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



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Agenda

Review Day 1

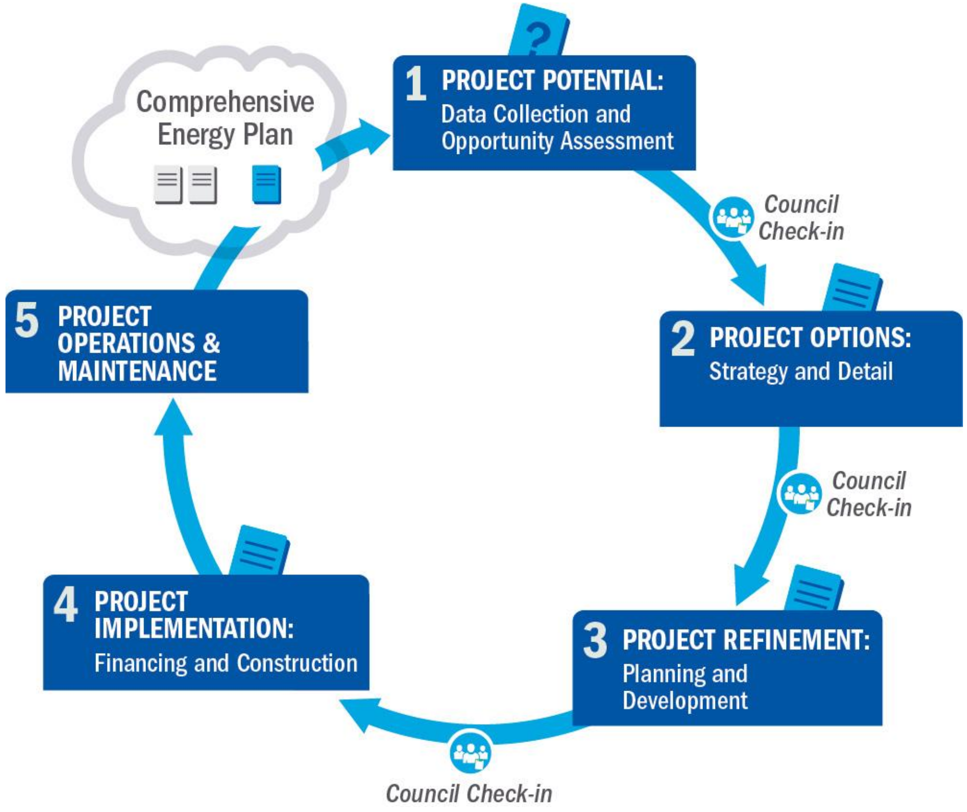
- Strategic Energy Planning
- Technologies (if time allowed)

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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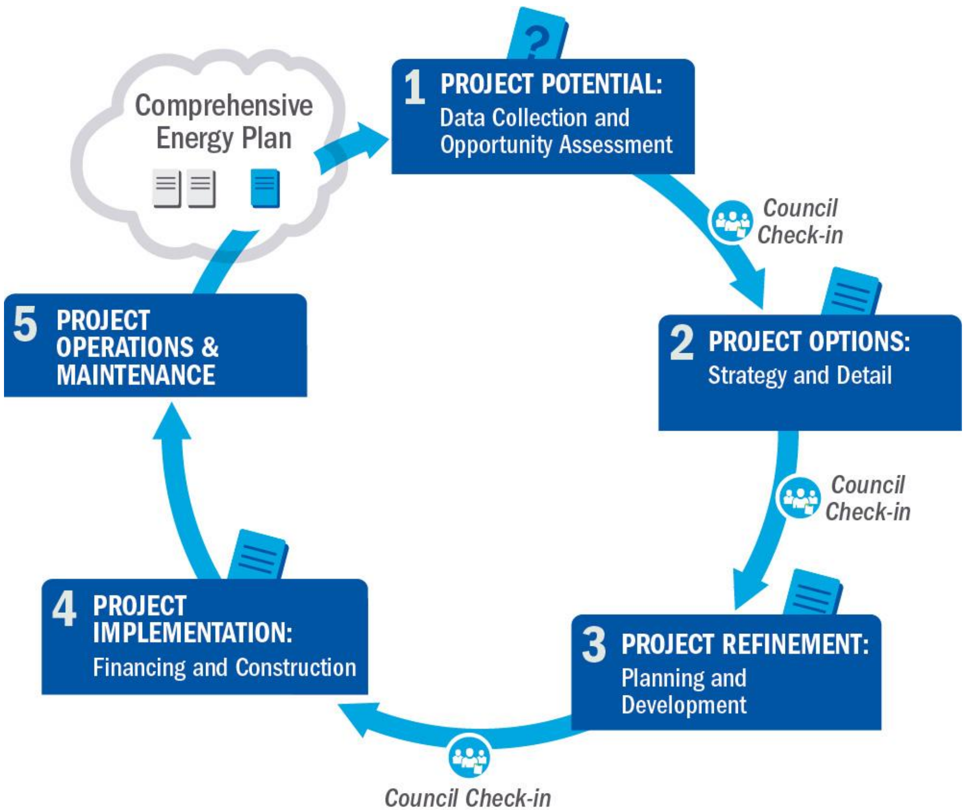
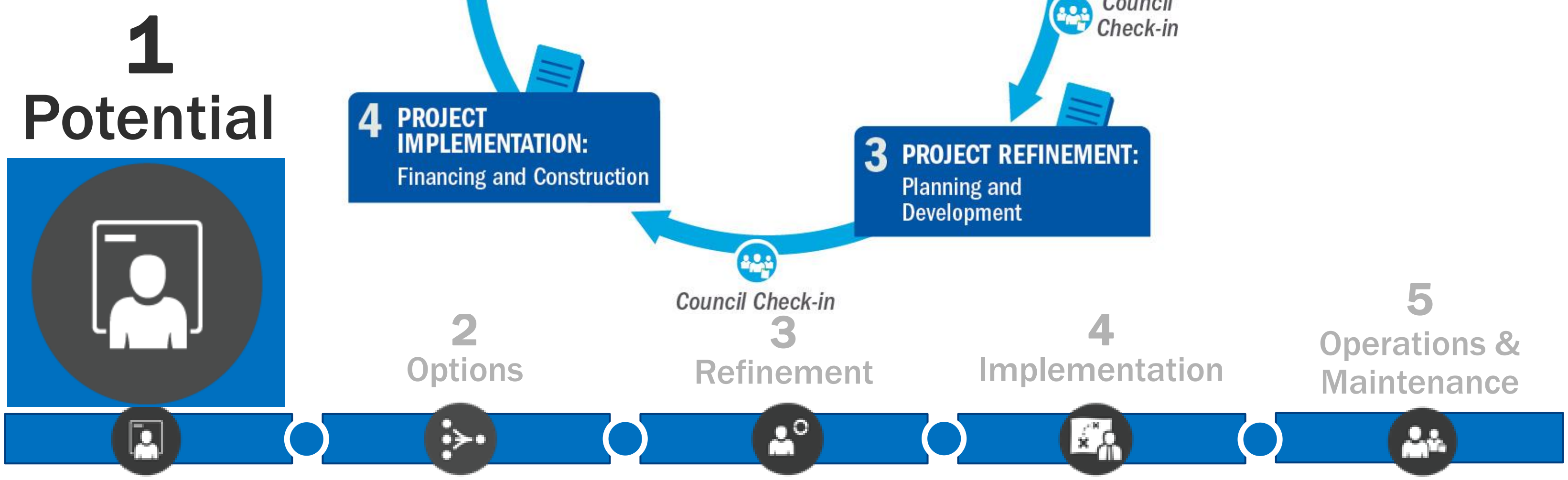
Project Potential





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)

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SEE TECHNOLOGY SECTION

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

Photo curtesy of Jason Meyer of Alaska Center for Energy and Power

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.

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

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

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

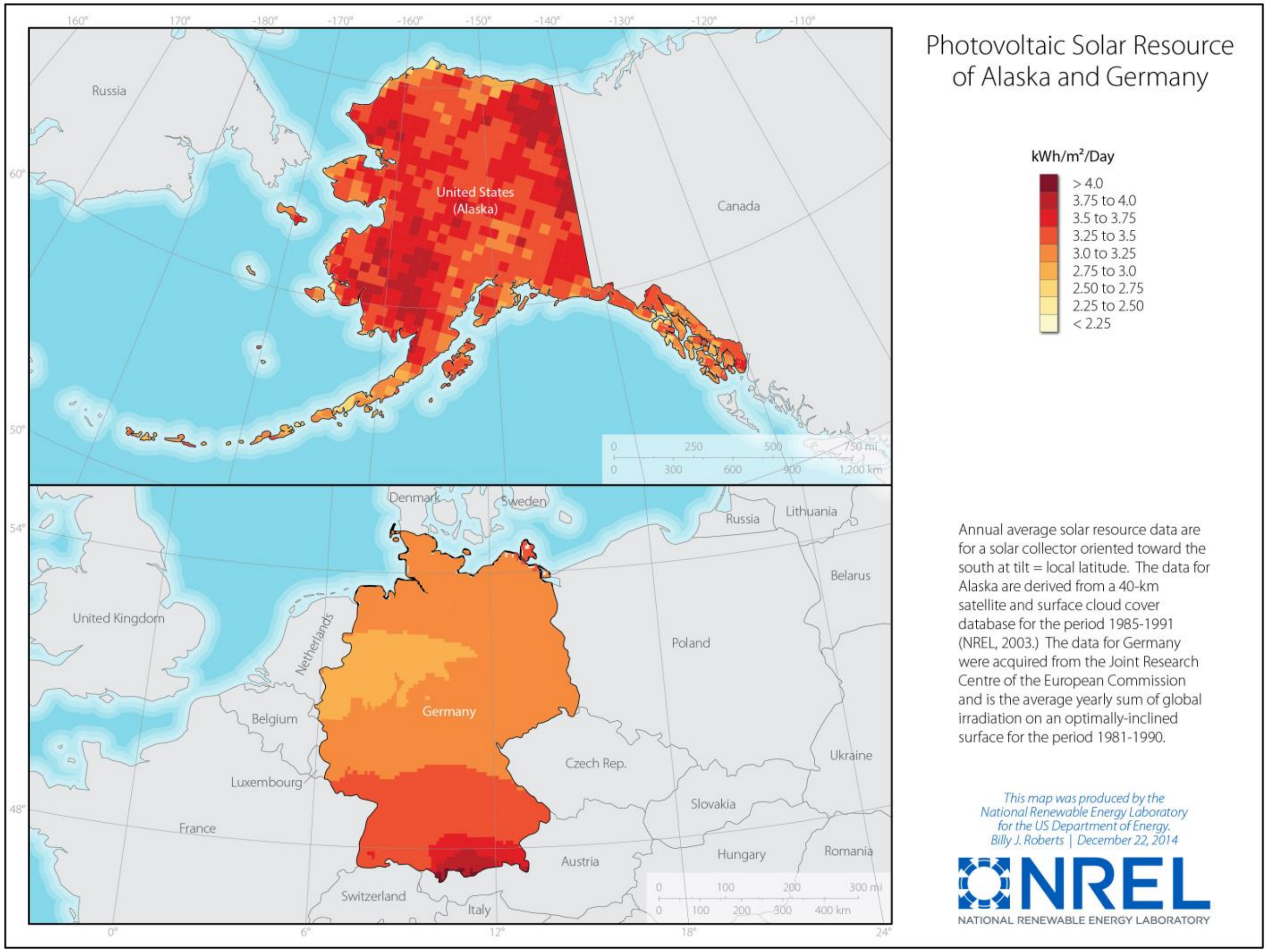
- Biomass
- Hydropower
- Solar Photovoltaics (PV)
- Solar Thermal & Concentrating Solar
- Wind

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)

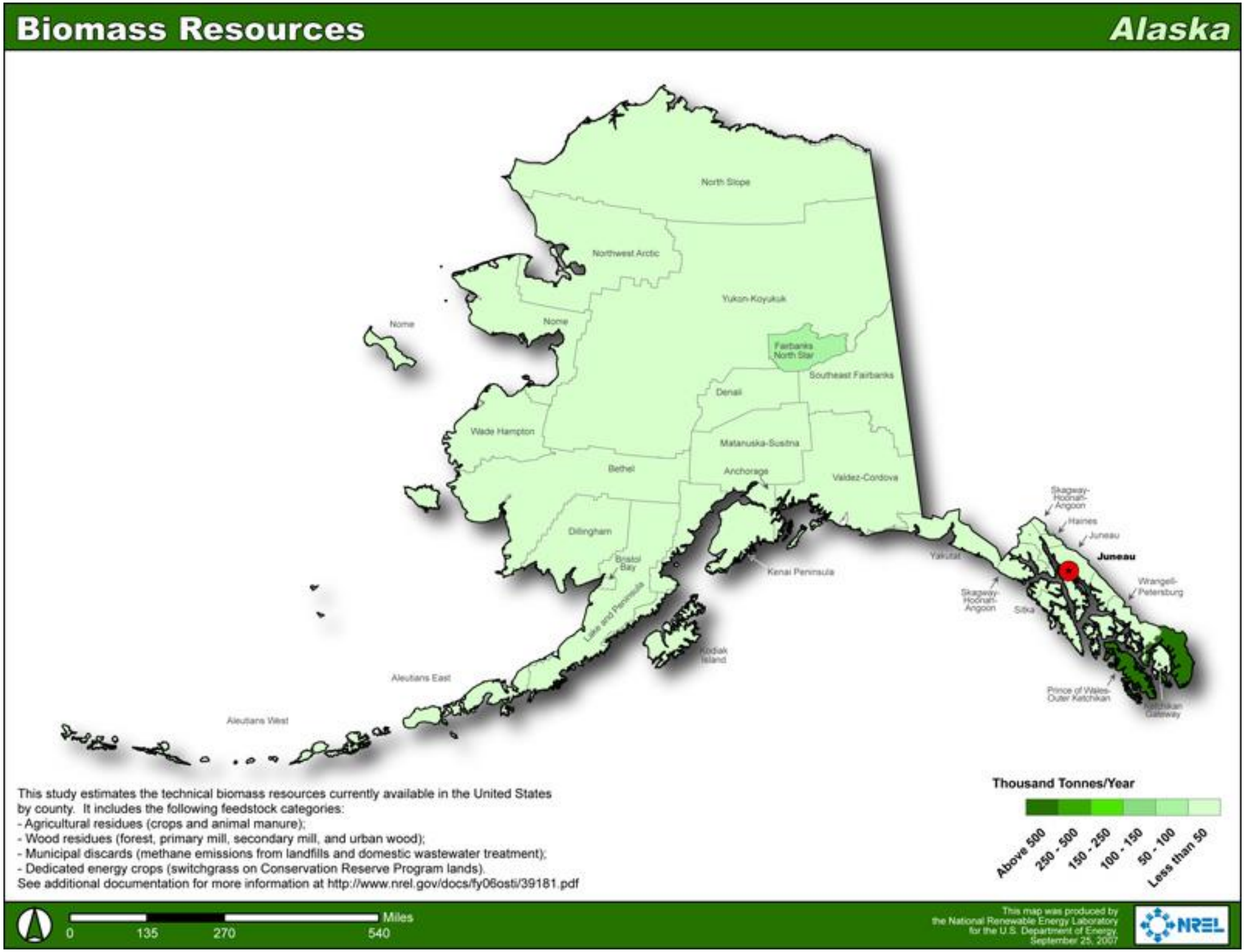
Renewable Energy Atlas of Alaska

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

Alaska Has Significant Solar Potential

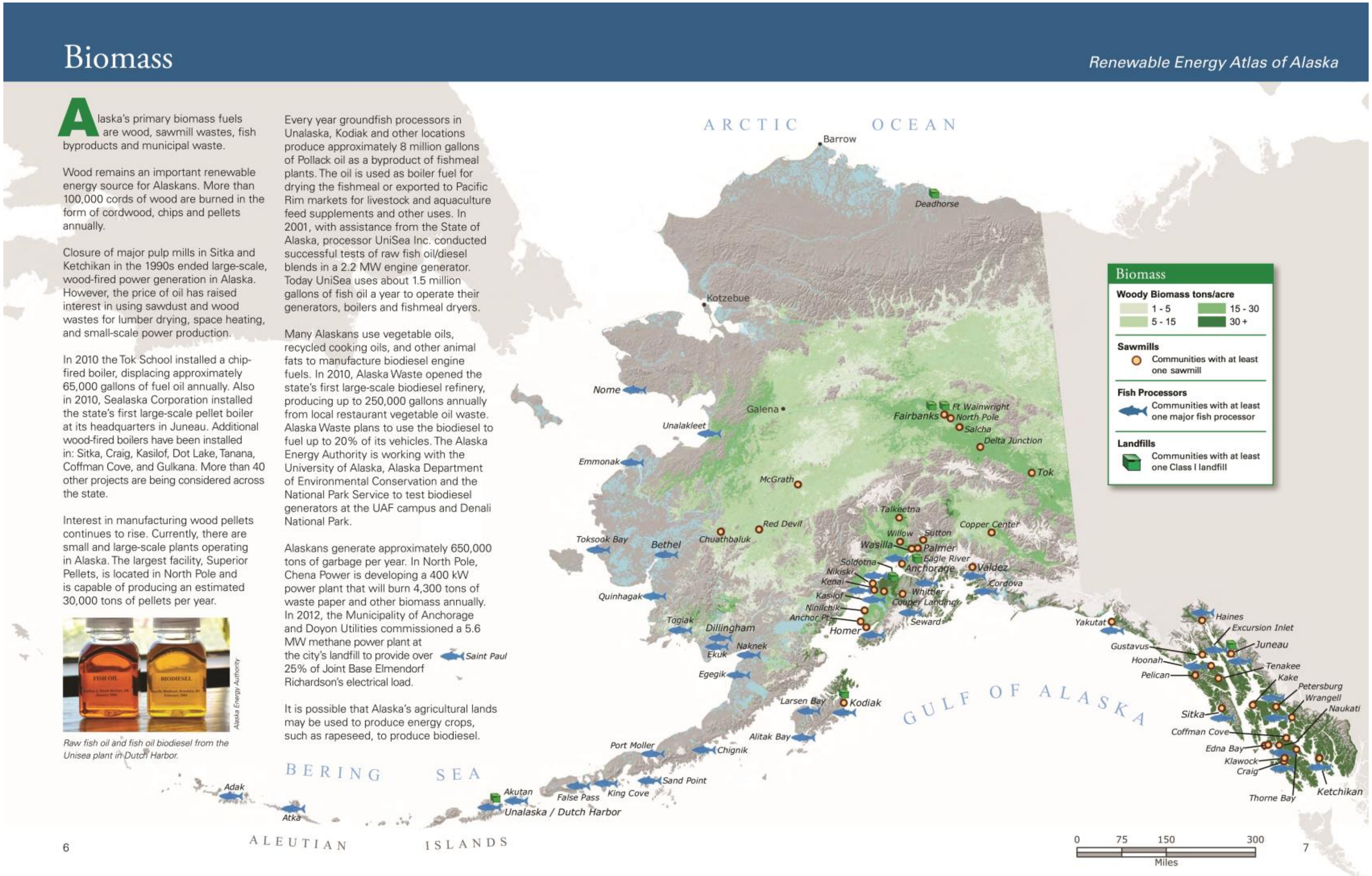


Alaska Resource Map – Biomass



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, Kasilof, 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.

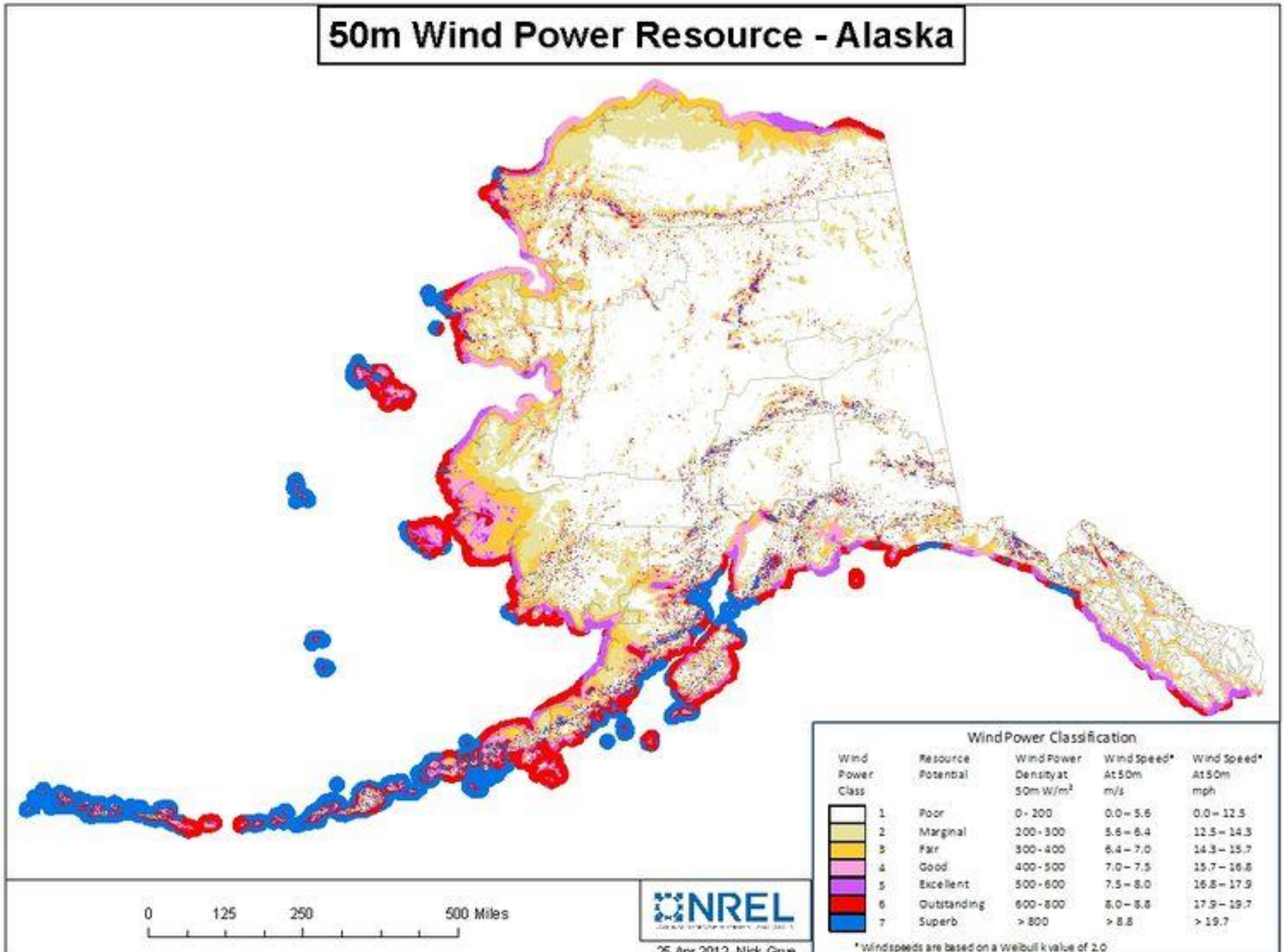
Every year groundfish processors in Unalaska, Kodiak and other locations produce approximately 8 million gallons of Pollack oil as a byproduct of fishmeal plants. The oil is used as boiler fuel for drying the fishmeal or exported to Pacific Rim markets for livestock and aquaculture feed supplements and 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.

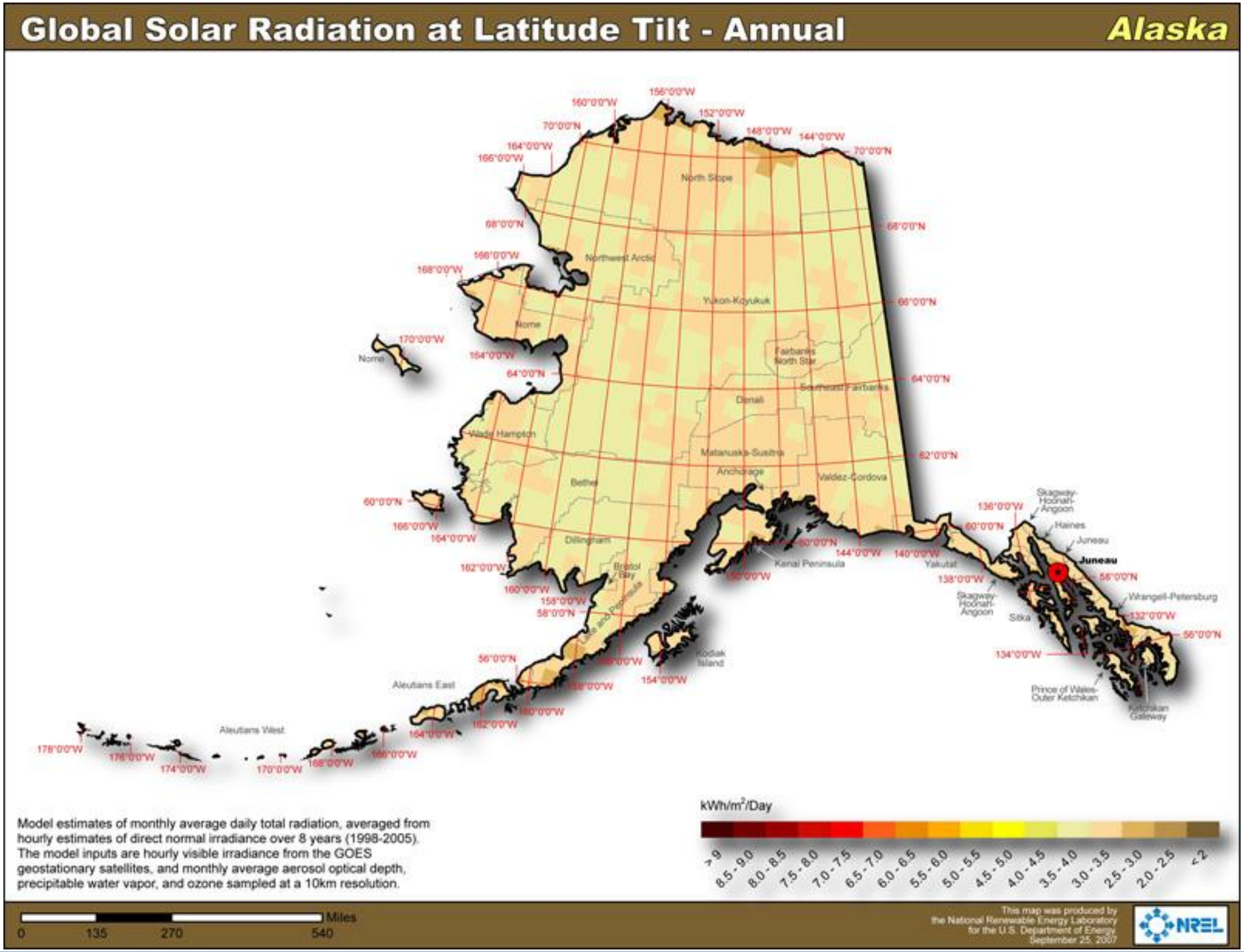
Alaskans generate approximately 650,000 tons of garbage per year. In North Pole, Chena Power is developing a 400 kW power plant that will burn 4,300 tons of waste paper and other biomass annually. In 2012, the Municipality of Anchorage and Doyon Utilities commissioned a 5.6 MW methane power plant at 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.

Wind Resources and Opportunity on Tribal Lands

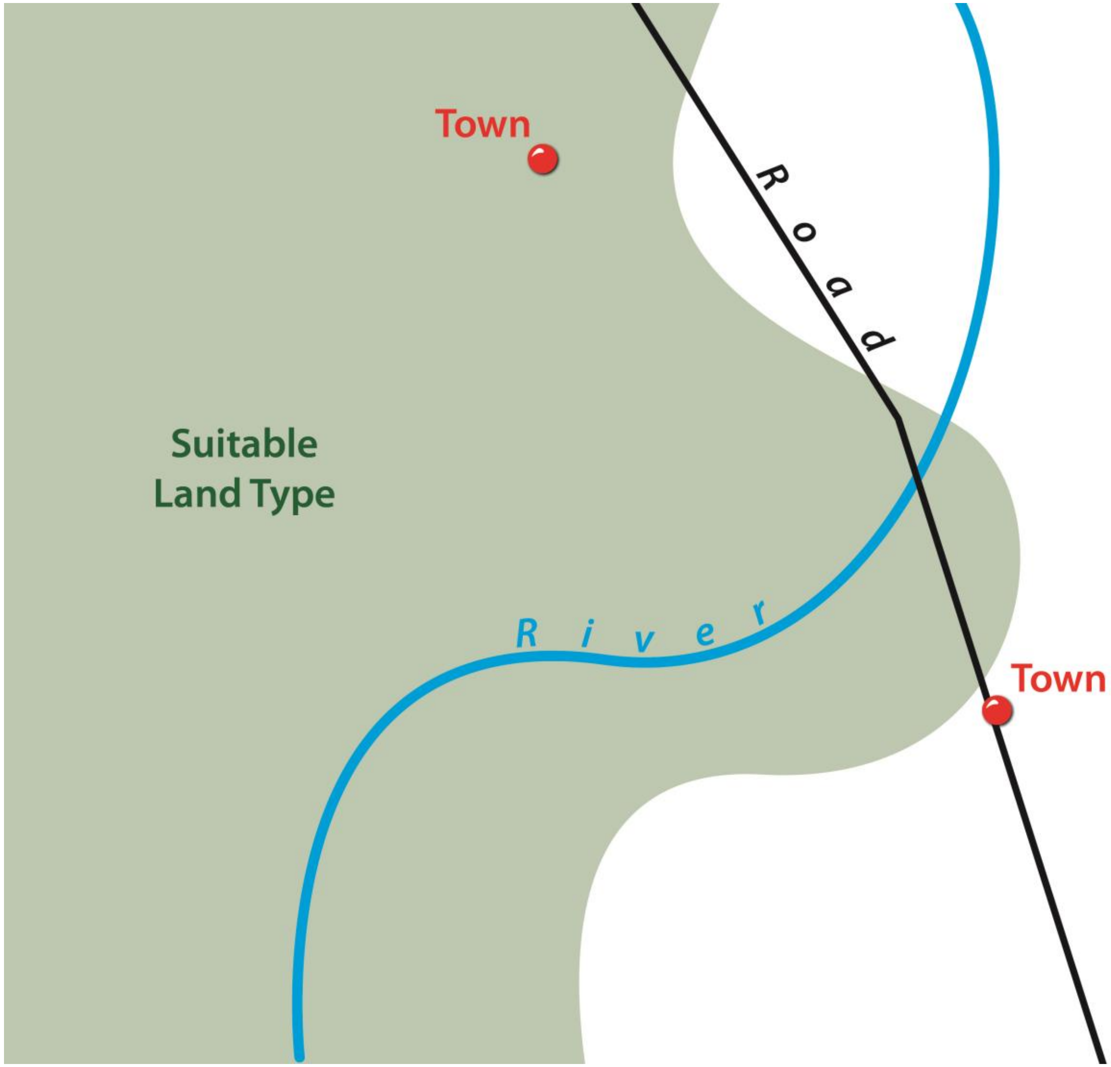


PV Solar Resource in Alaska

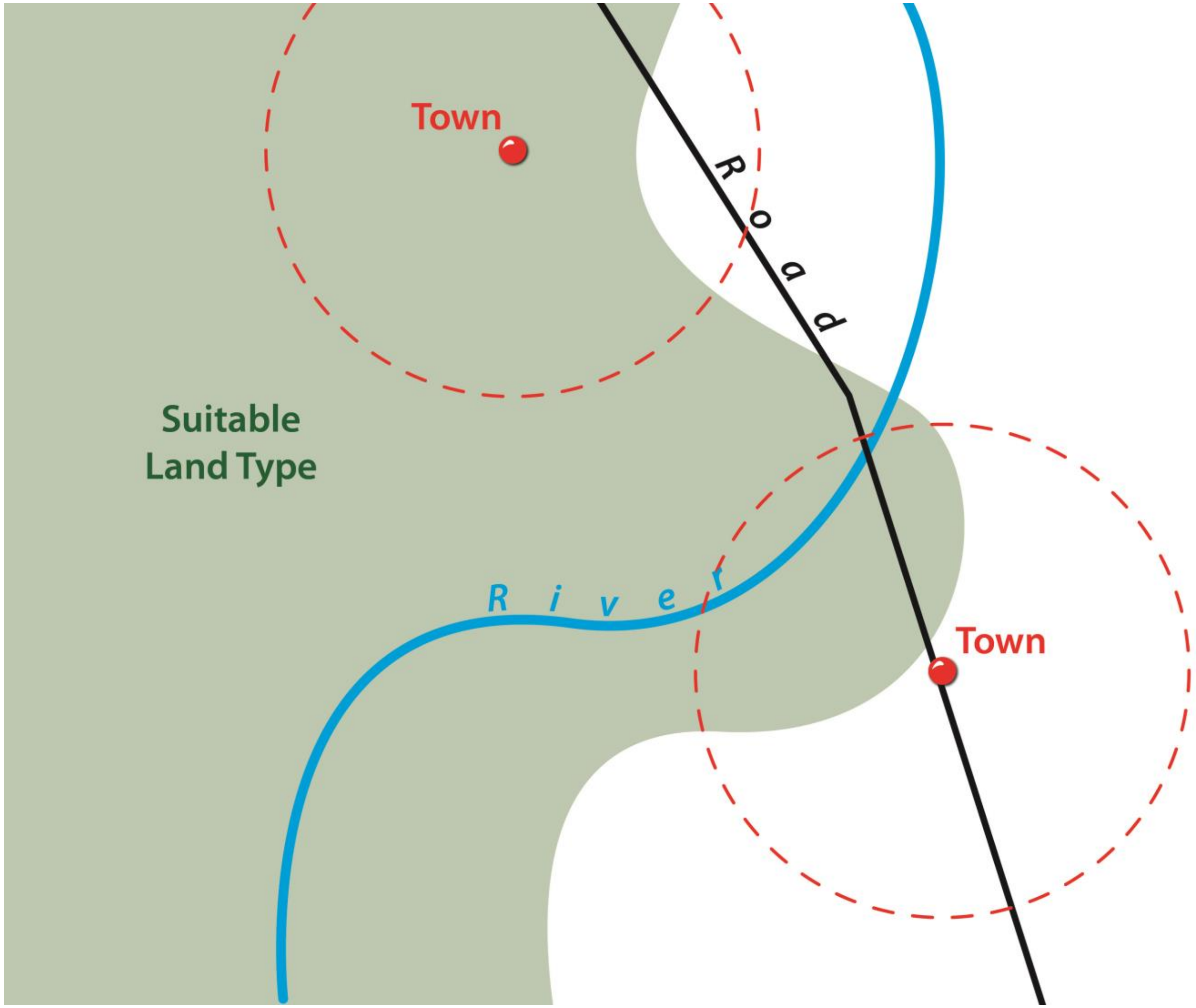


THE BEST SITE FOR YOUR RENEWABLES

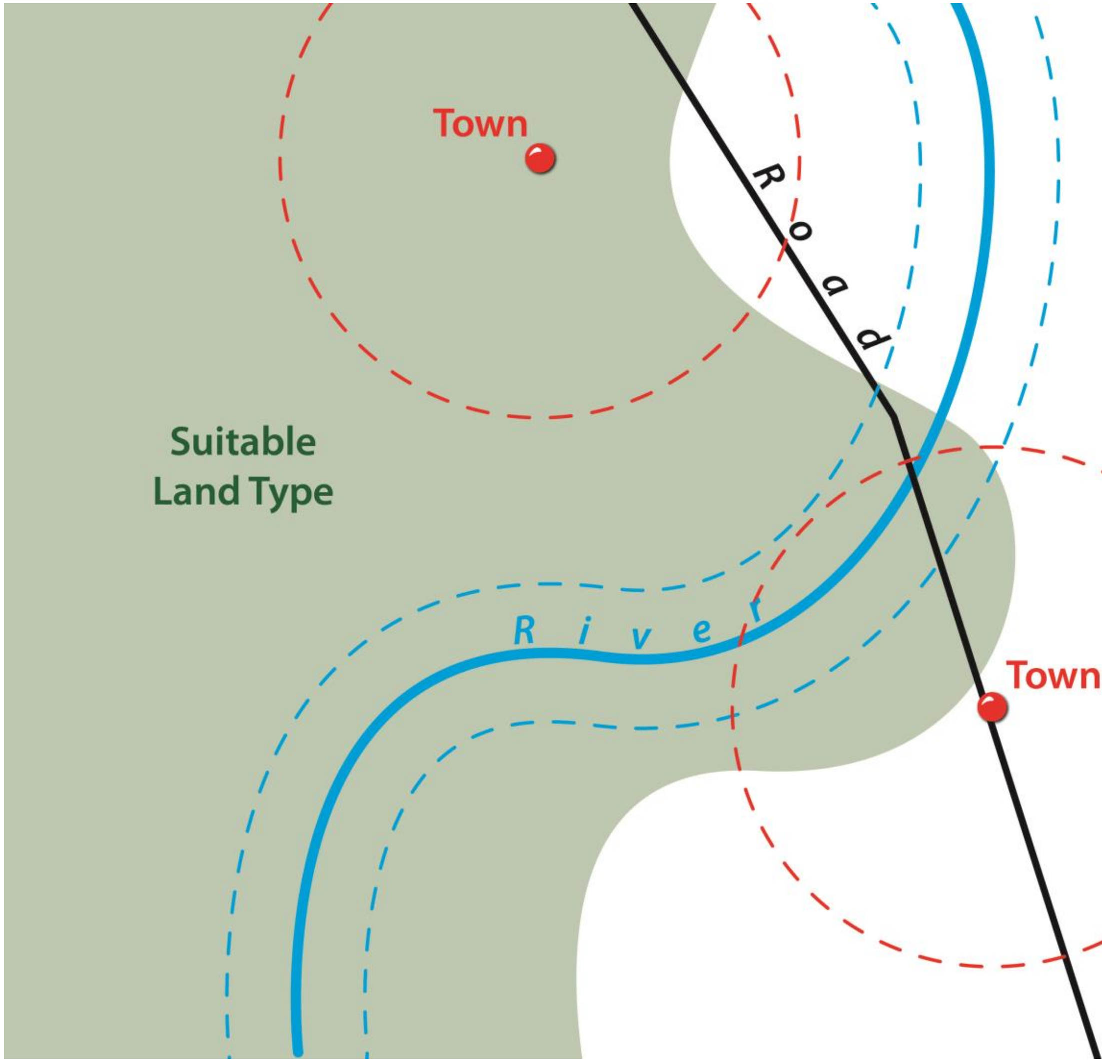
Initial Site Considerations - Community



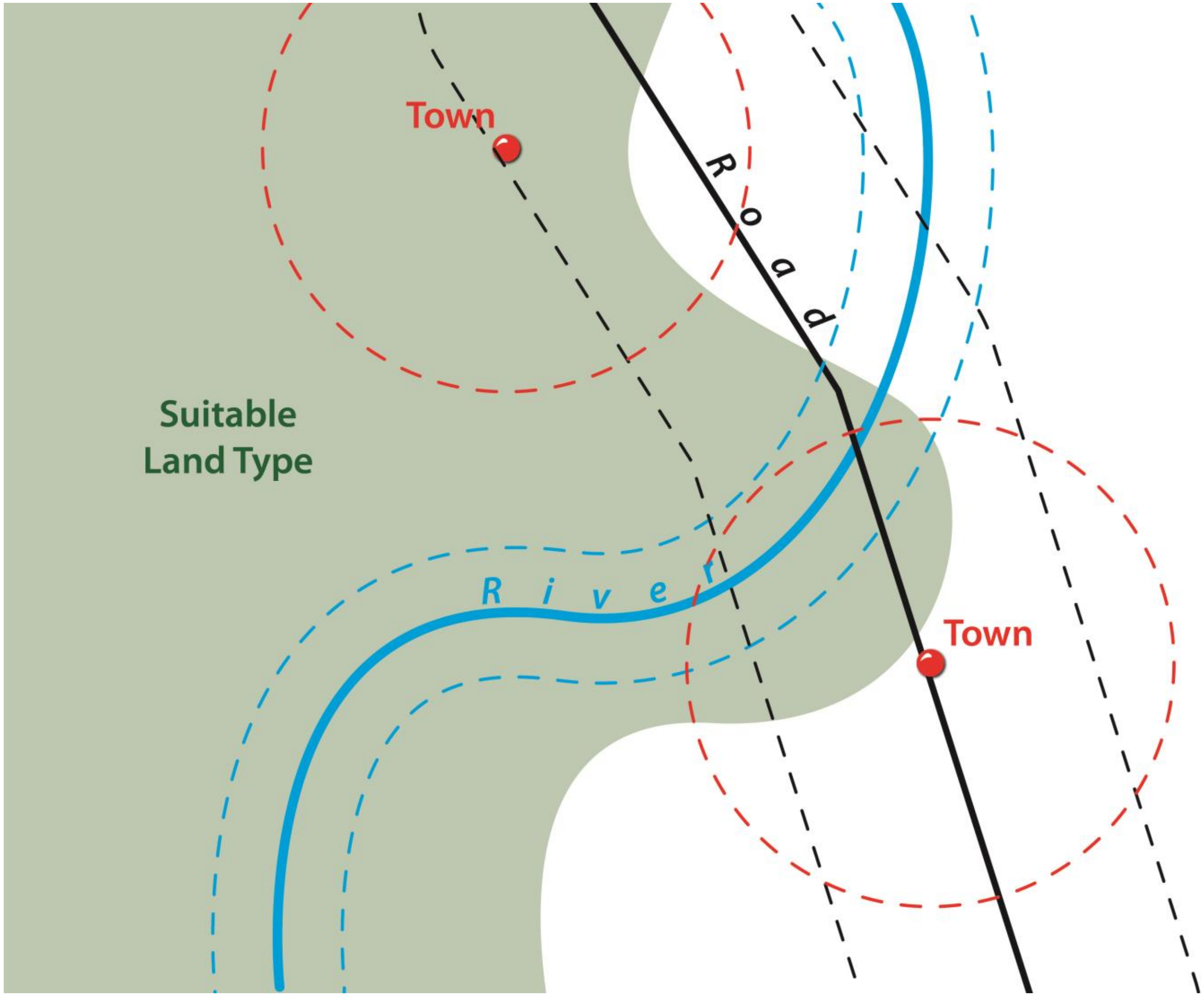
Initial Site Considerations – Urban Centers



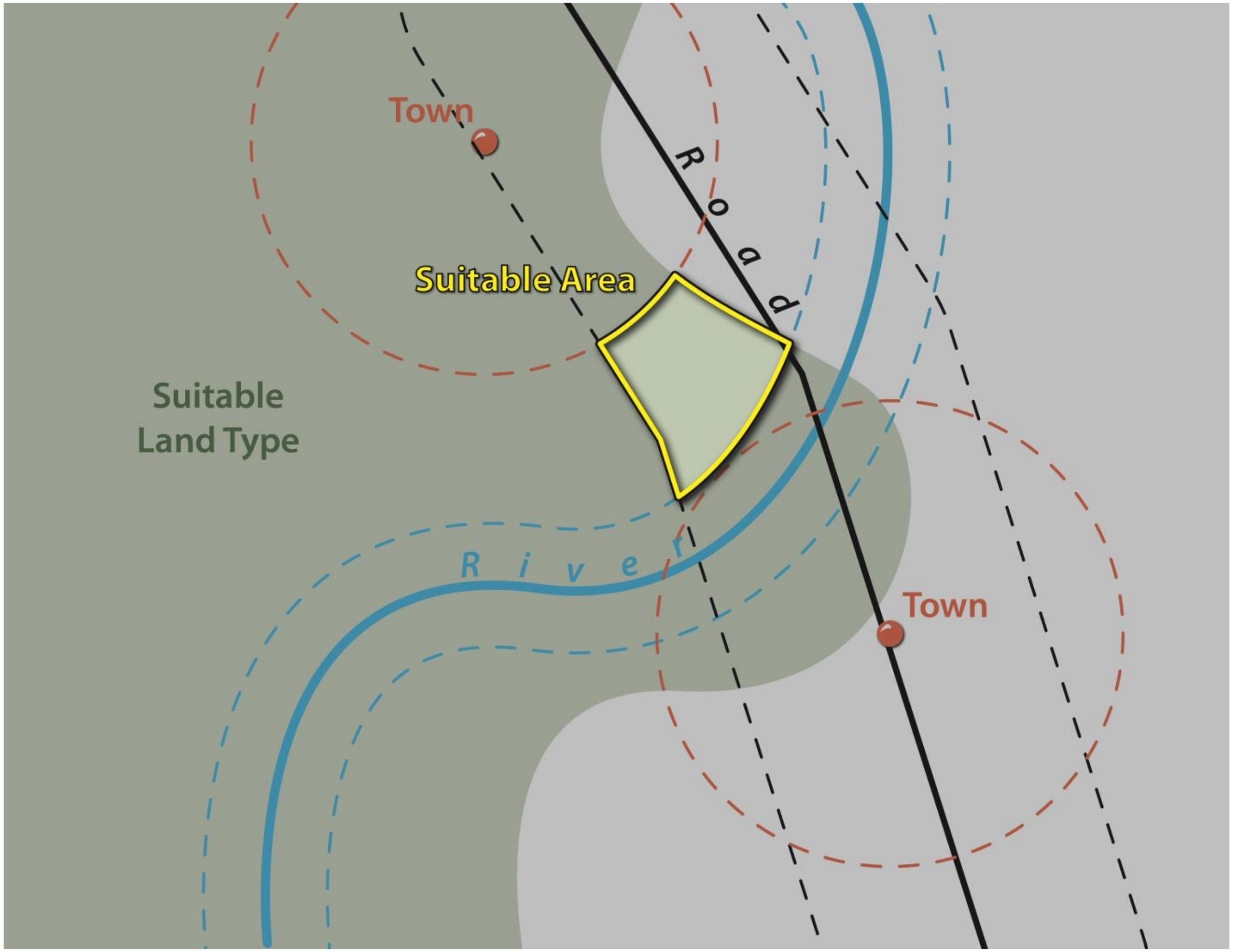
Initial Site Considerations - Rivers



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

Photo by Randy Hunsberger, NREL

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

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

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

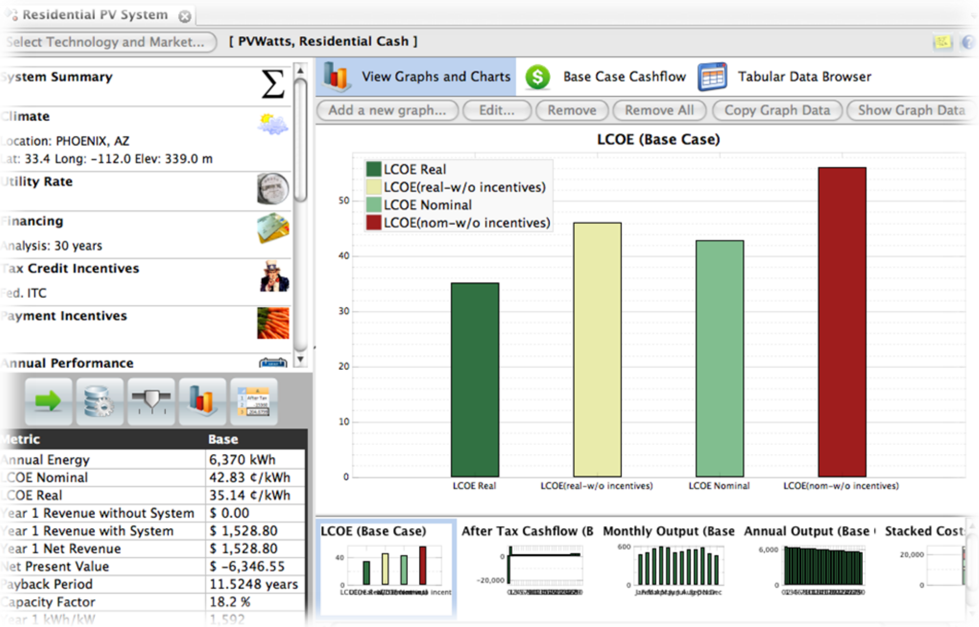
- At which energy scale does your community expect the most growth in energy demand?
- How much will you need?
- Will your community experience growth or reduced population?

System Advisor Model (SAM)

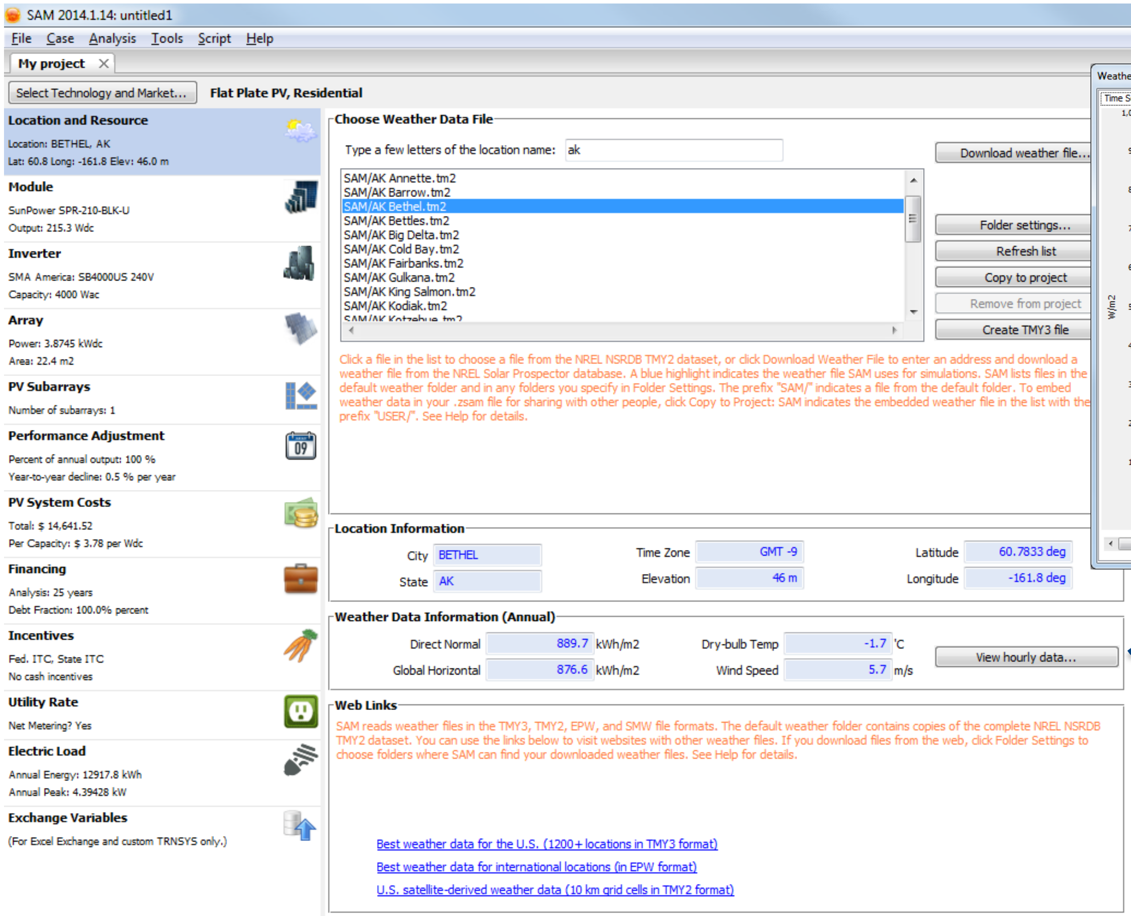
Available at: https://www.nrel.gov/analysis/sam/

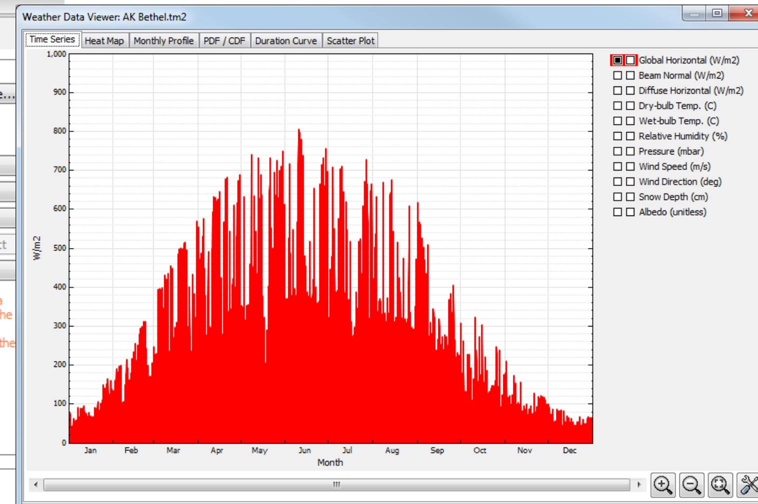
NREL's System Advisor Model (SAM) is a free computer program that **calculates a renewable energy system's hourly energy output** over a single year and **calculates the cost of energy** for a renewable energy project over the life of the project.

- 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



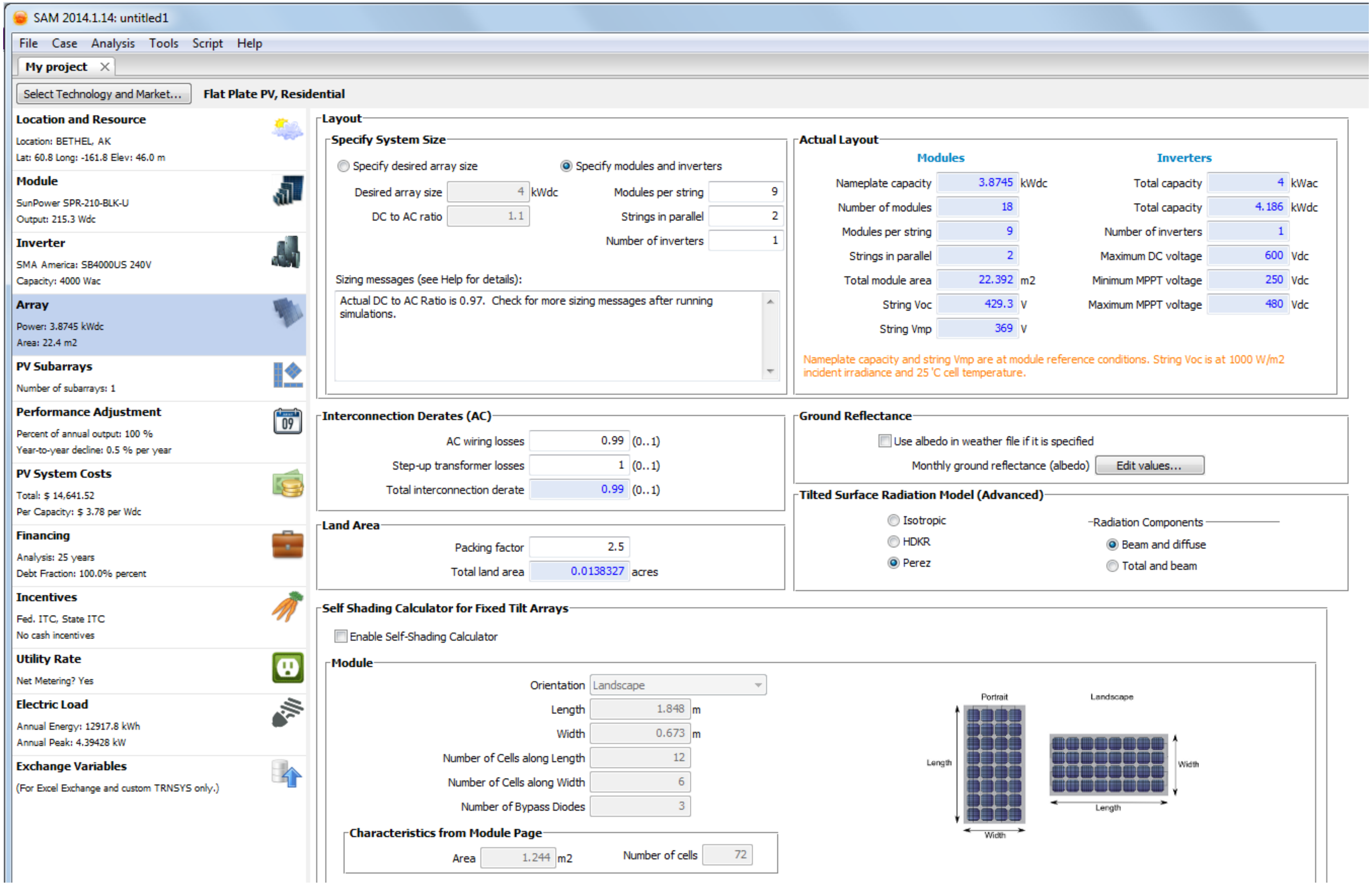
System Advisor Model: Location & Resource



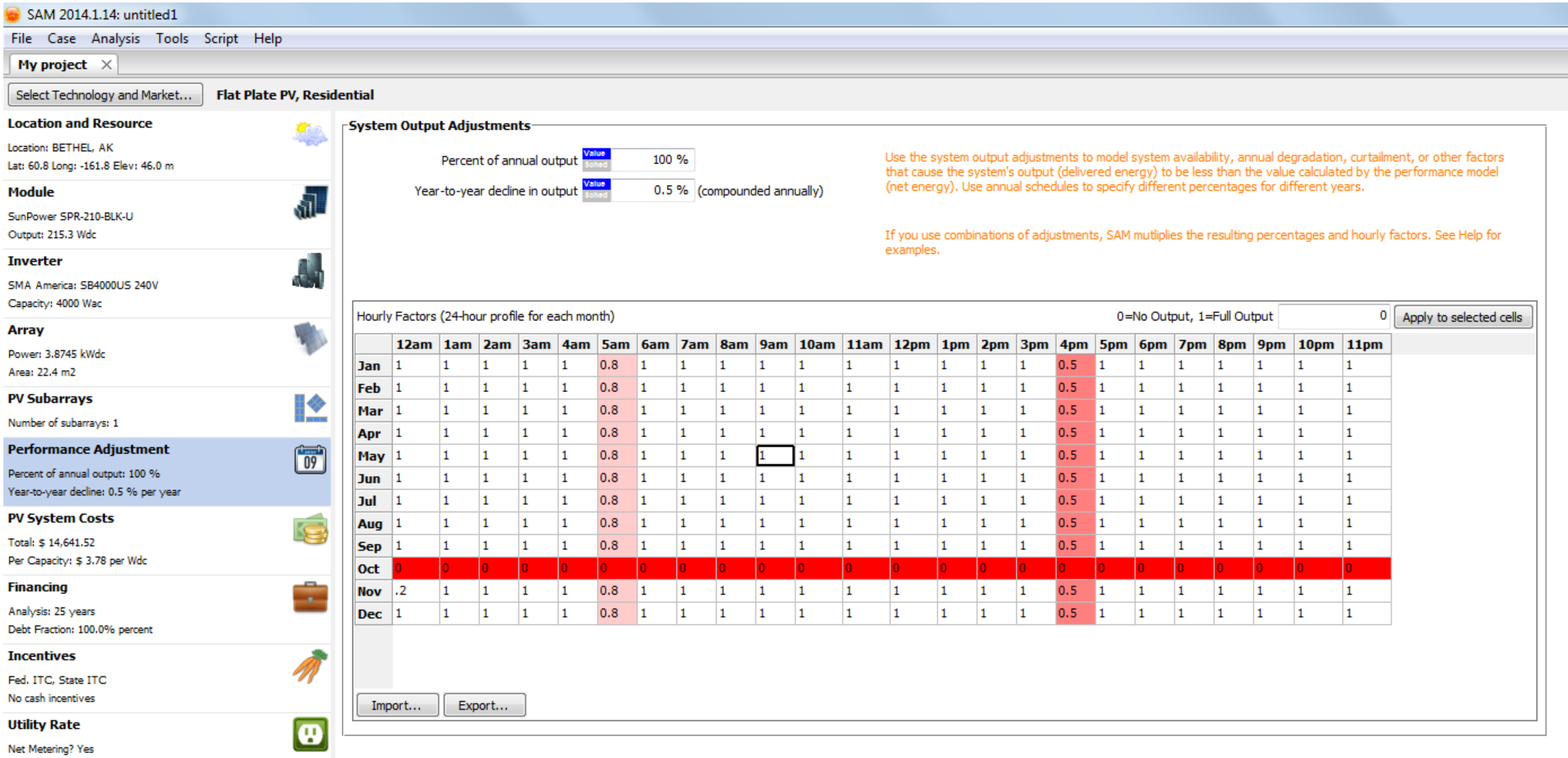


Hourly Weather Data

System Advisor Model: Array (# of panels)



System Advisor Model: Performance Adjustment



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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
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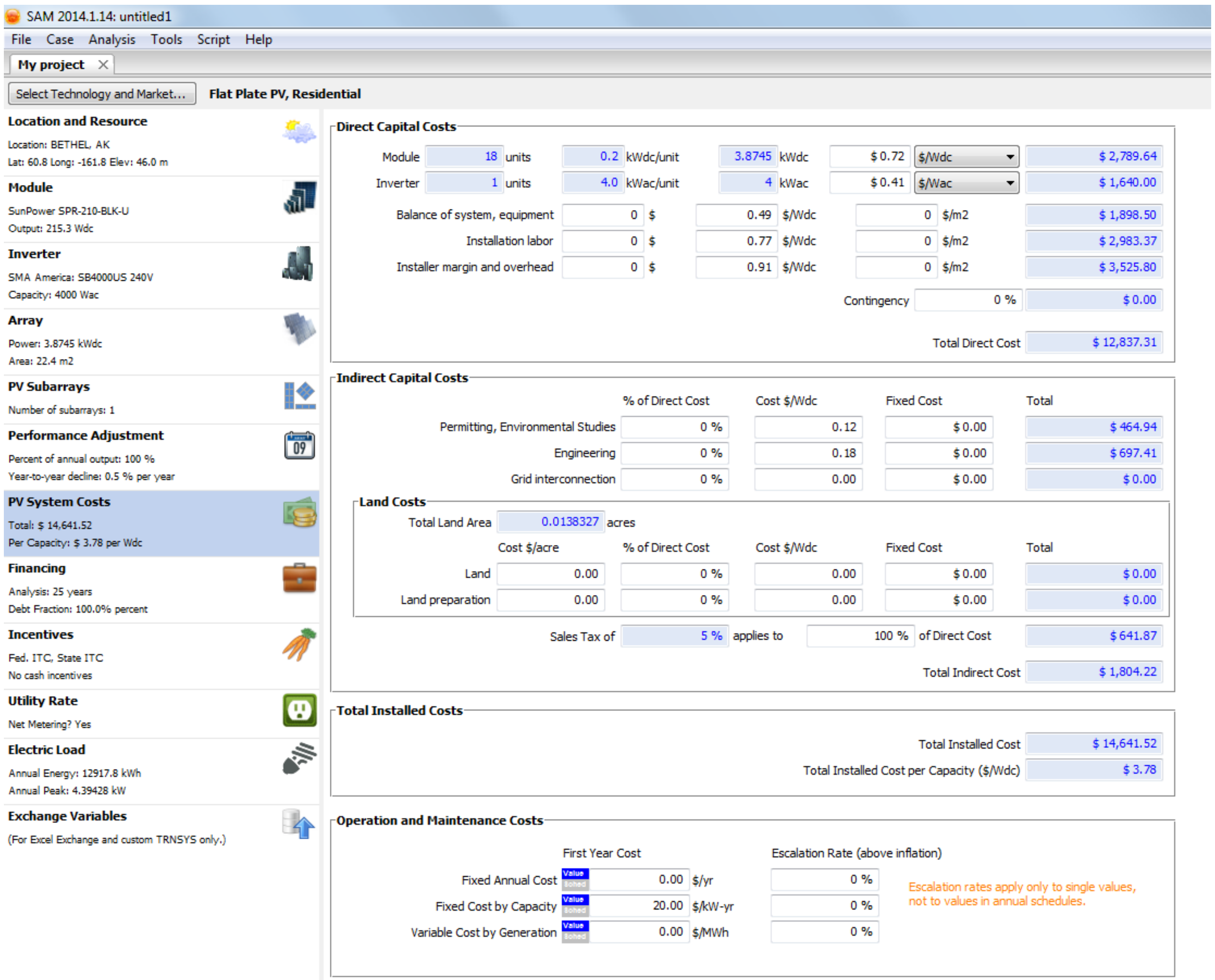
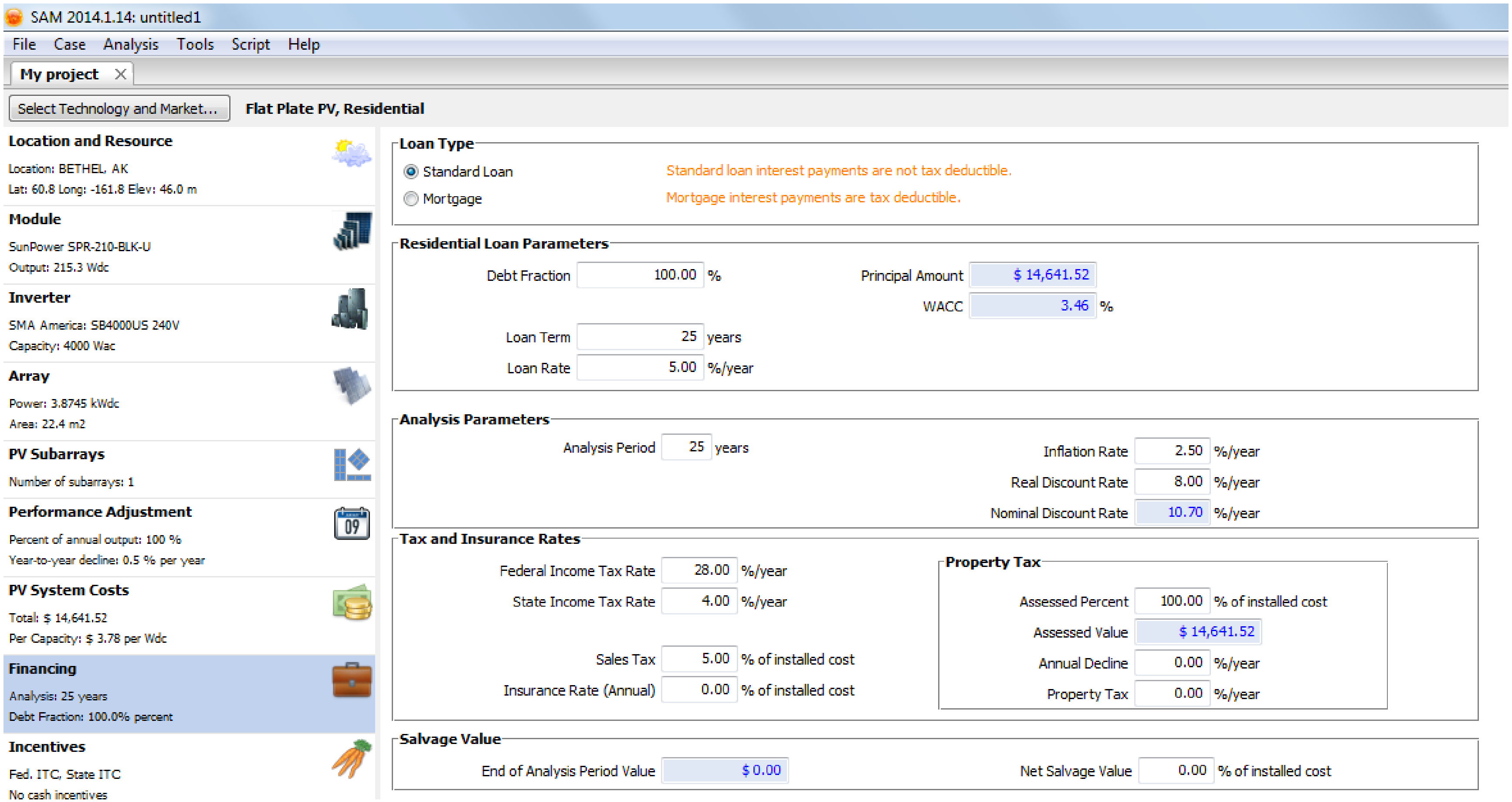
Oct	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nov	.2	1	1	1	1	0.8	1	1	1	1	1	1	1	1	1	1	0.5	1	1	1	1	1	1	1
Dec	1	1	1	1	1	0.8	1	1	1	1	1	1	1	1	1	1	0.5	1	1	1	1	1	1	1

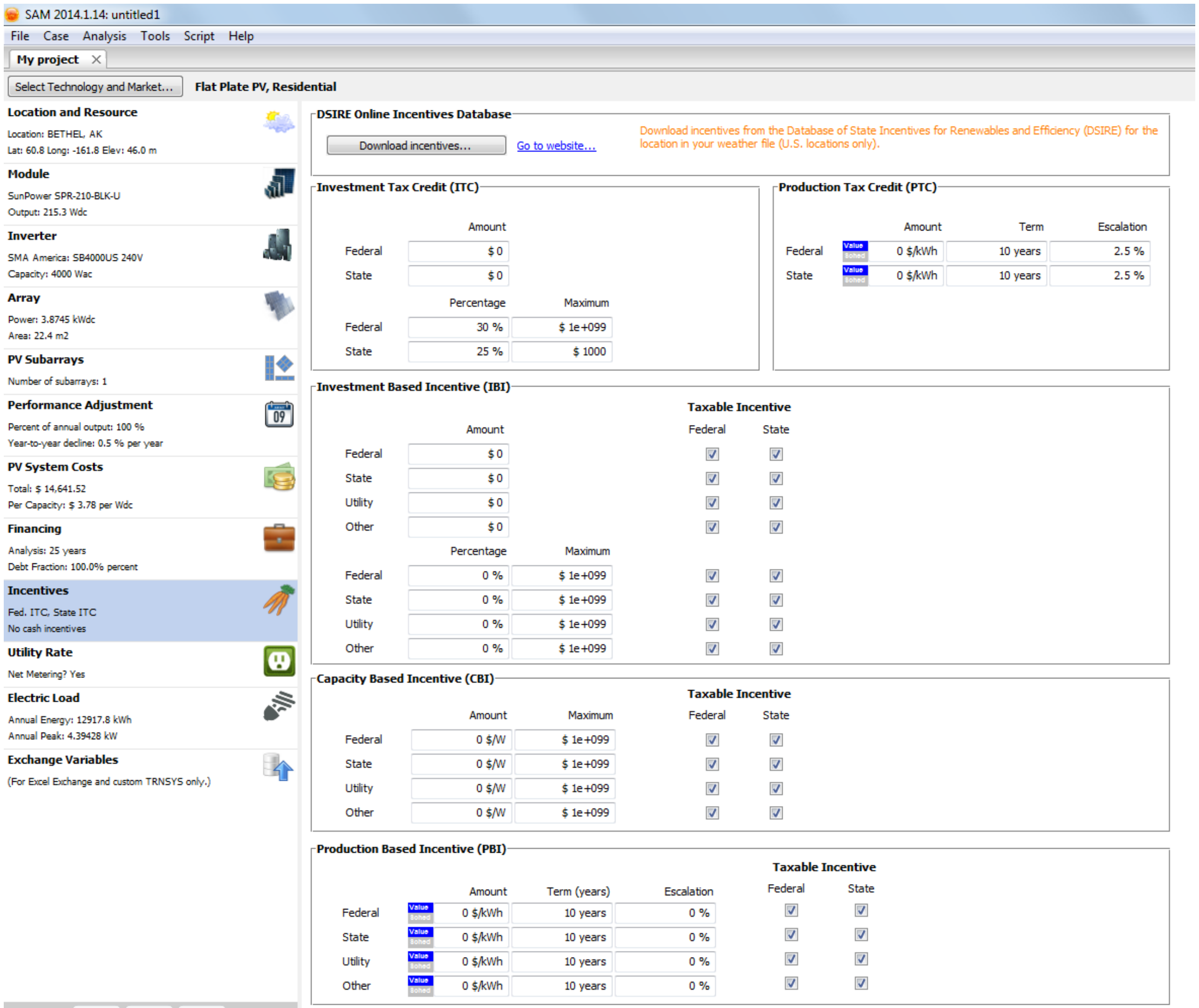
System Advisor Model: System Costs



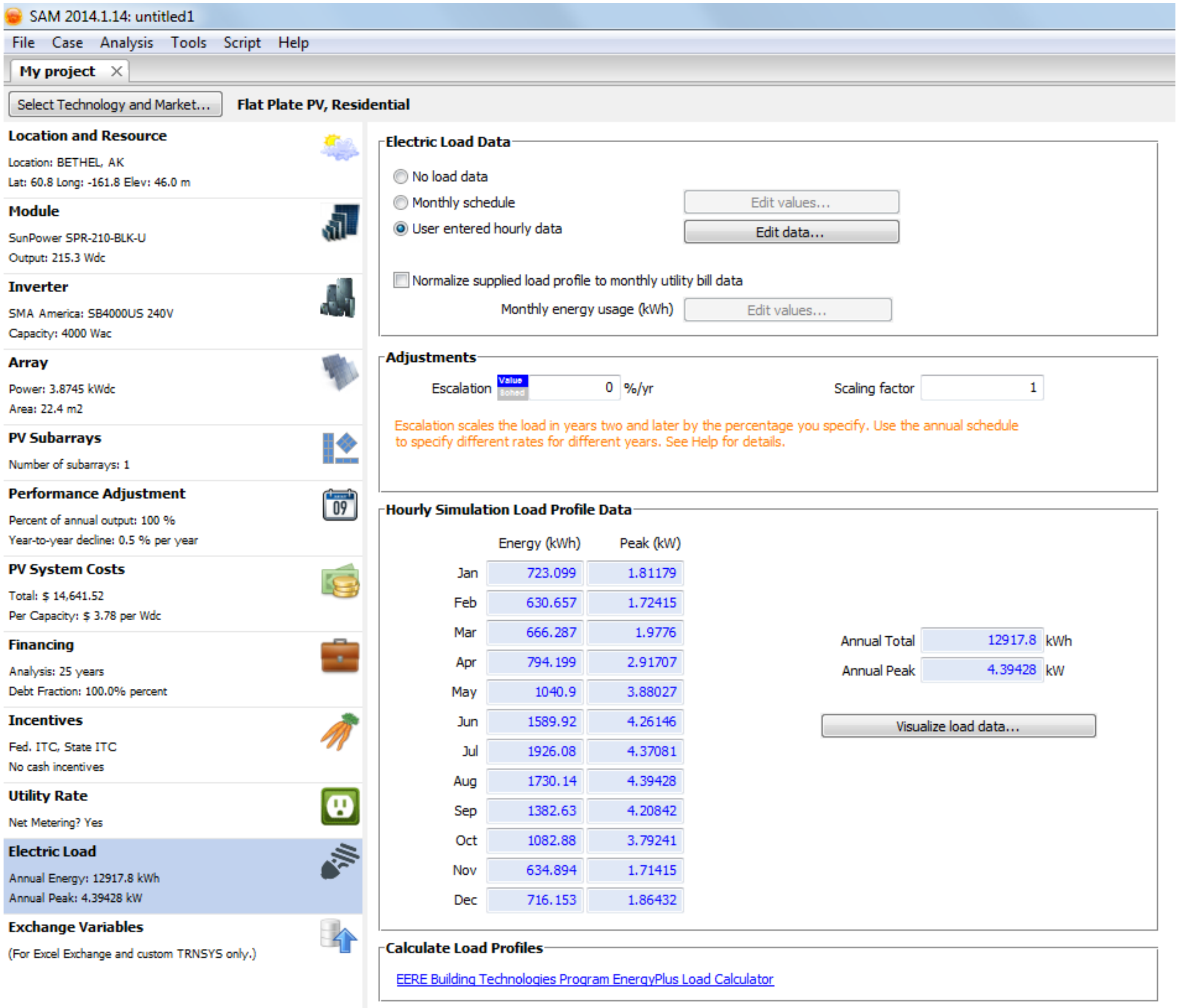
System Advisor Model: Financing



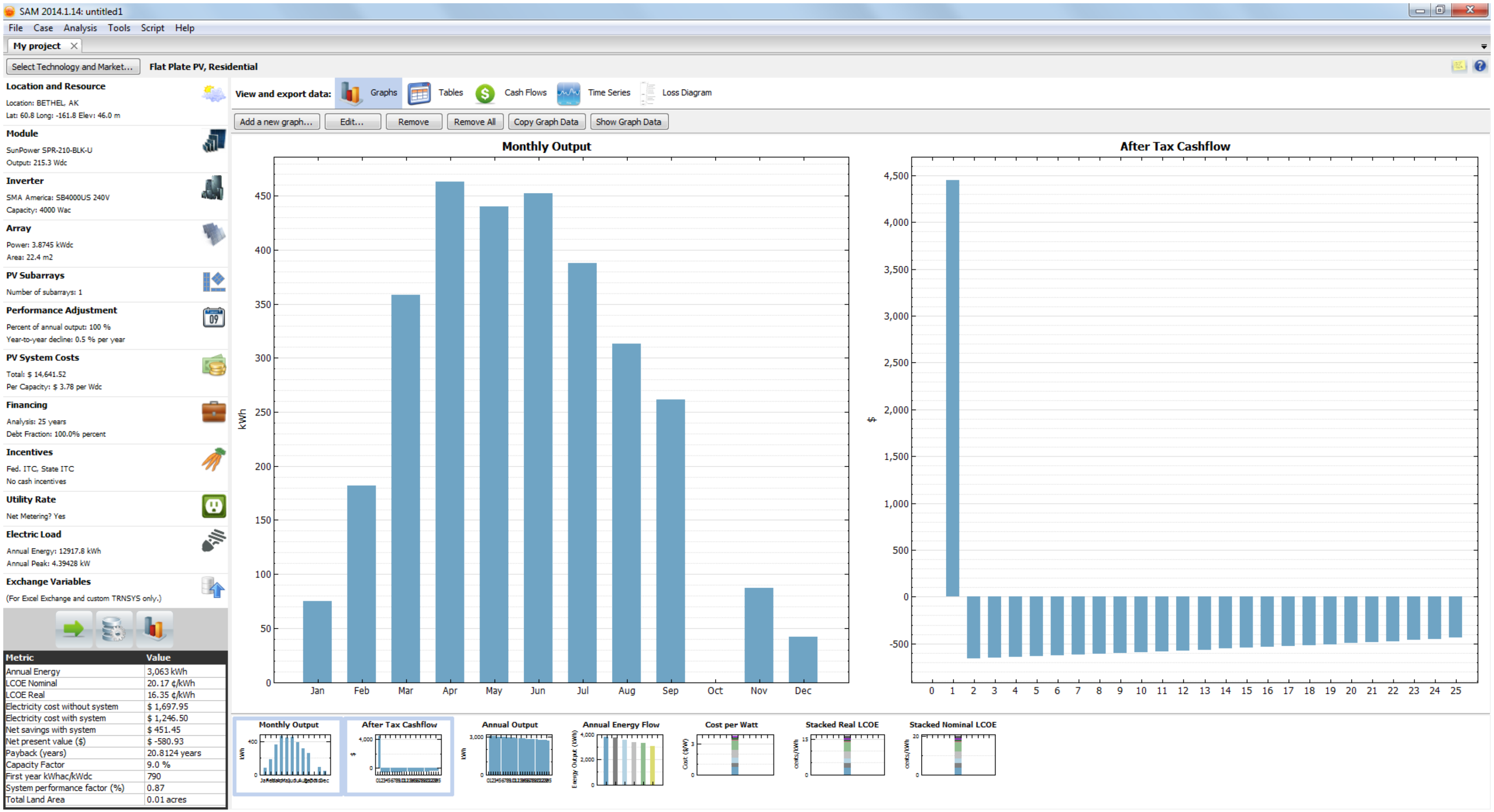
System Advisor Model: Incentives & Rebates



System Advisor Model: Electric Load



System Advisor Model: Outputs



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?

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

OPERATIONS AND MAINTENANCE

Operation and Maintenance Activities

- Administration;
  - billing; accounting;
  - hiring subcontractors,
  - enforcement of warranties
  - Economic optimization; management of budge 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

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