Gwichyaa Zhee Gwich'in Tribal Government

Gwich'in Solar and Energy Efficiency in the Arctic

Dept of Energy Tribal Energy Review
Golden, CO March 26, 2014

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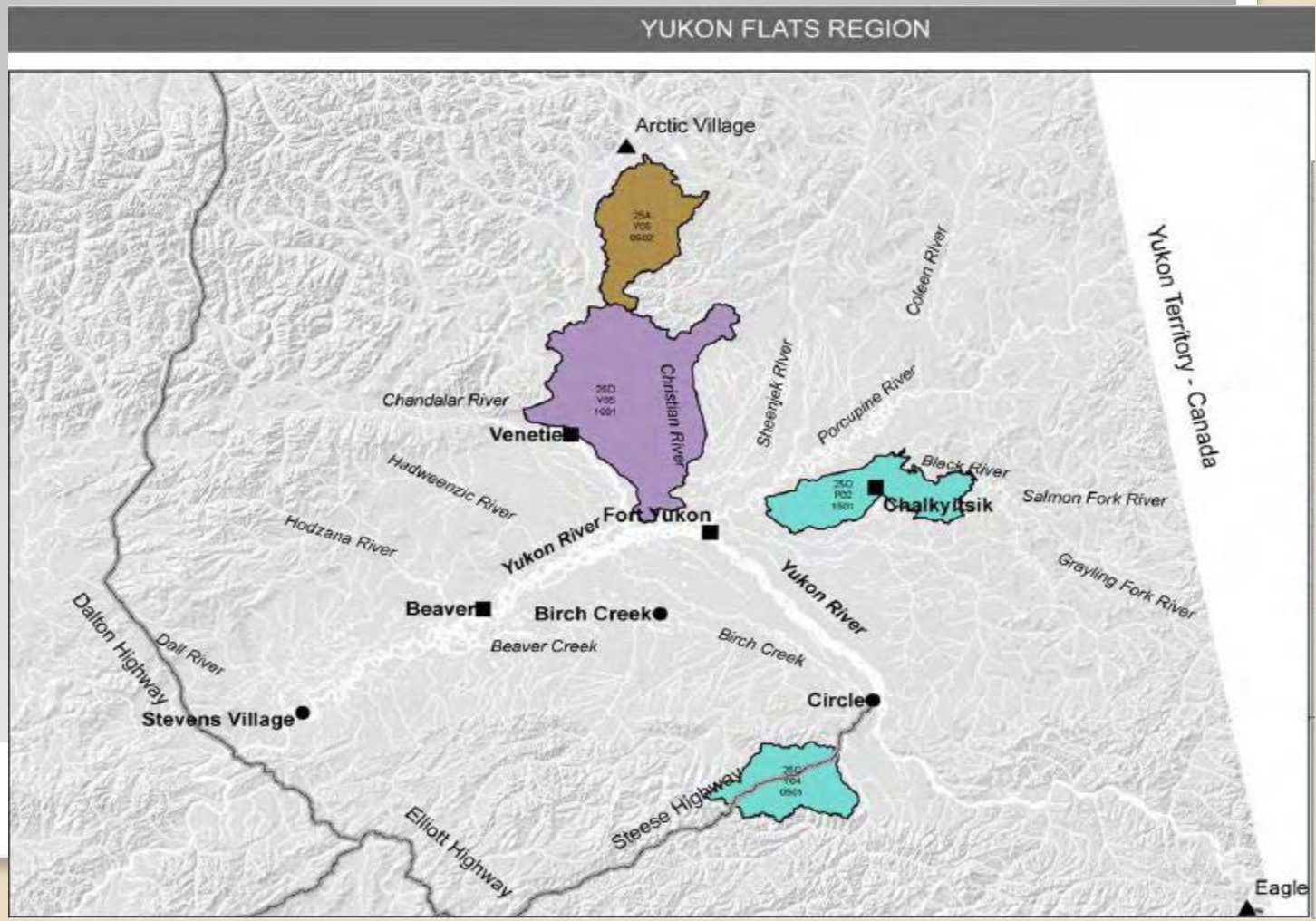
Dave P-M – Tanana Chiefs Conference, Rural Energy Coordinator

Yukon Flats

Yukon Flats Region:

- **Arctic Village**
  - **$10/gal**
  - **$.8/kWh**
- **Venetie**
- **Circle**
- **Beaver**
- **Stevens Village**
- **Chalkyitsik**
- **Birch Creek**



Gwichyaa Zhee Gwich'in Tribal Government (GZGTG)

Gwichyaa Zhee Gwich'in Tribal Government is a sovereign tribal government located in the Yukon Flats region of Alaska.

MISSION: "The Mission of the Gwichyaa Zhee Gwich'in Tribal Government is to exercise governmental authority to promote economic and social development, advocate and secure tribal rights, to secure tribal lands, to enhance educational opportunities and to protect traditional cultural values with a unified voice on behalf of our tribal members."

Gwichyaa Zhee Gwich'in Tribal Government (GZGTG)

Gwichyaa Zhee Gwich'in Tribal Government manages 17 full time employees over 10 different program areas:

- Indian Child Welfare Act Program (ICWA) Dept with 4 tribal judges
- Tribal Transportation Program
- Education & Employment Dept
- Elders Nutrition Program
- Environmental Program
- Tribal Housing Authority
- Natural Resources Dept
- Realty Dept
- Finance Dept
- Admin & Operations Dept

Fort Yukon Alaska

- Yukon Flats National Wildlife Refuge
- Population: 600
- Per Capita Income:
  - Fort Yukon: $13,360/yr
  - State of AK avg: $30,992
- North of the Arctic Circle
- GZ Corp owns 103,680 acres
- -78F record low +100F record high (178F deg temp range)

Fort Yukon Energy

Some of the Highest Energy Costs in the Nation

Electricity:
$.66/kWh (500% HIGHER than the national avg of $.11/kwh)

Heating Fuel:
$6.50/gal for diesel
$300/cord of wood

Transportation
$7.50/gal for gas

Energy Challenges (OR Opportunities)

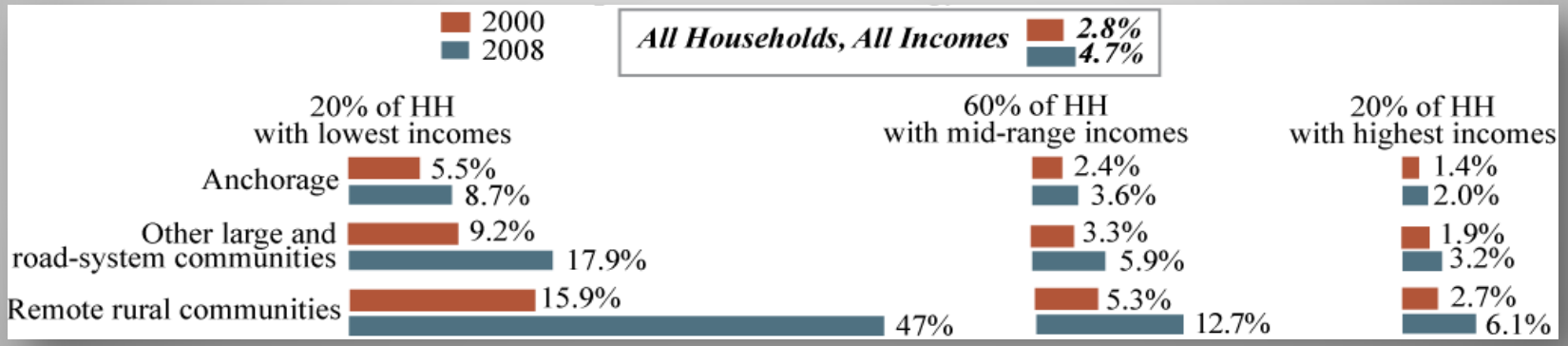
Electrical Use:

PCE report- In 2013 GZ Corporation, the local utility burned 218,949 gal of diesel for electrical production ($1.4 million/yr)

Avg Efficiency: 12.26 kwh/gal of diesel

Fuel costs account for 80% of the cost/kWh

Estimated Median Share of Income Alaska Households Spend for Home Energy Use (ISER)



Energy Challenges

Transportation:

- **Effects on Subsistence Activities**
- **Increase cost of travel to/from villages**
- **Increases Cost of Goods in the Village**
  - **$10/gal for milk average**

Lets Lead by Example in our community

Involving the School in Energy Savings

- **Future LED lighting retrofit?**
- **Educating Students**
- **More $ for School Programs**

Project goals

- **Reduce the Gwichyaa Zhee Gwich'in Tribal government's dependence on imported diesel fuel to run Tribal Operations and Services**
- **To serve as a model of sustainability for our youth and our surrounding communities, so that they may follow where we have led**
- **To lower operating costs and improve economic sustainability of GZGTG**

TCC Region Energy Model

1. Collect Data & Plan!

2. Efficiency First

3. Renewable Energy
(BIOMASS! SOLAR!)

Energy Opportunities

Energy Savings Break-Down	Space Heating (Gal of Diesel)	Electricity (Kwh / Diesel)	Total Gallons of Diesel
Tribal Building Fuel Oil Consumption 2012	2,493gal	30,847kWh/2,387gal	4,880 Gal
Potential Reduction	786gal	19,805kWh / 1,533 gal	2,319 Gal
Potential $ Saving	$4,716	$13,071	$17,787/yr
Percentage Decrease in GZG Tribal Gov't Fuel Consumption	31.5% Reduction	65.2% Reduction from solar array and Lighting upgrade	48% overall Reduction in Fuel Use

EFFICIENCY FIRST -Attic Insulation

Space Heating Conservation:

BEFORE..

=

EFFICIENCY FIRST -Attic Insulation

Space Heating Conservation:

After…

EFFICIENCY FIRST -Attic Insulation

Space Heating Conservation:

- Additional Insulation in the Attic, currently R-21 → R-100

TCC RESOLUTION: "Buildings Financed with Public Money Shall Seek To Achieve the Following Efficiency Standards…"

- Roof: R-100
- Walls: R-70
- Floor/Slab: R-50

•Potential Savings:
786 Gal/yr
=$5,100

Insulation Calculation WorkSheet

See information at NREL website: http://energy.gov/energysaver/articles/estimating-payback-period-additional-insulation

DIRECTIONS: CHANGE CELLS IN RED, SEE CHANGES IN YELLOW

	Years to Payback	=	Cost of Insulation $/SqFt	X	Original Insulation (r-value)	X	Final Insulation (R-value)	X	Efficiency of heat source	/	$/BTU	X	Change in Insulation	X	Heating Degree Days x24
Formula	Payback	=	C(i)	X	R(1)	X	R(2)	X	E	/	C(e)	X	[R(2)-R(1)]	X	HDDx24
DOE Example	5.62	=	0.18		19		30		0.88	/	9E-06		11		168000
Nenana	0.53	=	0.3		19		38		0.85	/	3E-05		38	X	338184
Fort Yukon	2.97	=	$2.00	X	21	X	81	X	0.9	/	4E-05	X	60	X	384000

YEARLY SAVINGS PER 1000 SQ FT	$673.88
50 YEAR SAVINGS PER 1000 SQ FEET:	$33,693.96
MATERIAL COST PER 1000 SQ FT:	$2,000.00
EST YEARLY FUEL SAVINGS PER 1000 SQ FT:	112
EST YEARLY FUEL SAVINGS FOR 7000 SQ FT:	786

Cost of Fuel $/gal:	$6.00
Heating Degree Days	16000
Original R-Value	21
New R-Value	81
$/sq Ft Insulation	$2.00

Heating Degree days available Via: http://www.huduser.org/portal/resources/UtilityModel/hdd.html

LED Lighting Retrofit

LED lighting Retrofit:

Convert Existing t8 lighting fixtures to 17 watt LED

LED Lighting Retrofit

LED lighting Retrofit:

- Convert Existing t8 lighting fixtures to 17 watt LED
- Total Yearly Electrical Savings: $3,088

Client Name	**Gwichyaa Zhee Gwich'in Tribal Government**
Address:	**3rd and Alder St Fort Yukon, AK 99740**
Attn:	**Walter Peter Jr. GZGTG Housing Director**

Lighting Payback	
Average Utility Rate ($/kWh)	0.66
kW Demand Charge:	0
Billing Category:	GS-2
Typical Hrs/week lights are	50
# of bulbs being replaced:	120
Wattage of current bulb	32
Wattage of LED bulb	17

Material Cost Per fixture:		$69
Labor cost/hr:		$0
Bulbs/hr:		1
Average LED life expectancy (hrs):		50,000

NOTE CHANGING ANY OF THE PARAMETERS ABOVE THIS LINE WILL EFFECT THE ENTIRE SPREADSHEET

LED light Savings

Current Lighting

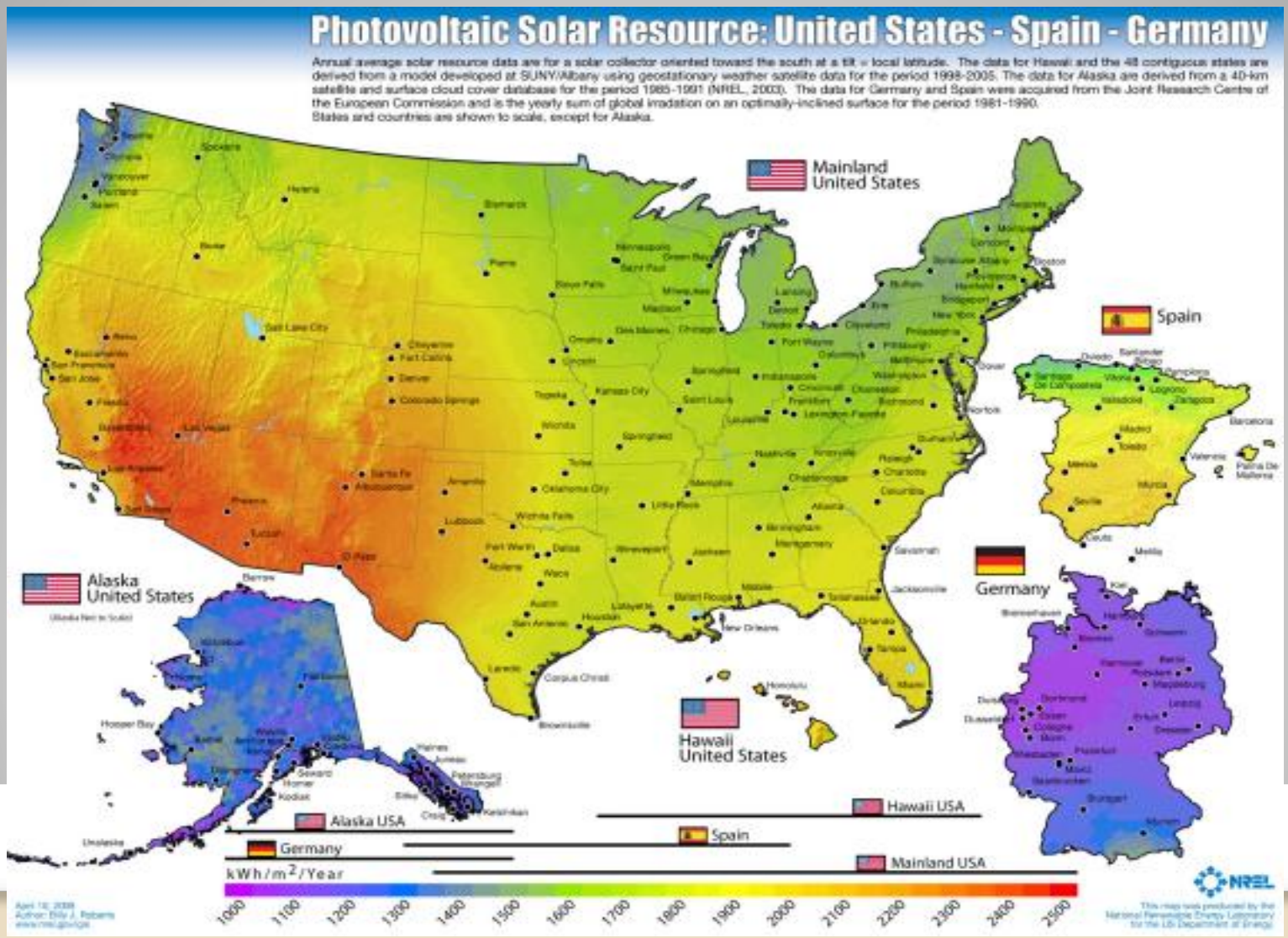
kw	$/kWh	$/bulb/hr	# bulbs	Hrs/yr		kWh Use	Total Cost/yr
0.032	0.66	0.02112	120	2,600	=	9984	6589.44

LED replacement Lighting

kw	$/kWh	$/bulb/hr	# bulbs	Hrs/yr		kWh Use	Total Cost/yr
0.017	0.66	0.01122	120	2,600	=	5304	3500.64

Total Yearly Electrical Savi	**$3,088.80**
Payback on bulbs (yrs):	**2.67**
Lifetime Savings:	**$51,144.00**
Yearly kWh Savings:	4680

17 kW Solar PV Array On Tribal Office



17 kW Solar PV Array On Tribal Office

Collect Data and Plan

Fort Yukon Tribal Office Energy Use

Fort Yukon kWh use								
	Admin	2011		Admin	2012		Admin	2013
	kWh	Cost		kWh	Cost		kWh	Cost
Jan	3244	1735.64		2870	1,874.12		3219	2,099.79
Feb	3270	1748.04		2430	1,615.89		3357	2,181.68
March	2738	1494.51		2961	1,927.53		2199	1494.56
April	2545	1402.54		1954	1,335.15		3079	2016.72
May	2658	1456.40		2130	1,439.82		2058	1410.9
June	2094	1329.01		2343	1,564.83			
July	2562	1583.47		1992	1334.64			
Aug	2495	1666.46		2228	1,497.51			
Sept	2192	1487.13		2138	1444.67			
Oct	2293	1546.90		2398	1597.29			
Nov	2537	1691.32		3049	1979.4			
Dec	2565	1707.89		4008	2,542.31			
Totals	31193.00	18849.31		30,501.00	20,153.16		13912	9,203.65

PV Watts Est. Production

Month	AC System Output(kWh)	Solar Radiation (kWh/m^2/day)	Value ($)
Jan	226	0.50	149
Feb	335	0.90	221
March	1888	4.03	1246
April	2062	4.74	1361
May	2260	5.44	1491
June	2216	5.75	1462
July	2435	5.93	1607
Aug	2318	5.57	1530
Sept	1147	2.92	757
Oct	1114	2.43	736
Nov	340	0.77	224
Dec	174	0.32	115
Totals	16516		10900

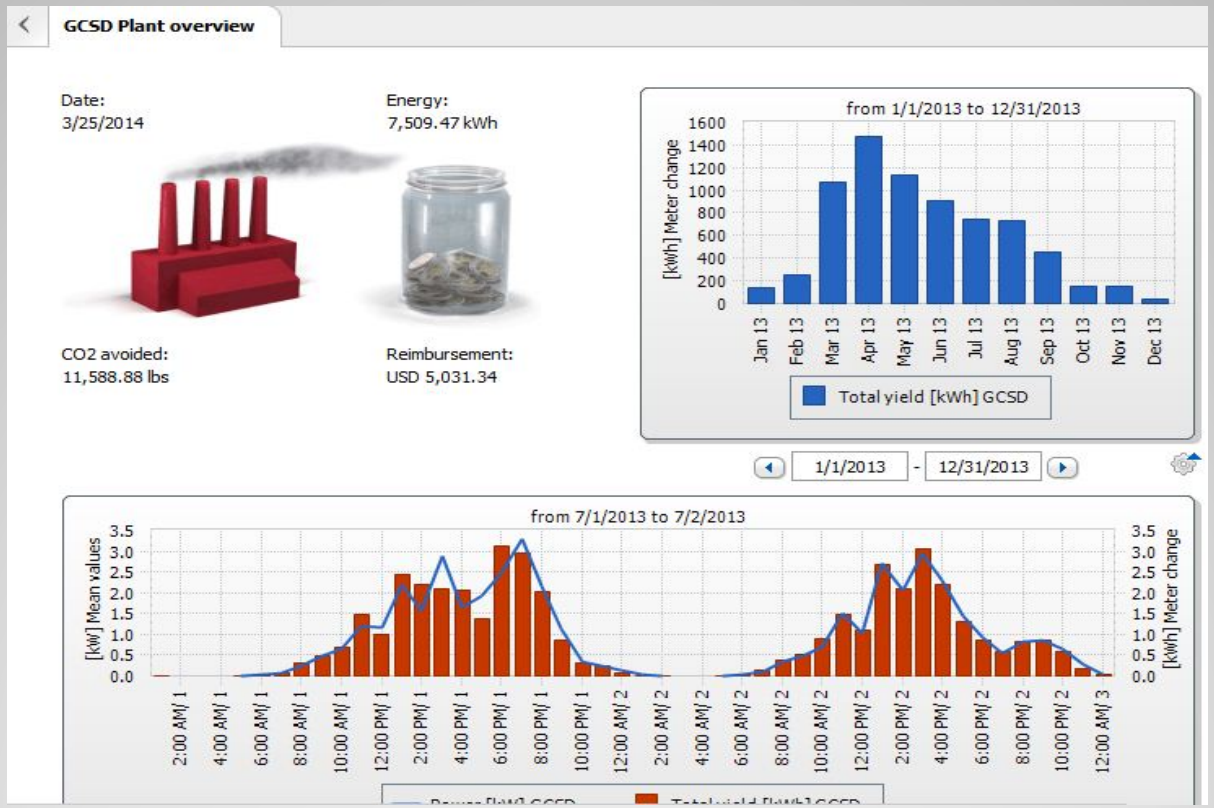
17 kW Solar PV Array On Tribal Office

PV Watts

- Est: 16,516 kWh/yr of electrical production
- $5/watt installed → roughly $3/watt equipment, $2/watt labor
- Estimated yearly electrical offset: $10,900

17 kW Solar PV Array On Tribal Office

Education and Outreach



"....If you don't got data, you don't got nothin"

3.4 kW Solar PV with Battery backup

Gwichyaa Zhee Gwich'in Tribal Government Passive Solar Greenhouse

Fort Yukon Greenhouse Phase 1

Original Site

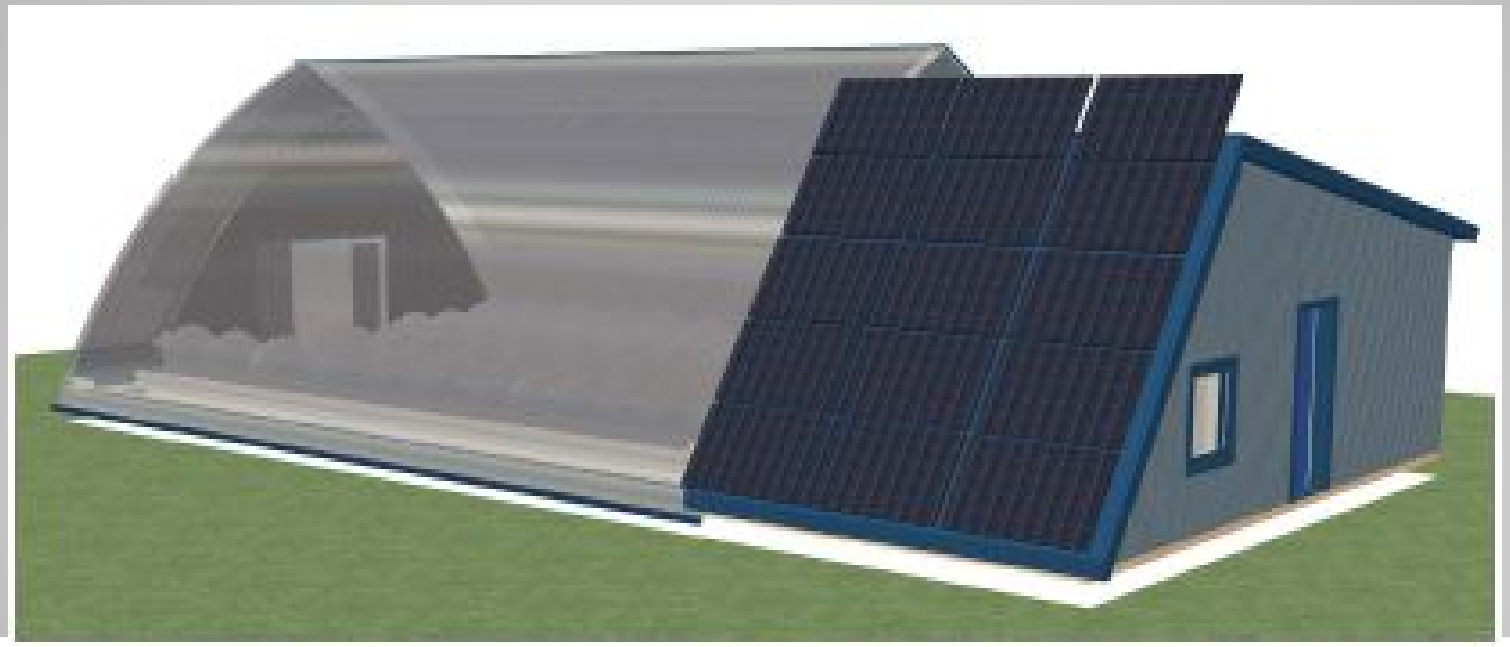
Foundation Work

Ready for Shell

3.4 kW Solar PV with Battery backup

Gwichyaa Zhee Gwich'in Tribal Government Passive Solar Greenhouse

Solar PV Array will cover 60-70% of the electrical draw
Passive Solar Thermal will cover 100% of the heating needs from March-Oct



Main Take-Aways

"We cannot solve our problems with the same thinking that we used when we created them"

-A. Einstein-

1. **Local/Cheaper Energy → Sustainable Communities**

2. **Energy is Expensive, Cheaper to Conserve than to Produce**
   - **LED lighting**
   - **Insulation is SEXY**
   - **Always share the information with youth and project partners**

3. **Renewables are only a part of the solution**