

DOE OFFICE OF INDIAN ENERGY

# Foundational Courses

# Assessing Energy Needs & Resources

Presented by the National Renewable Energy Laboratory



U.S. DEPARTMENT OF  
**ENERGY**

Office of  
Indian Energy

# Course Outline

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## What we will cover...

- About the DOE Office of Indian Energy Education Initiative
- Course Introduction
- Resource Mapping
- Tools to Evaluate Costs and Resources
  - PVWatts; IMBY; SAM; CREST; OpenPV; Solar Prospector
  - OpenEI; Transparent Cost Database; JEDI
- Data Challenges & Solutions: Information Sharing
- Additional Information & Resources



## Introduction

The U.S. Department of Energy (DOE) Office of Indian Energy Policy & Programs is responsible for assisting Tribes with energy planning and development, infrastructure, energy costs, and electrification of Indian lands and homes.

As part of this commitment and on behalf of DOE, the Office of Indian Energy is leading *education* and *capacity building* efforts in Indian Country.

# Training Program Objective & Approach

Foundational courses were created to give tribal leaders and professionals background information in renewable energy development that:

- *Present foundational information on strategic energy planning, grid basics, and renewable energy technologies;*
- *Break down the components of the project development process on the commercial and community scale; and*
- *Explain how the various financing structures can be practical for projects on tribal lands.*

# NREL's Presenter on Energy Needs and Resources is Mr. Nate Blair

Mr. Nate Blair, M.B.A., M.S.

[Nate.Blair@nrel.gov](mailto:Nate.Blair@nrel.gov)

Mr. Nate Blair is the group manager of the Data Analysis and Visualization Group and the Energy Forecasting and Modeling Group in the Strategic Energy Analysis Center at the National Renewable Energy Laboratory (NREL). Mr. Blair has been at NREL for 10 years and has been developing renewable energy and efficiency system modeling for 20 years. He has worked on tools such as TRNSYS, REEDS, WinDS, SAM, PVWatts, and others. Mr. Blair has an M.B.A. and an M.S. in mechanical engineering from the University of Wisconsin-Madison; and a B.A. in physics from Gustavus Adolphus College.

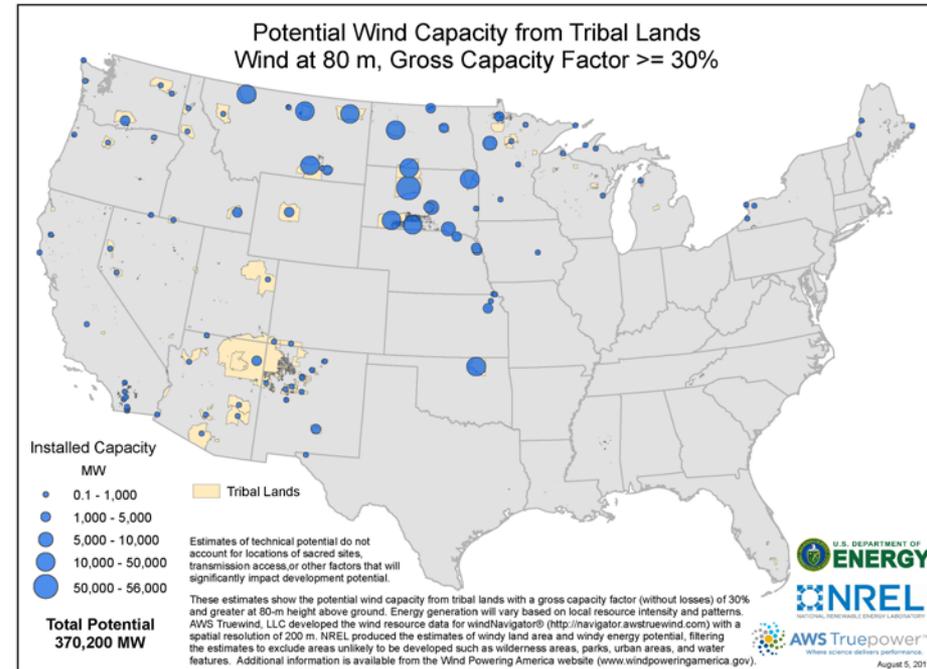
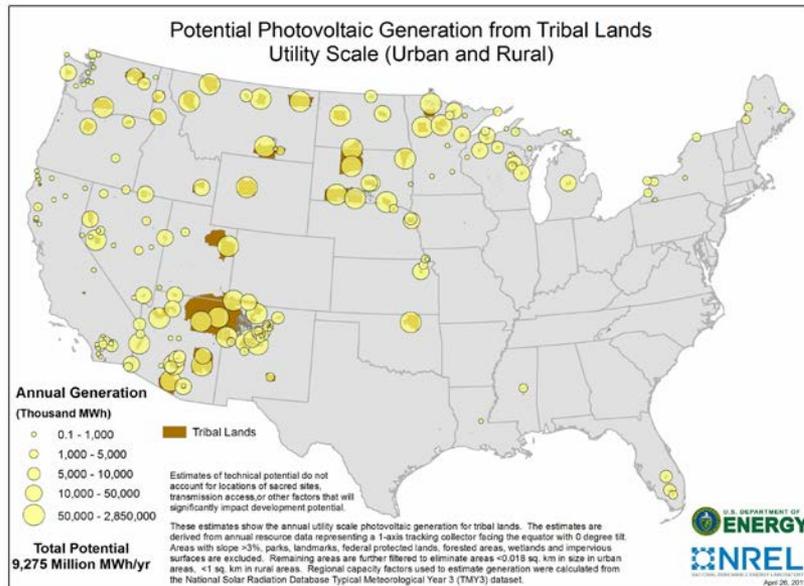
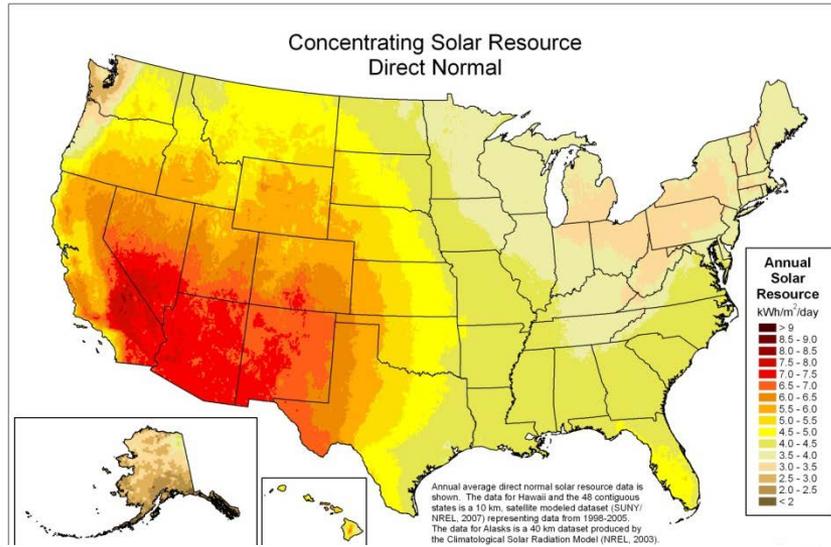


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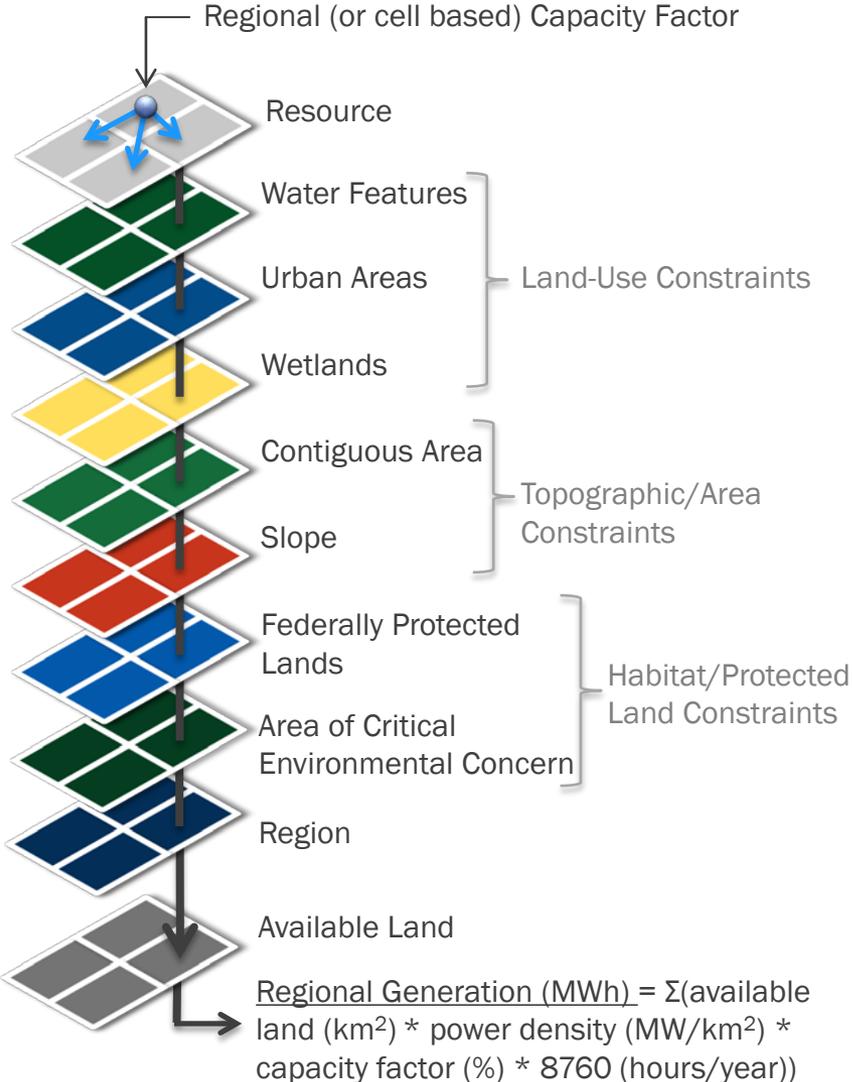
# Renewable Energy Resource Mapping (Regional and Tribal)



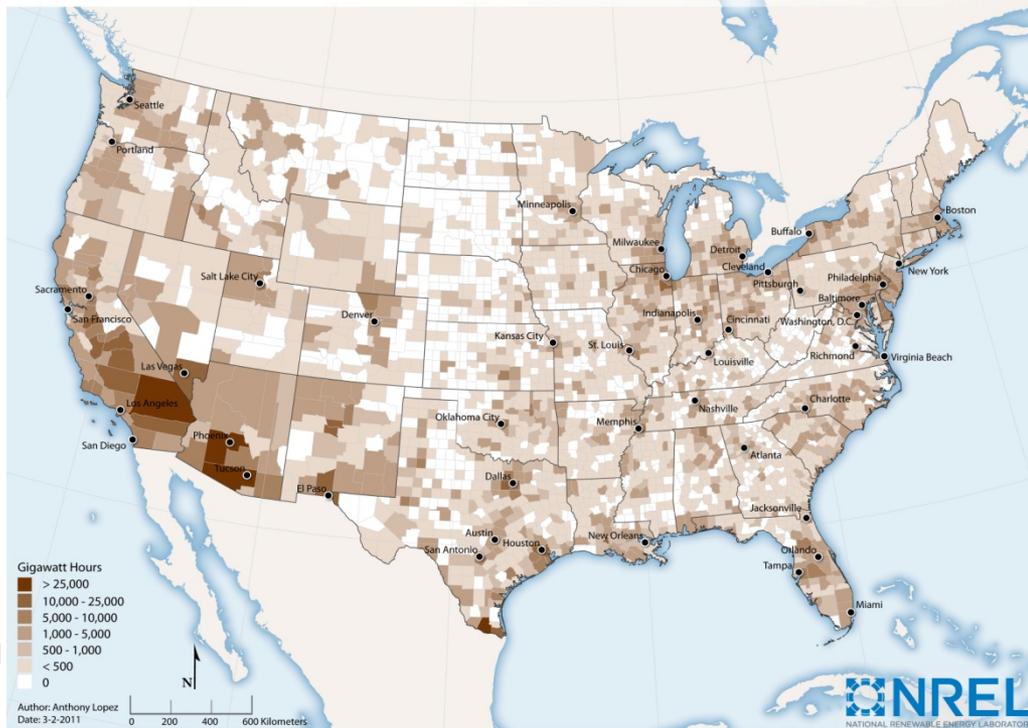
# Renewable Resource Characterization & Technical Potential

## Layer Stacking

Regional (or cell based) Capacity Factor



## PV Utility (Urban) Technical Potential - U.S. Counties



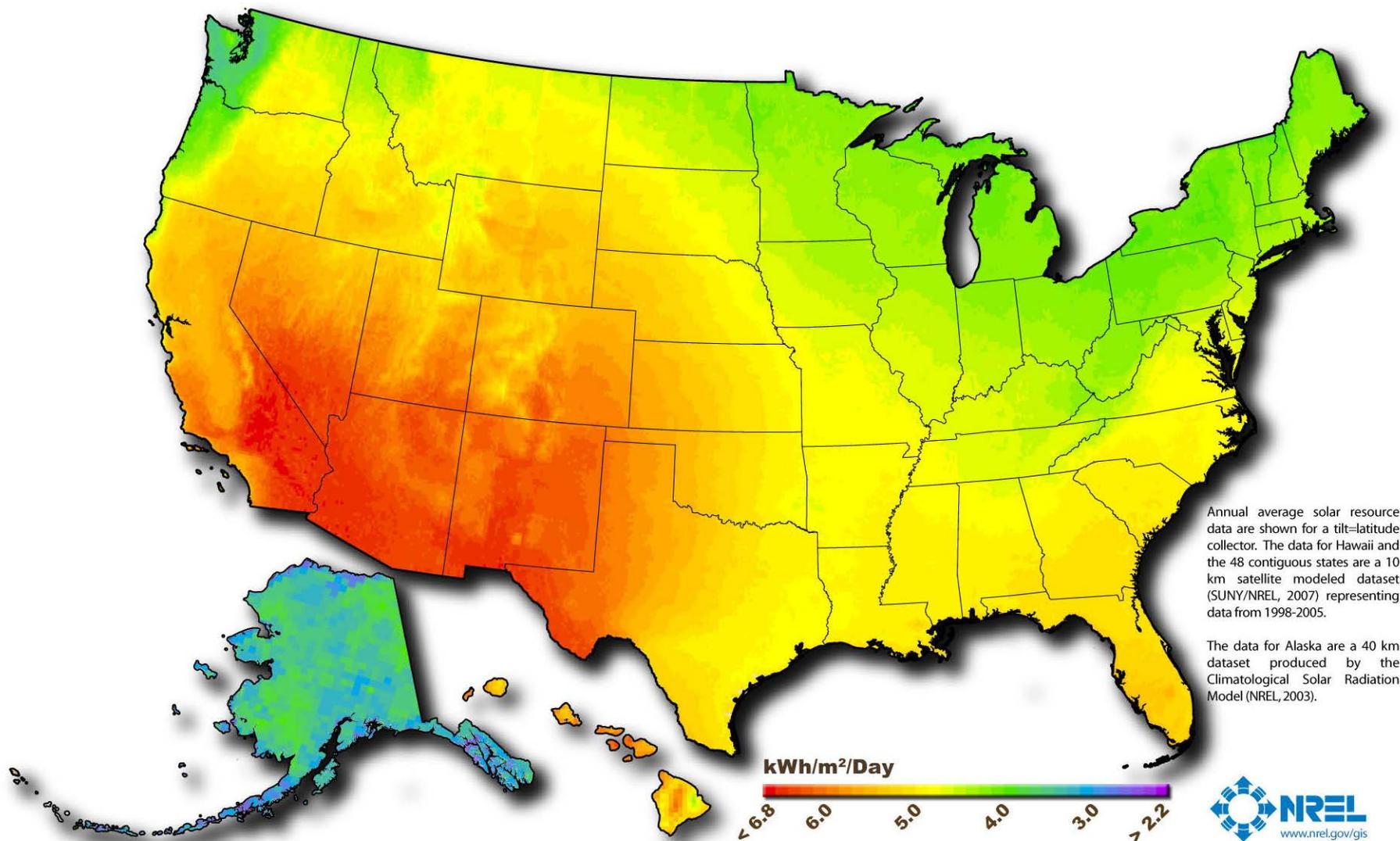
## Technical Potentials produced:

- Photovoltaic (PV) Utility - Urban & Rural
- PV Rooftop
- Concentrating Solar Power (CSP)
- Onshore Wind
- Offshore Wind
- Biopower - Gaseous and Solid Biomass
- Geothermal
- Hydropower

\*See Technical Potential Worksheet for data sources, descriptions, and details



# U.S. Photovoltaic Solar Resource



Annual average solar resource data are shown for a tilt=latitude collector. The data for Hawaii and the 48 contiguous states are a 10 km satellite modeled dataset (SUNY/NREL, 2007) representing data from 1998-2005.

The data for Alaska are a 40 km dataset produced by the Climatological Solar Radiation Model (NREL, 2003).

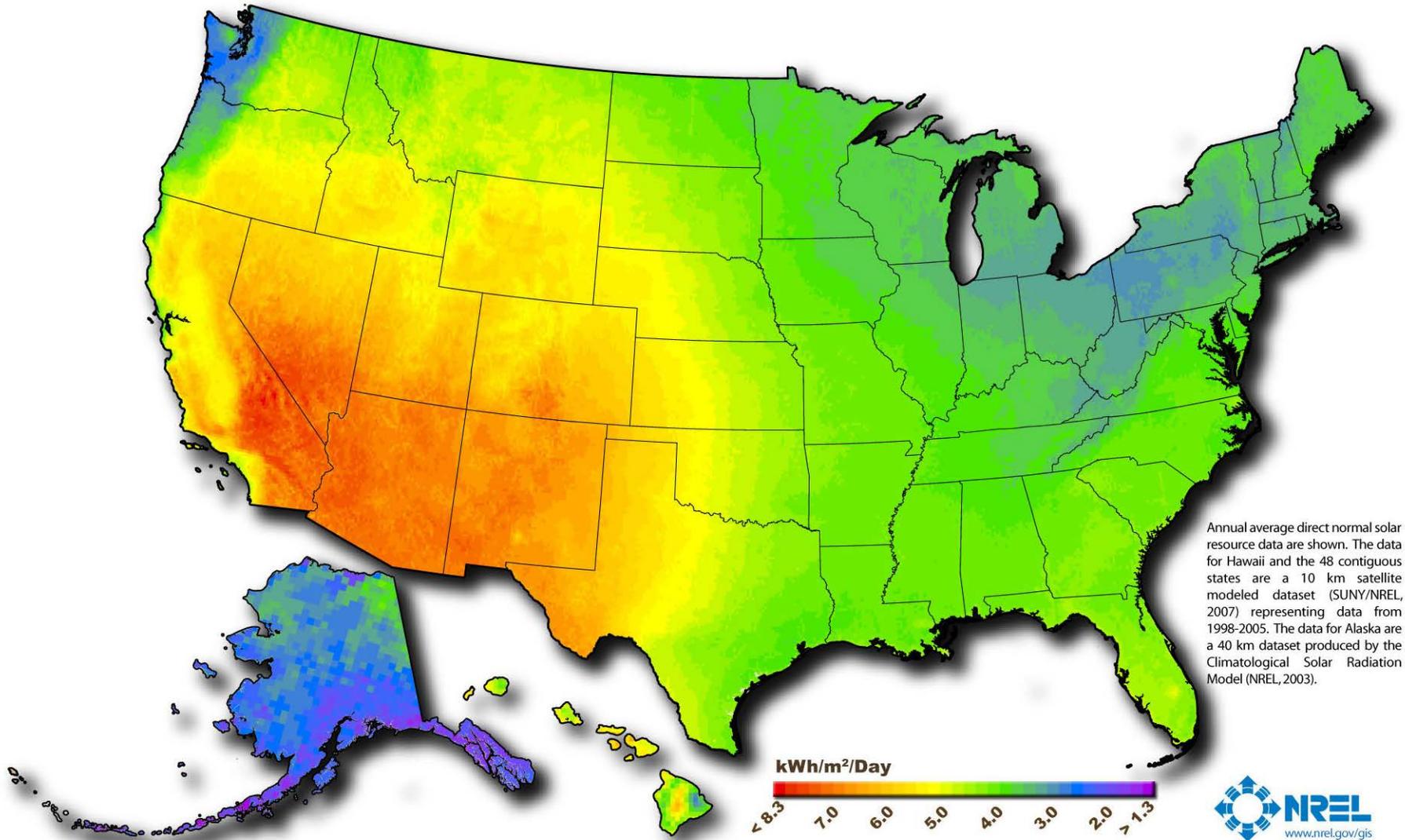


Author: Billy Roberts - October 20, 2008

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



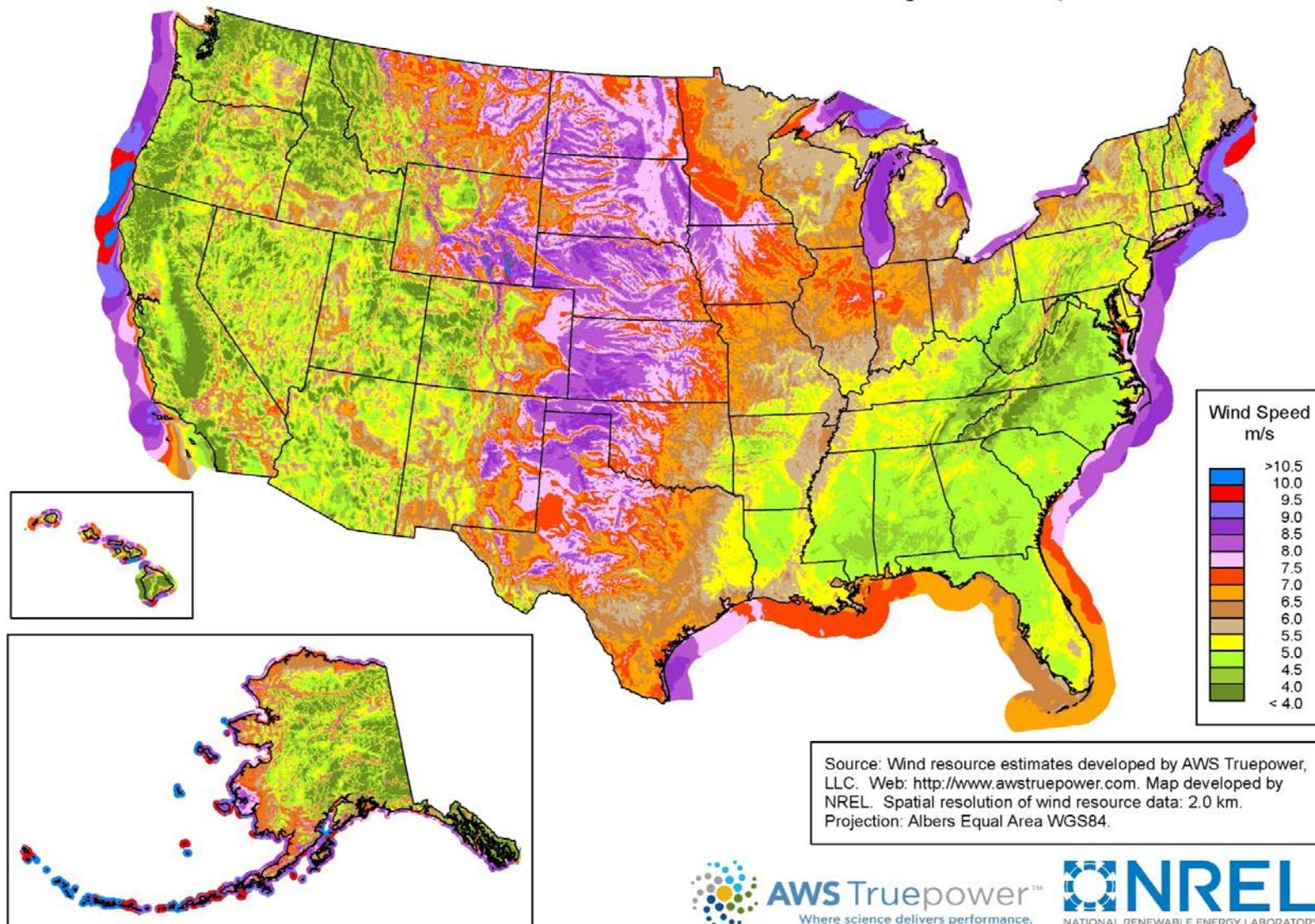
# U.S. Concentrating Solar Resource



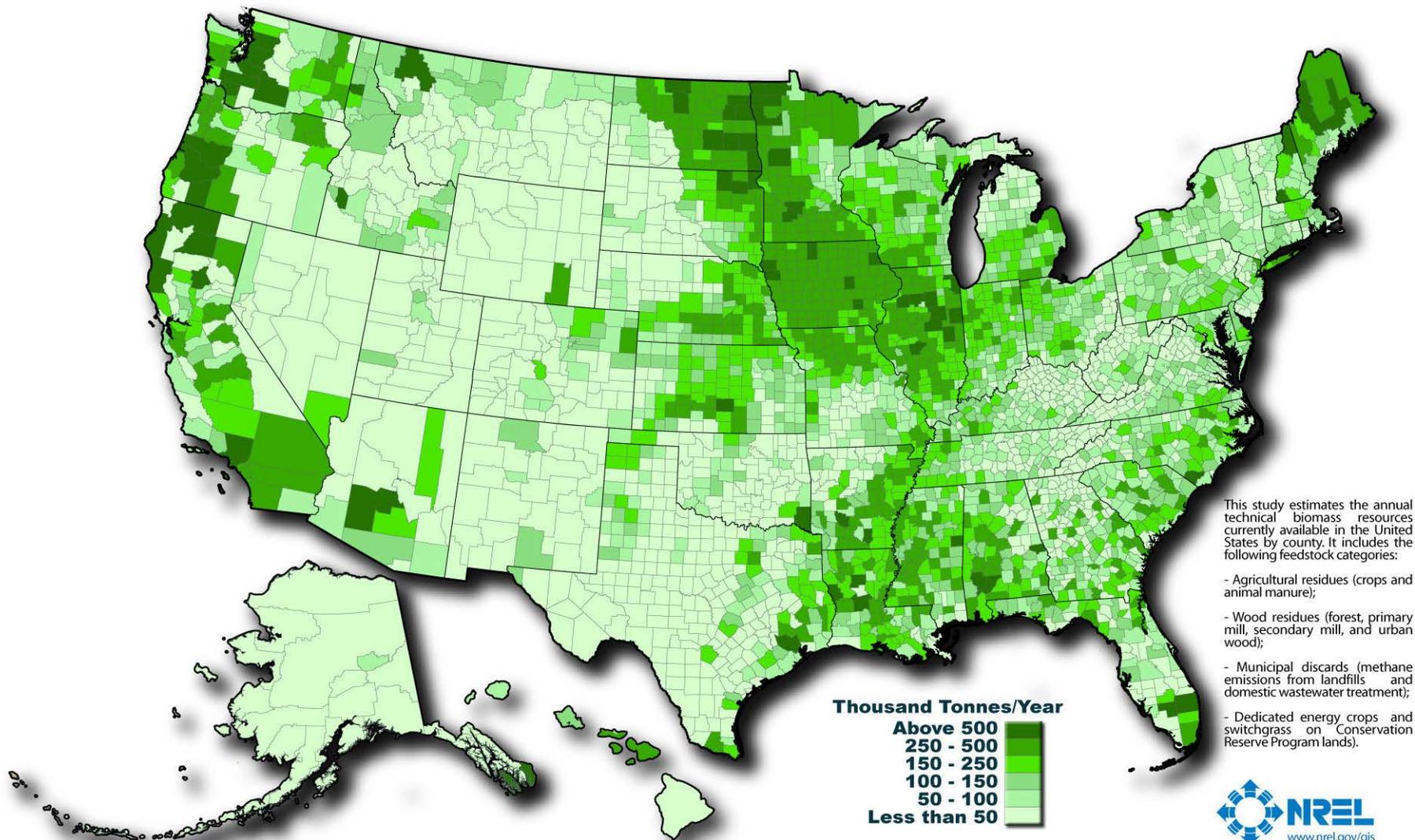
Author : Billy Roberts - October 20, 2008

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

# U.S. Wind Resource (at 80 meters)



# U.S. Biomass Resource



This study estimates the annual technical biomass resources currently available in the United States by county. It includes the following feedstock categories:

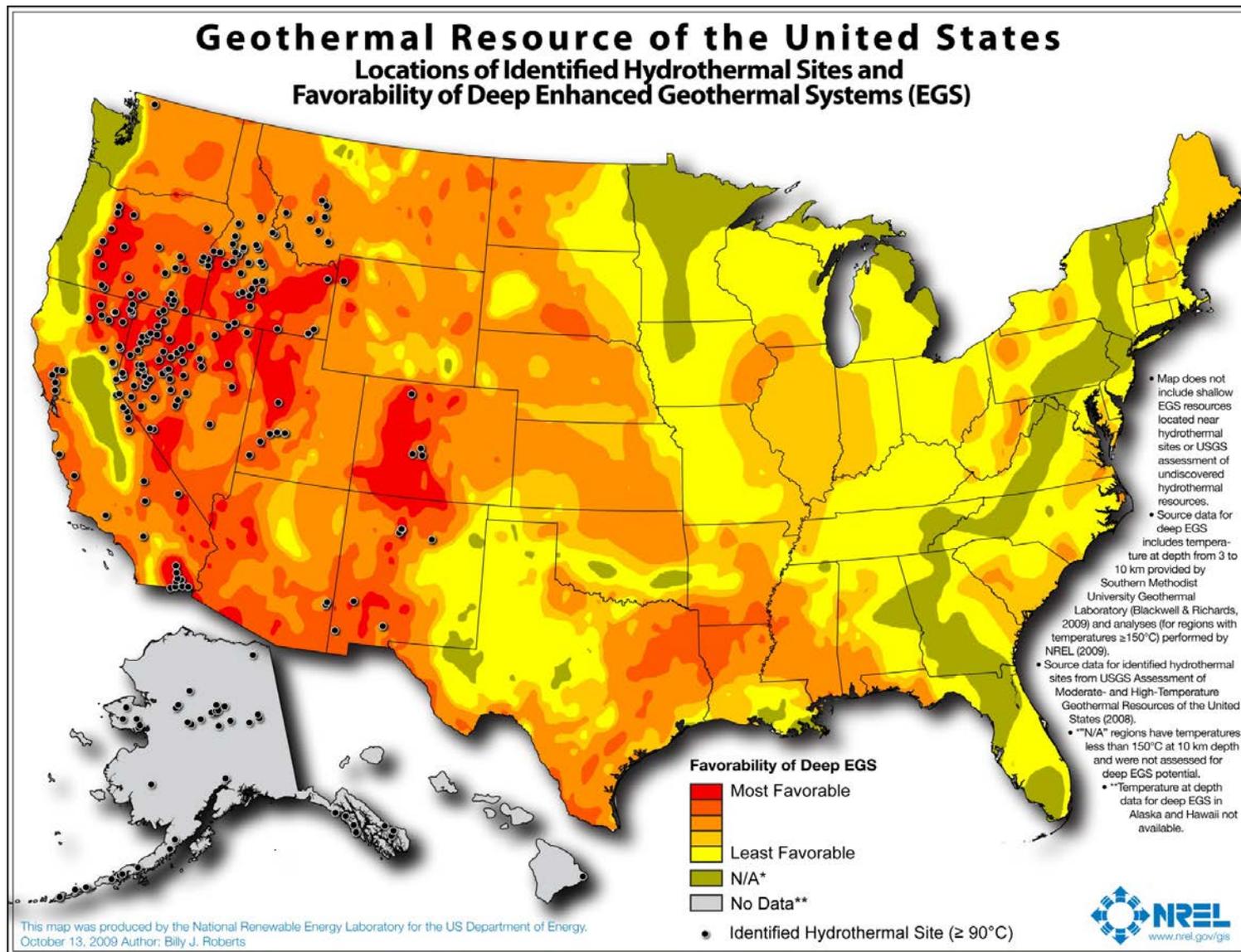
- Agricultural residues (crops and animal manure);
- Wood residues (forest, primary mill, secondary mill, and urban wood);
- Municipal discards (methane emissions from landfills and domestic wastewater treatment);
- Dedicated energy crops and switchgrass on Conservation Reserve Program lands).



This map was produced by the National Renewable Energy Laboratory for the U.S. Department of Energy. See additional documentation for more information at <http://www.nrel.gov/docs/fy06osti/39181.pdf>

Author: Billy Roberts - October 20, 2008

# U.S. Geothermal Resources





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## Basic PV Modeling

**PVWatts Viewer**  
National Renewable Energy Laboratory

Grid Visibility/Transparency

Current Action: PVWatts Tool

Click on the map to identify a PVWatts (v2) grid cell:

OR

Enter a zip code:

Click on **Calculate** if default values are acceptable, or after selecting your system specifications. Click on **Help** for information about system specifications. To use a DC to AC derate factor other than the default, click on **Derate Factor Help** for information.

**Site Location:**

Cell ID: 0221361  
State: Nebraska  
Latitude: 42.299  
Longitude: -98.763

**PV System Specifications:**

DC Rating (kW): 4.0  
DC to AC Derate Factor: 0.77 **DERATE FACTOR HELP**  
Array Type: Fixed Tilt

Fixed Tilt or 1-Axis Tracking System:

Array Tilt (degrees): 42.299 (Default = Latitude)  
Array Azimuth (degrees): 180.0 (Default = South)

**Energy Data:**

Cost of Electricity (cents/kWh): 7.693

Calculate **HELP** Reset Form

### Project Description

The PVWatts application is an interactive map-based interface to rapidly utilize the PVWatts calculator. The PVWatts calculator is a basic solar modeling tool developed at NREL to allow non-experts to quickly obtain performance estimates for grid-connected PV systems.

### Project Impact

This project is focused on providing the general public with a basic solar performance modeling tool and is one of the most heavily visited page on the NREL website. Users can get an estimate of expected monthly and annual solar resource values for any location in the United States.

### Users

Generally solar installers, but really anyone is able to use this to get a first cut of the potential output. Many national subsidy providers use PVWatts to determine the amount of subsidy a homeowner can receive.

Data Analysis and Visualization Group

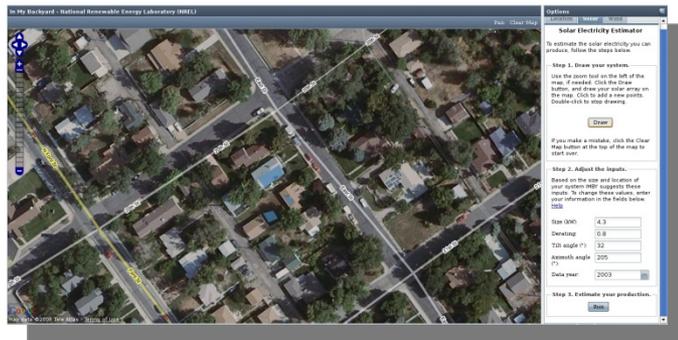
Project Lead: Dan Getman

Dan.getman@nrel.gov

# In My Backyard (IMBY)

<http://mercator.nrel.gov/imby/>

## Small-Scale PV & Wind



### Project Description

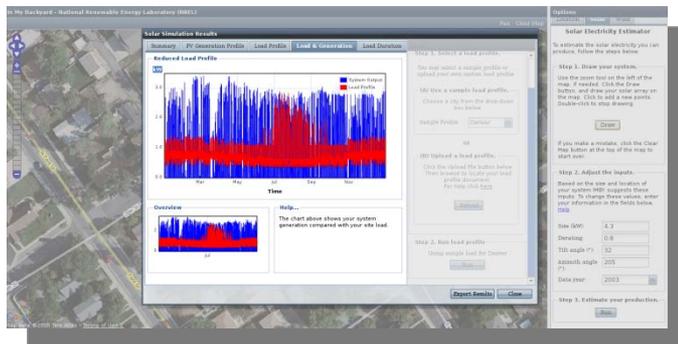
In My Backyard, or IMBY, is a small scale PV simulation tool that provides a quick estimation of production potentials and financial implications. Homeowners, business owners, and policy makers can use IMBY get a quick and easy estimate of whether PV makes economic sense at their location. This uses the same PVWatts performance engine.

### Project Impact

This project is focused on providing the general public with a tool that provides a slightly more complex analysis than PVWatts, but a more simple analysis than the Solar Advisor Model (SAM). IMBY is currently under active development with several updates and improvements meant to increase the tool's usability and exposure.

### Users

For building owners who want to do a graphical interpretation of the PV options for residential housing stock. This is a step more complex than PVWatts but also more informative.



Data Analysis and Visualization Group  
Project Lead: Dan Getman  
Dan.getman@nrel.gov

# SAM (System Advisor Model)

<http://www.nrel.gov/analysis/sam>

## Complete System Techno-Economic Modeling

### Project Description

The System Advisor Model (SAM) combines detailed performance modeling with detailed finance modeling, cost data, detailed incentive abilities, and a robust user interface to create a full system analysis tool. SAM is significantly more complex than PVWatts or IMBY.

### Project Impact

- For the CSP industry to use for performance information
- Robust usage by the PV industry
- 40,000 downloads of software in 2012
- Used for various DOE analyses
- Requires larger learning investment than other online solar tools
- Contains many technologies
- Links to various other NREL datasets and resources

### Users

- Plant Developers
- Manufacturers
- Solar Installers
- Utility Planners
- Consultants
- Analysts and Students



Data Analysis and Visualization Group

Project Lead: Nate Blair

Nate.Blair@nrel.gov



# Technologies in SAM



**Photovoltaics**



**Concentrating PV**



**Solar Water Heating**



**Geothermal**



**Parabolic Trough**



**Power Tower**



**Linear Fresnel**



**Dish-Stirling**



**Small Wind**



**Utility-Scale Wind**



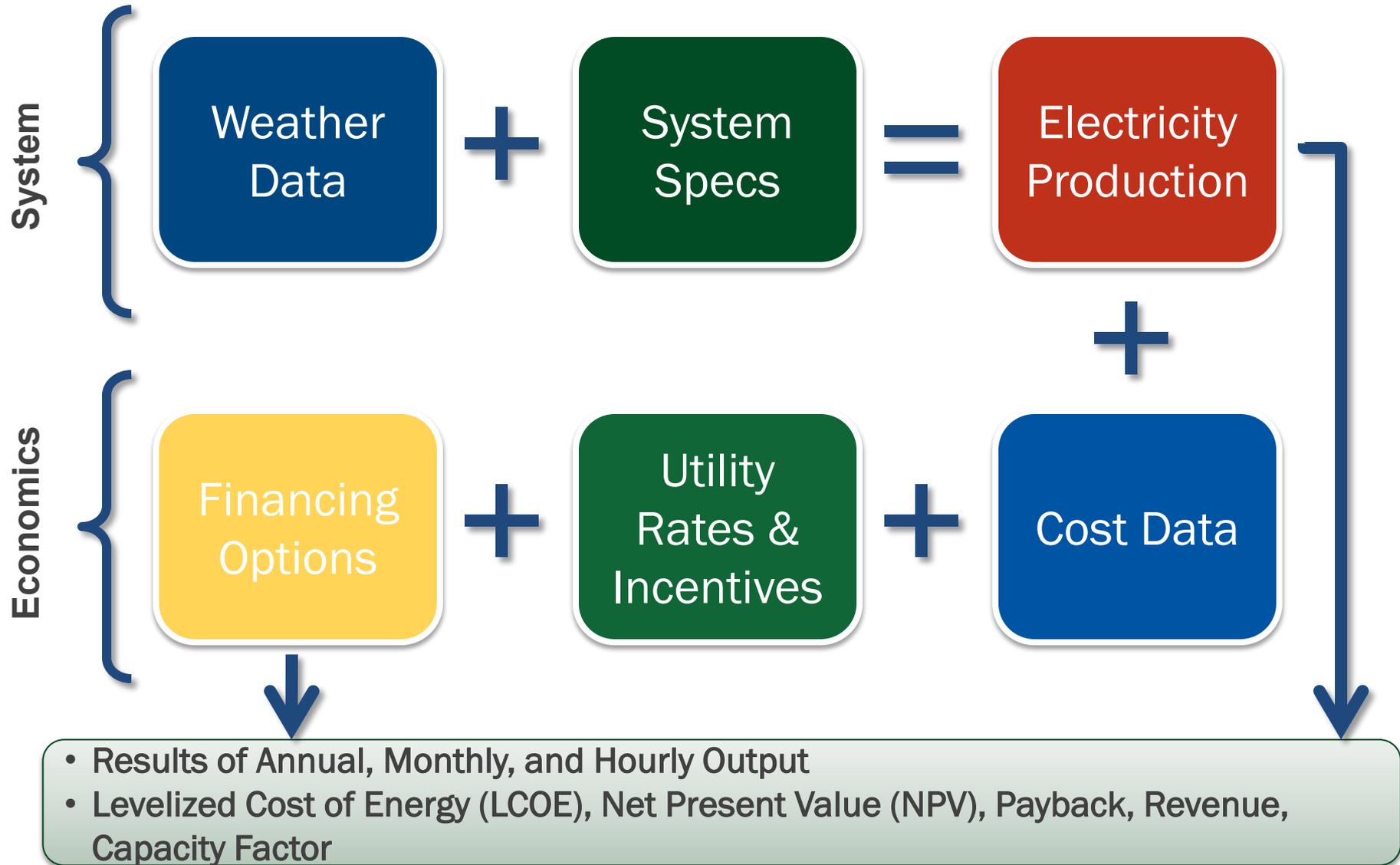
**Biomass Power**



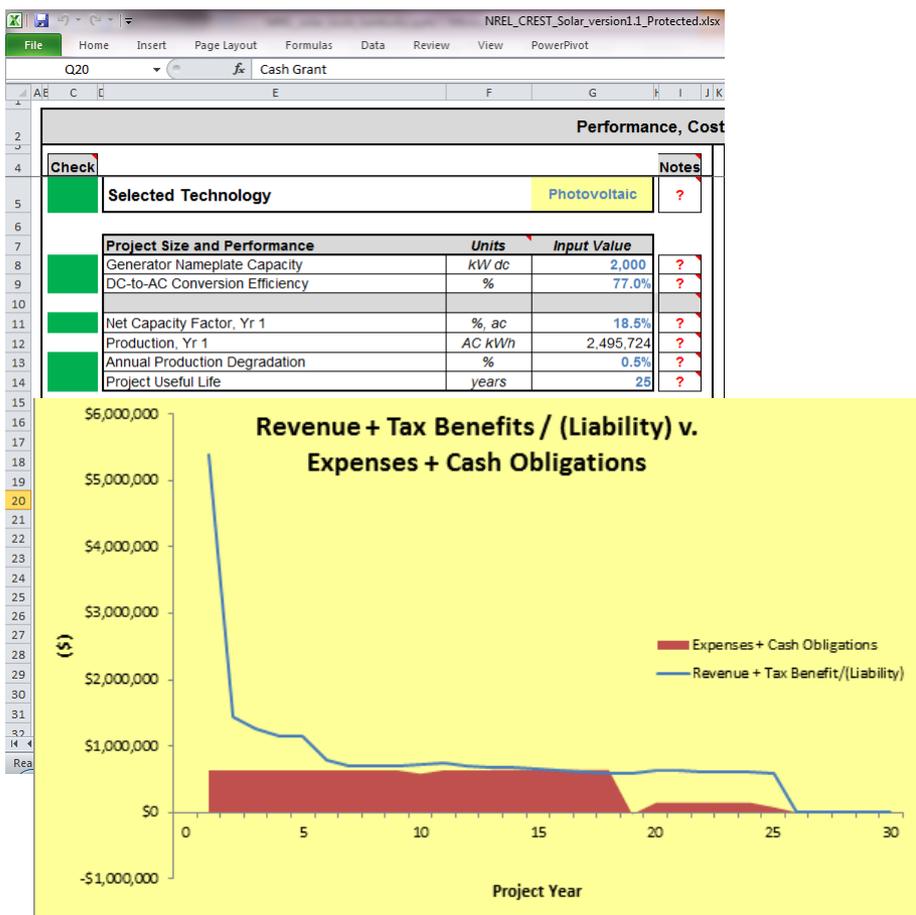
**Conventional**



# General Modeling Workflow



## Project Finance Modeling



### Project Description

The Cost of Renewable Energy Spreadsheet Tool (CREST) is an economic cash flow model designed to enable public utility commissions (PUCs) and the renewable energy community to assess projects, design cost-based incentives, such as feed-in tariffs, and evaluate the impact of tax incentives or other support structures. CREST is a suite of three analytic tools for solar (photovoltaic and solar thermal), wind, and geothermal technologies.

### Project Impact

Relatively new tool developed in conjunction with various public utility commissions and stakeholders.

### Users

Primarily state incentive developers and financial analysts.

### Data Analysis and Visualization Group

Project Lead: Michael Mendelsohn

Michael.Mendelsohn@nrel.gov

## Tracking PV Market

The screenshot shows the OpenPV website interface. At the top, there's a navigation bar with 'Login' and 'Register' links. Below that, the NREL logo and 'National Renewable Energy Laboratory' are displayed. The main content area is divided into several sections:

- The Open PV Project:** A summary box showing 'Total # of installs: 73,670', 'Cost \$/W (2010): \$7.58', and 'Capacity (MW): 834.89'. It also includes a 'Disclaimer' link.
- Explore the Open PV Project:** A search interface with fields for 'State' and 'Zip Code', and a 'Search' button.
- Search:** A section with a search bar and a 'Search' button.
- Data:** A section with a 'Data' icon and the text 'Contribute by uploading your data'.
- About:** A section with an 'About' icon and the text 'Learn about the project and its contributors'.
- Gallery:** A section with a 'Gallery' icon and the text 'The Open PV visualization gallery'.
- Market Mapper:** A map of the United States showing PV installation density by state. A sidebar on the right provides summary statistics: 'Total Number of Installs: 72920', 'Installed Capacity (MW): 826,495', and 'Average Cost (\$/W): 8.71'. Below the map is a 'Market Mapper' section with a 'See it in action in the Visualization Gallery' link.
- Table:** A table showing state rankings based on Total Count, Avg. Cost \$/W, and Capacity MW.

|     | Rank By Total Count | Rank By Avg. Cost \$/W | Rank By Capacity MW |      |
|-----|---------------------|------------------------|---------------------|------|
| #17 | OR                  | 167                    | 7.83                | 1.72 |
| #18 | OH                  | 166                    | 12.36               | 1.59 |
| #19 | WY                  | 152                    | 8.31                | 0.16 |
| #20 | SC                  | 133                    | 8.24                | 5.64 |
| #21 | TN                  | 93                     | 8.92                | 0.83 |
| #22 | AR                  | 69                     | 8.07                | 0.25 |
| #23 | LA                  | 69                     | 8.62                | 0.35 |
| #24 | MN                  | 57                     | 9.69                | 0.70 |
| #25 | MT                  | 56                     | 10.37               | 0.18 |
| #26 | WA                  | 41                     | 9.34                | 0.10 |
| #27 | IN                  | 35                     | 11.49               | 0.18 |
| #28 | AL                  | 24                     | 7.71                | 0.09 |
| #29 | NC                  | 23                     | 9.04                | 2.04 |
| #30 | VA                  | 21                     | 9.12                | 0.09 |
| #31 | IL                  | 8                      | 8.83                | 0.08 |
| #32 | MS                  | 8                      | 8.13                | 0.03 |
| #33 | WV                  | 7                      | 8.08                | 0.02 |

### Project Description

The OpenPV Mapping Project is a collaborative effort between government, industry, and the public that compiles a comprehensive database of PV installation data for the United States. Data for the project is voluntarily contributed from a variety of sources including utilities, installers, and the general public.

### Project Impact

The data collected is actively maintained by the contributors and constantly updated to provide an evolving snapshot of the U.S. solar power market.

### Users

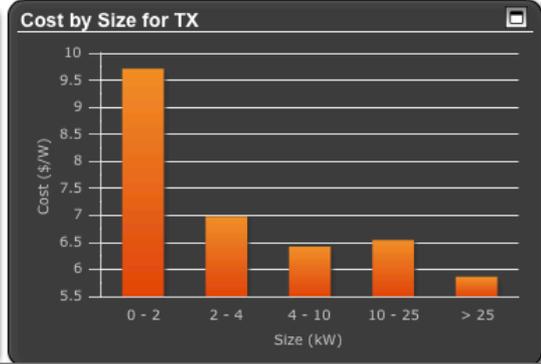
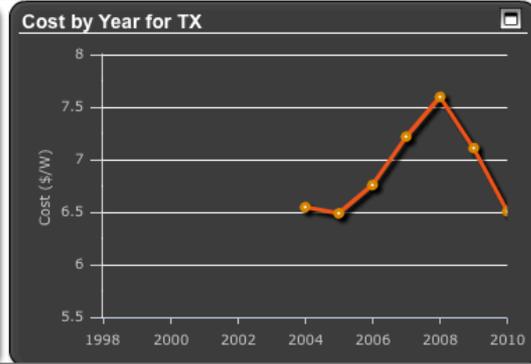
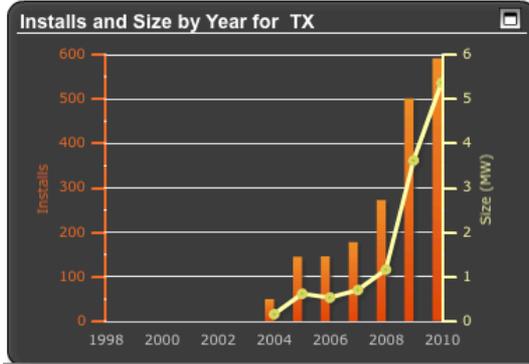
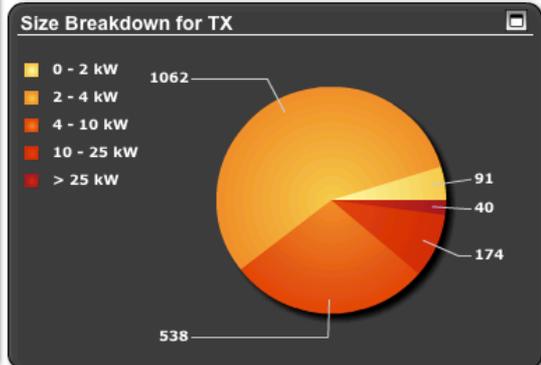
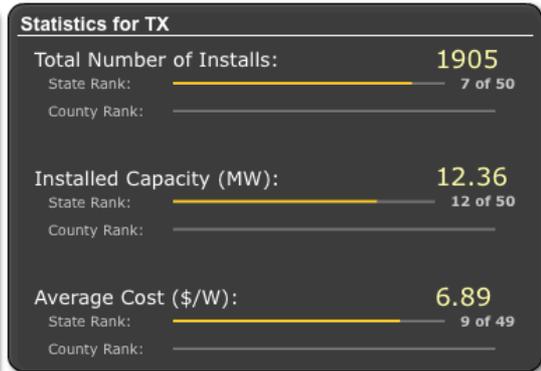
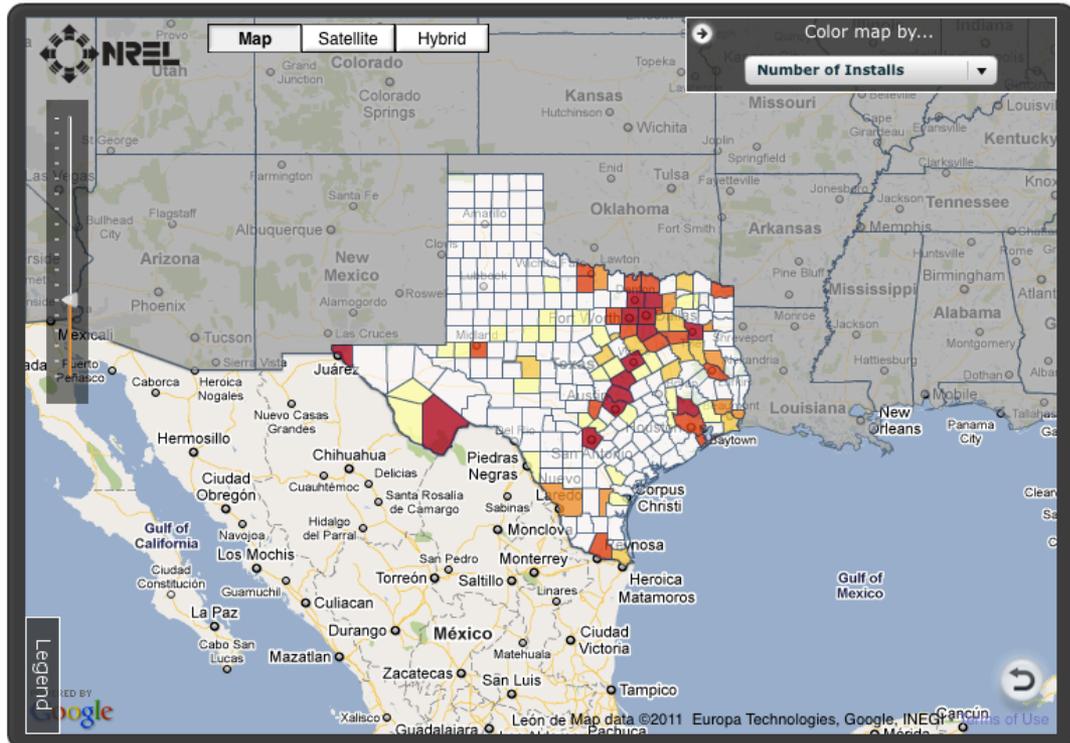
- Solar Installers
- PV Industry Business Analysts
- DOE/Lab Market Analysts

### Data Analysis and Visualization Group

Project Lead: Ted Quinby

Ted.Quinby@nrel.gov

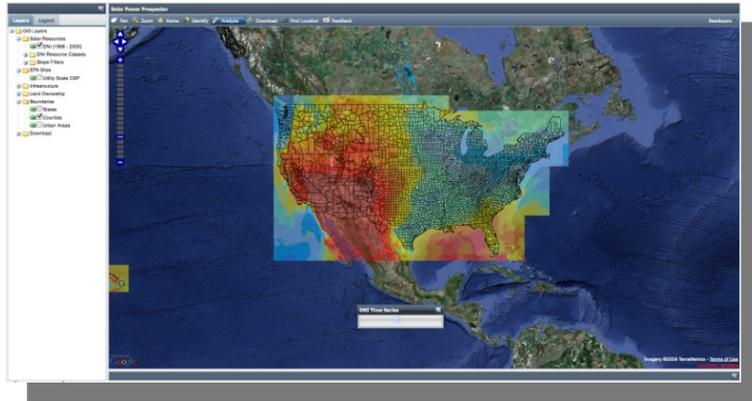
# OpenPV: Advanced Visualizations



# The Solar Prospector

<http://maps.nrel.gov/prospector>

## Citing Utility-Scale CSP



## Project Description

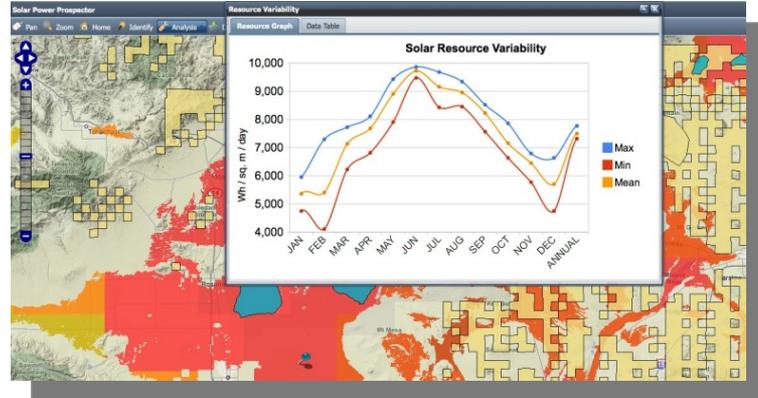
The Solar Prospector is a Web-based Geographic Information System (GIS) tool designed to assist industry professionals in the siting of utility-scale solar plants. The tool employs various GIS datasets to help identify areas that may have a high potential for solar plant development. Additionally, the Solar Prospector forms a platform to disseminate all solar related geospatial data to the larger industry and analysis community.

## Project Impact

This project provides the location of solar resources, land ownership, and general infrastructure in an easy to use map format. Users can quickly download hourly solar resource data for specific locations and perform temporal analyses for any location in the United States and North Mexico.

## Users

- Originally developed for CSP and expanded to PV; the CSP project development industry is a heavy user of the tool
- DOE/Lab analysts
- PV developers interested in information from the federal government



Data Analysis and Visualization Group

Project Lead: Ted Quinby

ted.quinby@nrel.gov

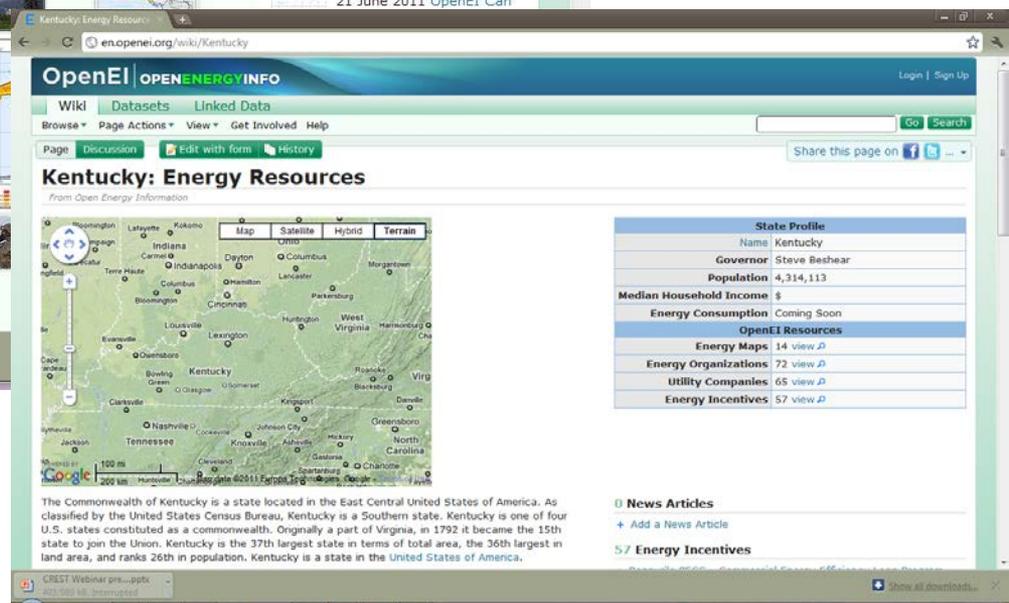
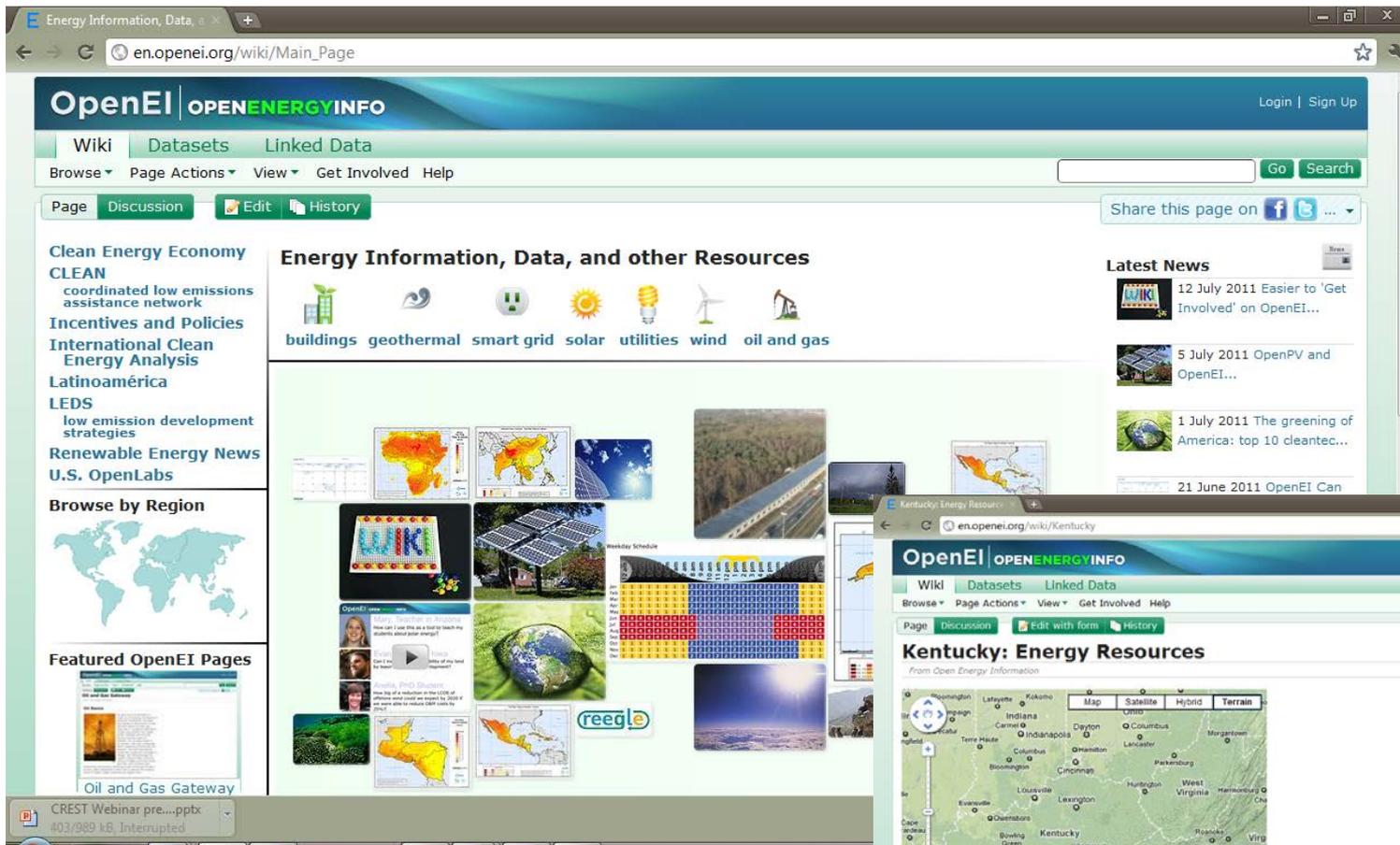
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# Open Energy Information (OpenEI)

<http://openei.org>



- Growing source of energy information contributed by variety of stakeholders
- Focus is on linked open data

# The Problem with Utility Rate Data...

- NREL tools have been using averaged rates from the U.S. Energy Information Administration (EIA), sometimes just state average, and other sources
- This has been a significant limitation, lacking the accuracy to reveal the value of energy efficiency and renewable power
- SAM lead the way with the ability to enter in advanced rate structures, but finding and entering rates is inefficient.

| Entity                         | State | Class of Ownership | Number of Consumers | Revenue<br>(thousand dollars) | Sales<br>(megawatthours) | Average Retail Price<br>(c/kWh) |
|--------------------------------|-------|--------------------|---------------------|-------------------------------|--------------------------|---------------------------------|
| Florida Power & Light Company  | FL    | Investor Owned     | 3,981,453           | 6,284,178                     | 55,065,086               | 11.41                           |
| Pacific Gas & Electric Co      | CA    | Investor Owned     | 4,544,498           | 4,650,510                     | 30,748,883               | 15.12                           |
| Southern California Edison Co  | CA    | Investor Owned     | 4,211,970           | 4,600,413                     | 29,824,161               | 15.43                           |
| Commonwealth Edison Co         | IL    | Investor Owned     | 3,421,075           | 3,161,083                     | 29,374,282               | 10.76                           |
| Virginia Electric & Power Co   | VA    | Investor Owned     | 2,002,884           | 2,496,677                     | 28,873,227               | 8.65                            |
| Georgia Power Co               | GA    | Investor Owned     | 2,015,817           | 2,442,501                     | 26,840,275               | 9.10                            |
| TXU Energy Retail Co LP        | TX    | Power Marketer     | 1,845,167           | 3,654,106                     | 26,589,947               | 13.74                           |
| Reliant Energy Retail Services | TX    | Power Marketer     | 1,619,371           | 3,205,646                     | 21,895,312               | 14.64                           |
| Duke Energy Corporation        | NC    | Investor Owned     | 1,539,519           | 1,719,094                     | 20,980,559               | 8.19                            |
| Florida Power Corp             | FL    | Investor Owned     | 1,442,854           | 2,363,142                     | 19,911,884               | 11.87                           |
| Alabama Power Co               | AL    | Investor Owned     | 1,202,491           | 1,833,563                     | 18,874,039               | 9.71                            |
| Detroit Edison Co              | MI    | Investor Owned     | 1,967,223           | 1,680,344                     | 16,146,745               | 10.41                           |
| Carolina Power & Light Co      | NC    | Investor Owned     | 1,058,588           | 1,411,517                     | 15,001,238               | 9.41                            |
| PPL Electric Utilities Corp    | PA    | Investor Owned     | 1,211,248           | 1,388,126                     | 14,568,456               | 9.53                            |
| Union Electric Co              | MO    | Investor Owned     | 1,027,668           | 980,231                       | 14,257,728               | 6.88                            |
| Public Service Elec & Gas Co   | NJ    | Investor Owned     | 1,826,039           | 1,904,724                     | 13,958,115               | 13.65                           |
| Arizona Public Service Co      | AZ    | Investor Owned     | 979,138             | 1,418,315                     | 13,771,481               | 10.30                           |

  
EIA data

Pacific Gas and Electric Company  
San Francisco, California  
U 35

Cancelling Revised Revised Cal. P.U.C. Sheet No. 27688-E  
Cal. P.U.C. Sheet No. 27353-E

**ELECTRIC SCHEDULE E-6  
RESIDENTIAL TIME-OF-USE SERVICE** Sheet 3

**UNBUNDLING OF TOTAL RATES**

Meter Charge Rates: Meter charge rates provided in the Total Rate section above are assigned entirely to the unbundled distribution component.

| Energy Rates by Component (\$ per kWh)                       | PEAK                | PART-PEAK             | OFF-PEAK      |
|--|---------------------|-----------------------|---------------|
| <b>Generation:</b>   |                     |                       |               |
| Summer:  |                     |                       |               |
| Baseline Usage   | \$0.17934 (I)       | \$0.07979 (I)         | \$0.03963 (I) |
| 101% - 130% of Baseline                                      | \$0.18992 (I)       | \$0.09037 (I)         | \$0.05021 (I) |
| 131% - 200% of Baseline                                      | \$0.26748 (I)       | \$0.16794 (I)         | \$0.12776 (I) |
| 201% - 300% of Baseline                                      | \$0.33918 (I)       | \$0.23963 (I)         | \$0.19946 (I) |
| Over 300% of Baseline  | \$0.37676 (I)       | \$0.27721 (I)         | \$0.23703 (I) |
| Winter:  |                     |                       |               |
| Baseline Usage   | -                   | \$0.05017 (I)         | \$0.04232 (I) |
| 101% - 130% of Baseline                                      | -                   | \$0.06075 (I)         | \$0.05289 (I) |
| 131% - 200% of Baseline                                      | -                   | \$0.13831 (I)         | \$0.13045 (I) |
| 201% - 300% of Baseline                                      | -                   | \$0.21000 (I)         | \$0.20215 (I) |
| Over 300% of Baseline  | -                   | \$0.24758 (I)         | \$0.23972 (I) |
| <b>Distribution**</b>  |                     |                       |               |
| Summer:  |                     |                       |               |
| Baseline Usage   | \$0.08306 (R)       | \$0.03410 (R)         | \$0.01434 (R) |
| 101% - 130% of Baseline                                      | \$0.08826 (I)       | \$0.03950 (R)         | \$0.01954 (R) |
| 131% - 200% of Baseline                                      | \$0.12640 (R)       | \$0.07744 (I)         | \$0.05769 (I) |
| 201% - 300% of Baseline                                      | \$0.18167 (I)       | \$0.11271 (I)         | \$0.06295 (I) |
| Over 300% of Baseline  | \$0.19314 (I)       | \$0.13116 (I)         | \$0.11453 (I) |
| Winter:  |                     |                       |               |
| Baseline Usage   | -                   | \$0.01953 (R)         | \$0.01566 (R) |
| 101% - 130% of Baseline                                      | -                   | \$0.02173 (R)         | \$0.02087 (R) |
| 131% - 200% of Baseline                                      | -                   | \$0.02187 (I)         | \$0.05981 (I) |
| 201% - 300% of Baseline                                      | -                   | \$0.04214 (I)         | \$0.09427 (I) |
| Over 300% of Baseline  | -                   | \$0.11861 (I)         | \$0.11275 (I) |
| Transmission*** (all usage)                                  | \$0.01034           | \$0.01034             | \$0.01034     |
| Transmission Rate Adjustments** (all usage)                  | (\$0.00026)         | (\$0.00026)           | (\$0.00026)   |
| Reliability Services* (all usage)                            | (\$0.00078)         | (\$0.00078)           | (\$0.00078)   |
| Public Purpose Programs (all usage)                          | \$0.01138           | \$0.01138             | \$0.01138     |
| Nuclear Decommissioning (all usage)                          | \$0.00027           | \$0.00027             | \$0.00027     |
| Competition Transition Charges (all usage)                   | \$0.00332           | \$0.00332             | \$0.00332     |
| Energy Cost Recovery Amount (all usage)                      | \$0.00318           | \$0.00318             | \$0.00318     |
| Fixed Transition Amount (FTA) (all usage)                    | \$0.00000           | \$0.00000             | \$0.00000     |
| Rate Reduction Bond Memorandum Account (RRBMA)** (all usage) | (\$0.00163)         | (\$0.00163)           | (\$0.00163)   |
| DWR Bond (all usage)   | \$0.00477           | \$0.00477             | \$0.00477     |
| <b>Minimum Charge Rate by Component</b>                      | <b>\$ per meter</b> | <b>\$ per kWh</b>     |               |
| Distribution**   | \$0.11837 (R)       |                       |               |
| Transmission***  |                     | \$0.01008             |               |
| Reliability Services*  | \$0.00000           |                       |               |
| Public Purpose Programs                                      | \$0.00472           |                       |               |
| Nuclear Decommissioning                                      | \$0.00011           |                       |               |
| Competition Transition Charges                               |                     | \$0.00332             |               |
| Energy Cost Recovery Amount                                  |                     | \$0.00318             |               |
| FTA  |                     | \$0.00000             |               |
| RRBMA**  |                     | (\$0.00163)           |               |
| DWR Bond   |                     | \$0.00477             |               |
| Generation***  |                     | Determined Residually |               |

1 page of 6!!!

\*\*\* Transmission, Transmission Rate Adjustments and Reliability Service charges are combined for presentation on customer bills.  
\*\* Distribution and RRBMA charges are combined for presentation on customer bills.  
\*\*\* Total rate less the sum of the individual non-generation components.

(Continued)

# The Solution: The OpenEI Utility Rate Database

- Completely Web based
- 23,000 rates and counting
- Nearly 1000 utilities represented (>80% of US load served)
- Residential and Commercial tariffs
- Can handle a wide variety of rate structures
- Collaboration now with Illinois State University
- Application Programming Interface (API) provided

**OpenEI** OPENENERGYINFO

Welcome Sformal | Log out

Wiki Datasets

Browse Page Actions View Contribute User Help

Data Edit with form History

Share / Save

## Portland General Electric Co: 32 - TOU

From Open Energy Information

1. Basic Information 2. Time of Use Rate 3. Demand Charges 4. Tiered Rates

1 2 3 4 Next >>

Utility name: [Portland General Electric Co](#)  
 Effective date: 2007/06/15  
 End date if known:  
 Rate name: 32 - TOU  
 Sector: Commercial  
 Description: - This is an optional rate  
 - This utility rate information was derived from data collected in the fall of 2008.

Source or reference: [Utility\\_Rate\\_PGE sched\\_032.pdf](#)  
 Assume net metering (buy = sell): No  
 Flat rate buy:  
 Flat rate sell:  
 Flat rate fuel adj:  
 Fixed monthly charge: \$12.00000000

1 2 3 4 Next >>

1. Basic Information 2. Time of Use Rate 3. Demand Charges 4. Tiered Rates

<< Previous 1 2 3 4 Next >>

| Period   | Buy \$/kWh   | Sell \$/kWh | Fuel Adj. \$/kWh |
|----------|--------------|-------------|------------------|
| Period 1 | \$0.03248000 |             | \$0.05949000     |
| Period 2 | \$0.05729000 |             | \$0.05949000     |
| Period 3 | \$0.09745000 |             | \$0.05949000     |
| Period 4 | \$0.03248000 |             | \$0.05949000     |
| Period 5 | \$0.05719000 |             | \$0.05949000     |
| Period 6 | \$0.09745000 |             | \$0.05949000     |
| Period 7 |              |             |                  |
| Period 8 |              |             |                  |
| Period 9 |              |             |                  |

Weekday Schedule

1. Basic Information 2. Time of Use Rate 3. Demand Charges 4. Tiered Rates

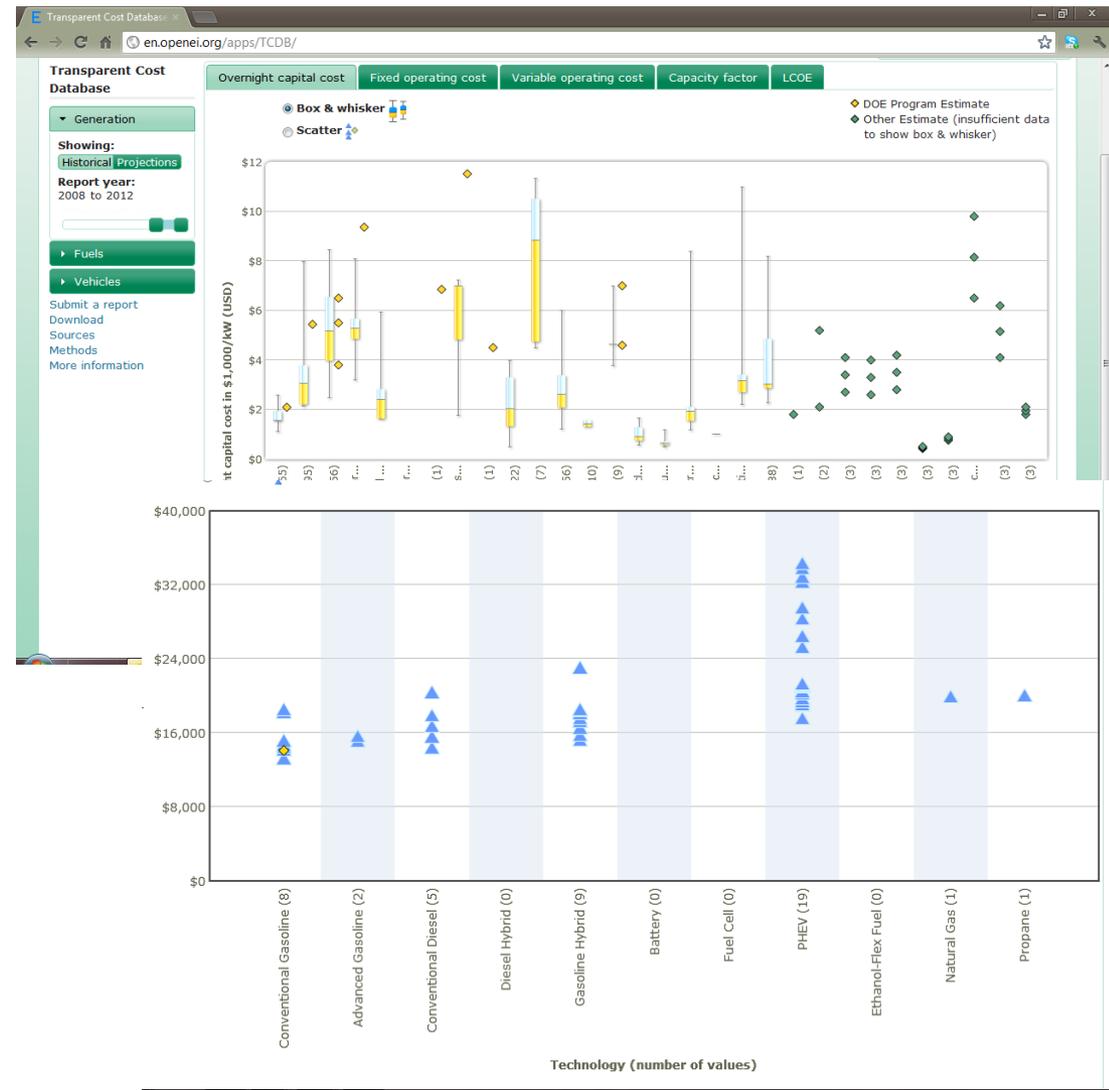
<< Previous 1 2 3 4 Next >>

| Period   | kWh Use | Rate \$/kWh | Fuel Adj. \$/kWh | Monthly Schedule |
|----------|---------|-------------|------------------|------------------|
| Period 1 |         |             |                  | Jan Period 1     |
| Period 1 |         |             |                  | Feb Period 1     |
| Period 1 |         |             |                  | Mar Period 1     |
| Period 1 |         |             |                  | Apr Period 1     |
| Period 1 |         |             |                  | May Period 1     |
| Period 1 |         |             |                  | Jun Period 1     |
| Period 1 |         |             |                  | Jul Period 1     |
| Period 1 |         |             |                  | Aug Period 1     |
| Period 1 |         |             |                  | Sep Period 1     |
| Period 1 |         |             |                  | Oct Period 1     |
| Period 1 |         |             |                  | Nov Period 1     |
| Period 1 |         |             |                  | Dec Period 1     |

# Transparent Cost Database (NEW!)

[http://en.openei.org/wiki/Transparent\\_Cost\\_Database](http://en.openei.org/wiki/Transparent_Cost_Database)

- Collection of cost data for renewable technologies
- Completely Web based
- Includes literature on technology cost and performance estimates
- Includes vehicles, biofuels, and electricity generation
- All data are downloadable for full transparency



# JEDI – Jobs and Economic Development Impact

## Renewable Energy Project Economic Impact Calculator

[http://www.nrel.gov/analysis/jedi/about\\_jedi.html](http://www.nrel.gov/analysis/jedi/about_jedi.html)

### Project Description

The Jobs and Economic Development Impact (JEDI) models are user-friendly tools that estimate the economic impacts of constructing and operating power generation and biofuel plants at the local (usually state) level.

### Project Impact

Jobs, earnings, and output are distributed across three categories:

- Project Development and Onsite Labor Impacts
- Local Revenue, Turbine, and Supply Chain Impacts
- Induced Impacts.

### Project History and Timeline

JEDI has been developed in Excel for various technologies for over 10 years – constantly being updated and extended to new technologies. Online version of PV JEDI is in beta release.

### Data Analysis and Visualization Group

Project Lead: Barry Friedman

Barry.Friedman@nrel.gov

The screenshot displays the JEDI PV web application interface. The top navigation bar includes 'Home', 'Run the Model', 'About JEDI PV', and 'Download JEDI PV'. The main content area is titled 'Project Descriptive Data' and contains a form for entering project information. The form fields are: Project Location (Arizona), Year of Construction or Installation (2011), System Application (Residential New Construction), Solar Cell/Module Material (Crystalline Silicon), System Tracking (Fixed Mount), and Average System Size - DC Nameplate Capacity (KW) (3.5). A 'View Results Summary' button is visible. Below the form, the 'Local Economic Impacts - Summary Results' table is shown, detailing impacts during construction and installation, as well as during operating years.

| Local Economic Impacts - Summary Results       |             |                              |                            |
|--|-------------|------------------------------|----------------------------|
| During construction and installation period    |             |                              |                            |
|  | Jobs        | Earnings \$000 (2010)        | Output \$000 (2010)        |
| Project Development and Onsite Labor Impacts   | 14.8        | \$796.6                      | \$1,365.7                  |
| Construction and Installation Labor            | 5.8         | \$454.8                      |                            |
| Construction and Installation Related Services | 9.1         | \$341.8                      |                            |
| Module and Supply Chain Impacts                | 15.5        | \$588.6                      | \$1,699.8                  |
| Manufacturing Impacts                          | 0.0         | \$0.0                        | \$0.0                      |
| Other Sector Impacts                           | 15.5        | \$588.6                      | \$1,699.8                  |
| Induced Impacts                                | 7.9         | \$255.4                      | \$849.9                    |
| <b>Total Impacts</b>                           | <b>38.3</b> | <b>\$1,640.6</b>             | <b>\$3,915.3</b>           |
| During operating years                         |             |                              |                            |
|  | Annual Jobs | Annual Earnings \$000 (2010) | Annual Output \$000 (2010) |
| Onsite Labor Impacts                           |             |                              |                            |
| PV Project Labor Only                          | 0.2         | \$11.1                       | \$11.1                     |
| Local Revenue and Supply Chain Impacts         | 0.0         | \$2.0                        | \$6.7                      |
| Induced Impacts                                | 0.0         | \$1.2                        | \$3.9                      |
| <b>Total Impacts</b>                           | <b>0.2</b>  | <b>\$14.3</b>                | <b>\$21.6</b>              |

# Course Outline

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- About the DOE Office of Indian Energy Education Initiative
- Course Introduction
- Resource Mapping
- Applications
  - PVWatts; IMBY; SAM; CREST; OpenPV; Solar Prospector
  - OpenEI; Transparent Cost Database; JEDI
- Data Challenges & Solutions: Information Sharing
- Additional Information & Resources



# NREL Tools Links

|                  |   |
|------------------|---|
| Map Apps at NREL | <a href="http://maps.nrel.gov">http://maps.nrel.gov</a>   |
| MapSearch        | <a href="http://www.nrel.gov/gis/mapsearch/">http://www.nrel.gov/gis/mapsearch/</a>                   |
| REAtlas          | <a href="http://maps.nrel.gov/reatlas">http://maps.nrel.gov/reatlas</a>                               |
| IMBY             | <a href="http://mercator.nrel.gov/imby">http://mercator.nrel.gov/imby</a>                             |
| SAM              | <a href="http://sam.nrel.gov">http://sam.nrel.gov</a>   |
| HyDRA            | <a href="http://maps.nrel.gov/hydra">http://maps.nrel.gov/hydra</a>                                   |
| RE_Atlas         | <a href="http://maps.nrel.gov/re_atlas">http://maps.nrel.gov/re_atlas</a>                             |
| Solar Prospector | <a href="http://maps.nrel.gov/prospector">http://maps.nrel.gov/prospector</a>                         |
| OpenPV           | <a href="http://openpv.nrel.gov/gallery">http://openpv.nrel.gov/gallery</a>                           |
| PVDAQ            | <a href="http://maps.nrel.gov/pvdaq">http://maps.nrel.gov/pvdaq</a>                                   |
| LCOE Calculator  | <a href="http://www.nrel.gov/analysis/tech_lcoe.html">http://www.nrel.gov/analysis/tech_lcoe.html</a> |
| GeoREServ API    | <a href="http://rpm.nrel.gov/docs/georeserv/">http://rpm.nrel.gov/docs/georeserv/</a>                 |
| REEDS            | <a href="http://www.nrel.gov/analysis/reeds/">http://www.nrel.gov/analysis/reeds/</a>                 |
| PV JEDI          | <a href="http://www.nrel.gov/analysis/jedi/">http://www.nrel.gov/analysis/jedi/</a>                   |
| OpenEI           | <a href="http://openei.org">http://openei.org</a>   |
| Smartgrid.gov    | <a href="http://smartgrid.gov">http://smartgrid.gov</a>   |



# Useful Resources

## Resource

RE\_Atlas: [http://maps.nrel.gov/re\\_atlas](http://maps.nrel.gov/re_atlas)  
Solar Prospector: <http://maps.nrel.gov/prospector>  
OpenPV: <http://openpv.nrel.gov/gallery>  
PVDAQ: <http://maps.nrel.gov/pvdaq>  
GeoREServ API: <http://rpm.nrel.gov/docs/georeserv/>

## Technology

SAM: <http://sam.nrel.gov>  
CREST: <http://financere.nrel.gov/finance/content/CRESTmodel>  
LCOE Calculator: [http://www.nrel.gov/analysis/tech\\_lcoe.html](http://www.nrel.gov/analysis/tech_lcoe.html)  
PV JEDI: <http://www.nrel.gov/analysis/jedi/>  
OpenEI: <http://openei.org>

## Policy

OpenEI: <http://openei.org>  
Utility Rate Database: <http://en.openei.org/wiki/Gateway:Utilities>  
Transparent Cost Database: [http://en.openei.org/wiki/Transparent\\_Cost\\_Database](http://en.openei.org/wiki/Transparent_Cost_Database)



# Thank You & Contact Information

For Technical Assistance:

[IndianEnergy@hq.doe.gov](mailto:IndianEnergy@hq.doe.gov).

DOE Office of Indian Energy Website:

[www.energy.gov/indianenergy](http://www.energy.gov/indianenergy)

NREL Technology Websites:

[www.nrel.gov/learning/re\\_basics.html](http://www.nrel.gov/learning/re_basics.html)



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# INFORMATION ON THE CURRICULUM PROGRAM & OFFERINGS

# Curriculum Structure & Offerings

## Foundational Courses

- Overview of foundational information on renewable energy technologies, strategic energy planning, and grid basics

## Leadership & Professional Courses

- Covers the components of the project development process and existing project financing structures

# Foundational Courses

## Energy Basics

Assessing Energy Needs  
and Resources

Electricity Grid Basics

Strategic Energy  
Planning

## Renewable Energy Technology Options

Biomass

Direct Use

Geothermal

Hydroelectric

Solar

Wind

All courses are presented as 40-minute Webinars online at

[www.energy.gov/indianenergy](http://www.energy.gov/indianenergy)