

Models & Tools for Evaluation of Project Options



**Tribal Energy Program Review
2015**

Lars Lisell

5/7/2015

Energy Audits/Energy Evaluation

- Envelope/Weatherization



- Lighting



- HVAC

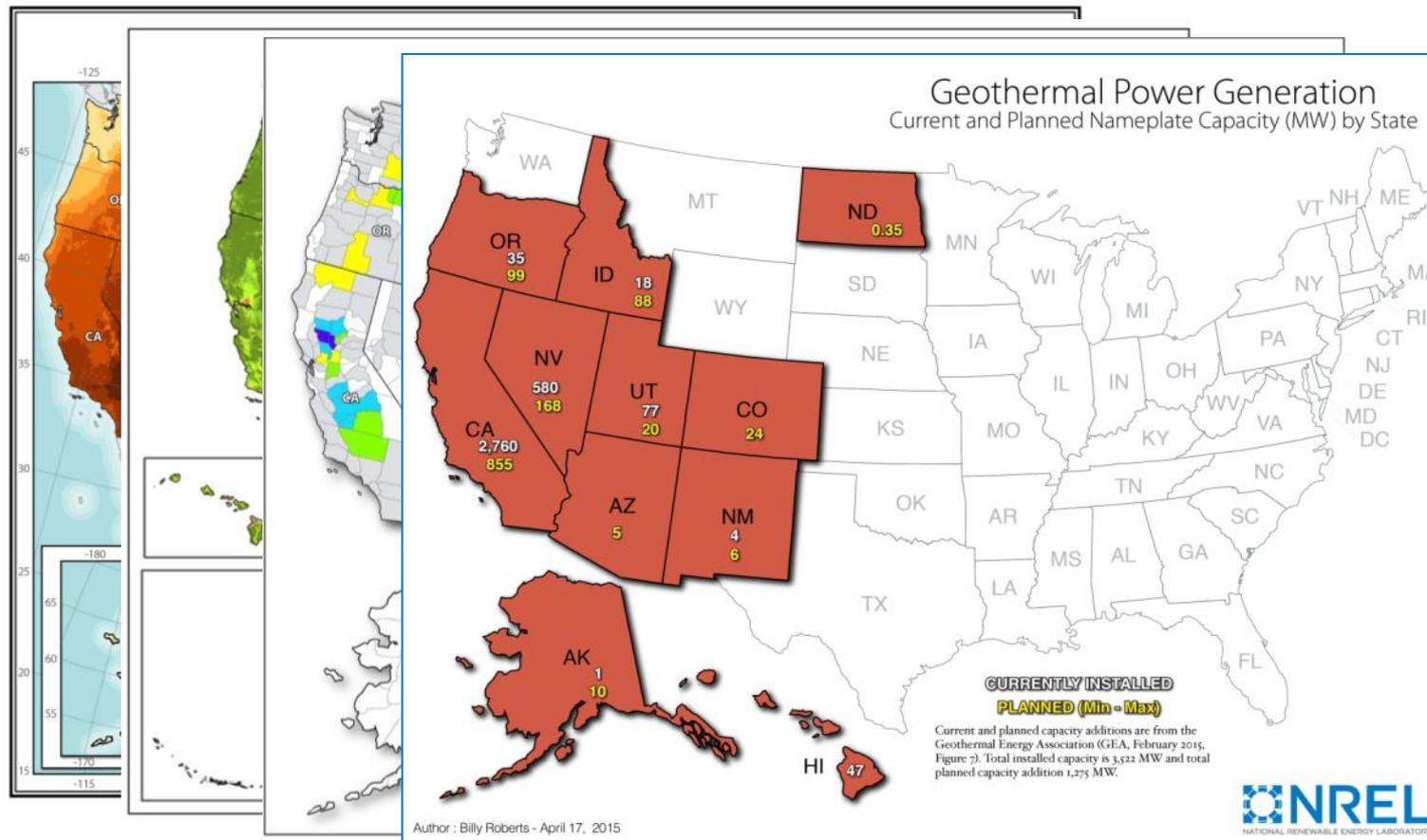


- Plug loads



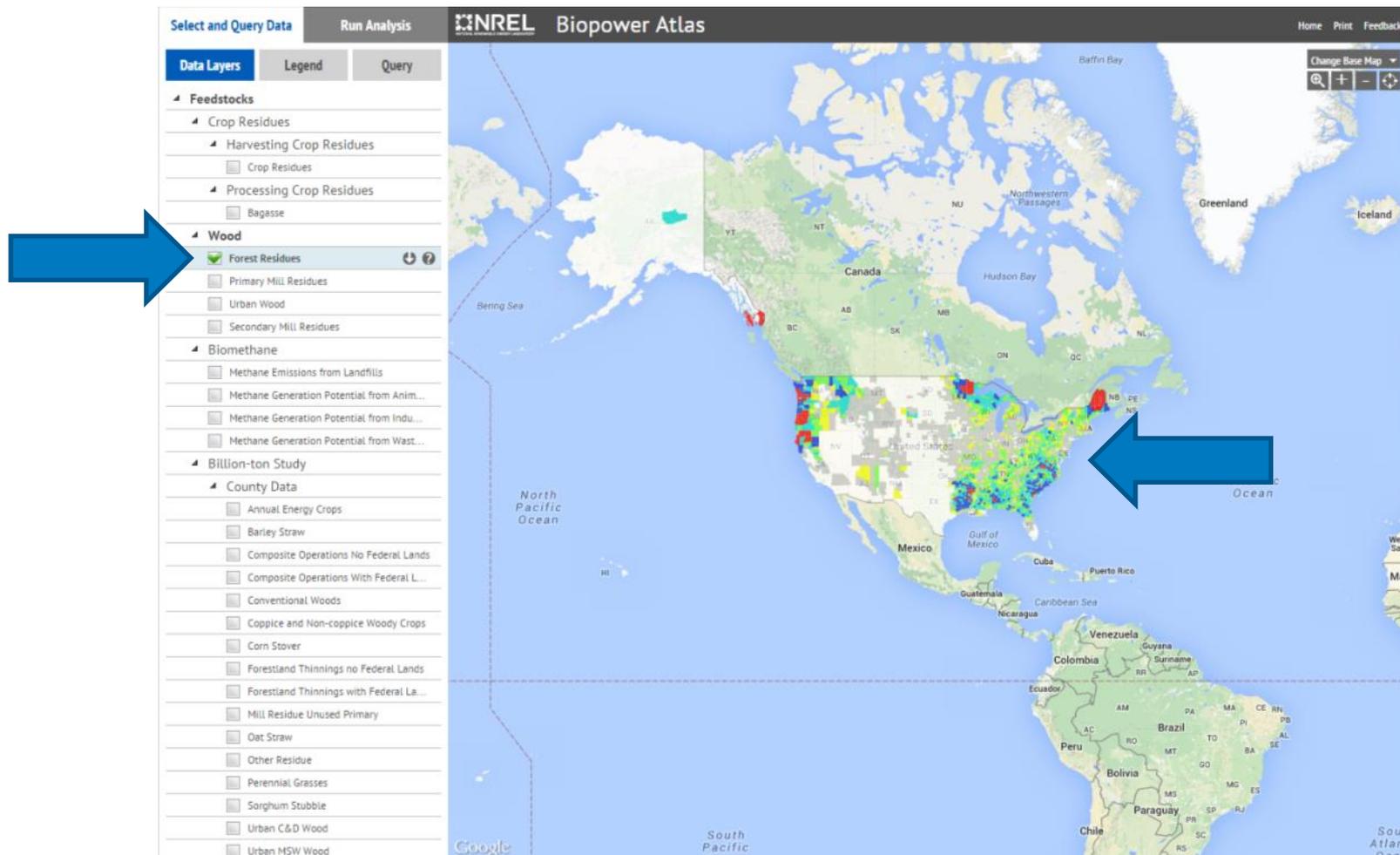
RE Resource Maps

- <http://www.nrel.gov/gis/>



RE Resource Maps

- Biopower Atlas



- <https://mapsbeta.nrel.gov/biopower-atlas/>

PVWatts® Calculator



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NREL's PVWatts® Calculator

Estimates the energy production and cost of energy of grid-connected photovoltaic (PV) energy systems throughout the world. It allows homeowners, small building owners, installers and manufacturers to easily develop estimates of the performance of potential PV installations.

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RESOURCE DATA SYSTEM INFO RESULTS

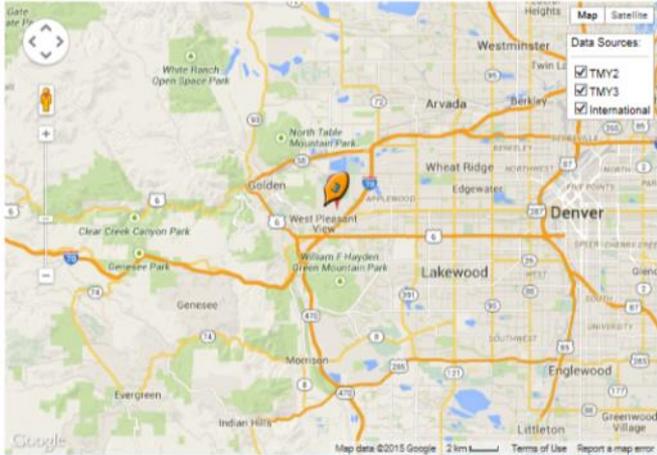
SOLAR RESOURCE DATA

The recommended weather data source is initially listed below. This is usually a good choice for your location, but you can optionally change the weather data using the map below.

Selected weather data for your location: **(TMY2) BOULDER, CO** 27 mi

Optionally, Select Different Weather Data

Currently, PVWatts® defaults to the closest TMY2 weather file (or international file). This will be the standard for the foreseeable future. We also offer the TMY3 locations and a 10 km gridded data set from SolarAnywhere®. We will not be including the older 40 km gridded data from PVWatts Version 2 as the other datasets are superior. The selected weather source pin is wrapped with a blue background. Click a different pin to select that source. If you enable SolarAnywhere® data for the continental US, then double-click anywhere on the map to select that grid cell (it must be enabled for each location). Refer to [Help](#) for more detailed information.



Map data ©2015 Google

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RESOURCE DATA **SYSTEM INFO** RESULTS

SYSTEM INFO

Modify the inputs below to run the simulation.

[RESTORE DEFAULTS](#)

DC System Size (kW): [i](#)

Module Type: [i](#)

Array Type: [i](#)

System Losses (%): [i](#) [Loss Calculator](#)

Tilt (deg): [i](#)

Azimuth (deg): [i](#)

[+ Advanced Parameters](#)

INITIAL ECONOMICS (Optional)

Modify the inputs below to provide an initial rough estimate of the cost of energy produced by the system. Note that complex utility rates and third-party financing can significantly change these values

System Type: [i](#)

Average Cost of Electricity Purchased from Utility (\$/kWh): [i](#)

Initial Cost (\$/Wdc): [i](#)

Draw Your System
Click below to customize your system on a map. (optional)



[Go to resource data](#) [Go to PVWatts[®] results](#)

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RESOURCE DATA **SYSTEM INFO** RESULTS

SYSTEM INFO

Modify the inputs below to run the simulation.

DC System Size (kW): [?](#)

Module Type: [?](#)

[RESTORE DEFAULTS](#)

Draw Your System

Click below to customize your system on a map. (optional)

[Go to resource data](#) [Go to PVWatts[®] results](#)

Customize Your System To Your Roof

On the map below, click the corners of the desired system. Note that the roof tilt and azimuth cannot be automatically determined from the aerial imagery, and consequently the estimated system capacity may not reflect what is actually possible.

System Capacity: 34.6 kWdc (231 m²)



[RESET](#) [CANCEL](#) [SAVE](#)

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ALL NREL SOLAR TOOLS



Go to
system info

RESOURCE DATA
SYSTEM INFO
RESULTS

RESULTS

52,907 kWh per Year *

[Print Results](#)

Month	Solar Radiation (kWh / m ² / day)	AC Energy (kWh)	Energy Value (\$)
January	3.57	3,232	296
February	4.21	3,380	310
March	5.61	4,921	451
April	6.15	5,084	466
May	6.46	5,396	494
June	6.74	5,316	487
July	6.60	5,250	481
August	6.44	5,122	469
September	5.99	4,702	431
October	4.99	4,186	383
November	3.80	3,250	298
December	3.38	3,069	281
Annual	5.33	52,908	\$ 4,847

User Comments

Optionally, add comments to include in the print out.

[Download Results: Monthly](#) | [Hourly](#)
[Find A Local Installer](#)


 * Caution: Photovoltaic system performance predictions calculated by PVWatts include many inherent assumptions and uncertainties and do not reflect variations between PV technologies nor site-specific characteristics except as represented by PVWatts inputs. For example, PV modules with better performance are not differentiated within PVWatts from lesser performing modules. Similarly, the "Energy Value" column simply multiplies the utility-average electricity price by production. Complex utility rates and financing can significantly impact the energy value. See [Help](#) for additional guidance.

Location and Station Identification

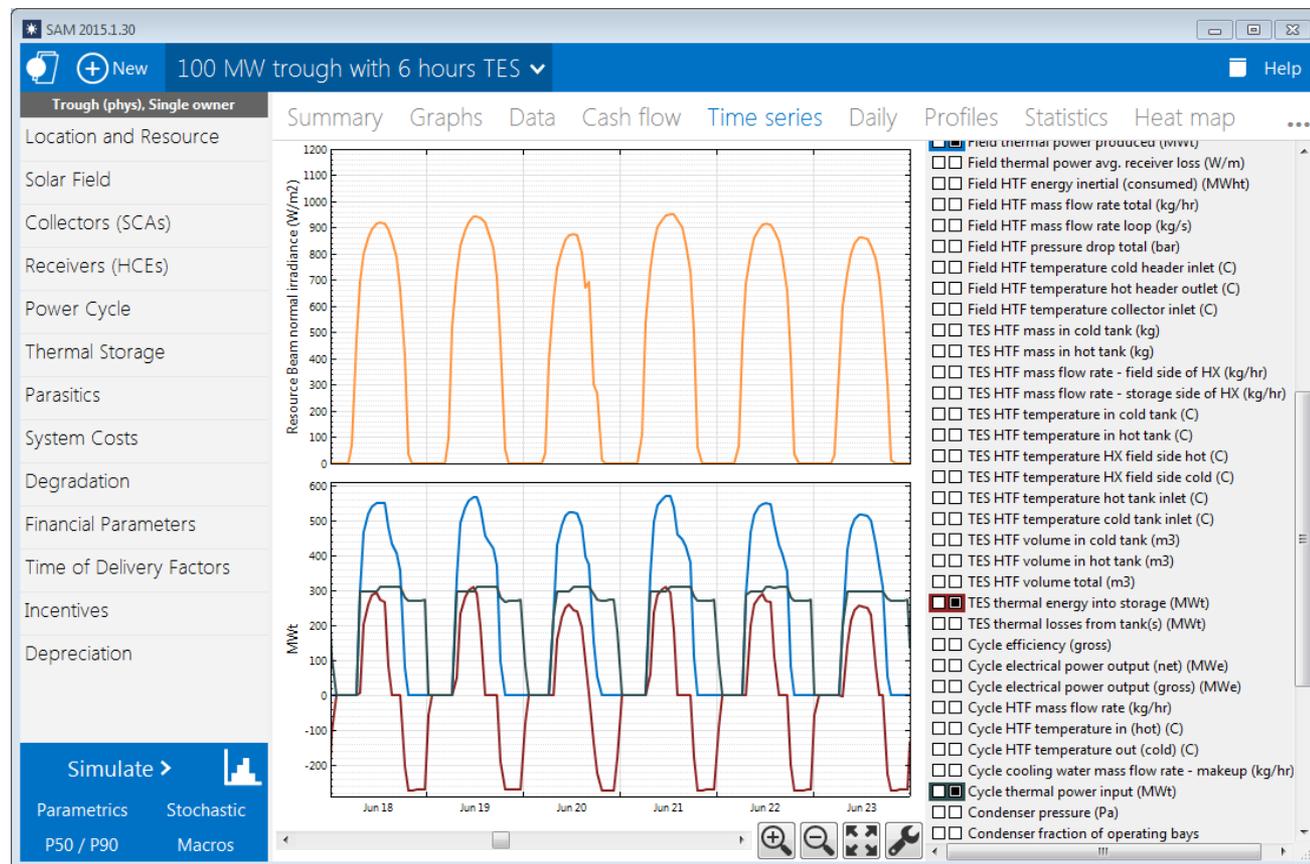
Requested Location	nrel
Weather Data Source	(TMY2) BOULDER, CO 27 mi
Latitude	40.029 N



- **Detailed Performance and Economic Model**
 - Component level inputs, hourly outputs

- **Analysis Types**

- Photovoltaic (PV)
- Solar Hot Water
- Concentrating Solar Power
- Wind
- Biomass Power
- Geothermal Power
- Generic System



- **Screening Level Evaluation Tool**

- Excel based tool with extensive technology list for EE and RE Systems

- **Analysis Types**

- Photovoltaic (PV)
- Solar Hot Water
- Concentrating Solar Power
- Wind
- Biomass Power
- Geothermal Power
- Tidal Power
- Wave Power
- Heat pump
- Solar Vent Preheat
- Envelope

The screenshot displays the RETScreen International software interface. At the top, it features the Canadian flag and the text 'Natural Resources Canada' and 'Ressources naturelles Canada'. The main header includes the 'RETScreen International' logo with a red maple leaf, the website 'www.etscreen.net', and the tagline 'Clean Energy Project Analysis Software'. The interface is divided into two main sections: 'Project information' and 'Site reference conditions'. The 'Project information' section includes fields for 'Project name', 'Project location', 'Prepared for', 'Prepared by', 'Project type' (set to 'Energy efficiency measures'), 'Facility type' (set to 'Commercial'), 'Analysis type' (set to 'Method 1'), and 'Heating value reference' (set to 'Higher heating value (HHV)'). There is also a 'Show settings' checkbox. The 'Site reference conditions' section includes a 'Climate data location' field set to 'Ottawa Int'l Airport' and a 'Show data' checkbox. At the bottom, there are logos for NASA, UNEP, GEF, and reeep, along with the text 'Complete Energy Model sheet'. The footer contains the version 'RETScreen4 2012-06-01', the copyright '© Minister of Natural Resources Canada 1997-2012', and 'NRCan/CanmetENERGY'.

Other Useful Resources

- **Open EI – www.openEI.org**
- **DSIRE USA – www.dsireusa.org**
- **Tribal Energy Program Website - <http://apps1.eere.energy.gov/tribalenergy/index.cfm>**
- **NREL Website - www.nrel.gov**
- **Regional Resource Centers DOE - <http://apps2.eere.energy.gov/wind/windexchange/regional.asp>**

Priorities: Where to Install Solar

- 1. On the “Built Environment” where unshaded – size to capacity (kW) and load (kWh & thermal)**
 - a. On existing building roofs that have an expected life of at least 15 more years and can accept added load. Reduces solar load on building. NEPA categorical exclusion.
 - b. On ALL new buildings – all new building should be “solar ready”, see <http://www.nrel.gov/docs/fy10osti/46078.pdf>
 - c. Over parking areas, pedestrian paths, etc. – energy generation and nice amenity.
- 2. On compromised lands such as landfills & brownfields.**
 - a. Saves green fields for nature.
- 3. IF installed on green fields minimize site disturbance, plant native low height vegetation as needed.**

Examples of RE Analysis with Tribes

- **Pascua Yaqui Tribe near Tucson, AZ**



Scenario 1 – System Purchase

System Capacity:	2,865 kW
LCOE Nominal:	\$0.193/kWh
LCOE Real:	\$0.148/kWh
Annual Energy Savings:	5,209,462 kWh/yr
Implementation Costs:	\$10,399,950
Simple Payback Period:	21.9 years

Scenario 2 – Power Purchase Agreement (PPA)

System Capacity:	2,865 kW
LCOE Nominal:	\$0.104/kWh
LCOE Real:	\$0.117/kWh
Annual Energy Savings:	5,209,462 kWh/yr
Implementation Costs:	\$0
First Year PPA Price:	\$0.104/kWh

Examples of RE Analysis with Tribes

- Pueblo of Picuris outreach
 - Hosted TEP Strategic Energy Planning Workshop August 2014
 - Created a strategic energy plan with the Northern Pueblo Housing Authority.
 - Performed a feasibility analysis of rooftop vs community solar through leveraging TA with NREL, NAU, and Grid Alternatives.
 - Kit Carson Utility has since agreed to purchase any extra solar power produced. Picuris have indicated they will be applying for START assistance to finish all of the feasibility work needed to get the project going.





Thanks!

lars.lisell@nrel.gov