes or standards for the specific end-use application, common practice is the baseline.
- The final baseline is determined by the BPA engineer.

Documentation Requirements

See the custom projects documentation requirements.

Payment

See the custom projects payment table.

Multi-Sector Opportunities

Additional commercial opportunities are available in the Multi-Sector chapter:

- Processes
- Measures and Initiatives
    1. Electric Storage Water Heaters
    2. Green Motors Rewind Initiative
    3. Non-Residential Lighting Program
    4. Engine Block Heaters
    5. Limited Availability Emerging Technology Field Test Projects
    6. Variable Frequency Drives in Small Compressed Air Systems
    7. Commercial Clothes Washers – Multifamily Common Areas
    8. Multifamily, Multi-Sector Measures

8. Federal Sector

Unlike other sectors, the Federal Sector does not have a unique set of measures. Rather, this sector incorporates the offerings of all other sectors. As such, a federal project is any energy efficiency project (available elsewhere in this Manual) installed in a qualifying federal facility.

A qualifying federal facility is one that meets the following requirements:

1. The site is (a) owned or leased by the federal government or (b) uses electric energy paid for by the federal government.
2. The site is (a) utility served or (b) direct served.
    a. Utility Served: The site uses electricity purchased from a BPA customer.
    b. Direct Served: The site uses electricity purchased directly from BPA.

Federal projects must follow the requirements of the section under which they are offered. Customers must report new projects under "federal," and customers, rather than BPA, must provide incentive payments to end users.

9. Industrial Sector

Please check the changes and corrections summary to see if revisions were made to any of the measures in this sector.

The Industrial Sector includes electrical energy used by fixed pieces of equipment, buildings or complexes to produce, manufacture or store goods in connection with, or as part of, any process (including transportation) or system (including those related to food production). These processes and systems also include, but are not limited to, the following: electric distribution system hardware; Voltage Optimization; water/waste-water production and treatment; and data centers/server farms (except Commercial Sector data centers/server farms, i.e., those integrated into a commercial building that serve the information technology needs of the business enterprise). In general, Industrial Sector activities must not devote the majority of energy use within a facility to non-process related HVAC or potable hot water.

Payment Summary*

Program Component or Measure	Payment
Custom Projects	See the custom projects payment table.
Energy Management Pilot	
o *Energy Project Manager*	See the payment section of this offering.
o *Track and Tune and High Performance Energy Management Projects*	See the payment section of this offering.
o *Limited Availability Small Industrial High Performance Energy Management*	See the payment section of this offering.
Trade Ally Delivered Small Industrial Measures	See the custom projects payment table.
BPA Funded Technical Service Providers (TSP)	Not applicable
Variable Frequency Drives for Fans in Spud and Onion Storage Facilities	$200.00/hp
Multi-Sector Measures	
o *Green Motors Rewind Initiative*	$2.00/hp
o *Non-Residential Lighting Program*	See the lighting calculators.
o *Engine Block Heaters*	$200.00-$1,500.00/unit
o *Limited Availability Emerging Technology Demonstration Field Test Projects*	See the custom projects payment table.
o *Variable Frequency Drives in Small Compressed Air System*	See the custom projects payment table.

* The payment levels described in this table provide a summary only. Complete details of the payment levels and associated requirements may be found in the corresponding text of the Manual. Please see the Table of Contents for the text location.

Industrial Sector Overview

The BPA Energy Efficiency industrial program includes Energy Smart Industrial (ESI) and Multi-Sector opportunities.

Customers must enroll in ESI to receive BPA funding for custom project incentives and technical services. Without ESI enrollment, industrial custom project incentives and technical services must be customer self-funded, and BPA funding is available only for Multi-Sector measures and initiatives.

Energy Smart Industrial

The bulk of industrial program offerings are located in ESI, which is managed by a third party contractor (ESI program partner). ESI participants are assigned an ESI Partner (ESIP) and offered the following program components:

- Industrial Custom Projects
- Energy Management Pilot: Energy Project Managers; Track and Tune Projects; High Performance Energy Management; and Limited Availability Small Industrial High Performance Energy Management
- Trade Ally Delivered Small Industrial Measures
- Northwest Trade Ally Network (Non-Residential Lighting Program)
- Technical Service Providers (TSP)
- VFDs for Fans in Spud and Onion Storage Facilities

Requirements and Specifications

Enrollment: A customer may request enrollment in ESI using the COTR Request and Acknowledgment Procedure. BPA acceptance of the request is discretionary.

ESI program partner: The customer must meet with the ESI program partner (in person or over the phone) to outline its intended level of program engagement and end-user communication expectations for the ESI program partner. The customer may engage the ESI program partner on any other pertinent topic including the customer’s industrial load, savings goals and desired program component rollout. The ESI program partner will e-mail an acknowledgement to the customer documenting the decisions made during the meeting.

ESI Partner (ESIP): An ESIP (provided by the ESI program partner) is assigned to the customer and is the single point of contact for customers and helps them understand and implement ESI. The customer ultimately determines the level of ESIP engagement, but, generally, the ESIP performs the following:

- Serves as an industrial technical resource to customers
- Works closely with the customer to develop an action plan for its end users
- Manages and reviews technical work products, including technical analysis of custom project submittals
- Helps the customer identify custom projects and secure BPA approval

Custom Projects: The end user must design and construct energy efficiency projects and is encouraged to solicit bids for such work.

The customer may receive assistance during the custom project process. The following chart demonstrates the party responsible for each custom project step.

Custom Project Process Step	Responsible Party	
	Option 1	Option 2
Develop M&V Plan.	ESIP, TSP or Customer	ESIP, TSP or Customer
Prepare Option 1 custom project proposal documents (optional).	ESIP or Customer	n/a
Submit Option 1 custom project proposal documents (optional).	Customer	n/a
Review Option 1 custom project proposal documents, if submitted.	BPA ESI Engineer, ESI program partner Quality Control Engineer and COTR	n/a
Provide technical advice to customer.	ESIP	ESIP
Develop custom project results data.	ESIP, TSP or Customer	ESIP, TSP or Customer
Prepare custom project completion documentation.	ESIP or Customer	ESIP or Customer
Submit custom project completion documentation to BPA.	Customer	Customer
Review custom project completion documentation.	BPA ESI Engineer, ESI program partner Quality Control Engineer and COTR	BPA ESI Engineer, ESI program partner Quality Control Engineer and COTR

Documentation Requirements

See the custom projects documentation requirements.

Payment

See the custom projects payment table.

Energy Management Pilot (Optional ESI Component)

Energy Management is a pilot component composed of (1) the Energy Project Manager, (2) Track and Tune Projects, (3) High Performance Energy Management and (4) Limited Availability Small Industrial High Performance Energy Management.

Required documents to be submitted by customer to BPA in support of ESI Energy Management projects must be sent to BPA by e-mail (as a link of the document from the secure, online ESI SharePoint site or the document itself) to eedocs@bpa.gov or fax 1-866-535-7955.

Effective April 1, 2015, the link must be submitted in lieu of the document, itself.

1. Energy Project Manager (Optional Energy Management Pilot Feature)

Requirements and Specifications

BPA will co-fund Energy Project Managers (EPMs), end-user employees or contractors who manage energy efficiency custom projects at the end users' facilities. If applicable, EPMs may manage Track and Tune (T&T) Projects, deemed lighting and High Performance Energy Management (HPEM), at the end users' facilities. A customer may request EPM co-fund approval by contacting BPA (e-mail eedocs@bpa.gov or 1-866-535-7955). The customer must send to BPA (a document or link from the ESI SharePoint site – note, effective April 1, 2015, submitting a link will be required) by e-mail to eedocs@bpa.gov the executed EPM agreement between itself and the end user that, at a minimum, identifies an energy savings goal of at least 1,000,000 kWh of verifiable annual busbar energy savings per year and the end user's obligation to employ a qualified EPM.

The customer (via its end user) must achieve projected energy savings of at least 1,000,000 kWh verifiable annual busbar energy savings and should do so within one year of the EPM funding Commencement Date (but is allowed up to 18 months from the Commencement Date). The Commencement Date is the date the final of the following actions occur: (1) customer sends to BPA by email eedocs@bpa.gov the executed EPM agreement, (2) an EPM is hired or designated by the end user and (3) BPA approves the EPM.The customer must ensure the end user meets the following requirements:

a. The end user must hire or designate an EPM to identify, evaluate and implement industrial electrical energy efficiency projects (e.g., T&T, deemed lighting and HPEM). The EPM must be familiar with, and have experience in, industrial electric energy efficiency and the end user's type of business.

b. The EPM must manage electrical energy efficiency projects that deliver 1,000,000 kWh or greater in verifiable annual industrial busbar energy savings. These savings must be verified, i.e., the savings must be reportable to and approved by BPA.

c. The end user may replace the EPM; however, the customer must inform BPA in writing, within 30 days of replacement, and the replacement EPM must meet the requirements of this Manual.

d. No later than 90 days after the Commencement Date, the EPM must submit by e-mail eedocs@bpa.gov the EPM Comprehensive Plan (available in the Document Library) to the customer and BPA. The EPM Comprehensive Plan must be approved by BPA and include, at a minimum, the following:

    i. Projected verifiable annual busbar energy savings (at least 1,000,000 kWh) (Eligible project status shall precede completion of post-project M&V at time of Commencement Date.)

    ii. Name of the EPM

    iii. Total annual cost of the EPM, which includes base salary, benefits, costs associated with attendance at ESI-sponsored annual EPM meeting, and associated direct costs (e.g., travel and training[22]), if known.[23]

    iv. Itemized summary of planned electrical energy efficiency projects (including participation in either HPEM or T&T) that will comprise the verifiable annual busbar energy savings, including estimates of the energy savings, cost savings and implementation costs

    v. Schedule for project development, implementation and completion

    vi. Project implementation schedule showing energy savings or energy savings progress expected at (a) six months after the Commencement Date and (b) over the life of the plan

[22] EPM training costs must be pre-approved by BPA based on the customer's budget, EPM costs and the relevancy of the training. EPM costs include only qualifying costs incurred between the EPM Commencement Date and the date the last project in the EPM Comprehensive Plan is approved by BPA. BPA will not pay customers for EPM time in a custom or Track and Tune project if that project was included in the EPM Comprehensive Plan.

[23] Prior to the final payment, the customer must adjust the EPM cost to reflect the total actual costs. The total EPM co-funding amount may not exceed the total annual EPM cost as specified in the EPM Comprehensive Plan. Documentation of actual EPM costs must accompany the final EPM status report, which precedes final payment. Where an EPM term is less than 12 months, the eligible EPM costs must be based on pay records from the period between the EPM commencement date and BPA acceptance of the final project. Customers may include a performance incentive as a portion of the EPM's salary.

vii. If applicable, participation plans for T&T and/or HPEM.[24]

The EPM must submit either a secure link or status reports to the customer and BPA (e-mail eedocs@bpa.gov) describing (1) energy savings achieved and projected and (2) projects completed in-process or planned. Status reports are due no later than (1) six months from the Commencement Date and (2) one year from the Commencement Date.

No later than six months after the Commencement Date, the end user must achieve, to BPA's satisfaction, the six-month verified annual busbar energy savings or energy savings progress (i.e., BPA-approved custom project proposals (Option 1), customer-approved custom projects (Option 2) or in-progress T&T and/or HPEM projects) described in the six-month status update section of the EPM Comprehensive Plan. If energy savings achievements differ significantly from savings predictions, BPA may revise the savings goal and use the revised goal for payment calculations.

Upon completion of the EPM Agreement, the customer may elect to extend the agreement for an additional 12-18 months by sending a request to BPA (e-mail eedocs@bpa.gov) including either a secure link of or the subsequent executed EPM agreement between the customer and end user for the second 12-18 month period that identifies an additional energy savings goal of at least 1,000,000 kWh of verifiable annual busbar energy savings and the end user's obligation to employ a qualified EPM. The customer must repeat the same process for the ensuing contract period including creating a new EPM Comprehensive Plan.

A customer may send a request to BPA (e-mail eedocs@bpa.gov) for consideration of BPA directly contracting with its end users to provide EPM funding. The request must include the following:

a. Documentation of the direct contract qualification, either because (a) the customer is prevented by charter or policy from contracting with its end users or (b) the EPM will be assigned to multiple facilities served by multiple customers

b. End-user information (name, address and contact information)

c. Amount to be allocated to that end user under a direct EPM contract (The allocated amount must be capped at the lesser of $0.025 per kWh of the energy savings goal; the total annual cost of the EPM as described in the EPM Comprehensive Plan; $250,000.00; or an amount specified in the EPM agreement.

If a customer's request is approved, BPA will (1) reduce the customer's ECA implementation budget by the allocated amount, (2) hold the funds to pay the EPM payment to the end user and (3) execute a contract with the end user to pay for an EPM. The allocation may not be changed without approval from BPA, the customer and the end user. At the end of the EPM contract period, if the customer's allocation exceeds the amount BPA paid the end user, the remaining budget will be returned to the customer's ECA implementation budget.

[24] T&T and HPEM first year savings and subsequent years' incremental savings may be applied toward the EPM savings goal.

Documentation Requirements

Documentation Description	Retention/Submittal Locations		
	BPA Energy Efficiency Reporting System	eedocs@bpa.gov or fax 1-866-535-7955	Customer File
Executed EPM agreement between customer and end-user		X	X
EPM Comprehensive Plan and status reports		X	X
EPM Calculator (available in the Document Library)	X		X

Payment

To receive payment, the customer must invoice BPA upon the end user reaching the milestones in the chart below. If the customer elects to renew the EPM for an additional period, the payment schedule repeats with the first payment starting with Payment No. 2. Customers are not obligated to return money already received.

Use the EPM Calculator (available in the Document Library) to calculate payment amounts.

Payment No.	Funding Amount	Milestone
1	$25,000.00[i]	Commencement Date
2	1/3 of the funding[ii] less previous payments	BPA approves the EPM Comprehensive Plan
3	2/3 of the funding[ii] less previous payments	End user achieves, to BPA's satisfaction, the six-month energy savings or energy savings progress described in the project implementation schedule of the EPM Comprehensive Plan
4	The lesser of (a) $0.025 per kWh of **actual** verified busbar energy savings, (b) the total annual cost of the EPM as described in the EPM Comprehensive Plan or (c) $250,000.00, less previous payments	End user meets, exceeds, or fails to meet (as certified by BPA) the EPM Comprehensive Plan projected Verified Energy Savings

[i] Funding beyond this payment will not be provided unless the verified energy savings goal or actual savings achieved is greater than 1,000,000 kWh.

[ii] Funding is based on the lesser of (a) $0.025 per kWh of the verified energy savings goal, (b) the total annual cost of the EPM as described in the EPM Comprehensive Plan, (c) $250,000.00 or an amount specified within the EPM agreement.

2. High Performance Energy Management & Track and Tune Projects (Optional Energy Management Pilot Feature)

Requirements

High Performance Energy Management (HPEM) and Track and Tune (T&T) Projects are optional energy management components of the ESI program. HPEM is designed to generate more (a) T&T Projects, (b) custom projects, and (c) savings via Monitoring, Targeting and Reporting (MT&R) analysis. Annual performance incentives are available from BPA for verified savings from the HPEM Completion Report. T&T Projects are a combination of site or sub-system tune-ups that focus on operations and maintenance (O&M) opportunities for increased energy efficiency. Option 1 and Option 2 customers must follow the M&V requirements addressed in the ESI MT&R Reference Guide (available in the Document Library). The tables below describe the requirements for (1) enrollment and staffing, (2) performance period, (3) component implementation, and (4) savings reports.

- **Enrollment and Staffing**

To enroll in the HPEM and T&T components, customer must meet these enrollment and staffing requirements outlined below.

Activity	HPEM *Develop energy management capabilities to drive the implementation of energy efficiency measures.*	T&T *Tune-up site or sub-system through no-cost or low-cost operations and maintenance (O&M) action items.*
Enroll. Send a request to BPA (e-mail eedocs@bpa.gov) and send either a link from ESI SharePoint or the actual executed agreement, between the customer and the participating end user. Note, effective, April 1, 2015, sending the link will be required.	Required	Required
Appoint Energy Champion. The Energy Champion is a key contact person for the energy management continuous improvement process and implements energy efficiency measures.	Required	Required
Appoint Executive Sponsor. The Executive Sponsor is the management level supporter of the energy management system.	Required	n/a
Attend Energy Management Training. Classroom and onsite training develops the end user's energy management system. End users must present their energy efficiency implementation. Training sessions are confidential.	Required as follows: • Two employees must attend monthly HPEM training sessions during the performance period.	n/a

- **Performance Period**

The customer must select a three-year or five-year performance period. The selected length of performance period determines the measure life and affects the T&T PTS maintenance budget.

	HPEM	T&T
Length	The customer may select either a three-year or five-year performance period. The Measure Life by Year lists the measure life by year for each of the performance period options.	
Performance Period Selection	Selection is made in first HPEM submission, Year-1 Completion Report.	Selection is made in first T&T submission, PTS Installation.

*Performance Period	Measure Life by Year					
	T&T Completion Report (T&T Only)	Year 1	Year 2	Year 3	Year 4	Year 5
3 year	1 year	1 year	1 year	3 year	n/a	n/a
5 year	1 year	1 year	1 year	1 year	1 year	6 year

Depending on the project type and customer request, BPA may allocate customers 75% of the calculated first-year savings. The remaining 25% verified energy savings from the first reporting period will be held and carried over to the second reporting period in order to increase the likelihood that booked energy savings persist.

	HPEM	T&T
Description	Customers will be credited with 75% of the verified energy savings as reported in the Year 1 HPEM Completion Report. Customers receive credit on the Year 2 Sustained Savings Report for sustained savings in excess of 75% of the Year 1 HPEM Completion Report verified energy savings.	Customers will be credited with 75% of the verified energy savings as reported in the T&T Completion Report. Customers receive credit on the Year 1 Sustained Savings Report for sustained savings in excess of 75% of the T&T Completion Report verified energy savings.
Requirement	Optional. BPA will allocate 75% of the calculated first-year HPEM savings, unless customer requests 100% in the Year 1 HPEM funding request.	Required

- **Component Implementation**

The HPEM and T&T components generate energy savings through project implementation.

Activity	HPEM	T&T
Performance Tracking System (PTS)	n/a	Follow requirements in the Performance Tracking System (PTS) requirements table.
Energy Management System	Conduct an assessment of current energy management practices (e.g., does end user track, manage or reduce energy usage?). Establish an energy management policy with goals and an energy team to implement energy efficiency measures.	n/a
Implement Energy Efficiency Measures	Use continuous improvement practices (led by the energy team) to identify potential energy efficiency measures, implement energy efficiency measures, and evaluate the energy efficiency measures.	Follow requirements in the T&T Tune-up requirements section.

	Performance Tracking System (PTS) – T&T Only
Description	The PTS is metering hardware or electric energy data collection software that tracks key independent variables to develop a meaningful normalized energy use profile. The PTS is installed and owned by the end user and eligible for BPA funding.
Requirements	1. Collect key process energy performance indicators sufficient to predict energy consumption. 2. Provide data frequently enough to measure T&T changes.
PTS Design Approval	Prior to installing the PTS, BPA may approve the PTS to ensure that collected baseline data will sufficiently model baseline energy consumption. BPA approval is optional.
Verification	Prior to beginning tune-up activities, BPA will verify the PTS and collected baseline data sufficiently models baseline energy consumption.

	T&T Tune-up Requirements – T&T Only
Scoping	Energy Champion, with T&T Provider (BPA provided, in-house, ESIP) must perform scoping study that results in tune-up scoping and monitoring plan. The tune-up scoping and monitoring plan includes: 1. An estimate of savings potential 2. Recommendations for energy savings tracking 3. Determination of baseline electrical energy consumption 4. Proposal for follow-up technical services to tune-up the system 5. A secure link or the scoping study (submitted to eedocs@bpa.gov)
Tune-Up	1. Facilitate a tune-up with the T&T Provider (BPA provided, in-house expert, ESIP, or contracted provider), which generates an Action Plan Report. 2. Action items are low-cost energy savings activities identified and recommended in the T&T Action Plan Report that in aggregate produce cost-effective energy savings. The end user does not have to implement every implementable action item. 3. The Action Plan Report includes: ▪ A summary of the activities and results of the tune-up ▪ A plan to implement specific energy efficiency project action items ▪ A secure link or the Action Plan Report (prepared by T&T Provider) (submitted to eedocs@bpa.gov)
Action Item Implementation	Upon Action Item completion, the participating end user begins the action item verification period. After the action item verification period, the customer submits either a secure link or the T&T Completion Report to eedocs@bpa.gov.

- **Savings Reports**

	HPEM	T&T
M&V Protocol	Both Option 1 and Option 2 customers must calculate verified energy savings following the M&V prescribed in the ESI MT&R Reference Guide (available in the Document Library).	
	HPEM energy savings may not include energy savings from other ESI program components BPA programs (e.g., custom projects, deemed project or T&T projects).	*T&T energy savings* may not include energy savings from other ESI program components BPA programs (e.g., custom projects, deemed project or HPEM projects).

Tracking	Establish and maintain a system to track energy use and energy savings, making available to BPA all information necessary to determine savings (e.g., electrical data, natural gas data, and production quantity).	Verify energy saved during the action item verification period (typically 90-days, using data collected by the PTS and production data, if necessary) and document the action items completed, implementation costs and verified energy savings in the T&T Completion Report (which must be submitted to customer and BPA).
Performance Period	The first year HPEM performance period starts no earlier than the date of the BPA HPEM Kick-off Workshop and no later than the first full monthly billing cycle following the workshop.	The first T&T year concludes the date the end user completes the implementation action items, no later than nine months following tune-up. After the performance period (typically 90 days), customers either send a secured link or the actual T&T Completion Report to BPA at eedocs@bpa.gov.
Sustain Savings.	Customers are required to send either a secure link or the annual HPEM completion report to BPA at eedocs@bpa.gov documenting energy usage and unit production over the previous year. Annual completion reports document energy usage and unit production over the previous year.	

Documentation Requirements

Documentation Description	Due Date	HPEM	T&T	Retention/Submittal Locations		
				BPA Energy Efficiency Reporting System	eedocs@bpa.gov or fax 1-866-535-7955	Customer File
Signed Customer/ End-user Agreement (secure link or file)	At sign-up	X	X		X	X
PTS design proposal (secure link or file)	Completion of T&T Scoping		X		X	
PTS installation invoice, design proposal and verification report (secure link or file)	Prior to requesting PTS payment		X		X	X
Tune-Up & Monitoring Plan (secure link or file)	Prior to the requesting T&T Completion Payment		X		X	X
Action Item Plan	Prior to the requesting T&T Completion Payment		X		X	X
Completion Report and supporting invoices (secure link or file)	After conclusion of 90-day T&T performance period		X		X	X
Annual Report (secure link or file)	Prior to annual payments	Completion Report	Sustained Savings Report		X	X
Calculator (secure link or file)	Prior to annual payments	HPEM Calculator	T&T Calculator	X		X
PTS Maintenance Invoice (secure link or file)	Prior to annual payments		X		X	X

Payment

The customer may invoice BPA when the end user reaches the milestones in the chart below. Use the T&T or HPEM Calculator (available in the Document Library) to calculate payment amounts.

Milestone	HPEM	T&T
For any payment, the customer may set a lower than allowable cap (i.e., select a payment smaller than the calculated payment).		
End user purchases and installs BPA-approved PTS.	n/a	<u>> 4 Million kWh System Baseline</u> Lesser of the following: • Documented PTS costs • $0.0025 per kWh of estimated annual energy consumption • $50,000.00 <u>=< 4 Million kWh System Baseline</u> Lesser of the following: • Documented PTS costs • $10,000.00
BPA Approves T&T Completion Report	n/a	Lesser of the following: • $0.075 per kWh of verified annual busbar energy savings • 70% of documented action item costs
BPA Approves Annual Sustained Savings Report (Year 1-5)	$0.025 per kWh of verified annual busbar energy savings for previous year. In the first year, the customer must also complete HPEM training.	Lesser of the following: • $0.025 per kWh of verified annual busbar energy savings • PTS maintenance budget
BPA Approves PTS maintenance payment (Year 1-5). The PTS maintenance budget is cumulative for the performance period. The customer can request an annual advance PTS maintenance payment.	n/a	Cumulative PTS maintenance payment <u>> 4 Million kWh System Baseline</u> Lesser of the following: • Documented PTS costs • <u>If 5-year performance period,</u> $0.0025 per kWh of estimated annual energy consumption • <u>If 3-year performance period</u>, $0.0015 per kWh of estimated annual energy consumption. • $50,000.00 <u>=< 4 Million kWh System Baseline</u> Lesser of the following: • Documented PTS costs • $10,000.00

3. *Limited Availability Small Industrial High Performance Energy Management (Optional Energy Management Pilot Feature)*

This limited availability Small Industrial High Performance Energy Management (SI HPEM) offering is designed to help 10 small industrial sites generate electrical energy savings through (a) operations and maintenance (O&M) improvements, (b) behavior-based changes, and (c) identification and implementation of custom projects.

Requirements and Specifications

Customers may nominate industrial end users with an annual, connected electric energy load between 1,000,000 kWh and 2.0 aMW by submitting a SI HPEM Utility Questionnaire (available in the Document Library) to the ESI program. From the qualifying nominations, the ESI program will work with customers to plan and conduct initial site visits prior to making the final selection of the 10 participants. Final SI HPEM participant selection is at BPA's discretion and will be based on:

1. Order nominated (first come, first served)
2. End user electric energy load (i.e., seeks a full range of eligible participants)
3. Geographic dispersion (i.e., seeks participants throughout BPA's service territory)
4. End user's readiness for energy management (e.g., stable process, available staff time, and continuous improvement programs)
5. Availability of data needed to model end user's energy consumption

If selected by BPA, a customer may enroll in the offering by sending a request to BPA (e-mail eedocs@bpa.gov or 1-866-535-7955) for enrollment. The customer must sign an SI HPEM agreement with the end user and report savings to BPA. The customer will send to BPA (a document or link from the secure, online ESI SharePoint site by e-mail to eedocs@bpa.gov; note, effective April 1, 2015 sending a link will be a requirement) the executed agreement and must demonstrate that the end user will meet the following requirements:

1. The end user must assign a staff member as Energy Champion, the point of contact for SI HPEM training. The assigned staff member is expected to complete assigned online SI HPEM training and attend at least one year of quarterly BPA SI HPEM training webinars.
2. Concurrent with SI HPEM training, and over the course of the SI HPEM program, the end user must implement a continuous improvement process program for energy management at end user's facility, including, but not limited to, the following:
    a. Establish energy management goals
    b. Implement energy efficiency activities and projects
    c. M&V

Option 1 and Option 2 customers must follow the SI HPEM requirements and report savings using one of the SI HPEM M&V Plans described below.

1. Top Down M&V Plan (two-year measure life): This M&V plan establishes and maintains an energy use data tracking system with an established baseline, energy use and energy savings and must follow the M&V requirements addressed in the ESI MT&R Reference Guide (available in the Document Library).
2. Bottom Up M&V Plan (one-year measure life): This M&V plan tracks and reviews indicators of improvement made to reduce energy usage. It applies short-term measurements of key performance indicators to calculate energy savings of discrete O&M improvement measures by using the BPA M&V Engineering Calculations with Verification Protocol (available in the Document Library).

Documentation Requirements

Documentation Description	Retention/Submittal Locations		
	BPA Energy Efficiency Reporting System	eedocs@bpa.gov or fax 1-866-535-7955	Customer File
Executed SI HPEM agreement between customer and end user (secure link or file)		X	X
SI HPEM Completion Report (secure link or file)		X	X
SI HPEM Calculator (available in the Document Library)	X		X

Payment

To receive payment, the customer must invoice BPA upon the end user reaching the milestones in the chart below. Use the SI HPEM Calculator (available in the Document Library) to calculate the Year 1 payment amount.

Funding Period	M&V Plan	Funding Amount	Milestone
Year 1	Top Down M&V Plan	Not to exceed $0.025 per kWh of BPA verified MT&R energy savings for previous year*	End user completes HPEM training, implements a continuous improvement process program for energy management and BPA receives and approves annual SI HPEM Completion Report.
	Bottom Up M&V Plan	Not to exceed $0.025 per kWh of BPA verified energy savings for previous year*	End user completes HPEM training, implements a continuous improvement process program for energy management and BPA receives and approves annual SI HPEM Completion Report.
Year 2	Top Down M&V Plan	Not to exceed $1,000*	BPA approves customer submission of end-user model data (production and consumption)
	Bottom Up M&V Plan	NA	NA

*Customers may choose a funding amount up to the amounts listed.

Trade Ally Delivered Small Industrial Measures (Optional ESI Component)

Requirements and Specifications

The Small Industrial Measures component provides cost-effective, simple measures with broad market applicability to leverage trade ally networks (e.g., compressed air, refrigeration and motors) to handle specific efficiency measures where the energy savings of individual projects are small. Simplified analysis tools will be created to assist with project development. Projects of this size justify a simple, streamlined analytical approach, including M&V, due to the small scale of energy savings and incentive. An ESIP is closely involved with Small Industrial Measures.

Documentation Requirements

There are no documentation requirements.

Payment

See the custom projects payment table.

BPA Funded Technical Service Providers (Optional ESI Component)

Requirements and Specifications

BPA funding, through the ESI program partner, is available for eligible technical services necessary to develop and complete custom projects. Technical Service Provider (TSP) consultants can be utilized for scoping, project assessments, completion reports (M&V) and miscellaneous consulting. BPA funding of technical services is based on the cost-effectiveness of the proposal and the likelihood of implementation by end user.

Documentation Requirements

There are no documentation requirements.

Payment

No funds are paid to the customer as BPA funds the TSP consultants directly.

Variable Frequency Drives (VFD) for Fans in Spud and Onion Storage Facilities

Requirements and Specifications

Effective April 1, 2015, savings for Variable Frequency Drives for Fans in Spud and Onion Storage Facilities will increase to 1,193 kWh per hp.

Ventilation fan VFD installations in spud and onion storage facilities have a deemed energy savings of 1,000 kWh per hp.

Documentation Requirements

Documentation Description	Retention/Submittal Locations		
	BPA Energy Efficiency Reporting System	eedocs@bpa.gov or fax 1-866-535-7955	Customer File
End-user identifying information including unique site ID and address	X		X
Equipment/contractor invoice showing (a) measure requirements have been met (e.g., manufacturer, model number, type, size and quantity of equipment or product installed/used), (b) the order/purchase date and (c) cost			X

Payment

BPA shall pay $200.00 per hp. To calculate the payment, the customer will add the total fan VFD hp installed on a per building basis.

Multi-Sector Opportunities

Additional industrial opportunities are available in the Multi-Sector chapter:

- Processes
- Measures and Initiatives
  1. Green Motors Rewind Initiative
  2. Non-Residential Lighting Program
  3. Engine Block Heaters
  4. Limited Availability Emerging Technology Field Test Projects
  5. Variable Frequency Drives in Small Compressed Air Systems (If customer does not enroll in ESI, it may use the RTF-approved NW Regional Small Compressed Air Calculator without technical assistance from BPA or ESI program partner.)

10. Residential Sector

Please check the changes and corrections summary to see if revisions were made to any of the measures in this sector.

The Residential Sector includes electrical energy used in a residential setting* (e.g., single-family residences, multifamily residential structures (up to three stories high) and manufactured homes). Excluded are temporary residences such as hotels, motels, nursing homes, dorms or any other generally temporary quarters. (Multifamily housing greater than three stories and all common areas within multifamily housing are considered commercial.)

* *Installations of High Intensity Discharge lighting in residential settings must be reported as commercial sector. See the Non-Residential Lighting Program.*

Payment Summary*

Program Component or Measure	Payment
Lighting	
o *Specialty CFLs*	$2.25-$5.50/CFL
o *Standard Twister CFLs*	$1.00-$4.00/CFL
o *ENERGY STAR CFL Fixtures*	$10.00/fixture
o *LED Bulbs*	$4.00-$6.00/LED
o *LED Fixtures*	$10.00/fixture
Showerheads	$12.00-$20.00/unit
BPA *Simple Steps, Smart Savings* Retail Promotion	See the payment section of this measure.
Advanced Power Strips	$40.00-$60.00/unit
Appliances (New)	
o *ENERGY STAR Clothes Washers*	$20.00-$70.00/washer
o *ENERGY STAR Freezers*	$15.00/freezer
o *ENERGY STAR Refrigerators*	$5.00-$20.00/refrigerator
Refrigerator and Freezer Decommissioning	$100.00/unit
Electric Water Heating	
o *Heat Pump Water Heaters*	$300.00-$500.00/water heater
o *Pipe Insulation*	$5.00-$25.00/unit
HVAC Measures	
o *Ductless Heat Pumps*	$800.00-$1,200.00/unit
o *Ducted Systems*	See the payment section of this measure.
Line Voltage Electronic Thermostats	$115.00-$160.00/unit
New Construction	
o *New ENERGY STAR Manufactured Homes*	$850.00-$1,450.00/unit
o *New HIGH PERFORMANCE Manufactured Homes*	$4,500.00/unit
o *New ENERGY STAR/Built Green Single- family Homes*	$200.00-$1,800.00/unit
o *Montana House (v 2.0)*	$200.00-$1,500.00/unit
o *New Multifamily Construction*	$200.00-$500.00/unit
Weatherization (Standard Income)	
o *Insulation*	See the Interim Reference Deemed Measure list in the Document Library.
o *Prime Window and Patio Door Replacement*	$6.00-$8.00/square foot
o *Insulated Exterior Doors*	$40.00/unit
o *Whole House Air Sealing and Testing*	See the Interim Reference Deemed Measure list in the Document Library.
Low-income Weatherization, Ductless Heat Pumps and Duct Sealing	See the payment section of this measure.
Residential Custom Projects	See the custom projects payment table.
Multi-Sector Measures	
o *Electric Storage Water Heaters*	See the payment section in the Multi-Sector chapter.
o *Engine Block Heaters*	$200.00-$1,500.00/unit
o *Limited Availability Emerging Technology Demonstration Field Test Projects*	See the custom projects payment table.
o *Commercial Clothes Washers – Multifamily Common Areas*	$25.00-$100.00/unit
o *Multifamily, Multi-Sector Measures*	See the measure specific section.

* The payment levels described in this table provide a summary only. Complete details of the payment levels and associated requirements may be found in the corresponding text of the Manual. Please see the Table of Contents for the text location.

Lighting

ENERGY STAR CFLs and Fixtures

Requirements and Specifications

Effective April 1, 2015, current CFL lighting measures will be expired and replaced. Please see the Interim Reference Deemed Measure List in the Document Library for details.

Effective April 1, 2015, delivery mechanisms for CFL bulb and fixture measures will be consolidated and reduced to four categories: Retail, By Request (includes Mail by Request, Over the Counter and Other Distribution Methods) Mailed Non-Request (bulbs only) and Direct Install. CFL measures being consolidated into the "By Request" category have the same savings and payment amounts. Documentation requirements capturing end user request, mailing documentation and/or limits to number of Mailed Non-Request bulbs do not change. New forms are available in the Document Library.

Compact Fluorescent Lamps (CFLs) and fixtures must be ENERGY STAR qualified, installed in a residential setting and claimed only once (e.g., CFLs in ENERGY STAR fixtures cannot be claimed as documented direct install CFLs if the ENERGY STAR fixture was already claimed under that measure).

Standard twister and specialty CFLs are both eligible. Specialty CFLs are defined as the following screw-base bulbs: candelabra, G-lamp (globe), R-lamp and PAR-lamp (reflector), torpedo, dimmable and three-way. *Note: T-2s and A-lamps are standard twisters, not specialty CFLs.*

CFLs must also be more than five watts and, if distributed via the direct install distribution method, must replace incandescent or halogen bulbs. Customers may distribute CFLs and fixtures via retail markdown, mail by request, non-requested direct mail (bulbs only, limited to four CFLs per household per fiscal year), direct install, over-the-counter or other distribution method[25] per the Measure Distribution Processes section in the Multi-Sector chapter.

Documentation Requirements

Documentation Description	Retention/Submittal Locations		
	BPA Energy Efficiency Reporting System	eedocs@bpa.gov or fax 1-866-535-7955	Customer File
Equipment/contractor invoice showing (a) measure requirements have been met (e.g., manufacturer, model number, type, size and quantity of equipment or product installed/used), (b) the order/purchase date and (c) cost			X
A copy of the ENERGY STAR product list showing the product or the product information insert or packaging that includes the ENERGY STAR logo (In the event that ENERGY STAR specifications change, BPA will accept pre-existing models that were ENERGY STAR qualified at the time they were manufactured.)			X
See the Measure Distribution Processes section in the Multi-Sector chapter for additional requirements.			

[25] Other distribution method applies to CFLs/LEDs distributed via a coupon or through online fulfillment. Customers must contact their COTRs to confirm documentation requirements.

Payment

Type	Retail Markdown	Direct Mail	Over-the-Counter & Other Distribution Methods	Direct Install
Standard Twister CFL *(CFLs not defined as specialty)*	$1.00	$2.50	$2.50	$4.00
Specialty CFL *(screw-base candelabra, G-lamp (globe), R-lamp and PAR-lamp (reflector), torpedo, dimmable and three-way)*	$2.25	$4.00	$4.00	$5.50
ENERGY STAR CFL Fixture	$10.00	$10.00	$10.00	$10.00

Effective April 1, 2015, the following payments will be in effect. Standard twisters will be referred to as general purpose CFLs. Specialty CFLs will be listed by bulb type in the Interim Reference Deemed Measure List in the Document Library.

Type	Retail	By Request	Mailed Non-Request	Direct Install
General Purpose CFLs (formerly Standard twisters)	$1.00	$2.50	$2.50	$4.00
Decorative and minibase; globe; three-way; reflector; outdoor CFLs (formerly specialty CFLs)	$2.25	$4.00	$4.00	$5.50
ENERGY STAR CFL Fixture	$10.00	$10.00	na	$10.00

ENERGY STAR Solid-State Lighting/Light Emitting Diodes Bulbs and Fixtures

Requirements and Specifications

Effective April 1, 2015, current LED lighting measures will be expired and replaced. Please see the Interim Reference Deemed Measure List in the Document Library for details.

Effective April 1, 2015, delivery mechanisms for LED measures will be consolidated and reduced to four categories: Retail, By Request (includes Mail by Request, Over the Counter and Other Distribution Methods) and Mailed Non-Request (limited to four LEDs per household per fiscal year) and Direct Install.

LED bulb measures being consolidated into the "By Request" category have the same savings and payment amounts. Documentation requirements capturing end user request and/or mailing documentation do not change. New forms are available in the Document Library.

Solid state lighting, also known as light emitting diodes (LED) bulbs, must be ENERGY STAR qualified or listed on the Lighting Design Lab (LDL) Qualified LED Lamp List as integral omnidirectional, directional or decorative, with corresponding measures on the Interim Reference Deemed Measure List in the Document Library.

For LED fixtures, the LED downlight retrofit kit qualifies.

LED bulbs may be distributed via retail markdown, mail by request, direct install and over-the-counter or other distribution method[26] per the Measure Distribution Processes section in the Multi-Sector chapter. LED fixtures[27] may be distributed via retail markdown only.

[26] Other distribution method applies to CFLs/LEDs distributed via a coupon or through online fulfillment. Customers must contact their COTRs to confirm documentation requirements.

[27] LED fixtures via other delivery mechanism are pending development and review by the RTF.

Documentation Requirements

Documentation Description	Retention/Submittal Locations		
	BPA Energy Efficiency Reporting System	eedocs@bpa.gov or fax 1-866-535-7955	Customer File
Equipment/contractor invoice showing (a) measure requirements have been met (e.g., manufacturer, model number, type, size and quantity of equipment or product installed/used), (b) the order/purchase date and (c) cost			X
A copy of the ENERGY STAR product list showing the product or the product information insert or packaging that includes the ENERGY STAR logo (In the event that ENERGY STAR specifications change, BPA will accept pre-existing models that were ENERGY STAR qualified at the time they were manufactured.)			X
See the Measure Distribution Processes section in the Multi-Sector chapter for additional requirements.			

Payment

Type	Retail Markdown	Direct Mail	Over-the-Counter & Other Distribution Methods	Direct Install
LED Omnidirectional (includes A-Lamps and globes) *	$4.00	$4.00	$4.00	$6.00
LED Directional (includes R, PAR, BR, MR)*	$4.00	$4.00	$4.00	$6.00
LED Decorative*	$4.00	$4.00	$4.00	$6.00
LED Fixtures (LED downlight kit only)	$10.00	n/a	n/a	n/a

* Savings is determined by LED bulb type and lumen categories. See the Interim Reference Deemed Measure list in the Document Library for details.

Effective April 1, 2015, payment will be as follows:

Type	Retail	By Request	Mailed Non-Request	Direct Install
LED Decorative and Minibase*	$4.00	$4.00	$4.00	$6.00
LED General purpose and dimmable, Globe, Three-way (Omnidirectional)*	$4.00	$4.00	$4.00	$6.00
LED Reflectors and Outdoor (Directional, includes R, PAR, BR, MR)*	$4.00	$4.00	$4.00	$6.00
LED Fixtures (LED downlight kit only)	$10.00	n/a	n/a	n/a

* Savings is determined by LED bulb type and lumen categories. See the Interim Reference Deemed Measure list in the Document Library for details.

Showerheads

Requirements and Specifications

Effective April 1, 2015, delivery mechanisms for Showerheads will be consolidated and reduced to three categories: Retail, By Request (includes Mail by Request, Over the Counter and Other Distribution Methods) and Direct Install. Showerhead measures being consolidated into the "By Request" category have the same savings and payment amounts. Documentation requirements capturing end user request, mailing documentation, site address and water heater fuel do not change.

This measure is available for all types of residential buildings (multifamily, single-family and manufactured homes). Showerheads must have a gallon per minute (GPM) flow rate of 2.0 or less and may be distributed via retail markdown, mail by request, direct install or over-the-counter (which includes showerheads left at the customer's residence at the customer's request) per the Measure Distribution Processes section in the Multi-Sector chapter. Customers claiming the measures for showerheads Mail by Request/distributed over-the-counter must document a request by customer and water heater fuel type. Direct install showerheads are only eligible in homes with electric water heat. All showerhead measures are limited to two showerheads per residence.

Documentation Requirements

Documentation Description	Retention/Submittal Locations		
	BPA Energy Efficiency Reporting System	eedocs@bpa.gov or fax 1-866-535-7955	Customer File
Equipment/contractor invoice showing (a) measure requirements have been met (e.g., manufacturer, model number, type, size and quantity of equipment or product installed/used), (b) the order/purchase date and (c) cost			X
Fuel source documentation (mailed/over-the-counter by request or directly installed showerheads)			X
See the Measure Distribution Processes section in the Multi-Sector chapter for additional requirements.			

Payment

Retail Markdown, Mail by Request and Over-the-Counter by Request[28]	Direct Install
$12.00	$20.00

Effective April 1, 2015, payment will be as follows:

Measure	Retail	By Request	Direct Install
All Showerhead measures	$12.00	$12.00	$20.00

BPA *Simple Steps, Smart Savings* Retail Promotion

Requirements and Specifications

The BPA *Simple Steps, Smart Savings* Retail Promotion, is implemented by a third party Simple Steps contractor (the Contractor). Current contact information may be found on the Residential Lighting Web site. The Contractor currently provides regional coordination of the delivery of retail CFLs, LEDs, lighting fixtures, showerheads, and advanced power strips measures and offers bulk purchase, direct mail and direct install delivery options. Participating customers receive credit for savings achieved in their service territory. Customers may participate by either signing a contract directly with the Contractor or by allocating ECA funds to the promotion through BPA. The participation options are described in the table below.

[28] Over-the-counter showerheads are claimed using the Mailed by Request measures.

Participation Option	Requirements
Signing a contract directly with the Simple Steps Contractor	• Customers must sign a Promotion Services Agreement with the Contractor and pay the Contractor directly for qualified sales under that agreement. • Interested customers must contact the Contractor, contact information available on the Residential Lighting Website. Customers may use any funding source available under this option and may invoice BPA for eligible measures.
Allocating ECA funds to the promotion through BPA	• Customers must send to BPA (e-mail eedocs@bpa.gov or fax 1-866-535-7955) (1) a completed *Simple Steps, Smart Savings* ECA Implementation Budget Release Form (available in the Document Library) and (2) a sales projection provided by the Contractor. • Customers must commit to a funding period of a minimum of six months, or be approved for participation by the Contractor. The funding period may not exceed the rate period. • BPA will reduce the customer's ECA implementation budget by the allocated amount in the budget release form and will pay the Contractor for program incentives using these funds. • BPA will track savings, and the Contractor will send the customer monthly savings reports. • If actual sales are below the sales projection at the mid-point of the customer's selected funding period, BPA, the Contractor and the customer may work together to recommend corrective action. If sales are still below the sales projection at the third quarter of the funding period, at the customer's request, BPA will return the unused funds to the ECA implementation budget. If actual sales are above the sales projection at the mid-point or at the third quarter of the customer's funding period, the customer may elect to add funds by submitting a new budget release form; if no funds are added, work in its service territory may be subject to curtailment. • If the Contractor fails to deliver according to its projection, the customer may terminate participation with 30 days notice to BPA using the COTR Request and Acknowledgement Procedure. • If allocated funds have not been spent at the conclusion of the funding period, they will be returned to the customer's ECA implementation budget.

Documentation Requirements

Documentation Description	Retention/Submittal Locations		
	BPA Energy Efficiency Reporting System	eedocs@bpa.gov or fax 1-866-535-7955	Customer File
Effective April 1, 2015, proof of payment to Simple Steps contractor and copy of invoice for sales in service territory (self-funded customers, only).			X

Payment

Customers are paid according to the established levels for ENERGY STAR CFLs, CFL fixtures, LED bulbs, LED fixtures, showerheads and advanced power strips.

Advanced Power Strips

Requirements and Specifications

The Residential Advanced Power Strip measure is an infrared remote sensing strip that reduces power consumption of home entertainment centers by shutting off power to the main device (television) and controlled peripherals when no infrared remote signal is detected for a predetermined period of time.

Qualified products are on the Advanced Power Strip Qualified Products List and may be distributed via direct install, mail by request, retail markdown or over the counter. (If a customer believes a product should be on the list, and is not, it should use the COTR Request and Acknowledgement Procedure to request approval to use the product.)

A qualified Advanced Power Strip must meet the following qualifications:

- Infrared remote sensing
- Consume less than 1W of energy
- One-year warranty and any length warranty for connected devices
- Surge protection to 740 joules
- UL1449 listed
- Rated for 15 amps
- Resettable circuit breaker

Effective April 1, 2015, delivery mechanisms for Advanced Power Strips will be consolidated to three categories: Retail, By Request (includes Mail by Request, Over the Counter[29] and Other Distribution Methods) and Direct Install.

Effective April 1, 2015, customers will be required to send a short survey via postal mail or e-mail to end users who received an Advanced Power Strip (By Request and Direct Install only) to gather data on this measure to help move it to a proven deemed measure. This survey is available in the Document Library.

Documentation Requirements

Documentation Description	Retention/Submittal Locations		
	BPA Energy Efficiency Reporting System	eedocs@bpa.gov or fax 1-866-535-7955	Customer File
Equipment/contractor invoice showing (a) measure requirements have been met (e.g., manufacturer, model number, type, size and quantity of equipment or product installed/used), (b) the order/purchase date and (c) cost			X
See the Measure Distribution Processes section in the Multi-Sector chapter for additional requirements.			
Effective April 1, 2015, completed end-user surveys		X	

Payment

Delivery Mechanism	Payment
Retail Markdown	$40.00
Mail by Request	$40.00
Direct Install	$60.00
Over-the-Counter (Use Mail by Request reference number until a By Request reference number is available April 1, 2015.)	$40.00

[29] Through March 31, 2015 utilities may claim Advanced Power Strips distributed Over the Counter by using the Mailed By Request RefNo.

Effective April 1, 2015, payment will change as follows:

Measure	Retail	By Request	Direct Install
Advanced Power Strip	$40.00	$40.00	$60.00

Appliances (new)

Requirements and Specifications

Appliances must be ENERGY STAR qualified.

Documentation Requirements

Documentation Description	Retention/Submittal Locations		
	BPA Energy Efficiency Reporting System	eedocs@bpa.gov or fax 1-866-535-7955	Customer File
End-user identifying information including unique site ID and address			X
Equipment/contractor invoice showing (a) measure requirements have been met (e.g., manufacturer, model number, type, size and quantity of equipment or product installed/used), (b) the order/purchase date and (c) cost			X
A copy of the ENERGY STAR product list showing the product or the product information insert or packaging that includes the ENERGY STAR logo (In the event that ENERGY STAR specifications change, BPA will accept pre-existing models that were ENERGY STAR qualified at the time they were manufactured.)			X
Documentation of water heater fuel and clothes dryer fuel (for washers, only) Customers who are able to document the absence of natural gas within in their service territory (through a statement or map provided by the public utilities commission or equivalent regulatory body) may claim Clothes Washer electric domestic hot water heater/electric dryer without the verification of water heat fuel type.			X

Payment

The payment differs for each type of appliance, listed below

Appliance	Payment
Any ENERGY STAR Refrigerator	$5.00
Refrigerator – CEE Tier 1	$5.00
Refrigerator – CEE Tier 2	$10.00
Refrigerator – CEE Tier 3	$20.00
Any ENERGY STAR Clothes Washer (electric water heater)	$30.00
Clothes Washer MEF 2.0-2.19 (electric water heater)	$30.00
Clothes Washer MEF 2.20-2.45 electric water heater)	$50.00
Clothes Washer MEF 2.46+ (electric water heater)	$70.00
Clothes washers with gas/unknown water heater	$20.00
Freezers 7.75 cubic feet or greater	$15.00

Refrigerator and Freezer Decommissioning

Requirements and Specifications

The existing appliance for decommissioning and recycling must be a residential-style appliance, verified as functional and have a minimum capacity of 10 cubic feet. The unit must be decommissioned and its components recycled.

Documentation Requirements

Documentation Description	Retention/Submittal Locations		
	BPA Energy Efficiency Reporting System	eedocs@bpa.gov or fax 1-866-535-7955	Customer File
Disposal/recycling documents (from recycler) for each unit			X
Disposal/recycling summary (from recycler)			X

Payment

BPA shall pay $100.00 per unit.

Electric Water Heating

BPA will pay customers for heat pump water heaters and pipe insulation. See also Electric Storage Water Heaters in the Multi-Sector chapter.

Heat Pump Water Heater (Provisionally Deemed)

Requirements and Specifications

Effective April 1, 2015, BPA will no longer provide payment for AirGenerate and Electrolux Heat Pump Water Heaters which were removed from the HPWH Qualified Product list. This is an exception to the rule that states that eligibility is determined by the placement of products on the list.

- Only new construction and existing single-family homes qualify for the heat pump water heater (HPWH) payment. In existing homes, the HPWH must replace an electric storage water heater.
- HPWHs must be (1) listed on NEEA's HPWH qualified products list as meeting Tier 1 or Tier 2 requirements of the Northern Climate Specification and (2) installed, according to manufacturer's specifications. The installer must have received installation training from the manufacturer of the installed HPWH equipment, if available. (If a customer believes a product should be on the list, and is not, it should use the COTR Request and Acknowledgement Procedure to request approval to use the product.)

Documentation Requirements

Documentation Description	Retention/Submittal Locations		
	BPA Energy Efficiency Reporting System	eedocs@bpa.gov or fax 1-866-535-7955	Customer File
End-user identifying information including unique site ID and address	X		X
Equipment/contractor invoice showing (a) measure requirements have been met (e.g., manufacturer, model number, type, size and quantity of equipment or product installed/used), (b) the order/purchase date and (c) cost			X
Heat Pump Water Heater Form (available in the Document Library)		X	X

Payment

Tier, Tank Size	Payment
Tier 1, 50-75 gallons	$300.00
Tier 1, greater than 75 gallons	$500.00
Tier 2, 50 gallons or greater*	$500.00

* Tier 2 tanks installed in conditioned space with tank not ducted must use Tier 1 measures.

Pipe Insulation (BPA Qualified)

Requirements and Specifications

This measure is available for all types of residential buildings (multifamily, single-family, and manufactured homes) with an electric water heater. Customers may claim only one measure per project.

Both Short and Whole House insulation measures must meet the following requirements:

- Hot and cold pipes must be insulated with a minimum of R-3 closed cell foam insulation for at least the first three feet past the water heater and if accessible, up to six feet adjacent to the water heater
- Insulation material, any jackets or facing and adhesive (if used) must have a flame spread/smoke density rating in accordance with ASTM E-84
- Pipe insulation must not cover pressure relief values, any handles, safety drain valves or any other safety control device
- All pipe elbows and joints must be mitered to ensure coverage to the same thickness as straight runs
- Pipe insulation must be secured with twine, corrosion resistant wire, or plastic compression ties every 12 inches and within 3 inches of the ends.

Whole House insulation must be installed on all accessible hot water pipes. If hot water pipes (trunk and branch lines) are already covered with floor or attic insulation, the project is not eligible.

Documentation Requirements

Documentation Description	Retention/Submittal Locations		
	BPA Energy Efficiency Reporting System	eedocs@bpa.gov or fax 1-866-535-7955	Customer File
End-user identifying information including unique site ID, address, and water heater fuel type			X
Equipment/contractor invoice showing (a) measure requirements have been met (e.g., manufacturer, model number, type, size and quantity of equipment or product installed/used), (b) the order/purchase date and (c) cost			X

Payment

Application	Payment
Short (3-6 foot minimum, hot and cold water pipes)	$5.00
Whole House (trunk lines and all exposed hot water pipe)	$25.00

HVAC Measures

This section covers the following:

- Ductless Heat Pumps (DHP)
- Ducted Systems

HVAC Measures - Ductless Heat Pumps (provisionally deemed)

Requirements and Specifications

- BPA will pay customers for one DHP per existing residence with electric resistance heating as the primary heating system. Qualifying applications include the following:
    - Single-family residences with zonal electric heat, including hydronic systems (provisionally deemed)
    - Single-family residences with electric forced air furnaces, with or without air conditioning (BPA qualified)
    - Manufactured homes with electric forced air furnaces, with or without air conditioning (BPA qualified)
    - Manufactured homes with zonal electric heat (provisionally deemed)
- The DHP must be (1) a split system heat pump employing inverter-driven outdoor compressor, with inverter-driven or variable-speed indoor blowers, (2) listed on BPA's DHP Qualified Product List and (3) installed, according to manufacturers' specifications and the Northwest DHP Project Best Practices Guides, by a contractor who attended a Northwest Ductless Orientation and received installation training from the manufacturer of the installed DHP equipment. (If a customer believes a product should be on the list, and is not, it should use the COTR Request and Acknowledgement Procedure to request approval to use the product.)
- Homes with electric forced air furnaces are still eligible for PTCS or Prescriptive Duct Sealing, but must meet the pre-existing duct leakage to the outside requirements, listed below, under "Duct Sealing Single-family and Manufactured homes" and must be claimed as "Duct Sealing - Air Source Heat Pump."

- The system must meet a Heating Seasonal Performance Factor (HSPF) requirement of 9.0 for single head systems and 8.0 for multi-head systems.
- Ducted indoor units do not qualify.
- Homes where plug-in electric heaters are the primary heating system in the home qualify for BPA DHP payment. The customer should determine if a weather-related heating signature exists that demonstrates electric resistance heating use.

Documentation Requirements

Documentation Description	Retention/Submittal Locations		
	BPA Energy Efficiency Reporting System	eedocs@bpa.gov or fax 1-866-535-7955	Customer File
End-user identifying information including unique site ID and address	X		X
Equipment/contractor invoice showing (a) measure requirements have been met (e.g., manufacturer, model number, type, size and quantity of equipment or product installed/used), (b) the order/purchase date and (c) cost			X
Ductless Heat Pump Homeowner Installation Form (or other form(s) that contain the same information) (available in the Document Library)			X

Payment

Building Type	Existing Heating System Type	Payment
Manufactured Homes	Zonal electric heat	$800.00
	Electric forced air furnace	$1,200.00
Single-family Homes	Zonal electric heat	$800.00
	Electric forced air furnace	$1,200.00

HVAC Measures - Ducted Systems

Measures include new high-efficiency heat pump upgrades; heat pump conversions; ground source heat pump systems installed to PTCS specifications; PTCS commissioning and controls for heat pumps of any efficiency; PTCS duct sealing; and prescriptive duct sealing.

Effective April 1, 2015, PTCS heat pump measures with "ducts required" will no longer be available; PTCS Commissioning, Controls and Sizing measures will be combined, eliminating the differentiation between new single-family homes and existing single-family homes; measures currently labeled "Commissioning Controls Sizing New Single-family Home Heat Pump – HSPF/SEER <9.0/14" will be expired; and PTCS Commissioning, Controls and Sizing measures will be combined, eliminating the differentiation between new manufactured homes and existing manufactured homes. The measures currently labeled "Commissioning Controls Sizing New Manufactured Home Heat Pump – HSPF/SEER <9.0/14" will be expired.

Effective April 1, 2015, the PTCS duct sealing measures for manufactured homes (low income) will no longer be available. New measures will be available October 1, 2014 as optional new measures.

Requirements and Specifications

The following requirements apply:

- Installations may be in new construction single-family, existing single-family or existing manufactured homes. Primary heating system requirements are listed in the measure table below.

- PTCS work must be performed by a technician certified in PTCS, or an approved alternative (listed in the PTCS Program Requirements), and must be certified as PTCS in the online registry. PTCS specifications and forms are available here.
- Prescriptive Duct Sealing must be performed by a technician certified in Prescriptive Duct Sealing, or an approved alternative (listed in the Prescriptive Duct Sealing Program Requirements), and must be certified in Prescriptive Duct Sealing in the online registry. Prescriptive Duct Sealing specifications and forms are available here.
- Heat pump equipment must be AHRI tested and certified. Manufacturer claims of “equivalent to AHRI certified equipment" are not accepted.
- Air Source and Variable Speed Heat Pumps must be installed according to the “PTCS Air Source Heat Pump Installation Specification” dated June 11, 2013. Duct systems must be installed and sealed according to the April 2009 version of “Performance Tested Comfort Systems® Duct Technical Specifications”; Closed Loop Ground Source Heat Pumps must be installed according to the October 4, 2011 “Ground Source Heat Pump System Installation Standards”; and Open Loop Ground Source Heat Pumps must be installed according to April 15, 2007 “Ground Source Heat Pump System Installation Standards.” Prescriptive Duct Sealing must be done according to the April 8, 2014 Prescriptive Duct Sealing Specification. All specifications are available in the Document Library and on the HVAC Web site.
- In existing homes with two, independent, electrically-heated duct systems, each duct system is eligible for duct sealing and a PTCS air source heat pump, provided all other program requirements are met.
- Where a home is hydronically heated, an electric resistance water heater is considered equivalent to an electric furnace.

Additional requirements apply to air-source heat pump upgrades and conversions, commissioning and controls, ground source heat pump systems and PTCS duct sealing. See the table, below. All documentation and requirements are also posted online.

Air-Source Heat Pump Upgrades and Variable Speed Heat Pump Upgrades	• Heat pump must be rated as having a minimum of 9.0 HSPF and 14 Seasonal Energy Efficiency Ratio (SEER). • Heat pump upgrades include replacing an existing heat pump, adding a heat pump to a non-electric heating system (i.e., gas/oil/propane/wood), replacing the heat pump portion of a ground source heat pump system, or upgrading from zonal to air-source heat pump. • Homes with heated floor area greater than 4,500 square feet or with two separate duct systems may claim up to two heat pump measures when two qualifying heat pumps are installed provided all other program requirements are met.
Electric Forced-Air Furnace to Air-Source Heat Pump Conversions and Variable Speed Heat Pump Conversions	• Heat pump must be rated as having a minimum of 9.0 HSPF and 14 SEER. • The installation must convert an electric forced air furnace to a high efficiency heat pump. • Homes with heated floor area greater than 4,500 square feet or with two separate duct systems may claim up to two heat pump measures when two qualifying heat pumps are installed.
Commissioning and Controls	• This measure may be applied to any new heat pump that meets federal standards, including federal minimum efficiency ratings of 7.7 HSPF and 13 SEER for air source heat pumps. • This measure cannot be claimed in combination with any other heat pump measure.
Ground Source Heat Pump Systems	• This measure is only available for existing and new construction single-family homes in heating zones 2 and 3. • For existing homes, only ground source heat pumps replacing an electric forced air furnace, an electric boiler used for hydronic heating, or an air source heat pump qualify. For new construction homes, the baseline is considered to be an electric forced air furnace. • All system components must be newly installed. The replacement of an existing ground source heat pump unit or the thermal exchange loop does not qualify. • Ground source heat pump systems must be ENERGY STAR qualified and installed according to the International Ground Source Heat Pump Association (IGSHPA) specifications available at the time of installation by a technician certified in PTCS (or an approved alternative found in the PTCS Program Requirements) and IGSHPA. • Only one ground source heat pump per home qualifies for BPA payment. Ground source heat pumps may be connected to hydronic heating systems in residential end-use applications if all PTCS and IGSHPA specifications are met.
PTCS Duct Sealing	• New and existing single-family homes and existing manufactured homes are eligible for PTCS duct sealing provided the ducts are connected to electric heat. • For manufactured homes, pre-existing duct leakage to the outside must be greater than 100 CFM_{50} for single-wide homes or 75 CFM_{50} leakage per section for multi-section homes (e.g., double wide 150 CFM_{50}, triple wide 225 CFM_{50}). • For existing single-family homes, pre-existing duct leakage to the outside must be greater than 250 CFM_{50} or 15% of the floor area, whichever is less. • For new single-family homes, the home must be new construction and occupied for less than a year. Pre-existing duct leakage test is not required. • Homes with two independent, electrically-heated duct systems may claim up to two duct sealing measures provided all other program requirements are met.

Prescriptive Duct Sealing	• New and Existing Single-family homes and Existing Manufactured homes are eligible for prescriptive duct sealing provided the home is electrically heated with new or existing ducts. • Prescriptive Duct Sealing measures are treated as PTCS measures for all documentation and QA purposes, including the online registry. • Homes with two independent, electrically-heated duct systems may claim up to two duct sealing measures provided all other program requirements are met.

Documentation Requirements

Documentation Description	Retention/Submittal Locations		
	BPA Energy Efficiency Reporting System	Site Registry	Customer File
End-user identifying information including unique site ID and address	X		X
PTCS site registry measure ID	X		
Equipment/contractor invoice showing (a) measure requirements have been met (e.g., manufacturer, model number, type, size and quantity of equipment or product installed/used), (b) the order/purchase date and (c) cost			X
Proof that the required form(s) for the claimed measure have been accepted in the PTCS site registry of certified systems		X	
Heat pump measures: • PTCS Air Source or Ground Source Heat Pump Form (available in the Document Library) • AHRI certificate • Documentation of size (e.g., PTCS Heat Pump and Central Air Conditioner Sizing Calculator (available in the Document Library) Duct sealing measures: • PTCS or Prescriptive Duct Sealing Form (available in the Document Library)			X

Payment

Measure Category		Payment
Heat Pump Upgrade to Air-Source or Variable Speed Heat Pump		$500.00
Heat Pump Upgrade with duct sealing* to Air-Source or Variable Speed Heat Pump		$1000.00
Conversion from Electric Forced-Air Furnace to Air-Source or Variable Speed Heat Pump		$1,400.00
Conversion with duct sealing* from Electric Forced-Air Furnace to Air-Source or Variable Speed Heat Pump		$1900.00
Commissioning and Controls		$300.00
Ground Source Heat Pump Systems	Single-family homes only – HZ 2-3 (for cost-effective applications)	$3,000.00
	Add desuperheater to a qualified ground source heat pump installation (HZ 2-3 only)	$500.00
Duct Sealing, PTCS or Prescriptive	Manufactured and new single-family homes	$200.00
	Existing single-family homes	$250.00

* Effective April 1, 2015, heat pump measures bundled with duct sealing will no longer be available. Heat pumps and duct sealing will still be available as stand-alone measures

Line-Voltage Thermostats

Requirements and Specifications

Customers must replace bi-metal line voltage thermostats in existing electrically heated single-family homes with line-voltage electronic thermostats. All existing thermostats, except those in bathrooms, must be replaced with thermostats in according to the current National Electric Code and must meet the following requirements:

- Have a digital display
- Be electronically anticipated
- Have a thermistor temperature sensing element accurate to within 1.5º or better
- Be UL or CSA listed for use with their application (i.e. fan-forced, baseboard, wall or ceiling radiant).

In addition, programmable thermostats must maintain temperature and program settings during power failures and have a temporary override feature.

Documentation Requirements

Documentation Description	Retention/Submittal Locations		
	BPA Energy Efficiency Reporting System	eedocs@bpa.gov or fax 1-866-535-7955	Customer File
End-user identifying information including unique site ID and address			X
Equipment/contractor invoice showing (a) measure requirements have been met (e.g., manufacturer, model number, type, size and quantity of equipment or product installed/used), (b) the order/purchase date and (c) cost			X
Written statement from end user that all thermostats (except those in bathrooms) have been replaced			X

Payment

Payments are per home as listed in the table below.

Heating Zone	Payment
1	$115.00
2	$160.00
3	$160.00

New Construction

New ENERGY STAR Manufactured Homes

Requirements and Specifications

Manufactured homes must be electrically-heated, new and designed, constructed and certified by the Northwest Energy Efficient Manufactured (NEEM) Homes program as ENERGY STAR, including Eco-Rated Homes.

NEEM has an online tracking and certification system and is operated by Northwest Energy Works. Contact Brady Peeks of Northwest Energy Works (888) 370-3277 ext. 102 for current information.

Documentation Requirements

Documentation Description	Retention/Submittal Locations		
	BPA Energy Efficiency Reporting System	eedocs@bpa.gov or fax 1-866-535-7955	Customer File
End-user identifying information including unique site ID and address	X		X
NEEM ENERGY STAR certificate of compliance			X

Payment

Heating Zone	Payment
1	$850.00
2	$1,150.00
3	$1,450.00

New HIGH PERFORMANCE Manufactured Homes

Requirements and Specifications

Manufactured homes must be electrically-heated; new; and designed, constructed and certified by NEEM as HIGH PERFORMANCE Manufactured Homes.

NEEM has an online tracking and certification system and is operated by Northwest Energy Works. Contact Brady Peeks of Northwest Energy Works (888) 370-3277 ext. 102 for current information.

Documentation Requirements

Documentation Description	Retention/Submittal Locations		
	BPA Energy Efficiency Reporting System	eedocs@bpa.gov or fax 1-866-535-7955	Customer File
End-user identifying information including unique site ID and address	X		X
NEEM HIGH PERFORMANCE Certificate of compliance			X

Payment

BPA shall pay customers $4,500.00 per home.

New ENERGY STAR/Built Green Single-family Homes

Requirements and Specifications

Effective April 1, 2015, All New ENERGY STAR/Built Green Single-family homes measures, Washington Only, will be expired and no longer available.

Single-family homes must be new and certified compliant with Northwest ENERGY STAR Homes standards by the state certifying organization or NEEA-approved RESNET Provider. Built Green opportunities must meet Northwest ENERGY STAR Homes standards. Current specifications for options below may be found on the Northwest ENERGY STAR website.

BPA will accept claims for homes built to the following standards:

- ENERGY STAR Builder Option Package #1 for homes with gas heat or a heat pump(s)
- ENERGY STAR Builder Option Package #2 for homes with zonal electric heat
- The Northwest Performance Path using the Northwest REM/Rate Modeling Software

- Built Green 4 and 5 Star specification (Washington, only)

When the Northwest Performance Path is used to certify a home, the ENERGY STAR Home certificate will indicate the appropriate measure to use for claiming the BPA payment.

Qualifying measures differ by state.

Northwest ENERGY STAR single-family homes may use one of the approved Technical Compliance Options (TCO) listed in the table below. All TCOs in the table below must use Building Option Package #1.

State	Home Type	TCO
OR	Gas	Natural-Gas-Fired Hydronic Heating System
	Heat Pump	Hybrid "Ductless-Split" Heat Pump/Electric Resistance Zonal Heat
		Packaged Terminal Heat Pump/Electric Resistance Zonal Heat
ID/MT	Gas	Natural-Gas-Fired Hydronic Heating System
	Heat Pump	Hybrid "Ductless-Split" Heat Pump/Electric Resistance Zonal Heat
	Heat Pump or Gas	Unvented Crawlspaces
WA	Gas	Natural-Gas-Fired Hydronic Heating System
	Heat Pump	Hybrid "Ductless-Split" Heat Pump/Electric Resistance Zonal Heat
	Heat Pump or Gas	Mechanically Exhausted, Sealed Crawlspaces
		Integrated Ventilation & Forced Air System
		Exhaust Ventilation w/Air Blending Strategy

In multiplex units where each unit is thermally separated from ground-to-roof, the units may be classified as single-family units (i.e., townhouses, condominiums or row houses).

Documentation Requirements

Documentation Description	Retention/Submittal Locations		
	BPA Energy Efficiency Reporting System	eedocs@bpa.gov or fax 1-866-535-7955	Customer File
End-user identifying information including unique site ID and address	X		X
Certification label from Northwest ENERGY STAR Provider organization that includes the name of the ENERGY STAR/Built Green home verifier/rater.			X

Payment

BPA shall pay customers as shown in the table below.

Home Type	State	Specification	Payment/Home
Northwest ENERGY STAR Homes	ID, MT, OR, WA	• Zonal Electric Heat • DHP/Zonal Electric Heat TCO** • PTCS Heat Pump	$1,500.00
		Gas Heat (electric savings only)	$200.00
Built Green 4 Star Homes*	WA	• Zonal Electric Heat • PTCS Heat Pump	$1,500.00
		Gas Heat (electric savings only)	$200.00
Built Green 5 Star Homes	WA	• Zonal Electric Heat • PTCS Heat Pump	$1,800.00
		Gas Heat (electric savings only)	$200.00

* Built Green 4 Star Homes, in WA, are equivalent to Northwest ENERGY STAR Homes and should be claimed as such, until such time as a distinct Built Green 4 Star Home is available.

** Homes built to the DHP/Zonal Electric Heat TCO should be claimed as Heat Pump Home built to Building Option Package 1.

Montana House (v 2.0)

Requirements and Specifications

Homes must be new, electrically heated and compliant with the Montana House specifications (available in the Document Library). This measure is available only for homes built in Montana and Heating Zones 2 and 3 of Idaho, Wyoming and Nevada.

Documentation Requirements

Documentation Description	Retention/Submittal Locations		
	BPA Energy Efficiency Reporting System	eedocs@bpa.gov or fax 1-866-535-7955	Customer File
End-user identifying information including unique site ID and address	X		X
Builder information (name and contact information)			X
HVAC system details (type of equipment, ventilation system, specific measures installed including rated CFM); foundation type; and home square footage			X
Report of inspections performed by the customer, including any substantial findings and documentation of any corrective actions taken			X

Payment

BPA shall pay for the Montana House as indicated below. Heat Pump, Duct Sealing, and Commissioning & Control payments can be combined with the Shell Upgrade payment.

Measure	Payment
Shell Upgrade only	$1,500.00
Air-Source Heat Pump	$300.00
Duct Sealing (prescriptive)	$200.00
Commissioning & Controls (customer verified)	$200.00

New ENERGY STAR Multifamily Construction

Requirements and Specifications

New residential multifamily construction may be made more efficient than code or standard practice per the Northwest Energy Star Homes Multifamily program. The following Builder Option Packages are available in the Document Library.

- The Northwest Multifamily Builder Option Package 1 (NWBOP1 MF) applies to multifamily units with gas heat or an air source, packaged terminal, or ductless mini-split heat pump.
- The Northwest Multifamily Builder Option Package 2 (NWBOP2 MF) applies to multifamily units with zonal electric heat.

Documentation Requirements

Documentation Description	Retention/Submittal Locations		
	BPA Energy Efficiency Reporting System	eedocs@bpa.gov or fax 1-866-535-7955	Customer File
End-user identifying information including unique site ID and address (Submittal is not required until BPA's reporting system is available.)	X		X
Northwest ENERGY STAR certificate documenting that the building meets or exceeds the ENERGY STAR Multifamily specification described in NW Multifamily BOP 1 or BOP 2			X

Payment

ENERGY STAR Multifamily Specification	Heating System	Payment
NWBOP 1 MF	Gas	$200.00
NWBOP 1 MF	Heat pump*	$500.00
NWBOP 2 MF	Zonal electric	$500.00

*Heat pump includes air-source, ground source, packaged terminal and ductless heat pumps.

Weatherization (Standard Income)

Weatherization measures include insulation, prime window replacement, insulated exterior doors and air sealing. All weatherization measures must be installed according to the 2014 BPA Residential Weatherization Specifications in the Document Library.

Weatherization measures must be installed in electrically heated homes with an electric heating system as the primary system (see definitions); or homes must have one of the following as an existing heating system:

1. A permanently-installed electric heating system with either (a) no other functioning non-electric heating system or (b) a wood stove, pellet stove, fireplace, fireplace insert (wood or pellet) or wood furnace
2. A electric heat pump system integrated with a non-electric heating system (e.g., natural gas, propane, or wood supplementary/backup system)
3. A wood stove or pellet stove with no other non-electric space heating system, accompanied by the current usage of plug-in electric space heaters
4. A electric heat system and a separate functional or non-functional, non-electric space heating system (i.e. oil, natural gas, or wood furnace) with the entire non-

electric space heating system decommissioned, removed, all penetrations sealed, and all fuel (electric, gas, oil) connections to the decommissioned heating system disconnected. System equipment includes furnace, air-handler, fuel lines, fuel tanks (abated in compliance with local code). If, however, construction limitations prevent the removal of the entire non-electric system (or other portions of the space heating equipment), then the remainder of the system must be decommissioned, removed, all penetrations sealed, and all fuel (electric, gas, oil) connections to the decommissioned heating system disconnected.

Insulation

Requirements and Specifications

Insulation	Home Type	Existing is:	Installed will be (minimum values):
Attic Insulation	Single-family	Less than R-11	R-19, R-38 or R-49
		R-11 to R-19	R-38 or R-49
		R-19 to R-38	R-49
	Multifamily	Less than R-11	R-19, R-38 or R-49
		R-11 to R-19	R-38 or R-49
		R-19 to R-38	R-49
	Manufactured	Less than R-11 Less than R-11	R-19 R-30[i]
		R-11 to R-19	R-30[ii]
Wall Insulation	Single-family	Closed cavity – none present	Closed cavity – R-11 or fill cavity
		Open cavity – none present	Open cavity – R-13*
	Multifamily	Closed cavity – none present	Closed cavity – R-11 or fill cavity
		Open cavity – none present	Open cavity – R-13*
	Manufactured	n/a	n/a
Floor Insulation	Single-family	Less than R-11	R-19 or R-30
		R-11 to R-19	R-30
	Multifamily	Less than R-11	R-19 or R-30
		R-11 to R-19	R-30
	Manufactured	Less than R-11	R-11 or R-22
		R-11	R-22

*Open cavity or unfinished walls (e.g., knee walls in attic spaces) must fill to R-13 minimum. Refer to the Weatherization Specifications in the Document Library.

Documentation Requirements

Documentation Description	Retention/Submittal Locations		
	BPA Energy Efficiency Reporting System	eedocs@bpa.gov or fax 1-866-535-7955	Customer File
End-user identifying information including unique site ID and address	X		X
Equipment/contractor invoice showing (a) measure requirements have been met (e.g., manufacturer, model number, type, size and quantity of equipment or product installed/used), (b) the order/purchase date and (c) cost			X
Audit or field notes detailing pre and post conditions			X
Documentation of R-value and square footage of installed insulation			X
Effective April 1, 2015, a description of home (single-family, multifamily or manufactured) is required.			X

Payment

Payments and busbar energy savings for specific measures are available in the Interim Reference Deemed Measure list in the Document Library.

Prime Window and Patio Door Replacement

Requirements and Specifications

Pre-existing windows and patio doors must be (1) single pane with/without storms, any frame type (e.g., metal, wood, vinyl), or (2) double pane, metal frame only. The weighted average of replacement windows must have a National Fenestration Rating Council (NFRC) minimum U-value of 0.30 or 0.22 for windows; 0.35 or 0.30 for patio doors. Multifamily does not qualify for 0.22 windows or 0.30 patio doors at this time.

Documentation Requirements

Documentation Description	Retention/Submittal Locations		
	BPA Energy Efficiency Reporting System	eedocs@bpa.gov or fax 1-866-535-7955	Customer File
End-user identifying information including unique site ID and address	X		X
Equipment/contractor invoice showing (a) measure requirements have been met (e.g., manufacturer, model number, type, size and quantity of equipment or product installed/used), (b) the order/purchase date and (c) cost			X
NFRC stickers or other verifications of U-value			X
Documentation of number of windows or patio doors and square footage of windows or patio doors replaced			X
Audit or field notes detailing pre and post conditions (including original window or patio door and frame)			X
Description of home (single-family, multifamily or manufactured)			X

Payment

Home Type	Existing Window or Patio Door Condition	Installed Average U-Factor	Payment (Square foot of glazing)
Single-family or Manufactured	Single pane window, any frame type or double pane window, metal frame type	0.30	$6.00
	Single pane patio door, any frame type or double pane patio door, metal frame type	0.35	$6.00
	Single pane window, any frame type or Double pane window, metal frame type	0.22	$8.00
	Single pane patio door, any frame type or double pane patio door, metal frame type	0.30	$8.00
Multifamily	Single pane window, any frame type or double pane window, metal frame type	0.30	$6.00
	Single pane patio door, any frame type or double pane patio door, metal frame type	0.35	$6.00

Insulated Exterior Doors (BPA Qualified)

Requirements and Specifications

The door must replace an un-insulated or otherwise substandard (e.g., from a thermal perspective) exterior door, be a pre-hung ENERGY STAR qualified door and include replacement of the threshold. This measure is available for existing single-family or manufactured homes. Multifamily does not qualify at this time.

Documentation Requirements

Documentation Description	Retention/Submittal Locations		
	BPA Energy Efficiency Reporting System	eedocs@bpa.gov or fax 1-866-535-7955	Customer File
End-user identifying information including unique site ID and address	X		X
Equipment/contractor invoice showing (a) measure requirements have been met (e.g., manufacturer, model number, type, size and quantity of equipment or product installed/used), (b) the order/purchase date and (c) cost			X
A copy of the ENERGY STAR product list showing the product or the product information insert or packaging that includes the ENERGY STAR logo. (In the event that ENERGY STAR specifications change, BPA will accept pre-existing models that were ENERGY STAR qualified at the time they were manufactured.)			X
Documentation of number of doors replaced			X
Audit or field notes detailing pre and post conditions and description of home (single-family or manufactured)			X

Payment

BPA shall pay $40.00 per door.

Whole House Air Sealing and Testing

Requirements and Specifications

Whole house air sealing requires the use of a blower door to measure and identify air leakage locations in the home.

- If combustion appliances are present (e.g., fireplace, wood or gas stove, gas range, gas water heater), a UL- or CUL-approved carbon monoxide detector must be present or be installed.
- Mechanical ventilation may be required. See the 2014 BPA Residential Weatherization Specifications in the Document Library.
- If PTCS duct sealing is performed at the same time as air sealing, the baseline blower door CFM_{50} reading for the whole house air sealing and testing measure must be taken with all the supply and return duct registers temporarily sealed off, so that house air leakage can be measured independently from duct leakage.
- This measure is available for all existing manufactured homes and for single-family homes built during or prior to 1982. Homes built after 1982 may qualify for Whole House Air Sealing if a pre-test measures the house leakage at greater than 9 air changes per hour at 50 Pascals.

Documentation Requirements

Documentation Description	Retention/Submittal Locations		
	BPA Energy Efficiency Reporting System	eedocs@bpa.gov or fax 1-866-535-7955	Customer File
End-user identifying information including unique site ID and address	X		X
Equipment/contractor invoice showing (a) measure requirements have been met (e.g., manufacturer, model number, type, size and quantity of equipment or product installed/used), (b) the order/purchase date and (c) cost			X
Effective April 1, 2015, audit or field notes detailing the following conditions are required: • Pre and post conditions CFM_{50} (CFM at -50 pascals) • Total square footage of the pressure zone tested and sealed (typically this is the interior space (conditioned) heated floor area of the home) • Building volume • Notes on mechanical ventilation requirement • Age and description of home (single family/manufactured)			X

Payment

BPA payment is based on the reduction in air infiltration per reduction in CFM_{50}, rounded to the nearest whole number. Payments and busbar energy savings are available in the Interim Reference Deemed Measure list in the Document Library.

Total Payment = Quantity x Payment

Quantity = Difference between pre and post CFM_{50}

Prescriptive Air Sealing

Requirements and Specifications

Prescriptive air sealing must be done according to the checklists found in sections 4.2 and 6.2 of the 2014 BPA Residential Weatherization Specifications in the Document Library.

If combustion appliances are present (e.g., fireplace, wood or gas stove, gas range, gas water heater), a UL- or CUL-approved carbon monoxide detector must be present or be installed.

This measure is available for existing single-family homes only. Multifamily and manufactured homes do not qualify at this time.

Documentation Requirements

Documentation Description	Retention/Submittal Locations		
	BPA Energy Efficiency Reporting System	eedocs@bpa.gov or fax 1-866-535-7955	Customer File
End-user identifying information including unique site ID and address	X		X
Equipment/contractor invoice showing (a) measure requirements have been met (e.g., manufacturer, model number, type, size and quantity of equipment or product installed/used), (b) the order/purchase date and (c) cost			X
Audit or field notes detailing pre and post conditions, age of home			X
Documentation of square footage of attic and/or crawlspace area air sealed			X

Payment

Payments and busbar energy savings are available in the Interim Reference Deemed Measure list in the Document Library and are based on the square footage of the area where prescriptive air sealing is performing.

Low-income Weatherization, Ductless Heat Pumps and Duct Sealing

Requirements and Specifications

All weatherization measures must be installed according to the 2014 BPA Residential Weatherization Specifications in the Document Library and follow the Specification, Requirements and Documentation requirements as listed under Weatherization (Standard Income) above.

To be eligible, homes must have an electric heating system as the primary system (see definitions); or homes must have one of the following as an existing heating system:

1. A permanently-installed electric heating system with either (a) no other functioning non-electric heating system or (b) a wood stove, pellet stove, fireplace, fireplace insert (wood or pellet) or wood furnace
2. A electric heat pump system integrated with a non-electric heating system (e.g., natural gas, propane, or wood supplementary/backup system)
3. A wood stove or pellet stove with no other non-electric space heating system, accompanied by the current usage of plug-in electric space heaters

4. A electric heat system and a separate functional or non-functional, non-electric space heating system (i.e. oil, natural gas, or wood furnace) with the entire non-electric space heating system decommissioned, removed, all penetrations sealed, and all fuel (electric, gas, oil) connections to the decommissioned heating system disconnected. System equipment includes furnace, air-handler, fuel lines, fuel tanks (abated in compliance with local code). If, however, construction limitations prevent the removal of the entire non-electric system (or other portions of the space heating equipment), then the remainder of the system must be decommissioned, removed, all penetrations sealed, and all fuel (electric, gas, oil) connections to the decommissioned heating system disconnected.

Low-income household eligibility is defined in the Federal Weatherization Assistance Program as 200% of the poverty income levels. Approved statewide eligibility definitions substitute for federally established low income levels, if provided.

All low-income weatherization funds must generate reportable, cost-effective savings in the customer's service territory.[30] Customers may run low-income weatherization programs themselves or through contractors, but must, at all times, retain responsibility for and control over the program.

Funds may be used for repair work (i.e. health and safety or to ensure efficacy of measure) directly associated with the installation of cost-effective weatherization measures, but repair costs must be reported separately. Customers may combine funding sources within a residence, but may not combine funding from multiple BPA sources for the same measure.

The table below summarizes eligible measures, which must be individually reported to BPA.

Home Type	Qualifying Measures
Single-family	• Attic insulation (up to R49) • Floor insulation (up to R30) • Wall insulation (up to R11) • Prime window or patio door replacement* • Exterior insulated doors • Whole House Air Sealing and Testing • Prescriptive Air Sealing • PTCS or Prescriptive duct sealing for heat pumps or electric forced air furnaces • Ductless Heat Pumps (zonal or EFAF)
Multifamily	• Attic Insulation (up to R49) • Floor Insulation (up to R30) • Wall Insulation (up to R11) • Prime window (Class 30 only) or patio door replacement (Class 35 only)*
Manufactured Homes	• Attic insulation (up to R30) • Floor insulation (up to R22) • Prime window or patio door replacement* Prime window or patio door replacement* • Whole House Air Sealing and Testing • PTCS or Prescriptive duct sealing for homes with heat pumps or electric forced air furnaces • Ductless Heat Pumps (zonal or EFAF)

* Prime window and patio door existing condition and replacement average U-Factor sections apply to Low Income installations. Payments are outlined below.

[30] Under a separate BPA program BPA funds low income energy efficiency activities through grants to states and tribes.

Documentation Requirements

Documentation Description	Retention/Submittal Locations		
	BPA Energy Efficiency Reporting System	eedocs@bpa.gov or fax 1-866-535-7955	Customer File
End-user identifying information including unique site ID and address	X		X
Equipment/contractor invoice showing (a) measure requirements have been met (e.g., manufacturer, model number, type, size and quantity of equipment or product installed/used), (b) the order/purchase date and (c) cost			X
Insulation (if installed): square feet and R-value documentation			X
Prime window replacement (if installed): description of the home (single-family, multifamily or manufactured) and original window and frame; documentation of number and square footage of windows replaced; and NFRC stickers or other verification of U-value			X
Audit or field notes detailing pre and post conditions			X
Effective April 1, 2015: Low-income documentation: number of individuals and verifiable documentation of the income for the entire household			X

Payment

All costs directly attributable to the installation of the measure are eligible for dollar-for-dollar reimbursement (except as noted in the table below, not to exceed 100% of actual cost) including costs that protect the integrity of the measure (e.g., manufactured home roofing membrane over rigid insulation; attic and crawl space ventilation; under-floor moisture barrier; and insulation of exposed water lines).

Home Type	Qualifying Measure	Payment
Single-family	Attic insulation	Dollar for dollar reimbursement
	Floor insulation	Dollar for dollar reimbursement
	Wall insulation	Dollar for dollar reimbursement
	Prime window	Dollar for dollar reimbursement, not to exceed $20.00/sq. ft.
	Patio Door	Dollar for dollar, not to exceed $20.00/sq. ft.
	Exterior insulated door	Dollar for dollar, not to exceed $400.00
	Whole House Air sealing	Dollar for dollar reimbursement
	Prescriptive Air Sealing	Dollar for dollar reimbursement
	PTCS duct sealing for heat pumps and electric forced air furnaces	Dollar for dollar reimbursement
	Prescriptive Duct Sealing	Dollar for dollar reimbursement
	Ductless heat pump	Dollar for dollar reimbursement, not to exceed $3,800.00
Multifamily	Attic insulation	Dollar for dollar reimbursement
	Floor insulation	Dollar for dollar reimbursement
	Wall insulation	Dollar for dollar reimbursement
	Prime window	Dollar for dollar reimbursement, not to exceed $20.00/square foot
	Patio door	Dollar for dollar reimbursement, not to exceed $20.00/square foot
Manufactured	Attic insulation	Dollar for dollar reimbursement

Home Type	Qualifying Measure	Payment
	Floor insulation	Dollar for dollar reimbursement
	Prime window	Dollar for dollar reimbursement, not to exceed $20.00/square foot
	Patio Door	Dollar for dollar reimbursement, not to exceed $20.00/square foot
	Whole House Air sealing	Dollar for dollar reimbursement
	Prescriptive Air Sealing	Dollar for dollar reimbursement
	PTCS duct sealing for heat pumps and electric forced air furnaces	Dollar for dollar reimbursement
	Prescriptive Duct Sealing	Dollar for dollar reimbursement
	Ductless heat pump	Dollar for dollar reimbursement, not to exceed $3,800.00

Residential Custom Projects

Requirements and Specifications

Residential custom projects may be submitted using the custom projects process.

Documentation Requirements

See the custom projects documentation requirements.

Payment

See the custom projects payment table.

Multi-Sector Opportunities

Additional residential opportunities are available in the Multi-Sector chapter.

- Processes
- Measures and Initiatives
  1. Electric Storage Water Heaters
  2. Non-Residential Lighting Program (High Intensity Discharge lighting, only, reported as commercial sector)
  3. Engine Block Heaters
  4. Limited Availability Emerging Technology Field Test Projects
  5. Commercial Clothes Washers – Multifamily Common Areas
  6. Multifamily, Multi-Sector Measures

11. Utility Distribution Sector

BPA acquires Utility Distribution Sector energy savings through Energy Smart Utility Efficiency, which includes Voltage Optimization (VO) and Electrical Distribution System Improvements (SI). VO is a technique for improving the efficiency of the electrical grid by reducing voltage on the feeder lines running from substations to retail loads, while SI improves the energy efficiency of the electrical distribution system.

Customers must submit VO and SI as custom projects and may combine SI and VO in one custom project when SI improvements increase the amount the voltage can be reduced or improve monitoring of reduced voltage.

Requirements and Specifications

The requirements of (1) VO, (2) SI and (3) custom project steps are discussed below.

1. Voltage Optimization (VO)

   The Simplified VO Measurement & Verification Protocol, based on RTF guidelines, focuses on residential and small commercial end-use loads and requires that specific system stability thresholds are met prior to lowering service voltages.

   All VO projects require a BPA-approved scoping study, and if the results of the scoping study indicate a cost-effective project, a detailed study. Customers should limit scoping and detailed study requests to a maximum of three substations and 12 feeders. These studies require the customer to collect data from feeders and the substations. Failure to provide requested substation, feeder, and voltage control data will delay scoping and detailed studies. Costs incurred prior to the acceptance of the custom project proposal (by BPA for Option 1 or the customer for Option 2) to gather required data, including additional metering and load flow analysis programs, are allowable project costs.

2. Electrical Distribution System Improvements (SI)

   BPA will not provide TSP support for SI without VO.

   SI may include the following measures:

   - Power transformer replacement
   - Service conductor replacement
   - Higher distribution primary voltage (including insulator additions and replacement)
   - Transformer load management (replacement of improperly sized transformers for loss improvements)
   - Balancing loads and phases
   - Adding parallel feeders
   - Operation improvement (recognition and phase balancing)
   - Power factor improvement to reduce line losses
   - Volt-Amperes-Reactive (Reactive Power) Management

- Fixed and switched capacitors
- Service distribution transformer
    - Replacing an existing or proposed transformer with a higher efficiency transformer
    - Multiple transformers versus single transformer based on system analysis
    - Voltage management

1. VO and SI Custom Project Process Chart

The following chart outlines the custom project tasks and responsible parties.

Custom Project Process Step	VO		Stand Alone System Improvements	
	Option 1	Option 2	Option 1	Option 2
TSP request	Customer	Customer	Customer	Customer
Utility questionnaire	Customer	Customer	n/a	n/a
Scoping Study	TSP	TSP	n/a	n/a
Detailed Study	TSP	TSP	n/a	n/a
Custom project proposal entry (optional)	TSP	n/a	Customer or TSP	n/a
Custom project proposal submittal (optional)	Customer	n/a	Customer	n/a
Custom project proposal review, if proposal is submitted	COTR and ESUE engineer	n/a	COTR and BPA Field Engineer	n/a
Estimated savings verification	TSP	TSP	Customer or TSP	Customer or TSP
Custom project entry/completion report development	TSP	TSP	Customer or TSP	Customer or TSP
Custom project/ completion report entry	TSP	TSP	TSP or Customer	TSP or Customer
Custom project/ completion report submittal	Customer	Customer	Customer	Customer
Custom project/ completion report review	COTR and ESUE Engineer	COTR and ESUE Engineer	COTR and BPA Field Engineer	COTR and BPA Field Engineer

Documentation Requirements

See the custom projects documentation requirements.

Payment

See the custom projects payment table.

12. Multi-Sector

Please check the changes and corrections summary to see if revisions were made to any of the measures in this sector.

This section contains general information applicable across sectors.

Payment Summary*

Program Component or Measure	Payment
Electric Storage Water Heaters	$25.00/heater
Green Motors	$2.00/hp
Non-Residential Lighting Program	See the lighting calculators.
Engine Block Heaters	$200.00-$1,500.00/unit
Limited Availability Emerging Technology Field Test Projects	See the custom projects payment table.
Variable Frequency Drives in Small Compressed Air System	See the custom projects payment table.
Commercial Clothes Washers – Multifamily Common Areas	$25.00-$100.00/unit
Multifamily, Multi-Sector Measures	See the specific measure section.

* The payment levels described in this table provide a summary only. Complete details of the payment levels and associated requirements may be found in the corresponding text of the Manual. Please see the Table of Contents for the text location.

12.1 Processes

COTR Request and Acknowledgement Procedure

Under the COTR Request and Acknowledgement Procedure, customers must send a written request to their COTRs to participate or make changes to participation in certain programs and processes. If the procedure is required, it will be listed in the specific section. The specific section may also require the customer to include supporting information with its request.

If approved, the COTR shall confirm the request by written notice. A customer request is not effective until the COTR approves the request in writing.

Measure Distribution Processes

Effective April 1, 2015 Measure Distribution Processes will be consolidated and reduced to: Retail Markdown, Direct Install, By Request (includes Mail by Request, Over the Counter and Other Distribution Methods), and Mailed Non-Request (CFL bulbs only). Documentation requirements do not change.

Measures requiring distribution may allow one or more of the following distribution methods: direct install, retail markdown, end-user reimbursement, direct mail/mail by request and other. Allowable distribution methods are listed in the specific measure section, and the requirements herein apply.

Distribution Type	Requirements and Specifications	Documentation Description (Retain in Customer File)
Direct Install	Customers must (1) physically install measures, (2) witness installation or (3) visually inspect a representative sample after installation by another party.[31]	Completed Measure Distribution Documentation form (available in the Document Library) or equivalent form with required information
Retail Markdown	• Customers may use in-store markdown or end-user coupons. • For in-store markdown, customers must submit a store sales report for each participating store with the date, manufacturer, model number, measure type and any other identifying elements of each sale generated by the promotion. Reports must document the allocation methodology when a store serves multiple utility customers. • Coupons must contain the (utility) customer name and end-user address and require the customer to (1) document that the product meets BPA's requirements or (2) create store sales reports	Store sales reports or, for coupons, other documentation that product meets BPA's requirements[32]
End-user Reimbursement	Customers must reimburse end users for the purchase, installation and operation of measures that meet BPA's requirements.	Completed Measure Distribution Documentation form (available in the Document Library) or equivalent form with required information

[31] Installation, witness or verification may be conducted by a customer program employee or an agent/contractor of the customer.

[32] The store sales report may substitute for invoices.

Distribution Type	Requirements and Specifications	Documentation Description (Retain in Customer File)
Direct Mail/ Mail by Request	The requirements and payment levels in place on the date the product enters the mail stream apply (i.e., for drop shipments, the "round stamp" date on United States Postal Service (USPS) form 8125 and for straight mailings, the "statement certification date" of USPS form 3607R).[33]	Completed Measure Distribution Documentation form (available in the Document Library) or equivalent form with required information
Over-the-Counter (e.g., distribution at customer events or customer's office or left a customer's house upon request)	Customer representatives must distribute measure to verified end users.	Completed Measure Distribution Documentation form (available in the Document Library) or equivalent form with required information
Other	See your COTR for requirements and specifications.	See your COTR for requirements. At a minimum, required documentation includes date of distribution, distribution recipients and quantity.

Effective April 1, 2015 the following Measure Distribution Processes will take effect.

Distribution Type	Requirements and Specifications	Documentation Description (Retain in Customer File)
Retail	• Customers may use in-store markdown or end-user coupons. • For in-store markdown, customers must submit a store sales report for each participating store with the date, manufacturer, model number, measure type and any other identifying elements of each sale generated by the promotion. Reports must document the allocation methodology when a store serves multiple utility customers. • Coupons must contain the (utility) customer name and end-user address and require the customer to (1) document that the product meets BPA's requirements or (2) create store sales reports	Store sales reports or, for coupons, other documentation that product meets BPA's requirements[34]
Mailed, Non-Request (CFL and LED bulbs only)	The requirements and payment levels in place on the date the product enters the mail stream apply (i.e., for drop shipments, the "round stamp" date on United States Postal Service (USPS) form 8125 and for straight mailings, the "statement certification date" of USPS form 3607R).[35]	Completed Measure Distribution Documentation form (available in the Document Library) or equivalent form with required information
By Request	Mail by Request – see requirements for Mailed, Non-Request above	
	Other delivery mechanisms that include distributing products "over the counter", at events, or otherwise directly to the	

[33] If using a non-United States Postal Service delivery service, contact your COTR for requirements and specifications.
[34] The store sales report may substitute for invoices.
[35] If using a non-United States Postal Service delivery service, contact your COTR for requirements and specifications.

Distribution Type	Requirements and Specifications	Documentation Description (Retain in Customer File)
	customer upon their request.	
Direct Install	Customers must (1) physically install measures, (2) witness installation or (3) visually inspect a representative sample after installation by another party.[36]	

12.2 Measures and Initiatives

Electric Storage Water Heaters

Requirements and Specifications

Tank Type	Tank Size (Gallons)	Minimum Requirements
Residential Applications		
Residential	25-54.99	Energy Factor of 0.94 or higher
	55-74.99	Energy Factor of 0.93 or higher
	75-99.99	Energy Factor of 0.92 or higher
	100-119.99	Energy Factor of 0.85 or higher
Commercial Applications		
Commercial	25-34.99	Standby loss of 157 Btu/hr or lower
	35-44.99	Standby loss of 185 Btu/hr or lower
	45-54.99	Standby loss of 201 Btu/hr or lower
	55-74.99	Standby loss of 238 Btu/hr or lower
	75-99.99	Standby loss of 249 Btu/hr or lower
	100-119.99	Standby loss of 287 Btu/hr or lower
Residential	25-34.9	Energy Factor of 0.94 or higher
	35-44.9	Energy Factor of 0.94 or higher
	45-54.9	Energy Factor of 0.94 or higher
	55-74.99	Energy Factor of 0.93 or higher
	75-99.99	Energy Factor of 0.92 or higher
	100-119.99	Energy Factor of 0.85 or higher

Documentation Requirements

Documentation Description	Retention/Submittal Locations		
	BPA Energy Efficiency Reporting System	eedocs@bpa.gov or fax 1-866-535-7955	Customer File
End-user identifying information including unique site ID and address			X
Equipment/contractor invoice showing (a) measure requirements have been met (e.g., manufacturer, model number, type, size and quantity of equipment or product installed/used), (b) the order/purchase date and (c) cost			X

Payment

BPA will pay $25.00 per unit.

36 Installation, witness or verification may be conducted by a customer program employee or an agent/contractor of the customer.

Green Motors Rewind Initiative

Requirements and Specifications

The Green Motors Rewind Initiative uses Direct Acquisition. The incentives paid through the Green Motors Rewind Initiative are paid by BPA as part of the third party program and are not counted against customer's EEI budget. No payments are required to BPA, the program implementer, or the participating end user. Customers receive credit for all energy savings achieved by the program in their service territory.

Qualified motors include National Electric Manufacturers Association (NEMA) standard horsepower (hp) rated motors between 15 and 5,000 hp (either NEMA premium or other) that are rewound via certified Green Motor Practices Group member service centers. Customers may enroll using the COTR Request and Acknowledgement Procedure.

A monthly report and annual report is created and sent to participating customers with end user names, total hp rewound, energy savings and incentives paid. Monthly reports will only be created/sent to customers with end user participation in their service territory.

Customers may be contacted by the program implementer to verify an end users' eligibility to receive incentives through the program.

Documentation Requirements

Documentation Description	Retention/Submittal Locations		
	BPA Energy Efficiency Reporting System	eedocs@bpa.gov or fax 1-866-535-7955	Customer File
Third-party provided monthly reports			X
Third-party provided annual reports			X

Payment

A payment of $2.00 per hp is made to the service center that rewound the motor. The service center acknowledges the payment is provided by the end user's serving customer and passes through $1.00 per hp to the end user as a credit on the end user's invoice.

Non-Residential Lighting Program

The Non-Residential Lighting Program applies to the following:

1. Existing building (retrofit/upgrade)
2. New construction projects in the agricultural, commercial, federal and industrial sectors
3. All High Intensity Discharge (HID) (metal halide, high pressure sodium, low pressure sodium and mercury vapor) lighting in exterior applications regardless of sector (Installations in residential settings must be reported as commercial.)

To participate in the program, customers capture project data in a lighting calculator and submit it to BPA for review and approval.

Lighting Calculators

Option 1 customers must use an eligible BPA lighting calculator. BPA will periodically release updated lighting calculators with improved functionality and other changes necessary to respond to an evolving marketplace. When a new lighting calculator is released, it will be posted in the Document Library, upon which time customers may begin using it immediately. The table below shows the effective dates and retirement dates for lighting calculators that are currently in use.

Calculator	Effective Date	Retirement Date*
LC 3.2	April 1, 2014	March 31, 2015
LC 3.3 (and LC 3.35, the promotional version of LC 3.3)	October 1, 2014	To Be Determined

* Note that "retirement date" means the last date that customers may submit a completed calculator to the BPA reporting system.

Measure Types and Approval Procedures

The lighting program includes two types of measures: (1) deemed and (2) calculated, which are submitted as projects, as discussed below.

1. Deemed Lighting Measures

   Deemed measures have been pre-approved by BPA and do not require review by BPA prior to submission to the BPA reporting system. Available deemed lighting measures are in the Program Offerings tab of all BPA lighting calculators.

2. Calculated Lighting Measures

   If a proposed measure is not on the deemed list, it may be submitted as a calculated measure. There are three types of calculated lighting measures:

   - Decommissioning: the number of proposed fixtures is less than the number of existing fixtures.
   - Fixture Increase: the number of proposed fixtures is greater than the number of existing fixtures.
   - Non-Standard: the measure is not deemed, decommissioning, or a fixture increase.

   No BPA approval is required for decommissioning or fixture increase measures. The BPA lighting calculator will automatically apply a calculated payment.

   To request a non-standard measure in the BPA lighting calculator, the user should select the "non-standard" option from the available drop-down menu. The calculator will highlight the measure in red and will indicate that the measure is non-standard and requires BPA approval. The customer must send the lighting calculator and any applicable product documentation requested by the BPA Lighting Team such as cut sheets, product specification sheets or third party tests (e.g. LM-79) to lighting@bpa.gov for review and acceptance.

   The BPA Lighting Team will review the non-standard measures and notify the customer and the BPA COTR whether or not the measures were accepted. Once the measures are accepted, the red highlighting and Project-Level Alert about needing BPA approval will disappear. No further documentation is required for non-standard measures.

Project Types and Requirements

There are four types of projects: (1) new construction, (2) retrofit, (3) batch and (4) custom projects. This section outlines eligibility criteria, requirements and payments for each of these project types.

1. New Construction Projects

   Eligibility: A non-residential lighting project is new construction if the answer to any of the following questions is "yes."

- Is this a newly-constructed facility or newly-constructed exterior area with new lighting fixtures?
- Is this a newly-constructed addition to an existing facility that adds usable floor area?
- Is the project a major renovation? A project is considered a major renovation whenever a whole building permit is required.
- Is there a change in occupancy type (e.g. office to food service or retail to office)?

Requirements: For new construction lighting projects, enter the Lighting Power Allowance (i.e., total watts allowed by applicable lighting code) and the project's Proposed Lighting Power (total watts of project) from the applicable code compliance form into the lighting calculator. The project must achieve at least a 20% kWh reduction from the Lighting Power Allowance.

Payments: Payments are calculated at $0.18 per kWh saved, using the total adjusted savings (factoring in HVAC and busbar adjustments).

2. Retrofit Projects for Existing Buildings

   Eligibility: Non-residential lighting projects which do not meet the criteria for new construction are eligible as retrofit projects.

   Requirements: The project must achieve at least a 25% kWh reduction. For non-standard measures, the minimum payment to the end user is $5.00 and the minimum fully adjusted net savings as determined by lighting calculator must be at least 10%,

   Payments: See the Program Offerings page in the lighting calculator for payments.

3. Batch Lighting Projects

   Eligibility: Retrofit projects that target a specific technology and specific application across an entire customer service territory (such as customer-owned street lights or area lights) may be submitted in a BPA lighting calculator or in a customer-generated spreadsheet in batch form. These projects may cover multiple pre and post conditions but are limited to a single technology and application.

   Requirements: For site address, enter the customer's address. Enter the project addresses or locations in the notes section of the lighting calculator or in a customer-generated spreadsheet. In cases where a street address is not applicable, enter the nearest street intersection.

   Payments: See the Program Offerings page in the lighting calculator for payments.

4. Custom Lighting Projects

   Eligibility: Eligibility: any non-residential lighting project may be submitted as a custom project.

   Requirements: Custom lighting projects may be submitted using a BPA custom project calculator or an equivalent, such as a vendor-provided lighting calculator or energy modeling software, and must follow the custom projects requirements of the Manual. BPA will review the calculator or energy model and supporting documentation to determine whether the project qualifies as a custom lighting project. Once the project is accepted as a custom lighting project, it must meet the following requirements:

- Equivalent calculators must use all current BPA baselines (as determined by applicable baseline on project start date), controls and requirements.
- If the measures contain additional fixtures (not replacements) that are required to meet operating requirements, the measures must be identified as new fixtures in the custom project, and incremental cost and savings information must be provided. The baseline description must contain the justification for the additional fixtures (e.g. required for safety, change in equipment layout or change in use of area).
- Power measurements for new induction and fluorescent fixtures are not required; customers may use manufacturers' published wattage specifications (e.g., cut sheets) to determine energy savings.
- The actual input power of all new or existing LED and high-intensity discharge (HID) fixtures must measure true root-mean-square power.
- Customers may use the manufacturer's stated wattage or lighting power estimates in the form of the submitted lighting calculator for all other non-HID or non-LED lights.
- Fixed schedule controls (e.g. time-based and photo cells) must have a fixed control operating schedule which documents commissioning and clearly outlines programmed hours of operation. These types of controls do not require logging.
- Non-fixed schedule controls (e.g., occupancy sensors and day lighting) require a minimum of two weeks of data logging to accurately determine hours of operation. Foot candle measuring is acceptable.

Payments: See the custom projects payment table.

Lighting Promotions

Periodically, BPA may promote specific lighting measures by temporarily offering higher incentives to cover up to 100% of the project cost. To claim these promotions, customers must contact Lighting@bpa.gov, and BPA will modify customers' existing version of 3.3 (creating version 3.35) to accommodate the promotions. This modified calculator will then only accommodate promotions, and if a project also contains non-promotional measures, such measures must be submitted on a separate calculator.

Promotions will be announced through normal communication channels.

Baselines

Baselines are used by the lighting calculator to determine the savings delta reportable to BPA. As the market changes and federal codes and standards take effect, BPA modifies reportable baselines as applicable. The table below follows the guidance offered by the RTF Lighting Protocols for baseline determination

Baseline	Application	Notes
Preconditions Baseline	Retrofit projects; technologies not deemed obsolete by RTF lighting protocols or covered by codes or standards	The Preconditions Baseline is the same as "what's in the ceiling."
Energy Policy Act: General Service Fluorescent Lamp	All 4' and 8' T12 linear fluorescent lamps	See the Market Average Baseline table

<table>
<tr><th colspan="3">Market Average Baseline</th></tr>
<tr><th colspan="2">Existing Obsolete Equipment
(Applies to all Ballast Types)</th><th>New Market Baseline</th></tr>
<tr><th>Lighting System Categories</th><th>Existing T-12 Lamp Wattages</th><th>Reportable Fixture Wattage/Lamp
(multiply by number of lamps in fixture to scale)</th></tr>
<tr><td rowspan="2">All 4' T12</td><td>34</td><td rowspan="2">28.7</td></tr>
<tr><td>40</td></tr>
<tr><td rowspan="2">All Slim line 8' T12</td><td>60</td><td rowspan="2">51.7</td></tr>
<tr><td>75</td></tr>
<tr><td rowspan="2">All HO 8' T12</td><td>95</td><td rowspan="2">90</td></tr>
<tr><td>110</td></tr>
<tr><td rowspan="2">All VHO 8' T12</td><td>185</td><td rowspan="2">131.5</td></tr>
<tr><td>215</td></tr>
<tr><td>State and/or local Codes</td><td>New construction</td><td>The maximum lighting power allowance is the baseline.</td></tr>
<tr><td>Energy Independence and Security Act (EISA)</td><td>All 100, 75, 60, and 40 watt standard incandescent A lamps</td><td>See the EISA Baseline table.</td></tr>
</table>

EISA Baseline	
Existing 'Obsolete' Equipment	**Reportable Lamp Wattage**
100 watt incandescent	72
75 watt incandescent	53
60 watt incandescent	43
40 watt incandescent	29

Documentation Requirements

Documentation Description	Retention/Submittal Locations		
	BPA Reporting System	eedocs@bpa.gov or fax 1-866-535-7955	Customer File
New Construction Lighting Projects			
Completed lighting calculator	X		X
Applicable code compliance form documenting the source of Lighting Power Allowance (watts) and Proposed Lighting Power (watts) figures used in lighting calculator			X
Retrofit Lighting Projects			
Completed lighting calculator	X		X
Project invoice(s) documenting site address and total project cost including costs incurred from equipment, labor, permits and disposal fees			X
Batch Lighting Projects			
Completed lighting calculator	X		X
Documentation of location and quantity of fixtures in batch, either in customer-generated spreadsheet or in the "notes" section of the lighting calculator			X
Custom Lighting Projects			
Custom projects must follow the custom projects documentation requirements.			

Engine Block Heaters (BPA Qualified)

Requirements and Specifications

Engine Block Heaters must be installed in generators or engines that meet the following requirements:

- The forced circulation heater must replace a thermo siphon electric resistance block heater.
- The generator or engine must be stationary and fixed.
- The install must meet manufacturer's recommendations and be performed by a manufacturer-certified installer.

Documentation Requirements

Documentation Description	Retention/Submittal Locations		
	BPA Energy Efficiency Reporting System	eedocs@bpa.gov or fax 1-866-535-7955	Customer File
End-user identifying information including unique site ID and address	X		X
Equipment/contractor invoice showing (a) measure requirements have been met (e.g., manufacturer, model number, type, size and quantity of equipment or product installed/used), (b) the order/purchase date (c) cost (d) installer's manufacturer assigned training number		X	X
Manufacturer's installation checklist			X

Payment

Replacement Heater Size	Payment
< 3 kW	$200.00
≥ 3 kW	$1,500.00

Limited Availability Emerging Technology Field Test Projects

Requirements and Specifications

Emerging Technology Field Test Projects allow BPA to collect detailed data to more accurately estimate savings and potential performance to create future deemed and BPA-qualified measures. BPA may contract with third parties to deploy the emerging technology, evaluate performance and verify energy savings.

On the BPA Emerging Technologies Web site, BPA maintains a list of available emerging technology projects with defined eligibility requirements, number of installations targeted, participation obligations, savings and payment.

If a customer is eligible for and wishes to participate in a project, it must use the Option 1 custom project process and submit a custom project proposal that uses the Engineering Calculations with Verification Protocol for measurement and verification. BPA will provide the information necessary to complete the custom project documentation and will provide staff assistance in the development of the proposal and completion report.

BPA may require metering to continue after project completion and may require customers to perform additional duties to support the research efforts (e.g., customers may be asked to provide access to end-user billing history and contact information). If additional metering is required, it will not change customers' payment or savings.

Documentation Requirements

Customers must follow the Option 1 custom project documentation requirements and may be required to provide end-user billing information and contact information.

Payment

See the custom projects payment table.

Variable Frequency Drives in Small Compressed Air Systems

Requirements and Specifications

VFDs applied to a single air compressor 75 hp or less must use the RTF-approved NW Regional Small Compressed Air Savings Calculator. Each VFD compressor must be submitted as an individual project (i.e., compressors may not be combined or divided).

The calculator will determine energy savings.

Documentation Requirements

Documentation Description	Retention/Submittal Locations		
	BPA Energy Efficiency Reporting System	eedocs@bpa.gov or fax 1-866-535-7955	Customer File
End-user identifying information including unique Site ID and address	X		X
Equipment/contractor invoice showing (a) measure requirements have been met (e.g., manufacturer, model number, type, size and quantity of equipment or product installed/used), (b) the order/purchase date and (c) cost			X
Completed NW Regional Compressed Air Savings Calculator (available in the Document Library)		X	X

Payment

Though this is not a custom project, payment is paid according to the custom projects payment table.

ENERGY STAR Commercial Clothes Washers – Multifamily Common Areas

Requirements and Specifications

The clothes washer must be ENERGY STAR and installed in the common area of a multifamily building.

Documentation Requirements

Documentation Description	Retention/Submittal Locations		
	BPA Energy Efficiency Reporting System	eedocs@bpa.gov or fax 1-866-535-7955	Customer File
End-user identifying information including unique site ID and address			X
Equipment/contractor invoice showing (a) measure requirements have been met (e.g., manufacturer, model number, type, size and quantity of equipment or product installed/used), (b) the order/purchase date and (c) cost			X
A copy of the ENERGY STAR product list showing the product or the product information insert or packaging that includes the ENERGY STAR logo (In the event that ENERGY STAR specifications change, BPA will accept pre-existing models that were ENERGY STAR qualified at the time they were manufactured.)			X

Payment

Measure Name	Payment

Clothes Washers ENERGY STAR Electric Water Heater/Electric Dryer Multifamily Common Area	$100.00
Clothes Washers ENERGY STAR Electric Water Heater/Gas Dryer Multifamily Common Area	$50.00
Clothes Washers ENERGY STAR Gas Water Heater/Gas Dryer Multifamily Common Area	$25.00
Clothes Washers ENERGY STAR Gas Water Heater/Electric Dryer Multifamily Common Area	$50.00

Multifamily, Multi-Sector Measures

Multifamily housing is defined as five or more dwelling units within the same structure. Multifamily housing may be either residential or commercial. Residential multifamily housing includes structures no more than three stories. Commercial multifamily housing includes structures more than three.

The table below provides opportunities and guidance for measures that may be used in multifamily applications by using existing measures contained elsewhere in the Manual.

Requirements and Specifications

Multifamily measures may be (1) non-envelope/HVAC or (2) envelope/HVAC as listed in the tables below. All measures must meet requirements and specifications found in the noted sector section.

1. Non-envelope/HVAC Measures

Non-envelope/HVAC measures may be applied to multifamily structures regardless of number of stories as provided in the table below.

Measure	Measure Installation Location	
	Residential Unit	**Common Area**
Lighting	Residential Sector • ENERGY STAR CFLs and Fixtures • ENERGY STAR Solid-State Lighting/ Light Emitting Diodes Bulbs and Fixtures	Multi-Sector • Non-Residential Lighting
Appliances	Residential Sector • ENERGY STAR Refrigerator and Freezer • ENERGY STAR Clothes Washer • Refrigerator and Freezer Decommissioning	Commercial Sector • Commercial Food Service Reach-in Refrigerators and Freezers • Commercial Combination and Convection Ovens • Commercial Dishwashers Multi-Sector • Commercial Clothes Washers – Multifamily Common Areas
Showerheads	Residential Sector • Showerheads	Commercial Sector • Commercial Showerheads
Power strips	Residential Sector Advanced Power Strips	Commercial Sector Smart Strips (offices)
Water Heating	Multi-Sector • Residential Electric Storage Water Heaters	Multi-Sector • Commercial Electric Storage Water Heaters Commercial Sector

Measure	Measure Installation Location	
	Residential Unit	Common Area
		• Heat Pump Water Heaters

2. Envelope/HVAC Measures

Envelope/HVAC measures shall be applied based on the definition of Residential multifamily or Commercial multifamily as found in the Definitions section.

Measure	Residential measures	Commercial measures
Weatherization	Custom Projects Residential Sector • Insulation • Prime Window Replacement	Custom Projects Commercial Sector • Commercial Insulation
HVAC	Custom Projects	Custom Projects Commercial Sector • Unitary Air Conditioning Equipment in Commercial Buildings • Ductless Heat Pumps in Commercial Buildings • Heat Pump Equipment Conversion and Upgrade in Commercial Buildings

Documentation Requirements

See the measure specific information in the sector section referenced in the table, above.

Payment

See the measure specific information in the sector section referenced in the table, above.

13. Updates/Revisions

The table below contains a directory of any revisions made to this Manual outside publications in April and October. In addition to a change description and effective date, the table includes the location of that change, whether contained solely in this table or also in the body of this chapter or in a sector specific chapter.

Change Description	Rationale	Effective Date (Posted Date)	Location
General			
Introduction			
Funding			
General Requirements			
Custom Projects			
Custom Programs			
Agricultural Sector			
Commercial Sector			
Federal Sector			
Industrial Sector			
Residential Sector			
Utility Distribution Sector			
Multi-Sector			

APPENDIX F – ENERGY EFFICIENCY WORKGROUP MEETING AGENDA AND ATTENDEES

TO: Tiffany Allgood

FROM: Andy Sorter, P.E., Principal Engineer, Ourevolution Energy & Engineering

RE: **Energy Group Meeting Agenda**

Coeur d'Alene Tribe Energy Workgroup Meeting #1 Agenda
Date: 10/29/2012
Time: 10:00 pm to 1:00 pm
Place: Coeur d'Alene Casino Lawrence Aripa conference room

I. Purpose of Meeting

II. Introduce Key Personnel
   a. OurEvolution Energy & Engineering Staff – Andy Sorter P.E., Scott Willits, EIT
   b. Coeur d'Alene Tribal Staff
   c. Energy Providers

III. Summarize the results of the previous energy work completed by McKinstry
   a. Eight "High Energy Use" buildings
      i. Early Childhood Learning Center
      ii. Benewah Auto
      iii. Tribal School (New and Old)
      iv. Benewah Market
      v. Benewah Medical Center
      vi. Tribal Wellness Center
      vii. Tribal Casino
      viii. Tribal Headquarters
   b. The rest considered "Low Energy Use"
   c. Energy Conservation Measures (ECMs)
      i. HVAC (furnaces, economizers, programmable thermostats, heat pumps)
      ii. Lighting
      iii. Insulation (Envelope and Water Heating)

IV. Discuss the purpose and scope of new work being completed by OurEvolution
   a. Review existing information and supplement the work completed by McKinstry
   b. Incorporate Energy Workgroup into planning and decision making
      i. Establishing goals, targets and priorities
   c. Complete onsite energy audits to:
      i. Supplement McKinstry information
      ii. Evaluate new buildings that have not had a previous assessment
      iii. Prioritize recommended ECMs

   iv. Evaluate renewable energy opportunities
   v. Develop conceptual designs as appropriate
d. Complete thorough baseline energy usage analyses and benchmarking using the EPA Portfolio Manager software
e. Train Tribal staff in the use of EPA Portfolio Manager
f. Develop building energy usage models(as appropriate) to provide Tribal decision makers with information regarding the cost effectiveness of alternative ECMs
g. Produce an Energy Efficiency Feasibility Study Report
   i. Complete conceptual designs as appropriate

V. Discuss energy audit field schedule
   a. Request data from building managers
      i. Plans, Plans, Plans
      ii. Occupancy Types and Scheduling
      iii. Key Contacts
   b. Discuss any conflicts in scheduling
   c. Discuss any specific issues that building managers may be concerned with or would like further evaluation of.

VI. Discuss planning as it applies to existing buildings within this study
   a. Benewah Market
   b. Old Police Station
   c. Old Benewah Medical Center modulars

VII. Identify date and time of next Energy Workgroup Meeting

VIII. Questions and Comments

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energy & engineering

TO: Tiffany Allgood

FROM: Andy Sorter, P.E., Principal Engineer, OurEvolution Energy & Engineering

RE: **Coeur d'Alene Tribe Energy Workgroup Meeting Attendees**

Date: 10/29/2012
Time: 10:00 pm to 1:00 pm
Place: Coeur d'Alene Casino Lawrence Aripa conference room

Attendance and Contact Information:
Lance Mueller, CDA Tribe Public Works (CDA) – lmueller@cdatribe.nsn.gov
Sabine Krier, CDA Tribe GIS (CDA) – skrier@cdatribe.nsn.gov
Glenda L. Matt, CDA Tribe/EPO (CDA)-
James Helmstetter, CDA Tribe/EPO (CDA) –
Tiffany Allgood – CDA Tribe/EPO (CDA) – tallgood@cdatribe.nsn.gov
Shawn Garcia – CDA Tribe Facilities (CDA) – sgarcia@cdatribe.nsn.gov , 208-686-4315
Donavan Chase, CDA Tribal School (CDA) – dchase@tribalschool.org , 208-987-0301
Chris Dohrman, CDA Tribe Finance (CDA) – ewdohrman@cda.nsn.gov
Andy Sorter, OurEvolution Energy & Engineering (OE) – andy@ourevolution.com
Scott Willits, OurEvolution Energy & Engineering (OE) – scott@ourevolution.com
Erik Boyer, Bonneville Power Administration (BPA) – ebboyer@bpa.gov
Don Crawford, Kootenai Electric (KEC)- dcrawford@kec.com
Debbie Argelan, City of Plummer Clerk (Plummer) – debbie@cityofplummer.org

TO: Tiffany Allgood

FROM: Andy Sorter, P.E., Principal Engineer, Ourevolution Energy & Engineering

DATE: March 2, 2013

RE: **Energy Group Meeting Agenda**

Coeur d'Alene Tribe Energy Workgroup Meeting Agenda
Date: Monday, March 4, 2013
Time: 1:00 pm to 3:00 pm
Place: Coeur d'Alene Tribal Casino Lawrence Aripa Room

I. Invocation – Mr. David Matheson, Tribal Casino CEO
II. Introduce Key Personnel and Discuss Minutes from Last Meeting
III. Introduce Purpose of Meeting
IV. Summarize the OurEvolution's DRAFT Energy Assessment Initial Findings Report
  a. Health and Safety Findings
  b. Building Performance
  c. Energy Conservation Measure Recommendations
V. Summarize Baseline Energy Usage Analyses
  a. Data Types
  b. Energy Benchmarking
    i. Indexing
    ii. EPA Portfolio Manager
    iii. High "density" vs. Low "density" energy use and their implications
VI. Energy Conservation Measure Prioritization
  a. Develop Selection Criteria
    i. Examples:
      1. Economic – Life Cycle, Simple Payback, ROI
      2. Health and Safety
      3. Technical Complexity and Feasibility
      4. Social Benefits
      5. Environmental Benefits
      6. Long Term Tribal Planning and Use and Repurposing of Buildings
      7. Planning for maximum incentives and grant funding (cost shares)
      8. ???
VII. Discuss known planning that may have direct impacts on energy efficiency and building performance prioritization.
VIII. Identify date and time of next Energy Workgroup Meeting
IX. Questions and Comments

TO: Tiffany Allgood, Project Manager, CDA Natural Resources Department

FROM: Andy Sorter, P.E., Principal Engineer, OurEvolution Energy & Engineering

RE: **DRAFT Coeur d'Alene Tribe Energy Workgroup Meeting #2 Minutes**

Date: Monday, March 4, 2013
Time: 1:00 pm to 3:00 pm
Place: Coeur d'Alene Casino Resort - Lawrence Aripa Conference Room

Attendance and Contact Information:

1) Glenda Matt, CDA Tribe (CDA) – gmatt@cdatribe-nsn.gov
2) A.C. Sanchez, CDA Tribe, Food Distribution Warehouse, Gaming Commission (CDA)– acsanchez@cdatribe.nsn.gov
3) Jill Wagner, CDA Tribe (CDA) – jwagner@cdatribe.nsn.gov
4) Jim Kackman, CDA Tribe Public Works (CDA) – jkackman@cdatribe.nsn.gov
5) Ron Ruddell, CDA Tribe (CDA) – rruddell@cdatribe.nsn.gov
6) Sabine Krier, CDA Tribe GIS (CDA) – skrier@cdatribe.nsn.gov
7) James Helmstetter, CDA Tribe/EPO (CDA) – jhelmstetter@cdatribe.nsn.gov
8) Tiffany Allgood – CDA Tribe/EPO (CDA) – tallgood@cdatribe.nsn.gov
9) Shawn Garcia – CDA Tribe Facilities (CDA) – sgarcia@cdatribe.nsn.gov
10) Donavan Chase, CDA Tribal School (CDA) – dchase@tribalschool.org
11) John M. Abraham, CDA Tribe (CDA) – jabraham@cdatribe-nsn.gov
12) Chris Dohrman, CDA Tribe Finance (CDA) – ewdohrman@cda.nsn.gov
13) Cody SiJohn, CDA Tribal Police (CDA) – csijohn@cdatribe-nsn.gov
14) James Alexie, CDA Tribal Development Corporation (CDA) – jalexie@cdatribe-nsn.gov
15) Sam Eli, CDA Tribe Casino Resort (CDA) – seli@cdacasino.com
16) Chris Meyer, CDA Tribe (CDA) – cmeyer@cdatribe-nsn.gov
17) Tim Ferguson, CDA Tribe Casino Resort (CDA) – tferguson@cdacasino.com
18) Andy Sorter, OurEvolution Energy & Engineering (OE) – andy@ourevolution.com
19) Scott Willits, OurEvolution Energy & Engineering (OE) – scott@ourevolution.com
20) Erik Boyer, Bonneville Power Administration (BPA) – ebboyer@bpa.gov
21) Bob Pierce, Clearwater Power Company – rdpierce@clearwaterpower.com
22) Don Crawford, Kootenai Electric (KEC) - dcrawford@kec.com
23) Debbie Argelan, City of Plummer Clerk (Plummer) – debbie@cityofplummer.org

TO: Tiffany Allgood

FROM: Andy Sorter, P.E., Principal Engineer, Ourevolution Energy & Engineering

DATE: November 13, 2013

RE: **Energy Group Meeting #3 Agenda**

Coeur d'Alene Tribe Energy Workgroup Meeting #3 Agenda
Date: Tuesday, December 3, 2013
Time: 10:00 am to 1:00 pm
Place: Coeur d'Alene Tribal Resort and Casino - Lawrence Aripa Room

I. Invocation –
II. Introduce Key Personnel and Discuss Minutes from Last Meeting
III. Introduce Purpose of Meeting
IV. Summarize and discuss the OurEvolution's DRAFT Energy Efficiency Feasibility Study:
   a. Main Findings from Initial Findings Report
   b. Main Findings from Utility Billing Analyses
   c. Health and Safety Findings
   d. Main Findings of Building Prioritization across Tribal Portfolio
      i. Building Prioritization by Annual Energy Cost Savings
   e. Main Findings of Individual Energy Conservation Measure Prioritization
      i. Common ECMs
      ii. Individual Building ECM Prioritization Examples
         1. Benewah Market
            a. Department of Energy Grant Status
         2. Tribal Resort and Casino
      iii. Resources and Strategies for Implementing Energy Conservation Measures
         1. Funding Sources
         2. Internal Administrative Strategies
V. Report on the status of the EPA Portfolio Manager Database
   a. Importance of keeping updated
      i. Tools for building managers and operators
      ii. Key metrics for tracking improvements and outliers
   b. Training
VI. Energy Project Next Steps
VII. Questions and Comments