

DOE OFFICE OF INDIAN ENERGY

Day 2

Project Development—The Five-Step Process

2015

Bethel: March 23-25

Dillingham: March 25-27

Juneau: March 30-April 1



U.S. DEPARTMENT OF
ENERGY

Office of
Indian Energy



Agenda

Review Day 1

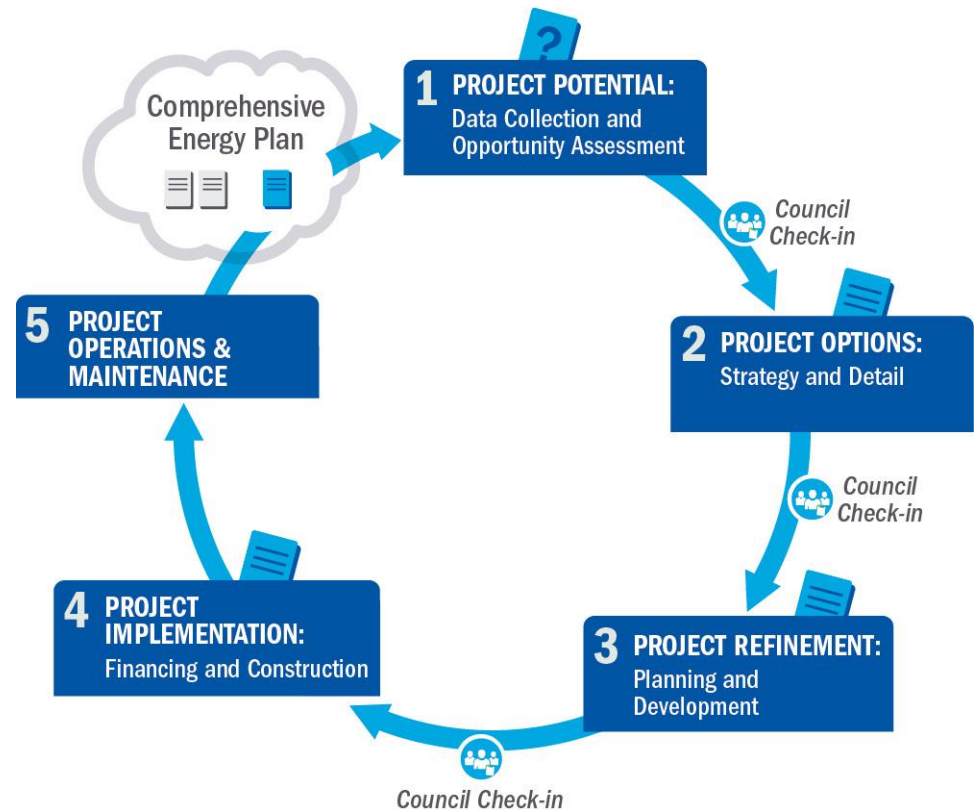
- Strategic Energy Planning
- Technologies (if time allowed)

Today

- Step 1: Project Potential
- Step 2: Project Options
- Step 3: Project Refinement
- Step 4: Project Implementation
- Step 5: Project Operations and Management

Project Development – The Five Step Process

- Project Steps defined using a wheel graphic
 - Potential
 - Options
 - Refinement
 - Implementation
 - Operations & Management
- Energy Plan and Council Check-in at every step



Summary of Actions by Step

Step 1 POTENTIAL – Data and Assessment: Gather all relevant data in order to make first pass at potential project; understand tribal role options

Step 2 OPTIONS – Strategy and Detail: Estimate value to Tribe; begin to identify off-takers, partners, vendors

Step 3 REFINEMENT – Planning and Development: Finalize finance, economic assumptions and roles, interconnection and offtake agreements, partnerships, ownership structure

Step 4 IMPLEMENTATION – Financial closing and Construction: Solidify financing, vendor contracting completion, project commercially delivered

Step 5 OPERATIONS & MAINTENANCE: Maintenance plan and implementation
Celebrate!

Resources to Work the 5 Steps

- Tools

- <http://www.energy.gov/indianenergy/resources/energy-resource-library>
- <http://www.energy.gov/indianenergy/resources/education-and-training>

- Support

- Tribal Energy Program Technical Assistance
 - http://apps1.eere.energy.gov/tribalenergy/technical_assistance.cfm
 - <http://www.energy.gov/indianenergy/resources/technical-assistance>

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Step 1: Identifying Project Potential

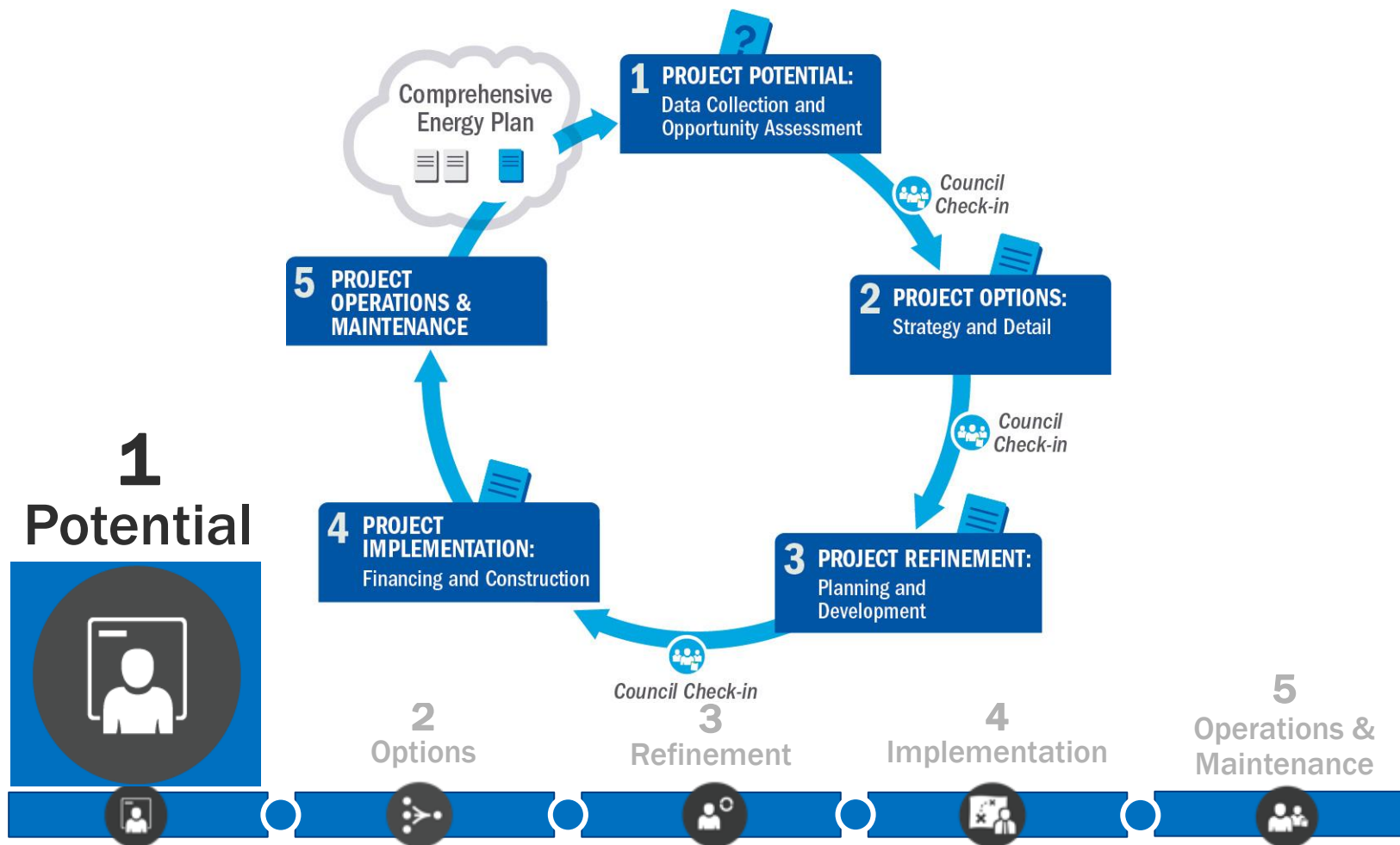
Data Collection and Opportunity Assessment



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Project Potential



Project Potential Agenda

TECHNOLOGY BASICS

- Efficiency
 - Deep Energy Retrofits
 - Appliances & Lighting
 - Retrocommissioning
 - Building Heat and Hot Water
 - Combined Heat and Power (CHP)
 - Water Energy Nexus
 - Solar
 - Wind
 - Diesel Efficiency: AEA and NREL
 - Biomass
 - Hydroelectricity
 - Geothermal
- Alaska is Microgrid Central
 - The Cost of Renewables in Alaska (Discussion)
 - Tools to determine your project
 - Renewable Resources
 - The Best Site for Renewables
 - SAM
 - Community Priorities
 - Technical Assistance (TEP & IE TA)

A photograph of three wind turbines standing on a mountain ridge. The turbines are partially obscured by a thick layer of white mist or fog that fills the valley and clings to the slopes. The sky above is a clear, pale blue. The overall scene is serene and emphasizes clean energy technology in a natural setting.

SEE TECHNOLOGY SECTION



The image shows three wind turbines on a mountain peak. The turbines are white with three blades each. The background is a clear blue sky with some light clouds. The foreground is a green, hilly landscape. A large blue rectangular box is overlaid on the bottom half of the image, containing the text 'ALASKA : MICROGRID CENTRAL' in white, bold, uppercase letters.

ALASKA : MICROGRID CENTRAL

A State of Microgrids

- In Alaska also microgrids are known as isolated hybrid systems, or isolated grids with a renewable system.
- Electricity distribution systems containing localized loads and distributed energy resources
- Distributed resources are generators, storage devices, or controlled loads), that can be operated in a controlled, coordinated way either while connected to the main power network [macrogrid] or while islanded [disconnected from a macrogrid for a short time period.]

Alaska Leads in Microgrid Deployments

- Alaska boasts a portfolio of somewhere between 200 and 250 permanently islanded microgrids ranging from 30 kW – about the size of a city block – to large remote hydro systems over 100 MW in size.
- “The State of Alaska alone has invested over \$250 million in developing and integrating renewable energy projects to serve these microgrids, – far more per capita than any other state in the country,” Gwen Holdmann of ACEP

Source: <http://www.navigantresearch.com/blog/alaska-leads-the-world-in-microgrid-deployments>

Alaska Microgrids

- In Alaska, microgrids are not designed to be operated as connected to -- or synchronous with a macrogrid.

The community of
Anaktuvuk Pass,
Alaska



■ ■ Combination Microgrids

- Many Alaskan utilities have set up voluntary goals to reach 70% or 80% renewable penetration within the next 8 to 10 years.
- [Kodiak Electric Association](#), which serves Kodiak Island on the southern coast of Alaska, reports it achieved 99.7% renewable energy penetration in 2014, using a hybrid wind/hydro/diesel/battery/flywheel microgrid.

Wind Microgrid

When considering a wind energy microgrid, for example, the following operating bounds are likely to exist:

- Each diesel generator has a minimum amount of time it must run before it can be switched off.
- Each diesel generator must run a certain amount of time before coming online and after going offline.
- Each diesel generator has a size dependent minimum power output below which it should not be operated.
- A set amount of online diesel generator capacity must remain available to handle a sudden increase in load.
- There must be online available diesel generator capacity equal to the wind production that is supplying unmanaged loads. This allows the grid to handle a sudden drop in wind production.

Utility Distributed Microgrids (UDMs)

- Utilities may partner with Alaska Native Villages to deploy smart grid technology.
- Utility distributed microgrids is a growing market with Alaska in the lead as of 2014.

A photograph of three wind turbines standing on a mountain peak. The turbines are partially obscured by a thick layer of white mist or fog that fills the valley below. The sky is a clear, pale blue. The overall scene is serene and emphasizes renewable energy in a natural setting.

DISCUSSION: THE COST OF ENERGY WITH RENEWABLES IN ALASKA



Why Energy Costs Don't Always Decrease with Renewables in Alaska

- Power Cost Equalization (PCE)
 - Mechanics of PCE
 - Subsidy after 500 hours
 - Non-residential cost of energy

- Renewable Energy Fund is Dwindling
 - Waiting for grants can delay good projects due to timing and uncertainty
 - A commissioned system and cost savings.
 - Find cost savings in collaborations, procurement, bulk purchasing

A photograph of three wind turbines on a mountain ridge. The turbines are white with three blades each. The mountain is covered in green grass, and a thick layer of white fog or mist is rolling over the ridge, partially obscuring the base of the turbines. The sky is a clear, light blue. The overall scene is serene and suggests a clean energy source.

TOOLS TO DETERMINE VIABILITY



Tools to Determine Project Viability

- AK Renewable Energy Assessment Atlas
 - <http://www.akenergyinventory.org/gallery>
- What resources are available to your Village?
- SAM– General Overview

- Community Priorities
- NREL Technical Assistance

The image shows three wind turbines on a mountain peak. The turbines are white with three blades each. The mountain is covered in green grass, and there is a thick layer of white mist or fog at the base of the turbines. The sky is a clear, bright blue. A large, semi-transparent blue rectangular box is overlaid on the bottom left of the image, containing the text 'RENEWABLE RESOURCES' in white, bold, sans-serif capital letters.

RENEWABLE RESOURCES



Assessing Energy Resources for Tribal Lands

- Renewable energy resources on tribal lands are either used directly or converted into electricity, which can be used onsite or fed into the power grid
- The sole exception is biomass, which in some forms (such as wood), can be shipped short distances
- Although Tribes may choose royalty-stream arrangements for some large-scale renewable energy projects, they generally accrue benefits more rapidly by owning the projects themselves and using their energy production as they see fit.

Learn more about renewable energy resources on the Tribal Energy Program website:

- [Biomass](#)
- [Geothermal](#)
- [Hydropower](#)
- [Solar](#)
- [Wind](#)

View the full *Guide to Tribal Clean Energy Development* online:

www.eere.energy.gov/tribalenergy/guide/index.html

Alaska Renewable Energy Resource Maps

Resource Maps for Alaska:

<http://apps1.eere.energy.gov/states/maps.cfm/state=AK>

- Biomass
- Hydropower
- Solar Photovoltaics (PV)
- Solar Thermal & Concentrating Solar
- Wind



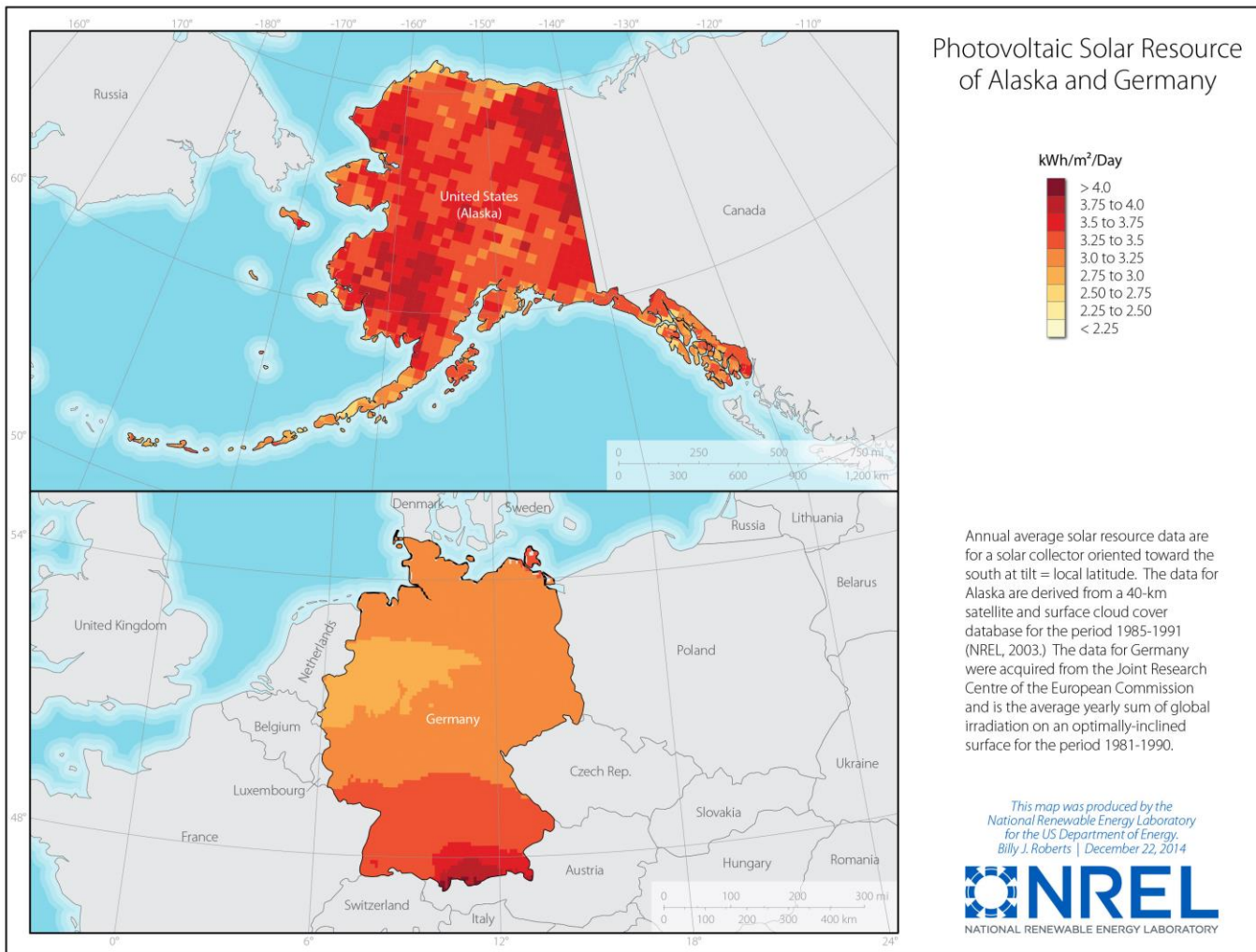
Workshop participants (clockwise, from left to right) Winter Jojola-Talbert (U.S. Department of the Interior), Shawn Jackson, (Klamath Tribe), Monica del Valle (Shoshone-Bannock Tribes), Belvin Pete (Navajo Nation), and Matthew Foster (Taos Pueblo Housing), review resource maps.

Photo by John De La Rosa /NREL (28048)

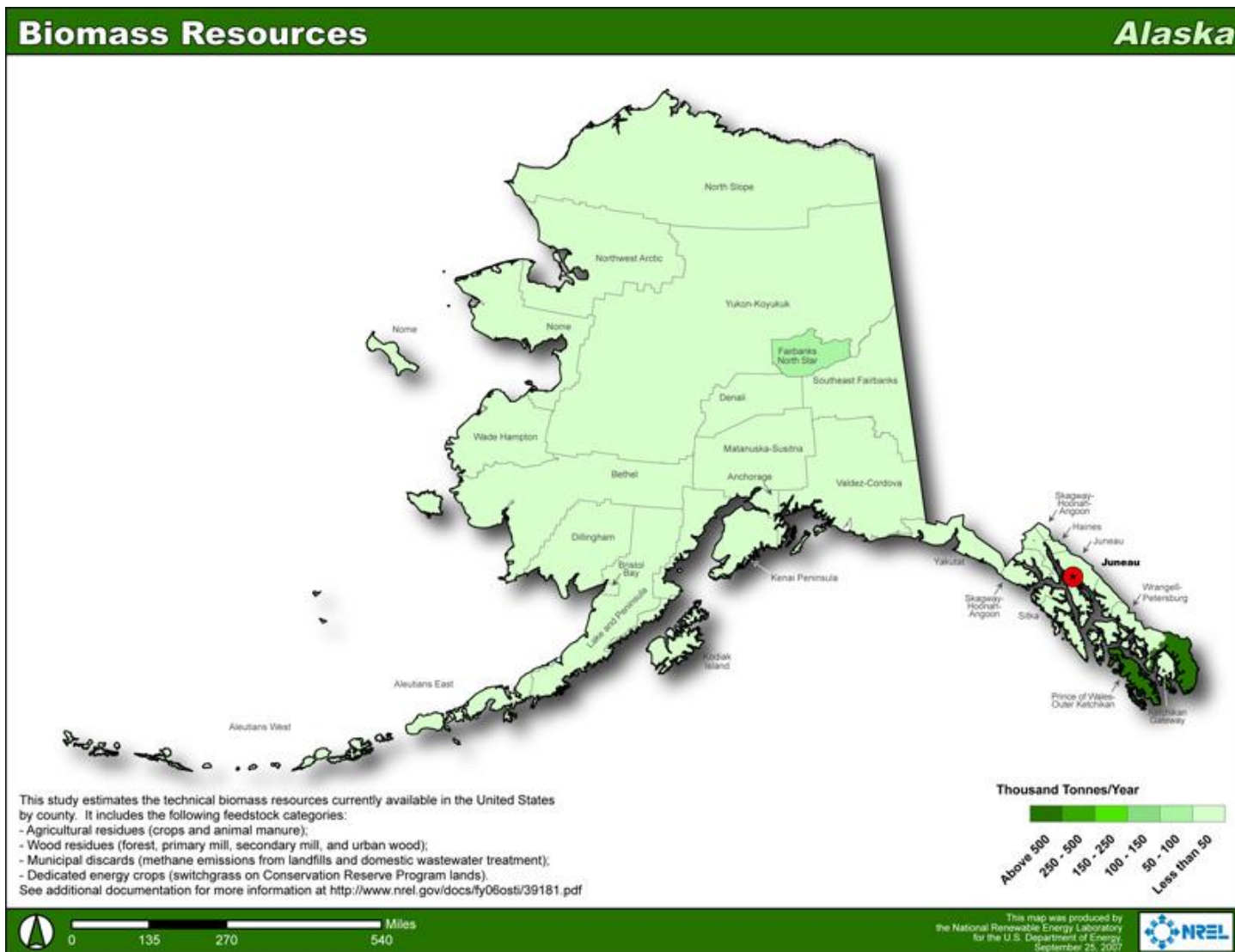
Renewable Energy Atlas of Alaska

- <http://akenergyinventory.org/data>
- Provides links to Alaska's energy resources data
 - Biomass
 - Geothermal
 - Solar PV
 - Wind

Alaska Has Significant Solar Potential



Alaska Resource Map – Biomass



Alaska Energy Inventory

<http://www.akenergyinventory.org/gallery>

Biomass

Renewable Energy Atlas of Alaska

Alaska's primary biomass fuels are wood, sawmill wastes, fish byproducts and municipal waste.

Wood remains an important renewable energy source for Alaskans. More than 100,000 cords of wood are burned in the form of cordwood, chips and pellets annually.

Closure of major pulp mills in Sitka and Ketchikan in the 1990s ended large-scale, wood-fired power generation in Alaska. However, the price of oil has raised interest in using sawdust and wood wastes for lumber drying, space heating, and small-scale power production.

In 2010 the Tok School installed a chip-fired boiler, displacing approximately 65,000 gallons of fuel oil annually. Also in 2010, Sealaska Corporation installed the state's first large-scale pellet boiler at its headquarters in Juneau. Additional wood-fired boilers have been installed in: Sitka, Craig, Kaslof, Dot Lake, Tanana, Coffman Cove, and Gulkana. More than 40 other projects are being considered across the state.

Interest in manufacturing wood pellets continues to rise. Currently, there are small and large-scale plants operating in Alaska. The largest facility, Superior Pellets, is located in North Pole and is capable of producing an estimated 30,000 tons of pellets per year.



Raw fish oil and fish oil biodiesel from the Unisea plant in Dutch Harbor.

Every year groundfish processors in Unalaska, Kodiak and other locations produce approximately 8 million gallons of Pollack oil as a byproduct of fishmeal plants. The oil is used as boiler fuel for drying the fishmeal or exported to Pacific Rim markets for livestock and aquaculture feed supplements and other uses. In 2001, with assistance from the State of Alaska, processor UniSea Inc. conducted successful tests of raw fish oil/diesel blends in a 2.2 MW engine generator. Today UniSea uses about 1.5 million gallons of fish oil a year to operate their generators, boilers and fishmeal dryers.

Many Alaskans use vegetable oils, recycled cooking oils, and other animal fats to manufacture biodiesel engine fuels. In 2010, Alaska Waste opened the state's first large-scale biodiesel refinery, producing up to 250,000 gallons annually from local restaurant vegetable oil waste. Alaska Waste plans to use the biodiesel to fuel up to 20% of its vehicles. The Alaska Energy Authority is working with the University of Alaska, Alaska Department of Environmental Conservation and the National Park Service to test biodiesel generators at the UAF campus and Denali National Park.

Alaskans generate approximately 650,000 tons of garbage per year. In North Pole, Chena Power is developing a 400 kW power plant that will burn 4,300 tons of waste paper and other biomass annually. In 2012, the Municipality of Anchorage and Doyon Utilities commissioned a 5.6 MW methane power plant at the city's landfill to provide over 25% of Joint Base Elmendorf Richardson's electrical load.

It is possible that Alaska's agricultural lands may be used to produce energy crops, such as rapeseed, to produce biodiesel.



Biomass

Woody Biomass tons/acre

- 1 - 5
- 5 - 15
- 15 - 30
- 30 +

Sawmills

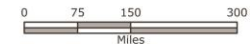
- Communities with at least one sawmill

Fish Processors

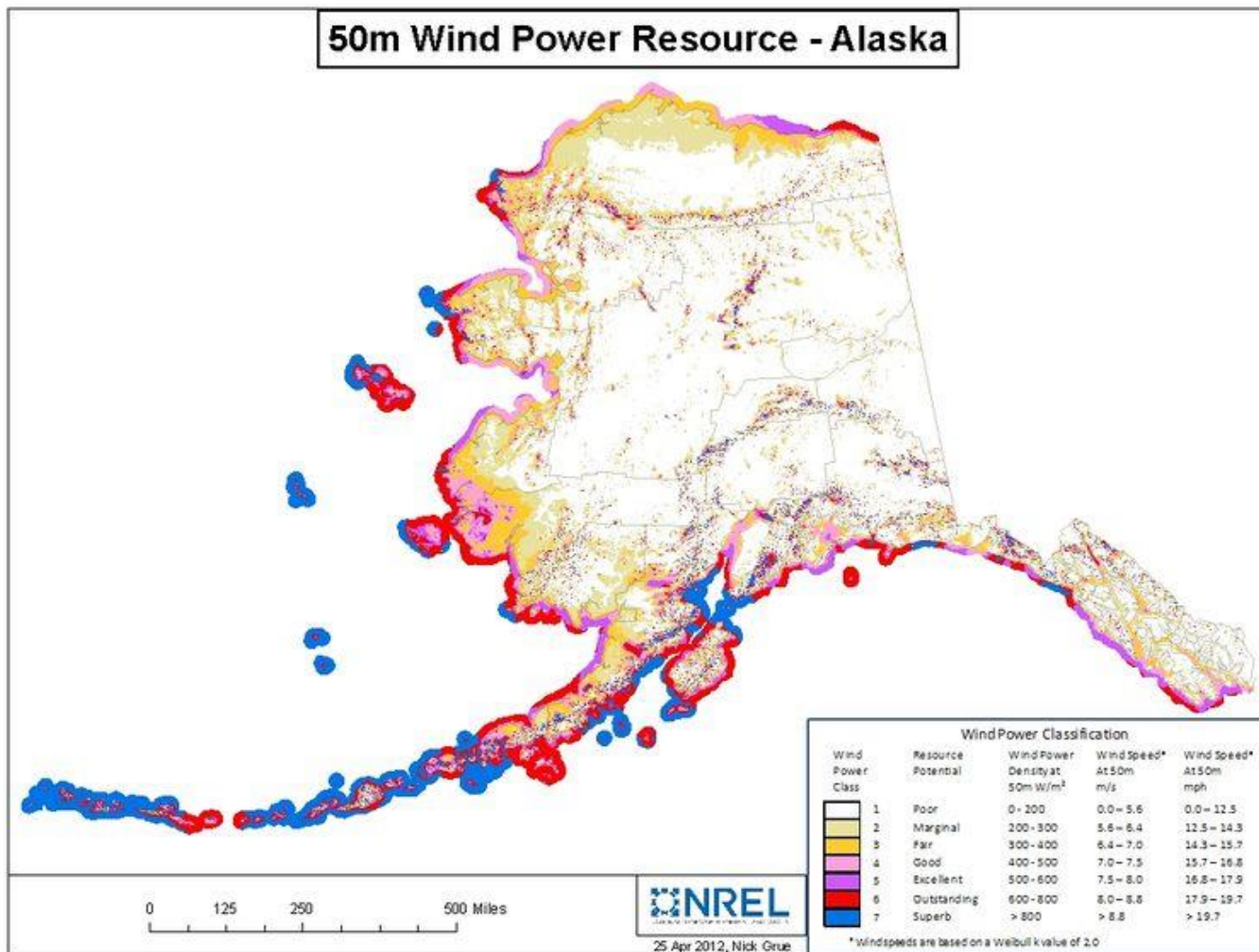
- Communities with at least one major fish processor

Landfills

- Communities with at least one Class I landfill



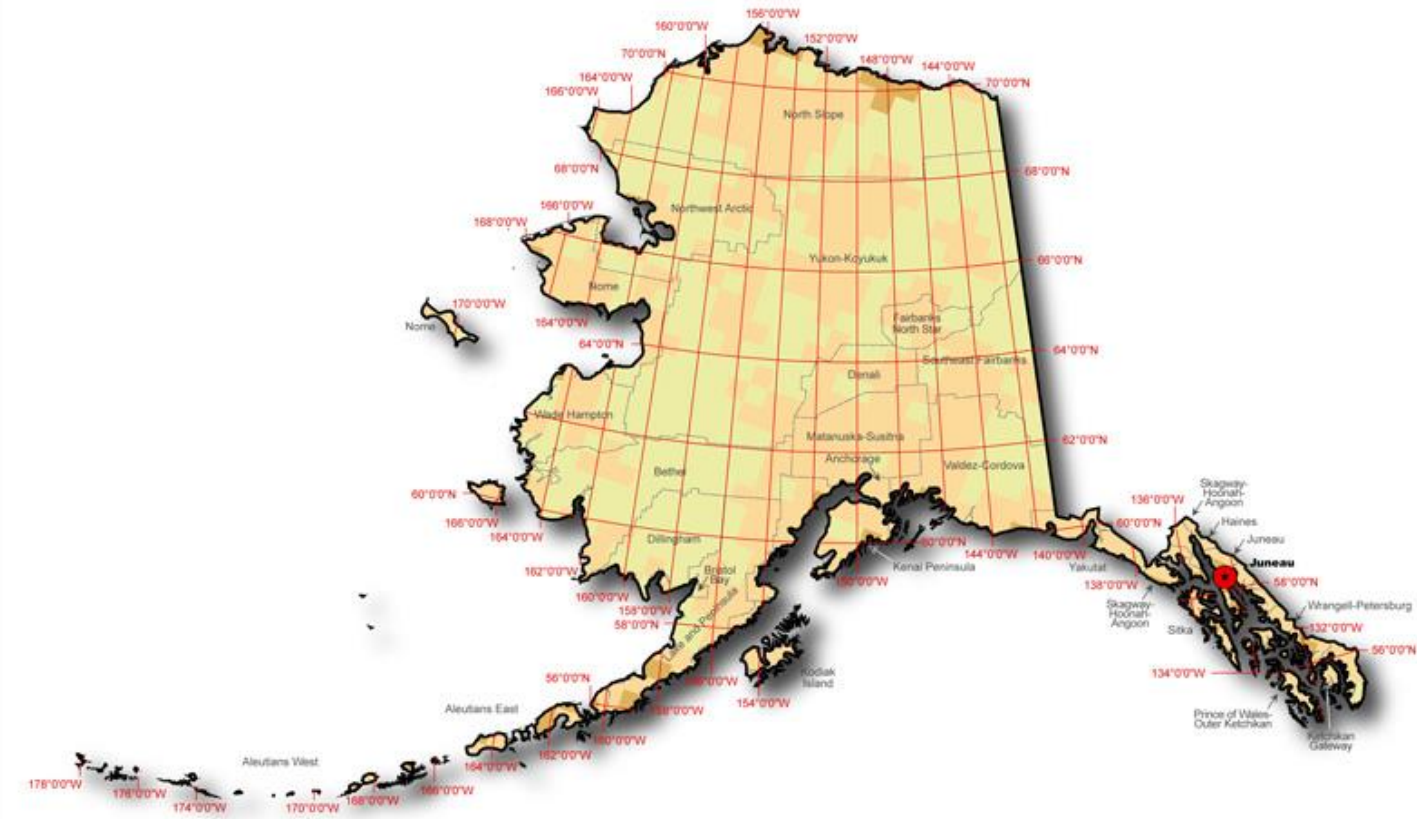
Wind Resources and Opportunity on Tribal Lands



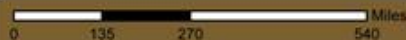
PV Solar Resource in Alaska

Global Solar Radiation at Latitude Tilt - Annual

Alaska



Model estimates of monthly average daily total radiation, averaged from hourly estimates of direct normal irradiance over 8 years (1998-2005). The model inputs are hourly visible irradiance from the GOES geostationary satellites, and monthly average aerosol optical depth, precipitable water vapor, and ozone sampled at a 10km resolution.



This map was produced by the National Renewable Energy Laboratory for the U.S. Department of Energy, September 25, 2007.



U.S. DEPARTMENT OF ENERGY

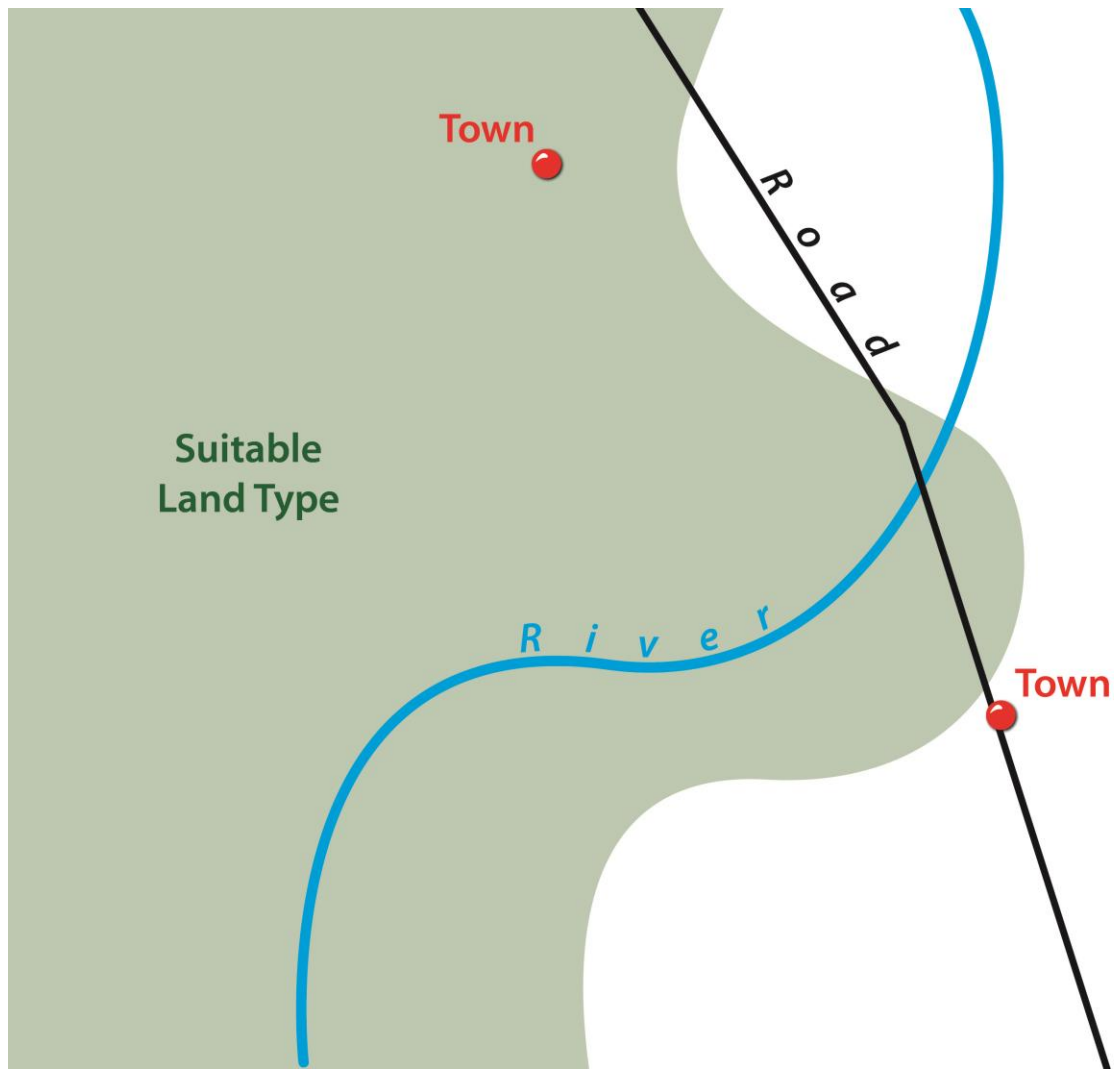
Office of Indian Energy

A photograph of three wind turbines standing on a mountain peak. The turbines are silhouetted against a bright, hazy sky. The mountain slopes are covered in green vegetation, and a thick layer of white mist or fog surrounds the base of the turbines and the mountain. The overall scene is serene and emphasizes the natural setting for renewable energy.

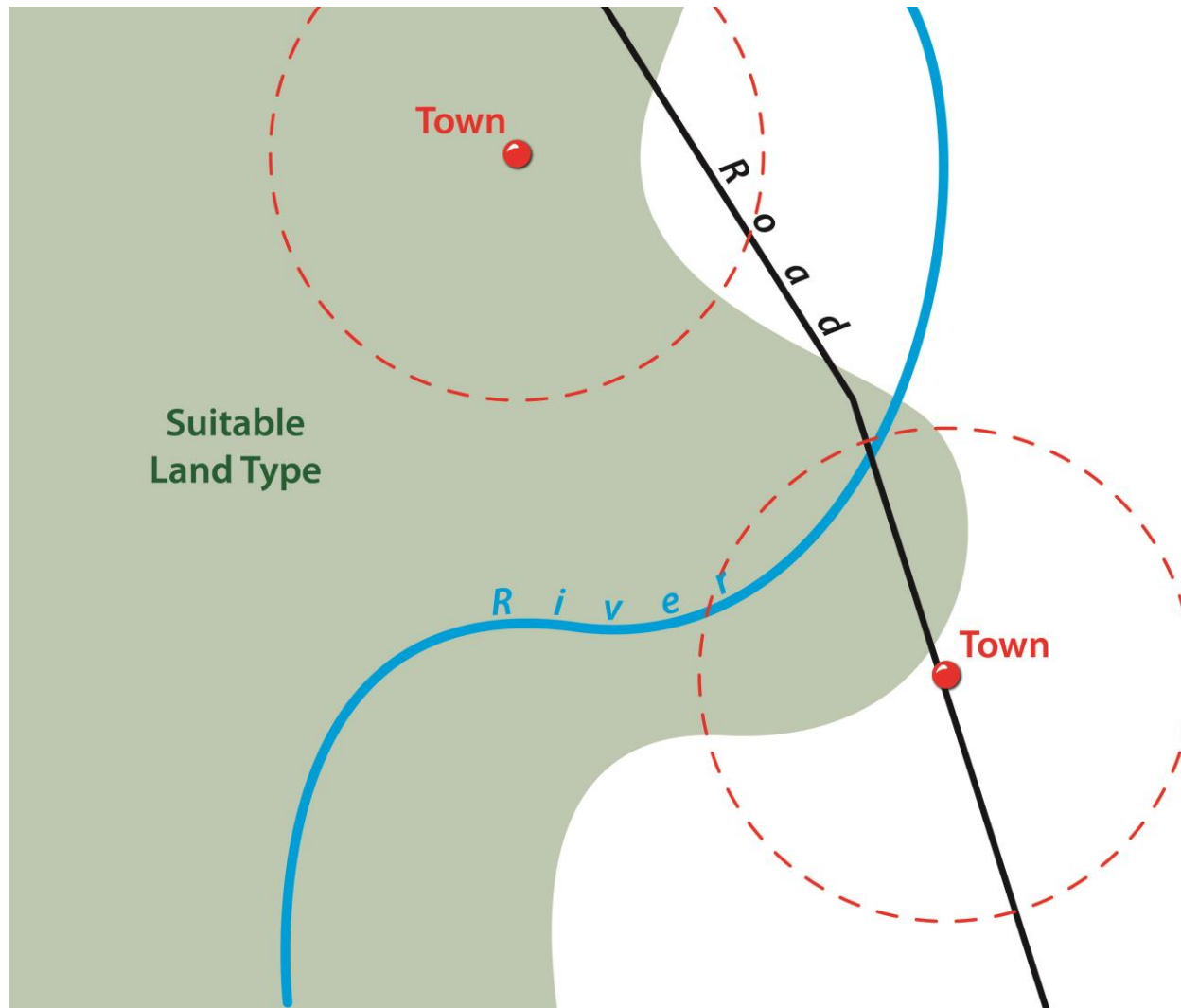
THE BEST SITE FOR YOUR RENEWABLES



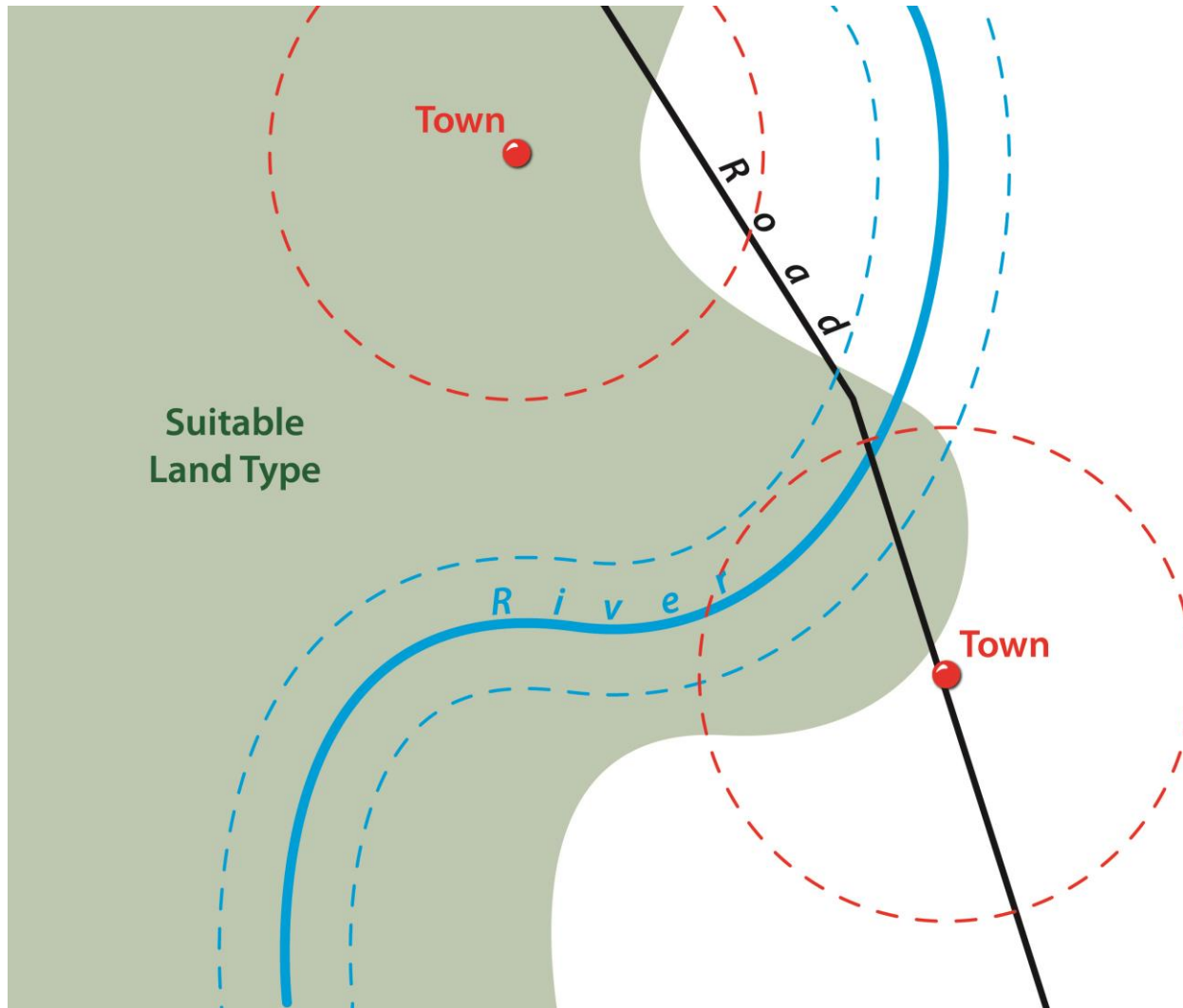
Initial Site Considerations - Community



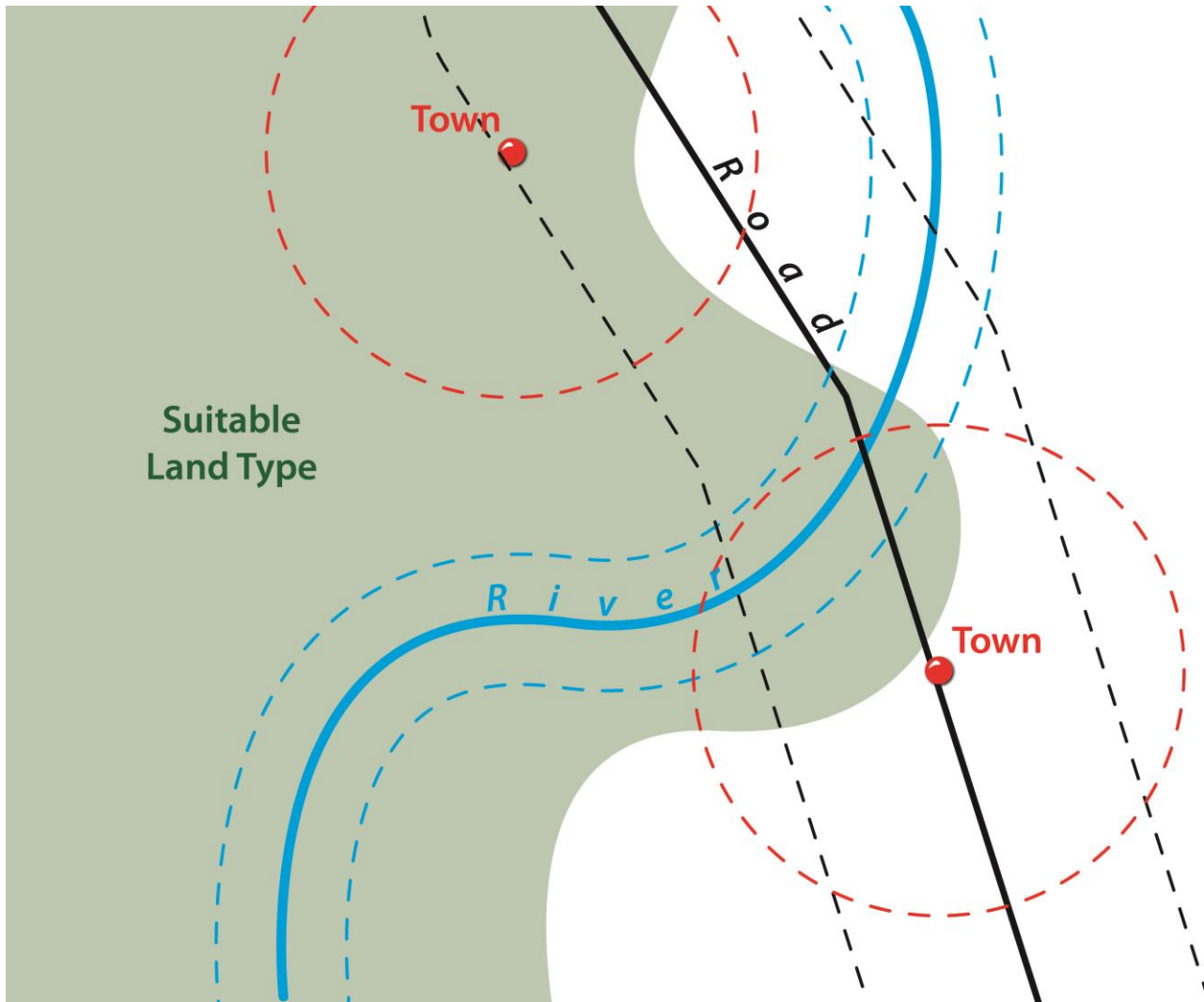
Initial Site Considerations – Urban Centers



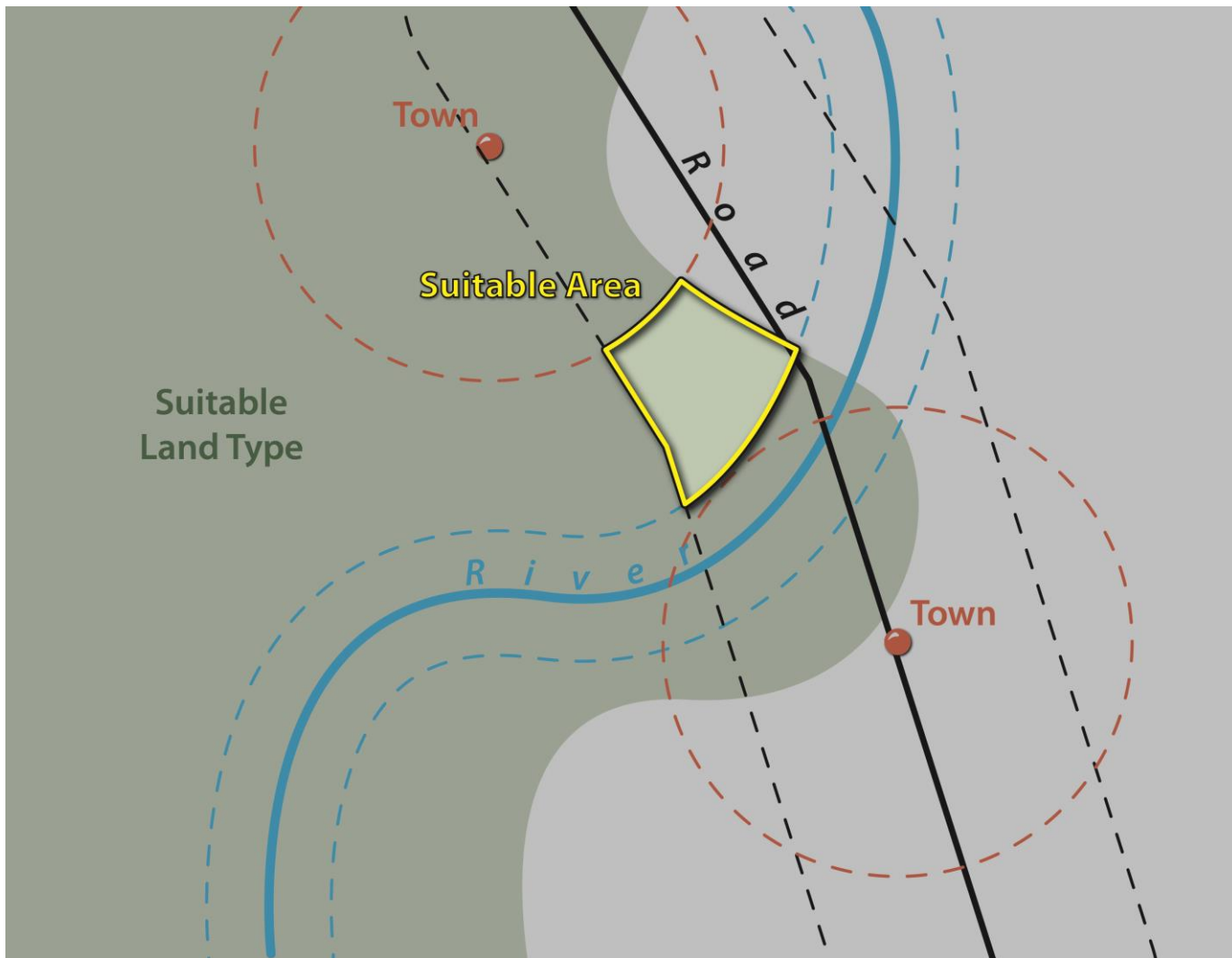
Initial Site Considerations - Rivers



Initial Site Considerations - Roads



Initial Site Considerations – Suitable Area



Initial Site Considerations – Biomass Example

Space requirements

- Ensure sufficient space for biomass boiler in boiler room
- Determine fuel requirements and storage space available
- Evaluate truck access, including space for maneuvering



Initial Site Considerations - Biomass

Permitting requirements; determine required:

- Air permits
- Ash disposal
- Fire permits

Potential resource; determine:

- Local suppliers and equipment
- Quantities available (including long-term)
- Cost
- Quality
- Compatibility between fuel delivery and receiving equipment

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TOOLS FOR PROJECT POTENTIAL



NREL Tools Links

Data or Tool	Link
State & Local Energy Data (SLED)	http://apps1.eere.energy.gov/sled/#/
Interactive Mapping Tools	http://maps.nrel.gov
MapSearch	http://www.nrel.gov/gis/mapsearch/
REAtlas	http://maps.nrel.gov/re_atlas
PV Watts	http://pvwatts.nrel.gov/
SAM (System Advisory Model)	http://sam.nrel.gov
HyDRA	http://maps.nrel.gov/hydra
Solar Prospector	http://maps.nrel.gov/prospector
OpenPV	https://openpv.nrel.gov/gallery
PVDAQ	http://maps.nrel.gov/pvdaq
LCOE Calculator	http://www.nrel.gov/analysis/tech_lcoe.html
REEDS (Regional Energy Deployment System)	http://www.nrel.gov/analysis/reeds/
PV JEDI (Jobs and Economic Development Impact Models)	https://jedi.nrel.gov/index.php
OpenEI	http://openei.org
CREST(Cost of Renewable Energy Spreadsheet Tool)	https://financere.nrel.gov/finance/content/crest-cost-energy-models
Smartgrid.gov	http://smartgrid.gov

The image shows three wind turbines on a mountain ridge. The turbines are positioned across the ridge, with the leftmost one being the tallest and the rightmost one being the shortest. The background is a clear blue sky. A thick layer of white mist or fog is rising from the valley, partially obscuring the base of the turbines and the lower slopes of the mountain. The foreground shows the green, grassy slopes of the mountain. A large, semi-transparent blue rectangular box is overlaid on the lower-left portion of the image, containing the text 'SAM' in white.

SAM



Sizing Your PV or Wind System

Current Load

- Use your past monthly energy bills to determine the demand. Start here: www.eere.energy.gov/sled
- Consider your scale: residential, commercial, or industrial
- Consider the current tariff structure (how the energy is metered and billed)

Future Load

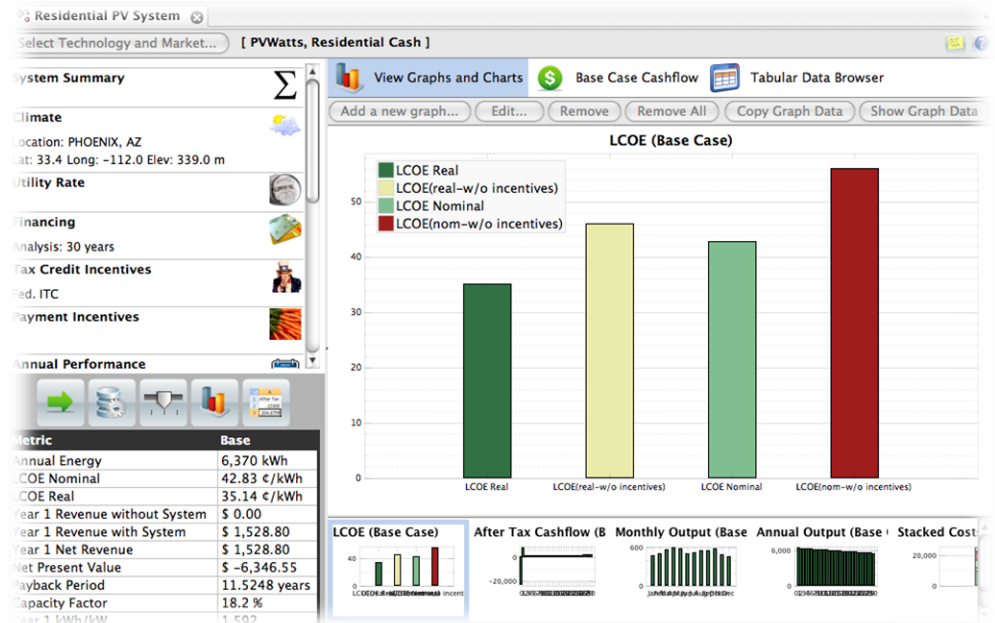
- At which energy scale does your community expect the most growth in energy demand?
- How much will you need?
- Will your community experience growth or reduced population?

System Advisor Model (SAM)

Available at: <https://www.nrel.gov/analysis/sam/>

NREL's System Advisor Model (SAM) is a free computer program that calculates a renewable energy system's hourly energy output over a single year and calculates the cost of energy for a renewable energy project over the life of the project.

- Solar, wind, geothermal, and other renewable and fossil technologies available
- These calculations are done using detailed performance models, a detailed cash flow finance model, and a library of reasonable default values for each technology and target market



System Advisor Model: Location & Resource

SAM 2014.1.14: untitled1
File Case Analysis Tools Script Help

My project X

Select Technology and Market... **Flat Plate PV, Residential**

Location and Resource
Location: BETHEL, AK
Lat: 60.8 Long: -161.8 Elev: 46.0 m

Module
SunPower SPR-210-BLK-U
Output: 215.3 Wdc

Inverter
SMA America: SB4000US 240V
Capacity: 4000 Wac

Array
Power: 3.8745 kWdc
Area: 22.4 m²

PV Subarrays
Number of subarrays: 1

Performance Adjustment
Percent of annual output: 100 %
Year-to-year decline: 0.5 % per year

PV System Costs
Total: \$ 14,641.52
Per Capacity: \$ 3.78 per Wdc

Financing
Analysis: 25 years
Debt Fraction: 100.0% percent

Incentives
Fed. ITC, State ITC
No cash incentives

Utility Rate
Net Metering? Yes

Electric Load
Annual Energy: 12917.8 kWh
Annual Peak: 4.39428 kW

Exchange Variables
(For Excel Exchange and custom TRNSYS only.)

Choose Weather Data File
Type a few letters of the location name: ak
Download weather file...

- SAM/AK Annette.tm2
- SAM/AK Barrow.tm2
- SAM/AK Bethel.tm2**
- SAM/AK Bettles.tm2
- SAM/AK Big Delta.tm2
- SAM/AK Cold Bay.tm2
- SAM/AK Fairbanks.tm2
- SAM/AK Gulkana.tm2
- SAM/AK King Salmon.tm2
- SAM/AK Kodiak.tm2
- SAM/AK Kotzebue.tm2

Folder settings...
Refresh list
Copy to project
Remove from project
Create TMY3 file

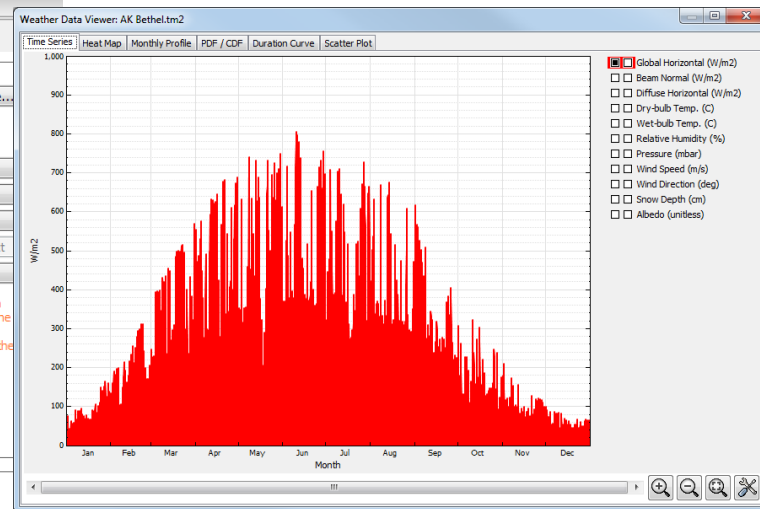
Click a file in the list to choose a file from the NREL NSRDB TMY2 dataset, or click Download Weather File to enter an address and download a weather file from the NREL Solar Prospector database. A blue highlight indicates the weather file SAM uses for simulations. SAM lists files in the default weather folder and in any folders where you specify in Folder Settings. The prefix "SAM/" indicates a file from the default folder. To embed weather data in your .zsm file for sharing with other people, click Copy to Project; SAM indicates the embedded weather file in the list with the prefix "USER/". See Help for details.

Location Information
City: BETHEL Time Zone: GMT -9 Latitude: 60.7833 deg
State: AK Elevation: 46 m Longitude: -161.8 deg

Weather Data Information (Annual)
Direct Normal: 889.7 kWh/m² Dry-bulb Temp: -1.7 °C
Global Horizontal: 876.6 kWh/m² Wind Speed: 5.7 m/s
View hourly data...

Web Links
SAM reads weather files in the TMY3, TMY2, EPW, and SMW file formats. The default weather folder contains copies of the complete NREL NSRDB TMY2 dataset. You can use the links below to visit websites with other weather files. If you download files from the web, click Folder Settings to choose folders where SAM can find your downloaded weather files. See Help for details.

- [Best weather data for the U.S. \(1200+ locations in TMY3 format\)](#)
- [Best weather data for international locations \(in EPW format\)](#)
- [U.S. satellite-derived weather data \(10 km grid cells in TMY2 format\)](#)



Hourly Weather Data

System Advisor Model: Array (# of panels)

SAM 2014.1.14: untitled1

File Case Analysis Tools Script Help

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Utility Rate

Net Metering? Yes

Electric Load

Annual Energy: 12917.8 kWh
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Exchange Variables

(For Excel Exchange and custom TRNSYS only.)

Layout

Specify System Size

Specify desired array size Specify modules and inverters

Desired array size: 4 kWdc
DC to AC ratio: 1.1

Modules per string: 9
Strings in parallel: 2
Number of inverters: 1

Sizing messages (see Help for details):
Actual DC to AC Ratio is 0.97. Check for more sizing messages after running simulations.

Actual Layout

Modules		Inverters	
Nameplate capacity	3.8745 kWdc	Total capacity	4 kWac
Number of modules	18	Total capacity	4,186 kWdc
Modules per string	9	Number of inverters	1
Strings in parallel	2	Maximum DC voltage	600 Vdc
Total module area	22.392 m ²	Minimum MPPT voltage	250 Vdc
String Voc	429.3 V	Maximum MPPT voltage	480 Vdc
String Vmp	369 V		

Nameplate capacity and string Vmp are at module reference conditions. String Voc is at 1000 W/m² incident irradiance and 25 °C cell temperature.

Interconnection Derates (AC)

AC wiring losses: 0.99 (0..1)
Step-up transformer losses: 1 (0..1)
Total interconnection derate: 0.99 (0..1)

Land Area

Packing factor: 2.5
Total land area: 0.0138327 acres

Ground Reflectance

Use albedo in weather file if it is specified
Monthly ground reflectance (albedo)

Tilted Surface Radiation Model (Advanced)

Isotropic HDKR Perez

-Radiation Components-
 Beam and diffuse Total and beam

Self Shading Calculator for Fixed Tilt Arrays

Enable Self-Shading Calculator

Module

Orientation: Landscape

Length: 1.848 m
Width: 0.673 m
Number of Cells along Length: 12
Number of Cells along Width: 6
Number of Bypass Diodes: 3

Characteristics from Module Page

Area: 1.244 m² Number of cells: 72

Portrait

Landscape

System Advisor Model: Performance Adjustment

SAM 2014.1.14: untitled1

File Case Analysis Tools Script Help

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System Output Adjustments

Percent of annual output

Year-to-year decline in output (compounded annually)

Use the system output adjustments to model system availability, annual degradation, curtailment, or other factors that cause the system's output (delivered energy) to be less than the value calculated by the performance model (net energy). Use annual schedules to specify different percentages for different years.

If you use combinations of adjustments, SAM multiplies the resulting percentages and hourly factors. See Help for examples.

Hourly Factors (24-hour profile for each month) 0=No Output, 1=Full Output

	12am	1am	2am	3am	4am	5am	6am	7am	8am	9am	10am	11am	12pm	1pm	2pm	3pm	4pm	5pm	6pm	7pm	8pm	9pm	10pm	11pm
Jan	1	1	1	1	1	0.8	1	1	1	1	1	1	1	1	1	1	0.5	1	1	1	1	1	1	1
Feb	1	1	1	1	1	0.8	1	1	1	1	1	1	1	1	1	1	0.5	1	1	1	1	1	1	1
Mar	1	1	1	1	1	0.8	1	1	1	1	1	1	1	1	1	1	0.5	1	1	1	1	1	1	1
Apr	1	1	1	1	1	0.8	1	1	1	1	1	1	1	1	1	1	0.5	1	1	1	1	1	1	1
May	1	1	1	1	1	0.8	1	1	1	1	1	1	1	1	1	1	0.5	1	1	1	1	1	1	1
Jun	1	1	1	1	1	0.8	1	1	1	1	1	1	1	1	1	1	0.5	1	1	1	1	1	1	1
Jul	1	1	1	1	1	0.8	1	1	1	1	1	1	1	1	1	1	0.5	1	1	1	1	1	1	1
Aug	1	1	1	1	1	0.8	1	1	1	1	1	1	1	1	1	1	0.5	1	1	1	1	1	1	1
Sep	1	1	1	1	1	0.8	1	1	1	1	1	1	1	1	1	1	0.5	1	1	1	1	1	1	1
Oct	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nov	.2	1	1	1	1	0.8	1	1	1	1	1	1	1	1	1	1	0.5	1	1	1	1	1	1	1
Dec	1	1	1	1	1	0.8	1	1	1	1	1	1	1	1	1	1	0.5	1	1	1	1	1	1	1

System Advisor Model: System Costs

SAM 2014.1.14: untitled1

File Case Analysis Tools Script Help

My project x

Select Technology and Market... Flat Plate PV, Residential

Location and Resource
 Location: BETHEL, AK
 Lat: 60.8 Long: -161.8 Elev: 46.0 m

Module
 SunPower SPR-210-BLK-U
 Output: 215.3 Wdc

Inverter
 SMA America: SB4000US 240V
 Capacity: 4000 Wac

Array
 Power: 3.8745 kWdc
 Area: 22.4 m2

PV Subarrays
 Number of subarrays: 1

Performance Adjustment
 Percent of annual output: 100 %
 Year-to-year decline: 0.5 % per year

PV System Costs
 Total: \$ 14,641.52
 Per Capacity: \$ 3.78 per Wdc

Financing
 Analysis: 25 years
 Debt Fraction: 100.0% percent

Incentives
 Fed, ITC, State ITC
 No cash incentives

Utility Rate
 Net Metering? Yes

Electric Load
 Annual Energy: 12917.8 kWh
 Annual Peak: 4.39428 kW

Exchange Variables
 (For Excel Exchange and custom TRNSYS only.)

Direct Capital Costs

Module	18 units	0.2 kWdc/unit	3.8745 kWdc	\$ 0.72 \$/Wdc	\$ 2,789.64
Inverter	1 units	4.0 kWac/unit	4 kWac	\$ 0.41 \$/Wac	\$ 1,640.00
Balance of system, equipment	0 \$		0.49 \$/Wdc	0 \$/m2	\$ 1,898.50
Installation labor	0 \$		0.77 \$/Wdc	0 \$/m2	\$ 2,983.37
Installer margin and overhead	0 \$		0.91 \$/Wdc	0 \$/m2	\$ 3,525.80
Contingency				0 %	\$ 0.00
Total Direct Cost					\$ 12,837.31

Indirect Capital Costs

	% of Direct Cost	Cost \$/Wdc	Fixed Cost	Total
Permitting, Environmental Studies	0 %	0.12	\$ 0.00	\$ 464.94
Engineering	0 %	0.18	\$ 0.00	\$ 697.41
Grid interconnection	0 %	0.00	\$ 0.00	\$ 0.00

Land Costs

Total Land Area: 0.0138327 acres

	Cost \$/acre	% of Direct Cost	Cost \$/Wdc	Fixed Cost	Total
Land	0.00	0 %	0.00	\$ 0.00	\$ 0.00
Land preparation	0.00	0 %	0.00	\$ 0.00	\$ 0.00

Sales Tax of 5 % applies to 100 % of Direct Cost \$ 641.87

Total Indirect Cost \$ 1,804.22

Total Installed Costs

Total Installed Cost \$ 14,641.52

Total Installed Cost per Capacity (\$/Wdc) \$ 3.78

Operation and Maintenance Costs

	First Year Cost	Escalation Rate (above inflation)
Fixed Annual Cost	0.00 \$/yr	0 %
Fixed Cost by Capacity	20.00 \$/kW-yr	0 %
Variable Cost by Generation	0.00 \$/MWh	0 %

Escalation rates apply only to single values, not to values in annual schedules.

System Advisor Model: Financing

SAM 2014.1.14: untitled1

File Case Analysis Tools Script Help

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Incentives

Fed. ITC, State ITC
No cash incentives

Loan Type

Standard Loan Standard loan interest payments are not tax deductible.

Mortgage Mortgage interest payments are tax deductible.

Residential Loan Parameters

Debt Fraction % Principal Amount

WACC %

Loan Term years

Loan Rate %/year

Analysis Parameters

Analysis Period years

Inflation Rate %/year

Real Discount Rate %/year

Nominal Discount Rate %/year

Tax and Insurance Rates

Federal Income Tax Rate %/year

State Income Tax Rate %/year

Sales Tax % of installed cost

Insurance Rate (Annual) % of installed cost

Property Tax

Assessed Percent % of installed cost

Assessed Value

Annual Decline %/year

Property Tax %/year

Salvage Value

End of Analysis Period Value Net Salvage Value % of installed cost

System Advisor Model: Incentives & Rebates

SAM 2014.1.14: untitled1

File Case Analysis Tools Script Help

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No cash incentives

Utility Rate

Net Metering? Yes

Electric Load

Annual Energy: 12917.8 kWh
Annual Peak: 4.39428 kW

Exchange Variables

(For Excal Exchange and custom TRNSYS only.)

DSIRE Online Incentives Database

Download incentives... [Go to website...](#)

Download incentives from the Database of State Incentives for Renewables and Efficiency (DSIRE) for the location in your weather file (U.S. locations only).

Investment Tax Credit (ITC)

	Amount
Federal	\$ 0
State	\$ 0

	Percentage	Maximum
Federal	30 %	\$ 1e+099
State	25 %	\$ 1000

Production Tax Credit (PTC)

	Amount	Term	Escalation
Federal	Value Based 0 \$/kWh	10 years	2.5 %
State	Value Based 0 \$/kWh	10 years	2.5 %

Investment Based Incentive (IBI)

	Amount	Taxable Incentive	
		Federal	State
Federal	\$ 0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
State	\$ 0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Utility	\$ 0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Other	\$ 0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

	Percentage	Maximum
Federal	0 %	\$ 1e+099
State	0 %	\$ 1e+099
Utility	0 %	\$ 1e+099
Other	0 %	\$ 1e+099

Capacity Based Incentive (CBI)

	Amount	Maximum	Taxable Incentive	
			Federal	State
Federal	0 \$/W	\$ 1e+099	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
State	0 \$/W	\$ 1e+099	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Utility	0 \$/W	\$ 1e+099	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Other	0 \$/W	\$ 1e+099	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Production Based Incentive (PBI)

	Amount	Term (years)	Escalation	Taxable Incentive	
				Federal	State
Federal	Value Based 0 \$/kWh	10 years	0 %	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
State	Value Based 0 \$/kWh	10 years	0 %	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Utility	Value Based 0 \$/kWh	10 years	0 %	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Other	Value Based 0 \$/kWh	10 years	0 %	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

System Advisor Model: Electric Load

SAM 2014.1.14: untitled1

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Incentives

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Utility Rate

Net Metering? Yes

Electric Load

Annual Energy: 12917.8 kWh
Annual Peak: 4.39428 kW

Exchange Variables

(For Excel Exchange and custom TRNSYS only.)

Electric Load Data

No load data
 Monthly schedule Edit values...
 User entered hourly data Edit data...

Normalize supplied load profile to monthly utility bill data
 Monthly energy usage (kWh) Edit values...

Adjustments

Escalation %/yr Value Submit Scaling factor

Escalation scales the load in years two and later by the percentage you specify. Use the annual schedule to specify different rates for different years. See Help for details.

Hourly Simulation Load Profile Data

	Energy (kWh)	Peak (kW)
Jan	723.099	1.81179
Feb	630.657	1.72415
Mar	666.287	1.9776
Apr	794.199	2.91707
May	1040.9	3.88027
Jun	1589.92	4.26146
Jul	1926.08	4.37081
Aug	1730.14	4.39428
Sep	1382.63	4.20842
Oct	1082.88	3.79241
Nov	634.894	1.71415
Dec	716.153	1.86432

Annual Total kWh

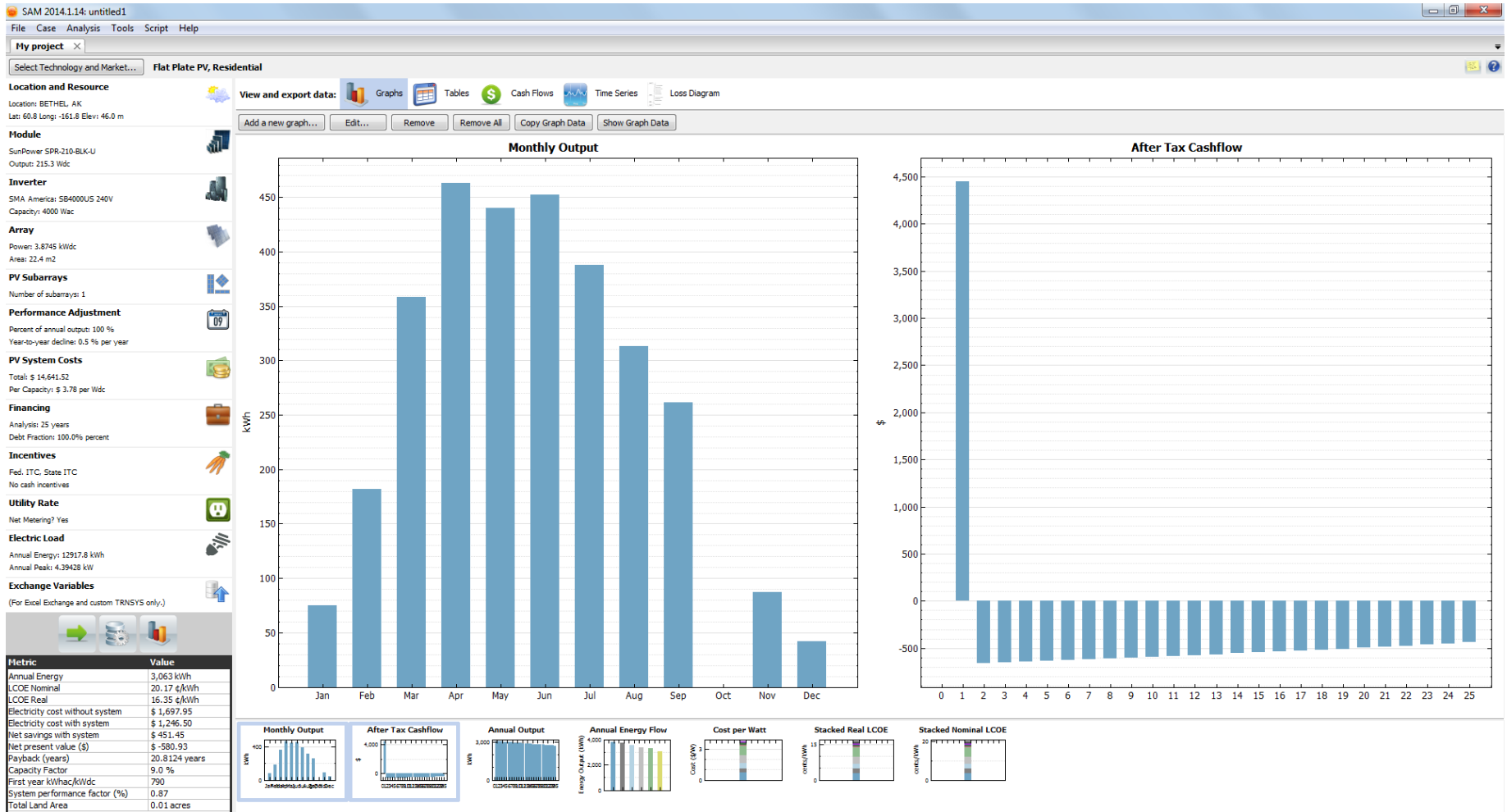
Annual Peak kW

Visualize load data...

Calculate Load Profiles

[EERE Building Technologies Program EnergyPlus Load Calculator](#)

System Advisor Model: Outputs



The image shows three wind turbines on a mountain peak. The turbines are white with three blades each. The background is a clear blue sky. The foreground is a green, hilly landscape. A large blue rectangular box is overlaid on the bottom half of the image, containing the text 'COMMUNITY DEVELOPMENT' in white, bold, uppercase letters.

COMMUNITY DEVELOPMENT



Community Development Potential

- Consider the Benefit to Costs
 - Regional
 - Economic Development
 - A Commissioned System
 - Water and Sewer
 - Housing
 - Schools

Collaborate with Regional Energy Planning

- Don't reinvent your strategic energy plan if the region already has a good one
- Invest with your neighbors
- What are they doing that you could do?
- What could they do that you are doing?

The image shows three wind turbines on a mountain ridge. The turbines are white with three blades each. The background is a clear blue sky. A thick layer of white mist or fog is rising from the valley, partially obscuring the base of the turbines and the lower slopes of the mountain. The foreground shows green, rolling hills. A large, semi-transparent blue rectangular box is overlaid on the lower half of the image, containing the text 'TECHNICAL ASSISTANCE' in white, bold, uppercase letters.

TECHNICAL ASSISTANCE



Resources to Work the 5 Steps

- Tools

- <http://www.energy.gov/indianenergy/resources/energy-resource-library>
- <http://www.energy.gov/indianenergy/resources/education-and-training>

- Technical Assistance and Support

- Tribal Energy Program Technical Assistance
 - http://apps1.eere.energy.gov/tribalenergy/technical_assistance.cfm
 - <http://www.energy.gov/indianenergy/resources/technical-assistance>

A photograph of three wind turbines on a mountain ridge. The turbines are silhouetted against a bright, hazy sky. The foreground is filled with thick, white fog or mist that partially obscures the lower parts of the turbines and the mountain. The overall scene is serene and atmospheric.

OPERATIONS AND MAINTENANCE



Operation and Maintenance Activities

- Administration;
 - billing; accounting;
 - hiring subcontractors,
 - enforcement of warranties
 - Economic optimization; management of budget and reserves
- Monitoring
 - Metering for revenue
 - Alarms
 - Diagnostics
- Preventative Maintenance
 - Scheduled and Planned
 - Expenditure is budgeted
- Corrective Maintenance (repair)
 - Unplanned or Condition-Based
 - Possible expenditure is kept in reserve or line-credit
 - Must be timely and effective



Project Potential: O&M

- What will the long term **operations costs** be:
 - For Biomass –a solid fuel source
 - For Wind –a warranty tied to a solid turbine builder
- Consider the maintenance AND management necessary to keep your project going:
 - Will the project create jobs?
 - Finance the operations of the project after it is built

The image shows three wind turbines on a mountain peak. The turbines are white with three blades each. The sky is a clear, bright blue. The mountain is covered in green grass, and there is a thick layer of white mist or fog at the base of the turbines. A large, semi-transparent blue rectangular box is overlaid on the lower half of the image, containing white text.

JACK HEBERT COLD CLIMATE HOUSING RESEARCH CENTER



■ Potential Guest Speaker

- Cold Climate Housing Research Center
 - Jack Hebert
 - Alaskan Tribal procurement
 - Jeff Weltzin 907-780-2503 or 907-509-1304
- GSA ENABLE Program – Energy efficiency for low-risk items, packaged procurement through GSA.

■ GSA Pricing for the ENABLE program

- ESPC ENABLE program allows smaller low-risk projects to be funded through an ESCO contract using GSA pricing schedule.
 - ESCOs that do GSA ENABLE projects:
<http://energy.gov/eere/femp/espc-enable-energy-service-companies>

■ Tribal Energy Funding Opportunities

- Tribal Energy Project Funding Opportunities
 - http://apps1.eere.energy.gov/tribalenergy/related_opportunities.cfm