

Energy Informatics Panel

May 17, 2012



World Renewable Energy Forum

Moderator: Bobi Garrett

National Renewable Energy Laboratory

Sr. Vice President – Outreach Planning and Analysis

NREL/PR-6A20-54678



Consumer Empowerment with Information

World Renewable Energy Forum

May 17, 2012

The Cloud Computing platform for Energy Internet

- Backed by leading European and US Venture Capital
- 35+ utility and ‘smart’ product providers
(in regulated and competitive markets)
- 200+ Employees
- Headquartered in Boulder, Colorado
(with offices in Boston, Melbourne, Australia, and San Francisco)

Multiple awards and recognitions, including:





One Platform. Every Connection.

- A cloud based platform for open, secure and scalable consumer engagement
- An integrated series of connected devices, applications and services for all users of the Energy Internet
- Agnostics to network, device and application



Three commitments:

1. **Utilities:** Green Button functionality native within the Connect Platform
2. **Developers:** Green Button API's for third-party applications
3. **Consumers:** A strong first experience through GreenButtonConnect.com



HOME

ABOUT US

OUTAGES

CONTACT US

MY ACCOUNT



Green Button

From

To

Download My Data



View My Data



Residential



- Pay Bill
- Customer Service
- Rebates
- Outages

Commercial



- Pay Bill
- Customer Service
- Rebates
- Outages

Environmental



- Environmental Commitment
- Smart Grid
- Electric Vehicles
- Renewable Energy

TE_NDRIL Connect™



Start developing for the Energy Internet with Tendrill Connect™ APIs

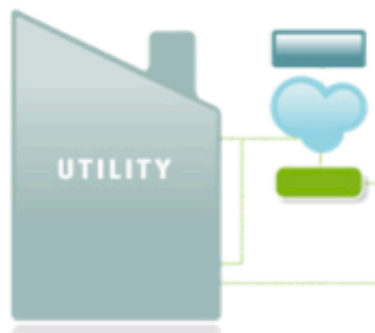
Create unique applications that monitor and control user data and devices

Get Started

Reasons to use Tendrill Connect™ APIs

Connect with the Energy Internet.

Gain first-time access to the Energy Internet, the world's largest marketplace. We've innovated an industry, so you can innovate the world.



Documentation

Access API documentation; test API calls with sample data



Community

Join discussions about our API, ask questions, and get answers



Blog

Follow the latest news, learn about upcoming events, and find out about new releases



Applications

Manage your Tendrill applications

Overview

General

API Primer

API Reference

Users

Metering

Pricing

Devices

Green Button

Interval Data

Interval Data

`/connect/greenbutton`

Returns historical cost and consumption metering data in the Green Button format.

This API is subject to change. The specification is still in DRAFT state. The goal: Enable consumers to download their detailed energy usage with the simple click of a "Green Button." The concept: Inspired by successes in getting Americans their own health care data, but developed by the energy industry in a consensus process that may be adopted voluntarily. Builds on policy objectives in the Obama Administration's Blueprint For a Secure Energy Future and Policy Framework for the 21st Century Grid to ensure that consumers have timely access to their own energy data in consumer-friendly and computer-friendly formats.

Note: Values listed in the Response descriptions are subject to change and may not be available in the final Green Button specification.

GET

Returns to the consumer their home's energy cost and consumption.

Try It

Sample

Parameters

Response

→ Request

```
/connect/greenbutton ? from = 12/24/2011 & to = 12/31/2011 & resolution = HOURLY & max-results = 20
```

GET

Reset

andrew.wood@tendril.com:password ▾

JSON ▾

Smarter ways to use your energy.



Understanding your energy data is one upload away.

It's your energy information. Get the most from it with a visit to the Green Button App Gallery.

Green Button apps help you understand how you're using energy today, find new ways to save, and participate in your energy community.

[Get Started](#)

Upload your energy information.

Easily upload information about your energy usage and costs. Get your Green Button file from your utility, then drag and drop it here.

Find valuable applications.

Once you've uploaded your information, get the most from it by visiting the Green Button App Gallery.

Live smarter, lowering your energy cost.

Get in the habit of using energy efficiently, and save money. There are several simple practices that can make a big difference.

A powerful platform for developers. Create game-changing applications powered by energy and device data. [Learn More](#)



www.GreenButtonConnect.com

dev.tendriline.com

Geospatial Energy Informatics

Dan Getman

WREF 2012

Geospatial Energy Informatics

Resource Information

- Generation and acquisition of spatial datasets that describe energy resources

Geospatial Analysis

- The process of deriving actionable information from energy resource datasets

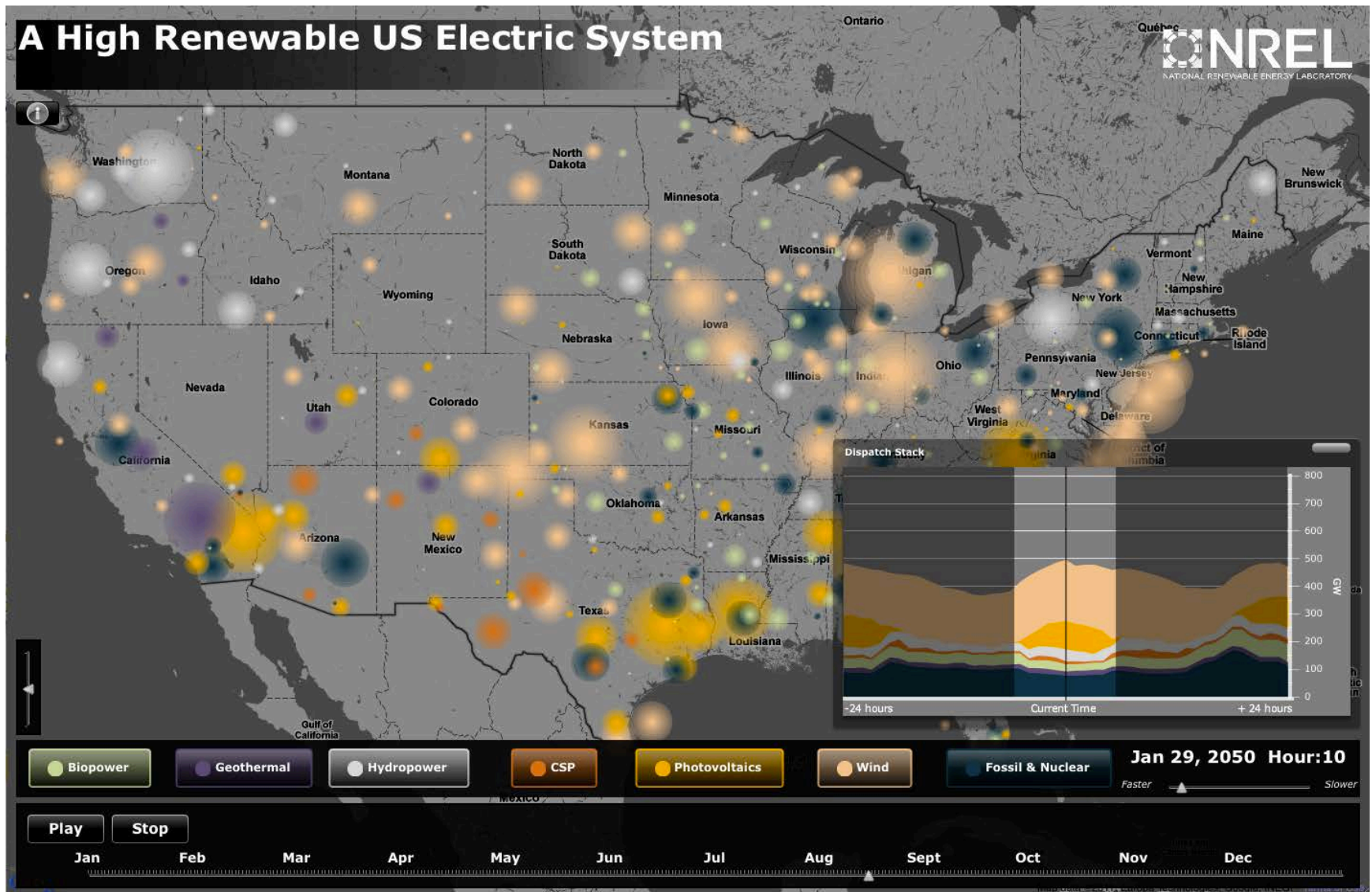
Information Technology

- Providing access to data and analysis through visualization and data services

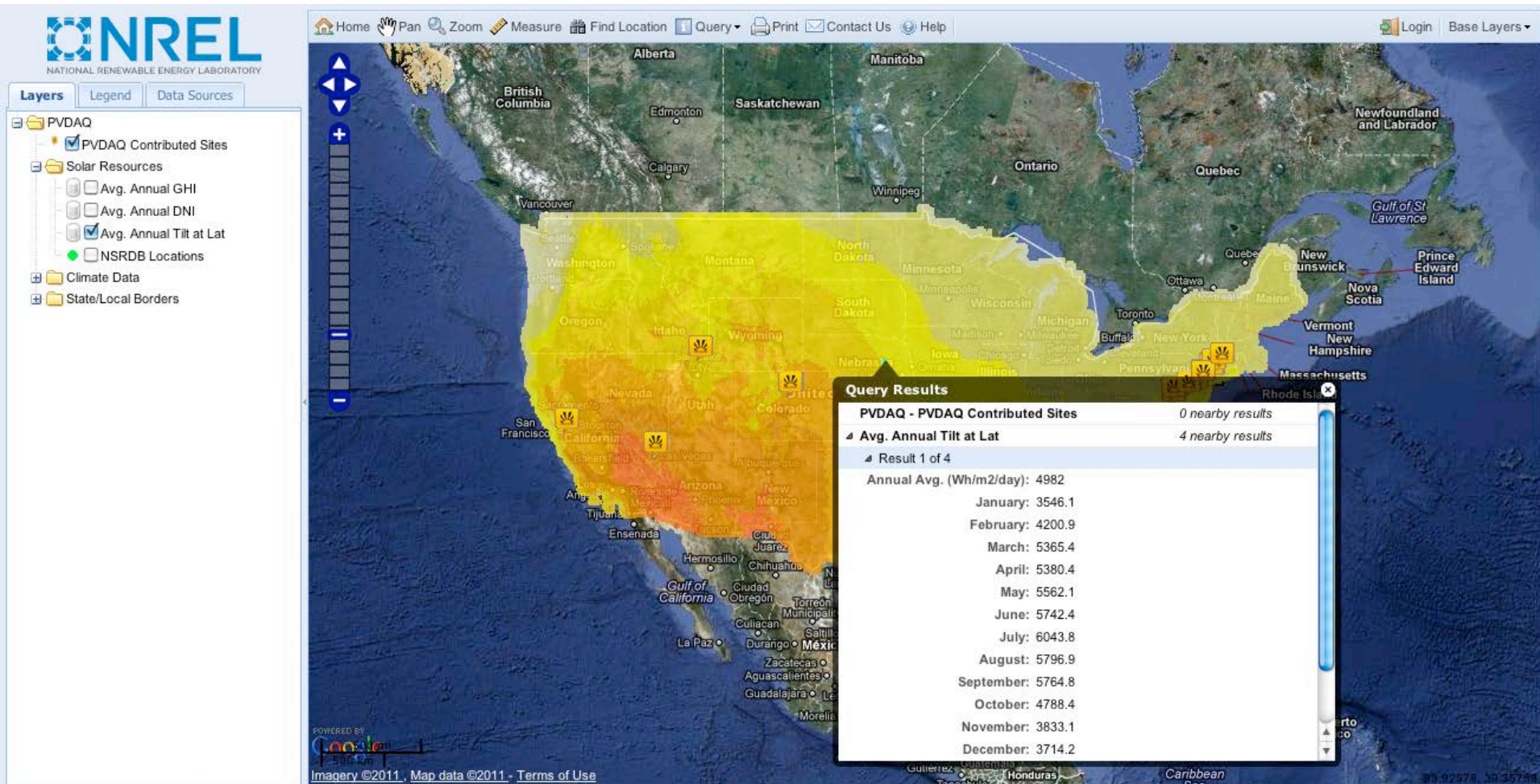
Decision Making

- Development of applications that utilize these data, visualizations, and services to empower decision making

Resource Data Estimation and Visualization



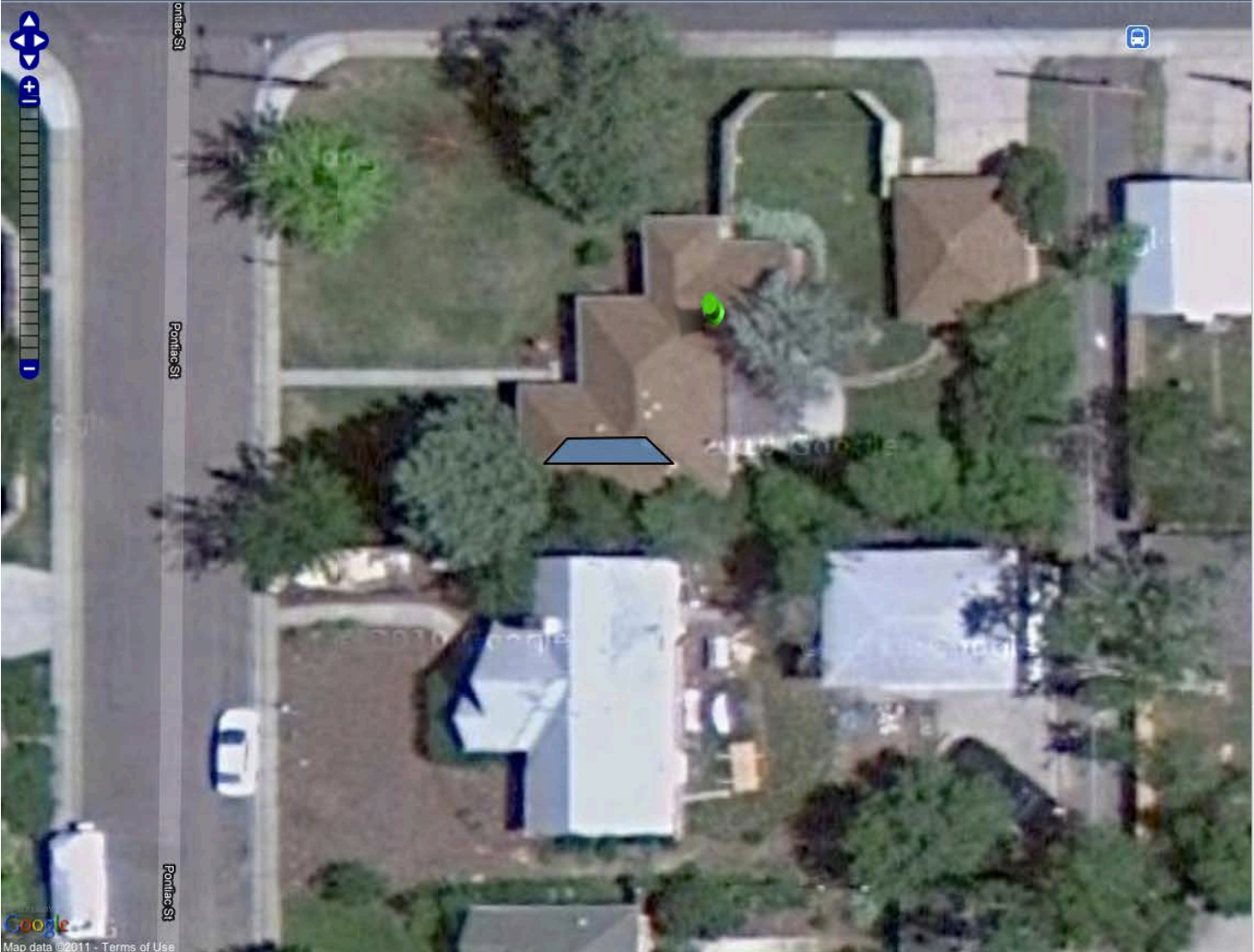
Resource Data Access



Decision Making: Residential PV

In My Backyard - National Renewable Energy Laboratory (NREL)

Pan Clear Map



Options

Location Solar Wind

Solar Electricity Estimator

To estimate the solar electricity you can produce, follow the steps below.

Step 1. Draw your system.

Use the zoom tool on the left of the map, if needed. Click the Draw button, and draw your solar array on the map. Click to add new points. Double-click to stop drawing.

If you make a mistake, click the Clear Map button at the top of the map to start over.

Step 2. Adjust the inputs.

Based on the size and location of your system IMBY suggests these inputs. To change these values, enter your information in the fields below. [Help](#)

Size (kW):

Derating:

Tilt angle (°):

Azimuth angle (°):

Data year:

Step 3. Estimate your production.

Additional Options

Map data ©2011 - Terms of Use

Decision Making: Residential PV

In My Backyard - National Renewable Energy Laboratory (NREL) Pan Clear Map

Solar Simulation Results

Summary
PV Generation Profile
Load & Generation
Utility Bill

Payback

The form below shows the values used to estimate the payback for this system. [help](#)

Size (kW):

Rebates (\$):

Tax Credits (\$):

Cost/W (\$):

Initial Cost (\$):

After Incentives (\$):

Payback (years):

System Outputs

This tables shows the amount of electricity (kWh) generated by this system each month, and the dollar amount that those values translate into.

Month	Output (kWh)	Value* (\$)
January	81	7.37
February	86	7.83
March	106	9.65
April	92	8.37
May	99	9.01
June	92	8.37
July	96	8.74
August	98	8.92
September	96	8.74
October	89	8.1
November	85	7.74
December	82	7.46
Annual	1102	100.28

*Value based on a electric rate of **\$0.09/kWh**

Electric Rate

Electric Rate \$/kWh:

To save these results, choose the Export Results button at the bottom right corner of this window.

Load

Now compare your estimated solar electricity production with your electricity consumption.

Step 1. Select a load profile.

You may select a sample profile or upload your own custom load profile.

(A) Use a sample load profile.

Choose a city from the drop-down box below.

Sample Profile:

or

(B) Upload a load profile.

Click the Upload File button below. Then browse to locate your load profile document. For help click [here](#)

Step 2. Run load profile

Using sample load for Denver

Options

Location
Solar
Wind

Solar Electricity Estimator

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Based on the size and location of your system IMBY suggests these inputs. To change these values, enter your information in the fields below. [Help](#)

Size (kW):

Derating:

Tilt angle (°):

Azimuth angle (°):

Data year:

Step 3. Estimate your production.

Additional Options

Fontaine St

Map data ©2011 - Terms of Use

Decision Making: Residential PV

In My Backyard - National Renewable Energy Laboratory (NREL)

Pan Clear Map

Solar Simulation Results

Summary PV Generation Profile **Load & Generation** Utility Bill

Reduced Load Profile

Legend: System Output (blue), Load Profile (red)

Y-axis: kW (0.00 to 2.50)

X-axis: Time (Feb, Apr, Jun, Aug, Oct, Nov)

Help...

The chart above shows your system generation compared with your site load. To zoom in on any part of the chart, click and drag over your area of interest. To move the chart data use the controls at the bottom of the graph window.

[View Duration Curve](#)

Load

Now compare your estimated solar electricity production with your electricity consumption.

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You may select a sample profile or upload your own custom load profile.

(A) Use a sample load profile.

Choose a city from the drop-down box below.

Sample Profile:

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Step 2. Run load profile

Using sample load for Denver

Options

Location Solar Wind

Solar Electricity Estimator

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If you make a mistake, click the Clear Map button at the top of the map to start over.

Step 2. Adjust the inputs.

Based on the size and location of your system IMBY suggests these inputs. To change these values, enter your information in the fields below. [Help](#)

Size (kW):

Derating:

Tilt angle (°):

Azimuth angle (°):

Data year:

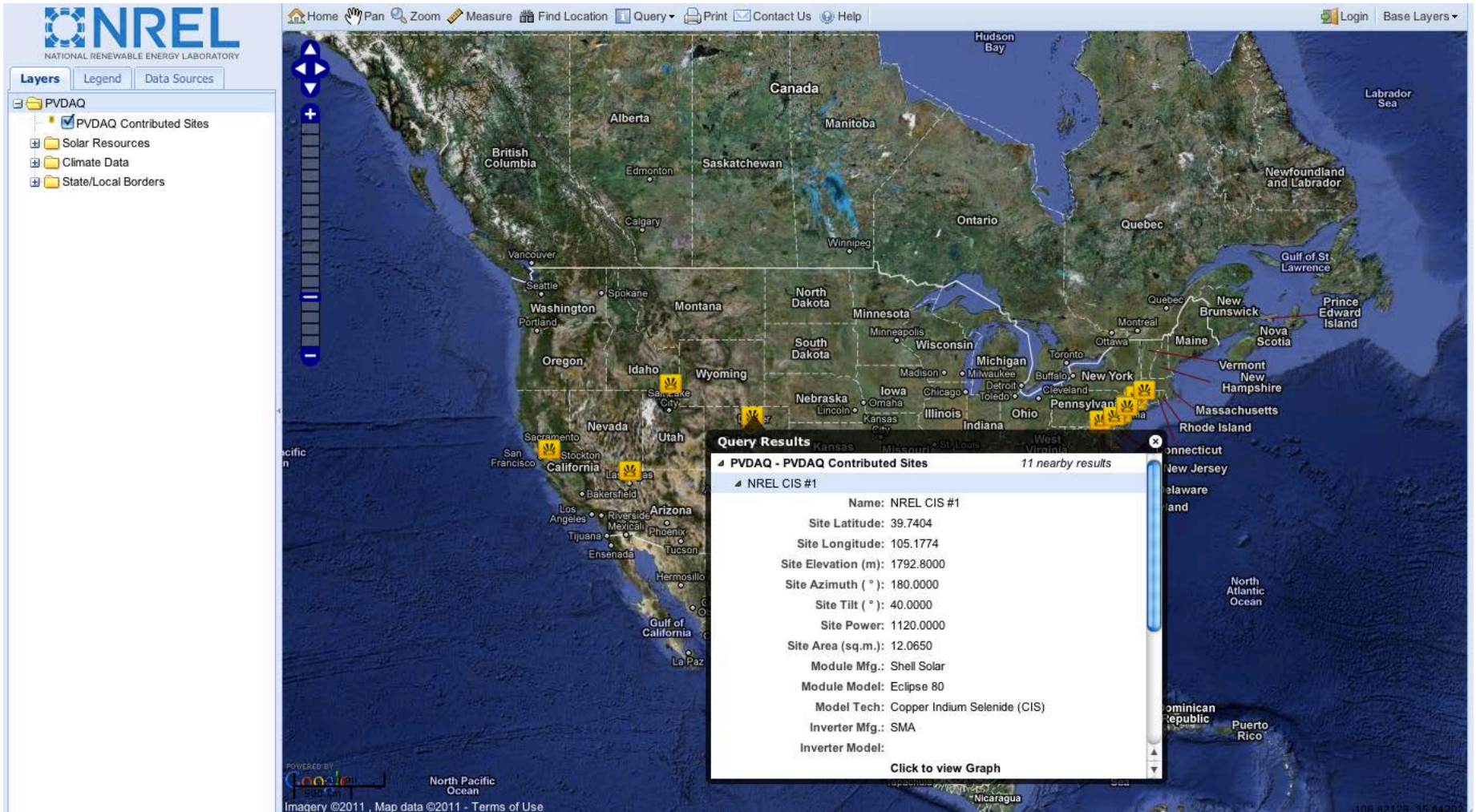
Step 3. Estimate your production.

Additional Options

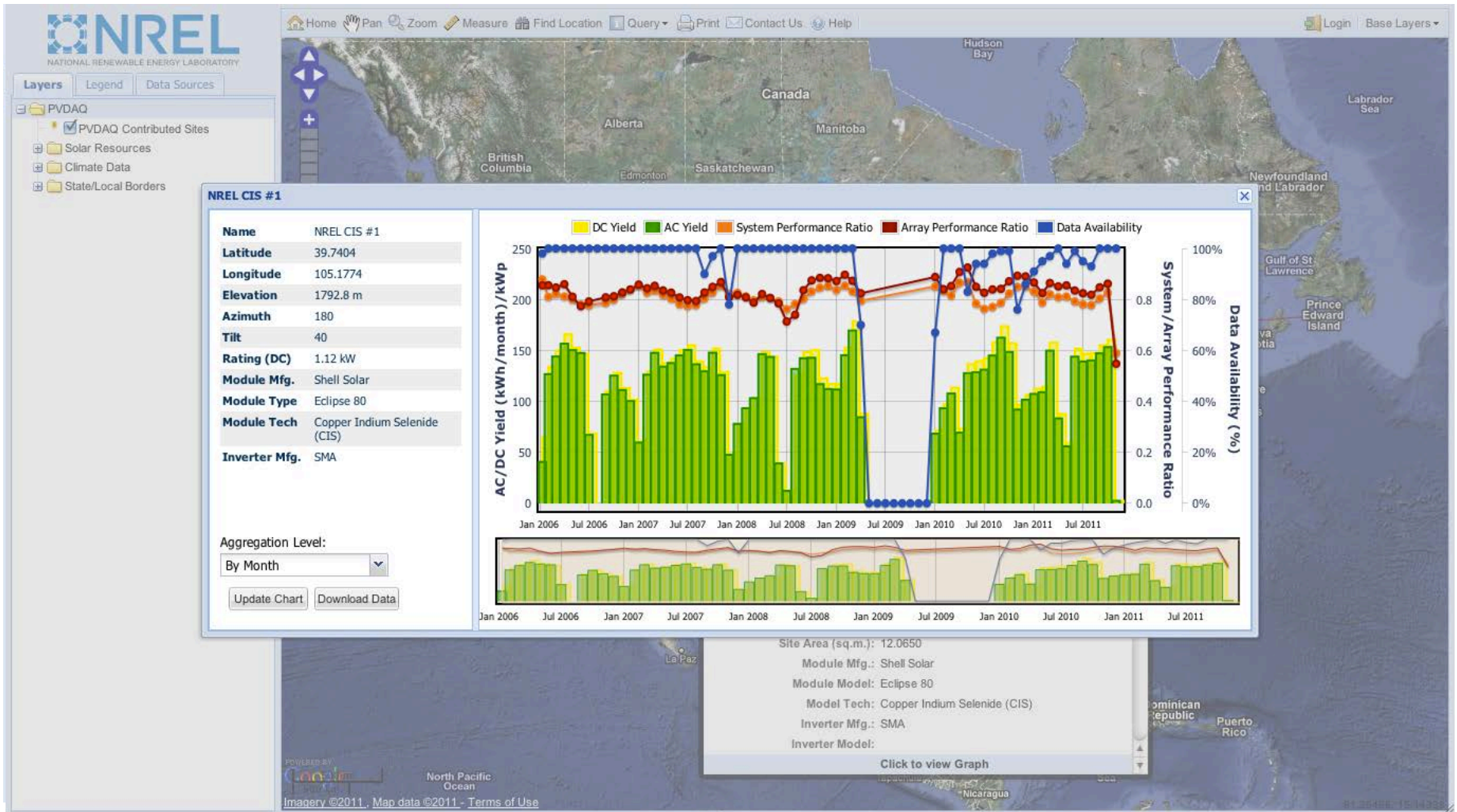
Fontaine St

Map data ©2011 - Terms of Use

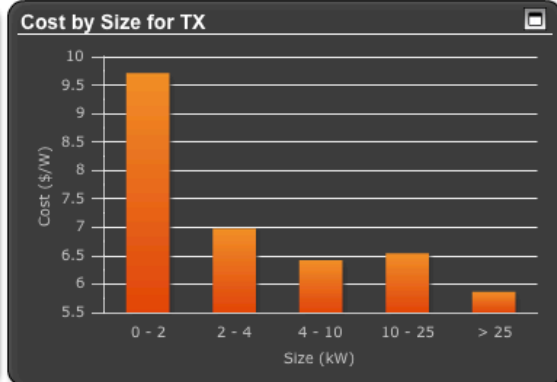
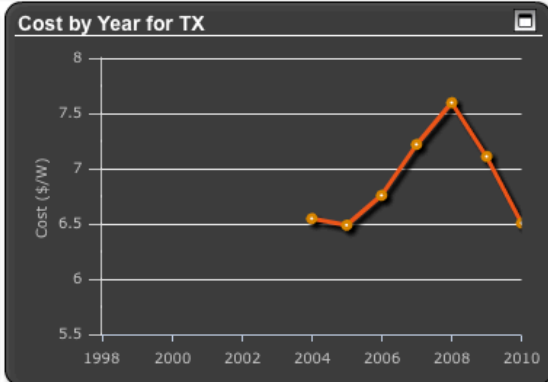
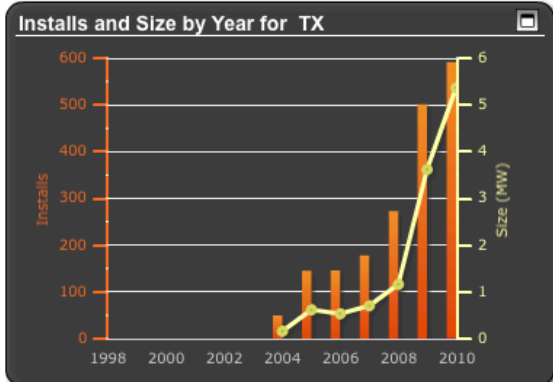
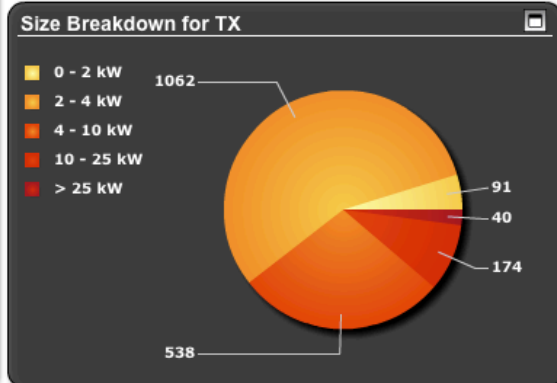
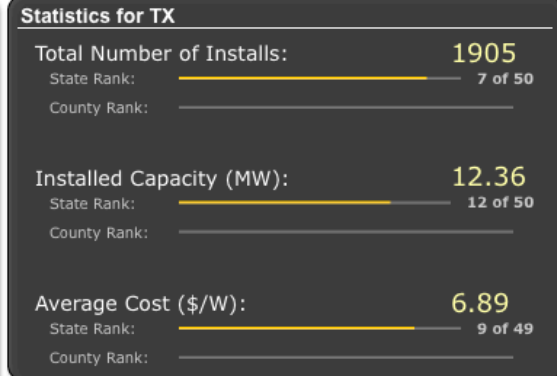
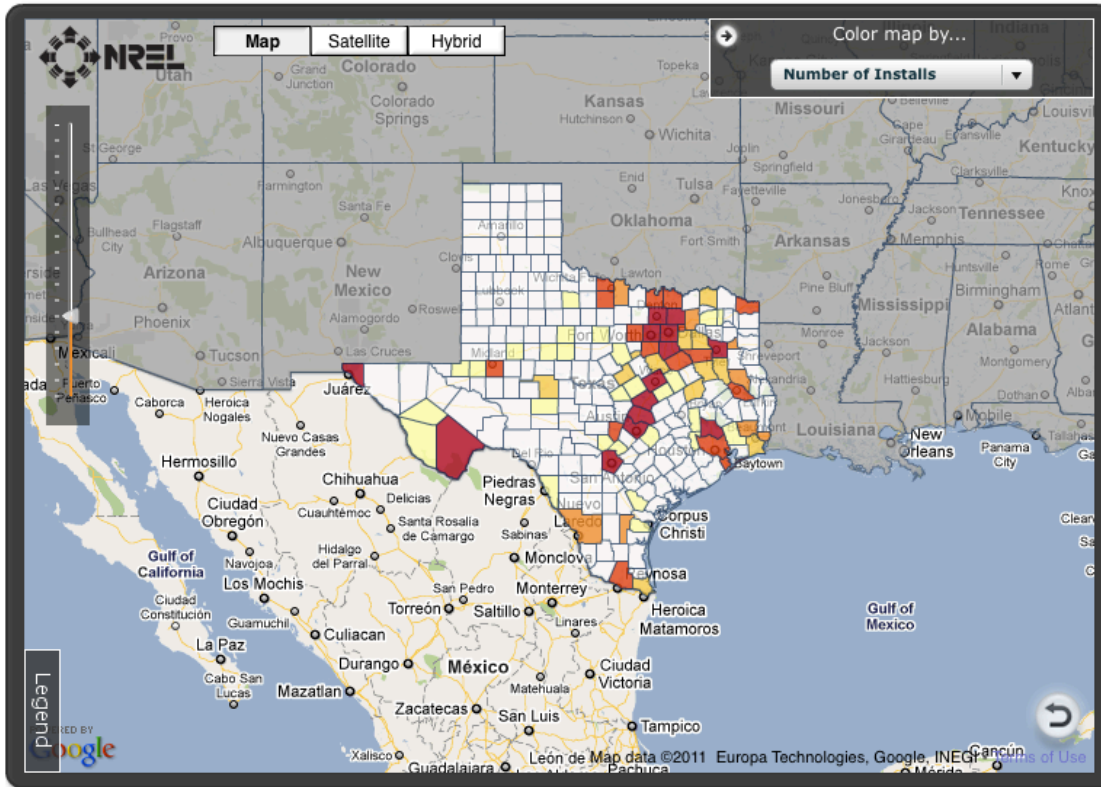
Decision Making: PV Performance



Decision Making: PV Performance



Decision Making: PV Adoption



Data and Analysis Services

The analysis available in IMBY, PVDAQ, OpenPV, Biopower Atlas and other applications is also available as API based services that provide the same data and analytical results.

Industry is actively using these to develop their own applications

All of these services are being made available through developer.nrel.gov

```
- inputs: {
  lat: "40.015",
  lon: "-105.27",
  system_size: "4.0",
  type: "res"
},
- outputs: {
  cost: 32676.591578681568,
  - incentives: {
    - all: {
      - {
        PV Com. Max. Rebate $: 15000,
        PV Com. Rebate $/kW: 1500,
        PV Com. Rebate Max. Size (kW): 25,
        PV NP/Govt Max. Rebate $: 15000,
        PV NP/Govt Rebate $/kW: 1500,
        code: "CO176F",
        gid: 63,
        memo: "4/22/10 added based on website and info provided by Jennifer Hampton BL...",
        notes: "The per-watt rebate rate specified below may be less if local incentives are available.",
        program_name: "Colorado - Commercial Renewable Energy Rebate Program",
        sector: "S",
        state: "Colorado",
        state_abbr: "CO",
        type: "State Rebate Program",
        web_active: "1"
      },
      - {
        PV Res. Rebate $/kW: 1500,
        code: "CO175F",
        gid: 64,
        memo: "4/20/10 added new program based on website BL...",
        notes: "Incentive amounts may be less if local incentives are available. Xcel and Black Hills customers not eligible for this incentive.",
        program_name: "Colorado - Residential Renewable Energy Rebate Program",
        sector: "S",
        state: "Colorado",
        state_abbr: "CO",
        type: "State Rebate Program",
        web_active: "1"
      },
      - {
        PV Com. Max. Rebate $: 200000,
        PV Com. PBI $/kWh: 0.07,
        PV Com. Rebate $/kW: 2000,
        PV Com. Rebate Max. Size (kW): 500,
        PV Com. Rebate Min. Size (kW): 0.5,
        PV NP/Govt Max. Rebate $: 200000,
        PV NP/Govt PBI $/kWh: 0.07,
        PV NP/Govt Rebate $/kW: 2000,
        PV PBI/FIT Duration (Years): 20,
        PV PBI/FIT Min. Size (kW): 10.01,
        PV Res. Max. Rebate $: 27000,
        PV Res. Rebate $/kW: 2700,
        PV Res. Rebate Max. Size (kW): 10,
        PV Res. Rebate Min. Size (kW): 0.5,
```


Data and Analysis Services

The analysis available in IMBY, PVDAQ, OpenPV, Biopower Atlas and other applications is also available as API based services that provide the same data and analytical results.

Industry is actively using these to develop their own applications

All of these services are being made available through developer.nrel.gov

Developer Network



HOME DOCUMENTATION COMMUNITY

Documentation » Solar » PVWatts » GET /api/georeserv/app/sam/pvwatts

GET /api/georeserv/app/sam/pvwatts

Returns a PVWatts simulation.

- Request URL
- Request Parameters
- Examples
 - JSON Output Format
 - XML Output Format
- Demo Application
- Rate Limits
- Errors
- Comments

Request URL

GET <http://developer.nrel.gov/api/georeserv/app/sam/pvwatts.Format?parameters>

Request Parameters

Parameter	Required	Value	Description
format	Yes	Type: string Default: None Options: <i>json, xml, csv</i>	The output response format. Given in the URL as the file extension.
api_key	Yes	Type: string Default: None	Your developer API key. See API keys for more information.
timeframe	No	Type: string Default: daily Options: <i>monthly, daily</i>	Granularity of the output response
lat	Depends	Type: decimal Default: None	Latitude, required if address not given.
lon	Depends	Type: decimal Default: None	Longitude, required if address not given.
address	Depends	Type: string Default: None	Address to use, lat/lon returned by Google's geocoding service.
climate_file_type	No	Type: string Default: perez Options: <i>city, perez</i>	Whether to use city-based observational data (city) or satellite data (perez).
city_file	No	Type: stream Default: None	City file to use for this simulation.
azimuth	No	Type: decimal Default: None	Azimuth angle (degrees).

Data and Analysis Services

Visualizations in applications are based on data obtained from service responses

```

- inputs: {
  lat: "40.015",
  lon: "-105.27",
  system_size: "4.0",
  type: "res"
},
- outputs: {
  cost: 32676.591578681568,
  - incentives: {
    - all: [
      - {
        PV Com. Max. Rebate $: 15000,
        PV Com. Rebate $/kW: 1500,
        PV Com. Rebate Max. Size (kW): 25,
        PV NP/Govt Max. Rebate $: 15000,
        PV NP/Govt Rebate $/kW: 1500,
        code: "CO176F",
        gid: 63,
        memo: "4/22/10 added based on website and info provided by Jennifer Hampton BL...",
        notes: "The per-watt rebate rate specified below may be less if local incentives are available.",
        program_name: "Colorado - Commercial Renewable Energy Rebate Program",
        sector: "S",
        state: "Colorado",
        state_abbr: "CO",
        type: "State Rebate Program",
        web_active: "1"
      },
      - {
        PV Res. Rebate $/kW: 1500,
        code: "CO175F",
        gid: 64,
        memo: "4/20/10 added new program based on website BL...",
        notes: "Incentive amounts may be less if local incentives are available. Xcel and Black Hills customers not eligible for this incentive.",
        program_name: "Colorado - Residential Renewable Energy Rebate Program",
        sector: "S",
        state: "Colorado",
        state_abbr: "CO",
        type: "State Rebate Program",
        web_active: "1"
      },
      - {
        PV Com. Max. Rebate $: 200000,
        PV Com. PBI $/kWh: 0.07,
        PV Com. Rebate $/kW: 2000,
        PV Com. Rebate Max. Size (kW): 500,
        PV Com. Rebate Min. Size (kW): 0.5,
        PV NP/Govt Max. Rebate $: 200000,
        PV NP/Govt PBI $/kWh: 0.07,
        PV NP/Govt Rebate $/kW: 2000,
        PV PBI/FIT Duration (Years): 20,
        PV PBI/FIT Min. Size (kW): 10.01,
        PV Res. Max. Rebate $: 27000,
        PV Res. Rebate $/kW: 2700,
        PV Res. Rebate Max. Size (kW): 10,
        PV Res. Rebate Min. Size (kW): 0.5,
      }
    ]
  }
}
  
```

Solar Simulation Results

Summary | PV Generation Profile | Load & Generation | Utility Bill | Load

Payback

The form below shows the values used to estimate the payback for this system. [help](#)

Size (kW): 0.74
 Rebates (\$): 0
 Tax Credits (\$): 1838.89
 Cost/W (\$): 8.28
 Initial Cost (\$): 6130
 After Incentives (\$): 4291
 Payback (years): 43

System Outputs

This table shows the amount of electricity (kWh) generated by this system each month, and the dollar amount that those values translate into.

Month	Output (kWh)	Value* (\$)
January	81	7.37
February	86	7.83
March	106	9.65
April	92	8.37
May	99	9.01
June	92	8.37
July	96	8.74
August	98	8.92
September	96	8.74
October	89	8.1
November	85	7.74
December	82	7.46
Annual	1102	100.28

*Value based on a electric rate of \$0.09/kWh

Electric Rate

Electric Rate \$/kWh: 0.09

To save these results, choose the Export Results button at the bottom right corner of this window.

Load

Now compare your estimated solar electricity production with your electricity consumption.

Step 1. Select a load profile.

You may select a sample profile or upload your own custom load profile.

(A) Use a sample load profile.

Choose a city from the drop-down box below.

Sample Profile: Denver

or

(B) Upload a load profile.

Click the Upload File button below. Then browse to locate your load profile document. For help click [here](#).

Upload

Step 2. Run load profile

Using sample load for Denver

Run

Export Results | Close

Solar Simulation Results

Summary | PV Generation Profile | Load & Generation | Utility Bill | Load

Reduced Load Profile

kW

Time

System Output (blue line) and Load Profile (red line) are plotted against time from February to November. The y-axis ranges from 0.00 to 2.50 kW.

Help...

The chart above shows your system generation compared with your site load. To zoom in on any part of the chart, click and drag over your area of interest. To move the chart data use the controls at the bottom of the graph window.

View Duration Curve

Load

Now compare your estimated solar electricity production with your electricity consumption.

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Upload

Step 2. Run load profile

Using sample load for Denver

Run

Export Results | Close

Data and Analysis Services

It is just as easy to access these data and analysis services through Excel and scripting

```
- inputs: {
  lat: "40.015",
  lon: "-105.27",
  system_size: "4.0",
  type: "res"
},
- outputs: {
  cost: 32676.591578681568,
  - incentives: {
    - all: [
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        PV Com. Max. Rebate $: 15000,
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        PV NP/Govt Max. Rebate $: 15000,
        PV NP/Govt Rebate $/kW: 1500,
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        PV Res. Rebate $/kW: 2700,
        PV Res. Rebate Max. Size (kW): 10,
        PV Res. Rebate Min. Size (kW): 0.5,

```

The screenshot shows an Excel spreadsheet with a complex data table. The table has many columns, including headers for various parameters and values. Some rows are highlighted in yellow, indicating specific data points or results. The spreadsheet appears to be a detailed report or analysis tool.

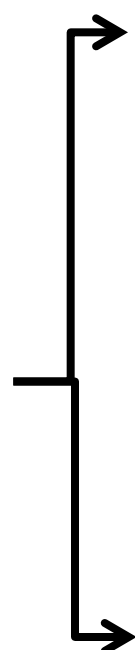
```
dgetman@maps-dev: /var/www/opencarto/dgetman/src/custom_modules/geothermal
dgetman@maps-dev: /...
!php
// vim: set filetype=php expandtab tabstop=2 shiftwidth=2:
/**
 * Implementation of hook_install().
 */
function geothermal_install() {
  $geothermal_nid = db_result(db_query("SELECT nid FROM {node} WHERE title LIKE 'Geothermal'"));
  if($geothermal_nid == FALSE) {
    // Create our Opencarto Application
    $node_options = variable_get('node_options_opencarto', array('status', 'promote'));
    $opencarto_node = array();
    $opencarto_node['type'] = 'opencarto';
    $user = user_load(array('uid' => 1));
    $opencarto_node['uid'] = $user->uid;
    $opencarto_node['name'] = $user->name;
    $opencarto_node['promote'] = in_array('promote', $node_options);
    $opencarto_node['comment'] = variable_get('comment_', $opencarto_node['type'], 2);
    $opencarto_node['revision'] = in_array('revision', $node_options);
    $opencarto_node['format'] = FILTER_FORMAT_DEFAULT;
    $opencarto_node['status'] = 1;
    $opencarto_node['title'] = 'Geothermal';

    $node = node_submit($opencarto_node);
    node_save($node);

    $geothermal_nid = $node->nid;
  }

  variable_set('geothermal_app_id', $geothermal_nid);

  $folder_id = db_query("INSERT INTO oc_app_folder
  (oc_nid, parent_id, name, machine_id, expanded) VALUES (id, NULL, 'Geothermal Main Folder', 'geothermal', 0);", $geothermal_nid);
  $machine_id = $geothermal_nid . "-" . $folder_id;
  db_query("UPDATE oc_app_folder SET machine_id = '$machine_id' WHERE id = $folder_id");
}
/**
```



World Renewable Energy Forum

May 17, 2012

Debbie Brodt-Giles

Turning Data into Energy Informatics

Importance of Data

- Data is driving our innovation and our future
 - Global, Regional, Local, Campus data – all are important!
-
- **My Goal:**
 - Provide a brief overview of NREL's Energy Data and Informatics Activities
 - Spark your interest to learn more!

Clean Energy Economy
CLEAN
coordinated low emissions assistance network
Incentives and Policies
International Clean Energy Analysis
Latinoamérica
LEDS
low emission development strategies
Renewable Energy News
U.S. OpenLabs

Browse by Region



Featured OpenEI Pages

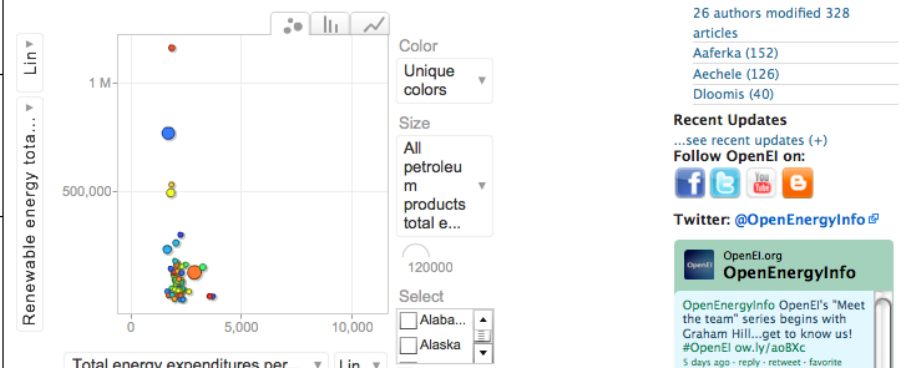
GREEN BUTTON APPS
View, Access, and Share Green Button Apps



Energy Information, Data, and other Resources



Energy Expenditures and Renewable Energy Consumption in the US: Visualizing Trends with a Motion Chart



Recent Contributors
new this week:
Susan Walzer (1)
Amjad (1)
Cleveland (1)

most active:
26 authors modified 328 articles
Aaferka (152)
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Doomis (40)

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OpenEnergyInfo OpenEI's "Meet the team" series begins with Graham Hill...get to know us! #OpenEI ow.ly/aobXc
5 days ago · reply · retweet · favorite

Colorado: Energy Resources

From Open Energy Information



Colorado is the US state that encompasses most of the Southern Rocky Mountains as well as the northeastern portion of the Colorado Plateau and the western edge of the Great Plains. Colorado is part of the Western United States, the Southwestern United States, and the Mountain States. Colorado is the 8th most extensive and the 22nd most populous of the 50 United States. Colorado is a state in the United States of America.

Energy Production by Technology in Colorado

Fuel Source	Value	Units
Solar Power	16,530	MWh
Wind Power	2,942,133	MWh
Geothermal Power	0	MWh
Biomass Power	50,528	MWh
Total Energy Production from Non-Hydro Renewables	3,009,191	MWh
Hydro Power	2,058,215	MWh
HPS Power ↑	108,658	MWh
Total Energy Production from Renewables	5,067,406	MWh

State Profile	
Name	Colorado
Governor	John Hickenlooper
Population	Unavailable
Median Household Income	\$56,993.00
Energy Consumption	Coming Soon
OpenEI Resources	
Energy Maps	40 view #
Energy Organizations	397 view #
Utility Companies	70 view #
Active Energy Incentives	70 view #

13 News Articles

- OpenEI News Feature on NREL News
- U.N. Secretary General tells NREL Clean Energy a Top Priority
- Vice President Joe Biden's visit to NREL
- Explore what's new on OpenEI
- Running the numbers: OpenEI can help you weigh the costs versus the benefits of making your home green

70 Energy Incentives (Active)

- Black Hills Energy (Gas) - Commercial Energy Efficiency Program (Colorado)
- Black Hills Energy (Gas) - Residential Energy Efficiency Program (Colorado)
- Black Hills Energy (Electric) - Residential Energy Efficiency Program (Colorado)
- Xcel Energy (Gas) - Residential Energy Efficiency Rebate Programs (Colorado)
- Xcel Energy (Gas) - Business Energy Efficiency Rebate Programs

Energy Datasets

About

The Energy Datasets section of OpenEI stores structured information in widely-used formats. The Energy Datasets section of OpenEI stores structured information in widely-used formats. The Energy Datasets section of OpenEI stores structured information in widely-used formats. This is a beta release of this functionality, and thus is subject to change. OpenEI users have contributed **798** energy datasets to date.

Name

STIL2 Swedish Office Buildings Survey
The STIL2 project has performed a survey of high performance office buildings in Sweden. The data covers...
efficiency data for non-residential premises. The data covers...

National Solar Radiation Data Base
The National Solar Radiation Data Base (NSRDB) is the most comprehensive collection of solar radiation data available. The 1991 - 2005 NSRDB contains hourly solar radiation (...)

Energy Technology Cost and Performance Data
This data indicates the range of recent cost estimates for renewable energy and other energy technologies. Estimates are shown in dollars per installed kilowatts of generating capacity...

Commercial Building Profiles
This dataset includes simulation results from a national-scale study of the commercial buildings sector. Electric load profiles contain the hour-by-hour demand for electricity...

Electric Power Monthly - Monthly Data Tables
Monthly electricity generation figures (and the fuel consumed to produce it). Source information available at EIA.

Low temperature Direct Use Geothermal Facilities
Contains generating capacity information for low temperature direct use geothermal facilities by state.

NOAA Borehole Data
NOAA borehole data with temperatures at different depths.
<http://www.ncdc.noaa.gov/paleo/borehole/nam.html>

National Biorefineries Database
This phase of the project began with the development of a geodatabase with the focus predominantly on ethanol production locations...
Ethanol. The task involved collection of data on ethanol production locations...

National Biorefineries Database
This phase of the project began with the development of a geodatabase with the focus predominantly on ethanol production locations...
Ethanol. The task involved collection of data on ethanol production locations...

NREL

EIA

NREL

NOAA

Oak Ridge

Crowdsourcing Success



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 >>

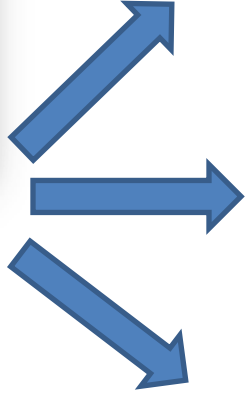
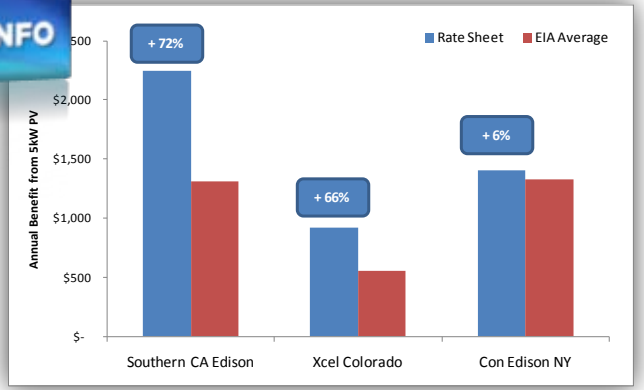
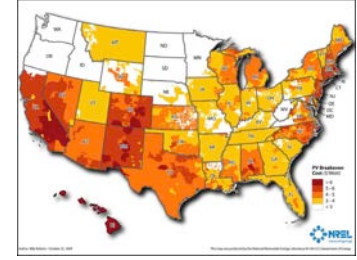
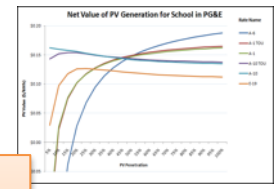
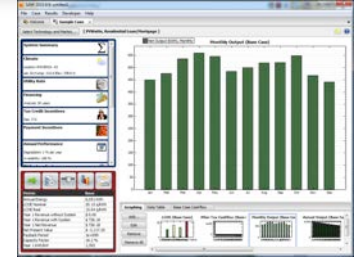
1. Basic Information 2. Time of Use Rate 3. Demand Charges 4. Tiered Rates

<< Previous 1 2 3 4 Next >>

	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

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

More than 3,000
Utility Rates Covering
80+% of the country!

Maximizing the Value of Photovoltaic Installations on Schools in California: Choosing the Best Electricity Rates
Sean Ong and Paul Denholm

Utility Access Map Highlighting Data Connectivity

OpenEI | OPENENERGYINFO Login | Sign Up

Wiki | Apps | Datasets | Linked Data

Browse ▾ Page Actions ▾ View ▾ Get Involved Help Search

Utility Data Access Map

Having access to your electricity use data is a very important step in understanding your overall energy usage. Comparing historical data to your current usage is one way to see trends and determine ways for reducing electricity costs and improving overall efficiency. We asked all U.S. electric utility companies to tell us how accessible their electricity use data is for both residential and commercial customers. The results are updated live based on the responses we have to date. As more utilities provide information, the utility boundaries will be automatically colored and the overall map will become more complete. Try searching for your utility company to see your electricity data access options. [Read more...](#)

Residential Customers | Commercial Customers

select a map Time Period

State summary information

Colorado ▾

- Highline Electric Assn
- San Luis Valley R E C, Inc
- City of Julesburg, Colorado
- City of Delta, Colorado
- Sangre De Cristo Elec Assn Inc
- Southwestern Electric Coop Inc (Colorado)
- Black Hills/Colorado Elec.Utility Co. LP
- City of Aspen, Colorado
- San Isabel Electric Assn, Inc
- ...

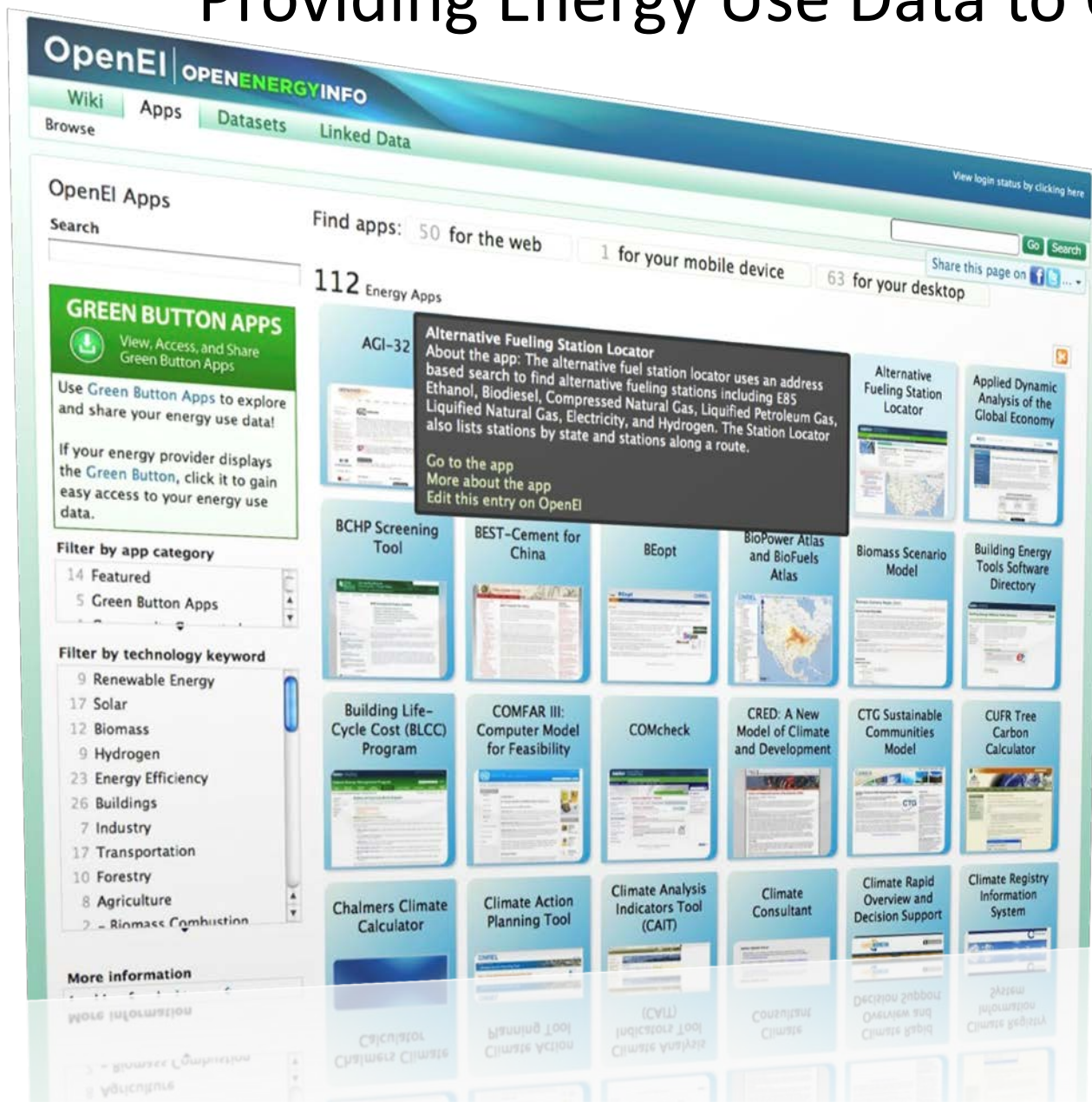
What do these colors represent?

Time period

This map shows customers' access to 13 months worth of historical data. Color coding indicates varying levels of access to historical data.

- Light gray signifies that only the previous month's data is available.
- Medium blue indicates that data for the past 13 months is available.
- Dark blue indicates that data since the last bill is available, as well as data for the past 13 months.

Green Button Apps – Providing Energy Use Data to Consumers



OpenEI | OPENENERGYINFO

Wiki Apps Datasets Linked Data

OpenEI Apps

Find apps: 50 for the web 1 for your mobile device 63 for your desktop

112 Energy Apps

GREEN BUTTON APPS
View, Access, and Share Green Button Apps

Use Green Button Apps to explore and share your energy use data!

If your energy provider displays the Green Button, click it to gain easy access to your energy use data.

Filter by app category

- 14 Featured
- 5 Green Button Apps

Filter by technology keyword

- 9 Renewable Energy
- 17 Solar
- 12 Biomass
- 9 Hydrogen
- 23 Energy Efficiency
- 26 Buildings
- 7 Industry
- 17 Transportation
- 10 Forestry
- 8 Agriculture
- 2 - Biomass Combustion

More information

Alternative Fueling Station Locator
AGI-32
About the app: The alternative fuel station locator uses an address based search to find alternative fueling stations including E85 Ethanol, Biodiesel, Compressed Natural Gas, Liquefied Petroleum Gas, Liquefied Natural Gas, Electricity, and Hydrogen. The Station Locator also lists stations by state and stations along a route.
Go to the app
More about the app
Edit this entry on OpenEI

Alternative Fueling Station Locator

Applied Dynamic Analysis of the Global Economy

BCHP Screening Tool

BEST-Cement for China

BEopt

BioPower Atlas and BioFuels Atlas

Biomass Scenario Model

Building Energy Tools Software Directory

Building Life-Cycle Cost (BLCC) Program

COMFAR III: Computer Model for Feasibility

COMcheck

CRED: A New Model of Climate and Development

CTG Sustainable Communities Model

CUFR Tree Carbon Calculator

Chalmers Climate Calculator

Climate Action Planning Tool

Climate Analysis Indicators Tool (CAIT)

Climate Consultant

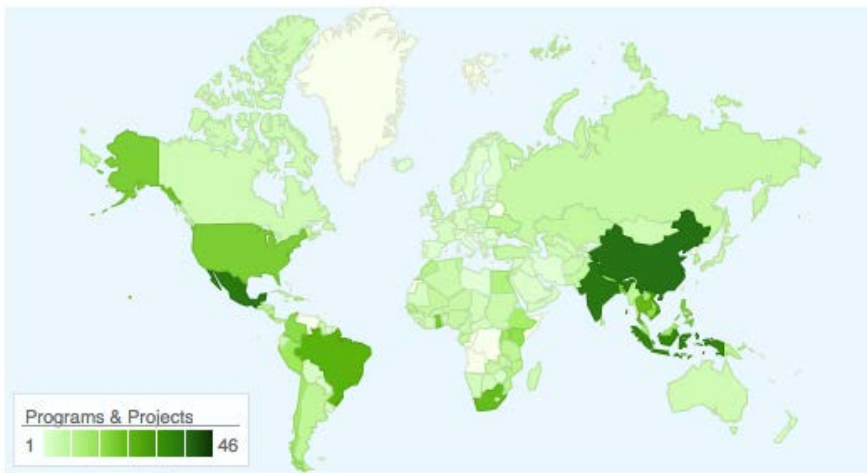
Climate Rapid Overview and Decision Support

Climate Registry Information System



Connecting to the World and Federating with Data.gov

International Initiatives



The screenshot shows the Data.gov website interface. At the top, there's a navigation bar with links for HOME, DATA, APPS, COMMUNITY, METRICS, OPEN DATA SITES, GALLERY, and WHAT'S NEW. The main content area features a large banner for "RADNET" (Radioactive Anomaly Detection Network) with a blue background and a globe. Below the banner, there are three columns of featured content: "DATA AND APPS" (379,931 raw and geospatial datasets), "COMMUNITIES" (invite to explore and discuss), and "OPEN GOVERNMENT" (latest news on Japanese Earthquake and Radiation Data). At the bottom, there are sections for "LEARN", "SEMANTIC WEB", and "DEVELOPER'S CORNER". The footer includes "About | FAQ | Contact Info | Data Policy | Accessibility | Privacy Policy | Storage" and the "DATA.GOV" logo.

The screenshot shows the Energy.Data.gov website interface. It features a green header with the "DATA.GOV / ENERGY BETA" logo and a "WELCOME TO ENERGY.DATA.GOV" message. The main content area is titled "AMERICA'S HOME ENERGY EDUCATION CHALLENGE" and includes a "VIEW MORE" button. Below the main content, there are three columns: "Welcome", "Energy Data Features", and "Challenges". The footer includes "Data.gov » All Communities" and a search bar.



- Smart Grid Data Hub manages data from the 132 ARRA funded Smart Grid Projects
 - Equipment and Expenses
 - Impacts and Benefits
 - Consumer Behavior Study Data
- Consumer Behavior Data will be coming October 2012
- Live data updates, analyses, tabular complete data views – all focusing on accessibility and transparency!

What is the Smart Grid?

Recovery Act Smart Grid Programs

Federal Smart Grid Initiatives

Smart Grid Information Clearinghouse



Home | About | News | Library | Glossary | Contact

SmartGrid.gov is the gateway to information on federal initiatives that support the development of technologies, policies and projects transforming the electric power industry.

ShareThis

What is the Smart Grid?

Information for Consumers

Recovery Act Smart Grid Programs

Program Progress and Results

Federal Smart Grid Initiatives

Policies and Programs

Smart Grid Information Clearinghouse

Utility Industry Information



Project	States	Award Amount	Total Project Value
AEP Ohio (gridSMARTSM Demonstration Project)	Ohio	\$75,161,246	\$150,322,752
Amber Kinetics, Inc. (Flywheel Energy Storage Demonstration)	California	\$4,000,000	\$10,000,000
Ameren Services Company	Missouri	\$5,679,895	\$9,200,000
American Transmission Company LLC (Smart Grid Project)	Wisconsin	\$11,444,180	\$22,888,360
American Transmission Company LLC II (Smart Grid Project)	Wisconsin	\$1,330,825	\$2,661,650
Aquion Energy (Sodium-Ion Battery for Grid-level Applications)	Pennsylvania	\$5,179,000	\$10,359,827

BUILDING THE 21ST CENTURY GRID



CenterPoint Energy's Smart Grid Solutions Improve Operating Efficiency and Customer Participation

CenterPoint Energy Houston Electric is deploying smart metering technology and *distribution automation* equipment to make its operations run more efficiently, lower costs and environmental emissions, and provide the opportunity for consumers to better manage both their electricity use and costs.

[GO TO STORY >](#)
[SEE MORE >](#)



NEWS

April 5, 2012

Energy Dept. Competition

March 9, 2012

Agriculture Transmittion Benefit Cor

January 18, 2012

Administrat Consumers

January 4, 2012

DOE Smart Series

[SEE MORE >](#)

Total Investments. Deployed as of March 31, 2012

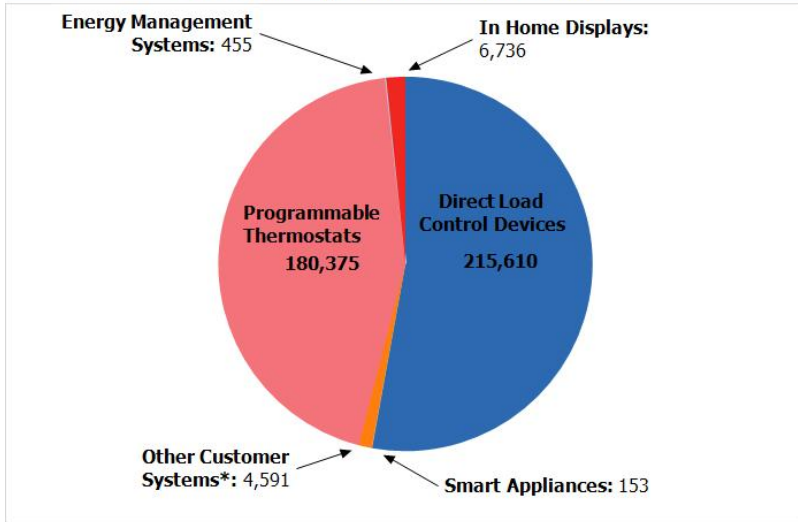


Green Button Gives Millions of Consumers Access to Electricity Usage Information

Breakdown of Technologies Installed



Customer Systems Installed To-Date



- Direct Load Control Devices
- Smart Appliances
- Other Customer Systems
- Programmable Thermostats
- Energy Management Systems
- In Home Displays

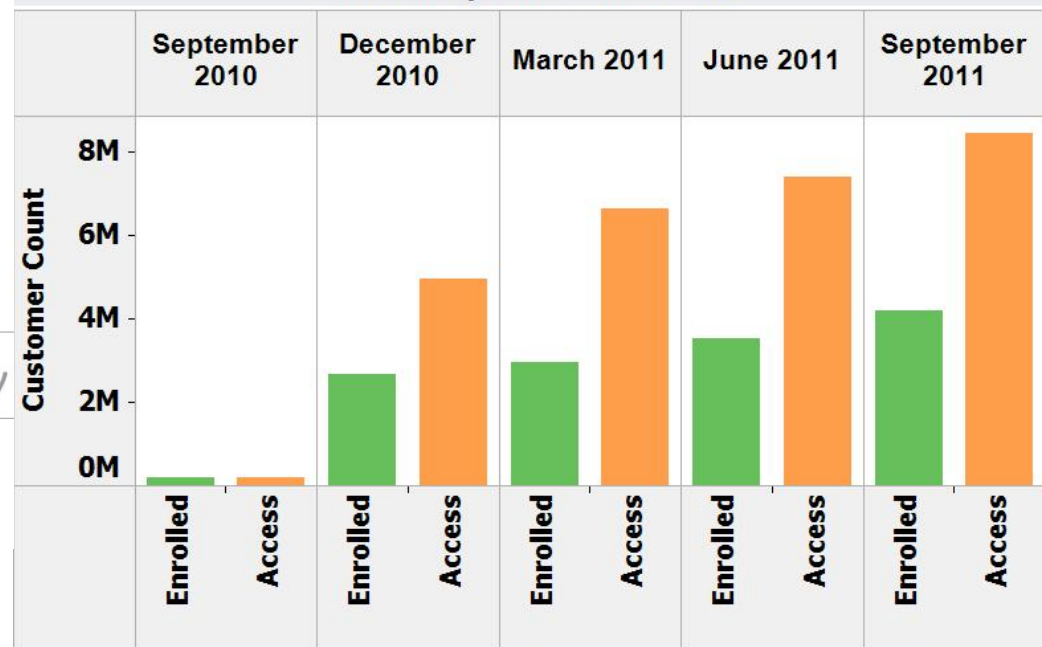


March 13, 2012 18:5:17

* Other Customer Systems include premises with multiple customer systems, electric vehicle supply equipment, and commercial and industrial controllable air conditioning systems.

Enrollments vs Access Over Time 1

Customer Systems - Web Portals



- Enrolled
- Access



March 13, 2012 18:5:17

NREL's Campus Energy Informatics Initiative

- Campus energy meters
 - 80 meters at 1-5 second interval readings
 - PV, Plugs, Mechanical, Elevators, Data Center sub-meters
 - Real/Apparent/Reactive Power in all three phases + Energy
- Primary weather sensors (12 streams at 3 second interval readings)
 - Temp, Humidity, Irradiance, Wind speed/direction
- Building Automation System (~1000 Variable interval readings)
 - Temp, Humidity, CO2, Lighting, HVAC, Heating/Cooling



Photo by Dennis Schroeder, NREL/PIX 19547



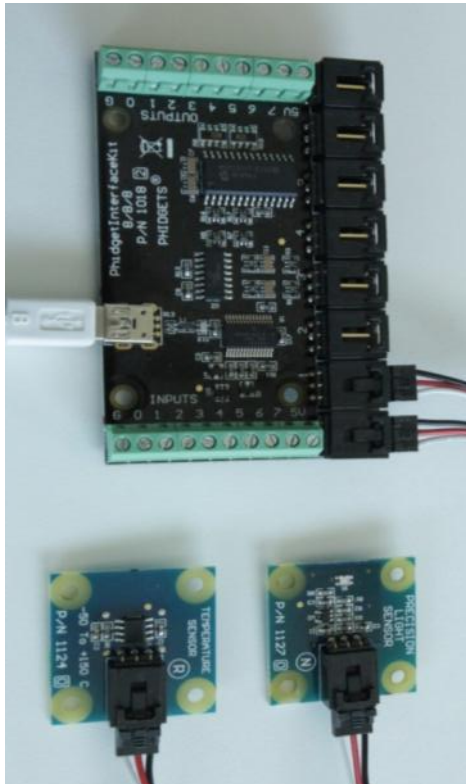
Photo by Dennis Schroeder, NREL/PIX 19089

Client Application – BuildingAgent

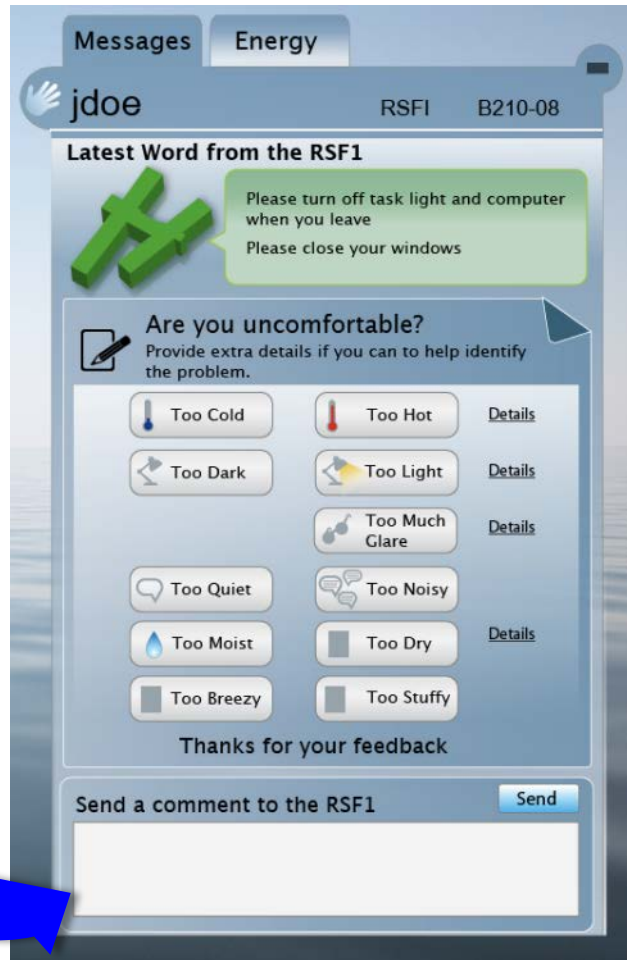
- Provide user with:
 - Messages from building
 - Ability to report comfort
 - LEED Survey
- User logs in with NREL credentials
- Majority of application functionality is through web API (i.e. questions, plots, etc)



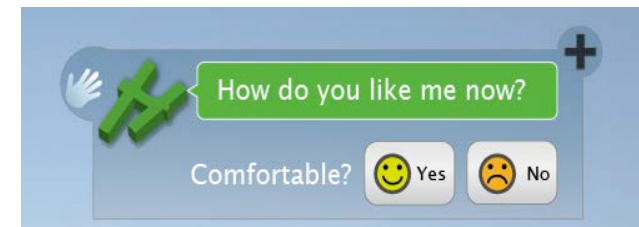
BuildingAgent Local Data Collection



Correlate local measurements to occupant feedback



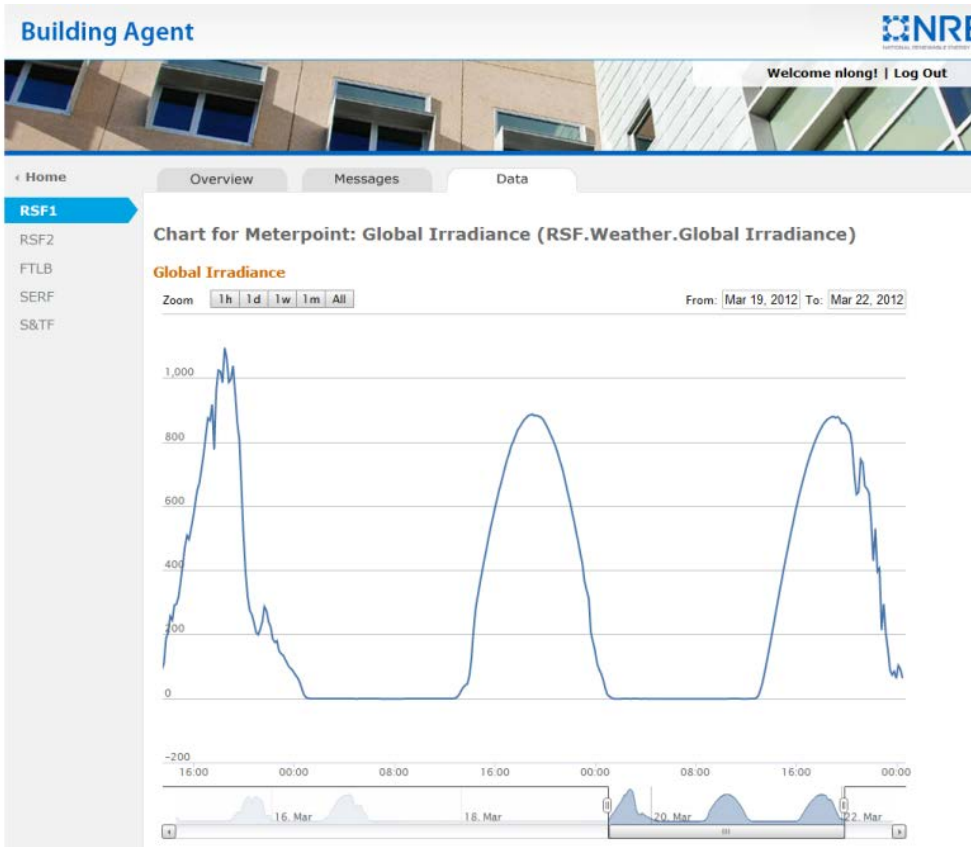
- Client software pushes occupant feedback and local measurements to server
- Temperature, Humidity, and Lighting Levels



Credit: Marj Schott / NREL

Web Application

- Manages users, meters, data, and APIs for client application data



Credit: Nicholas Long / NREL

Whole Campus View



Energy Tracker

5:00 PM 69.4 % Outside Relative Humidity
23.5° F 1.4 mph Wind Speed out of Northwest



STM SITE XXXX kW

XXXX kW

Single Building Views and End Use Views



Research Support Facility
Energy Tracker

8:00 PM 69.4 % Outside Relative Humidity
23.5° F 1.4 mph Wind Speed out of Northwest

Lighting

Todays total = **1 kWh**
Annual Total = **XXX kWh**
Annual Percent: **23**



If you are leaving late, check to see if you are the last person and turn off the lights and your computer before leaving.



Research Support Facility
Energy Tracker

5:00 PM 69.4 % Outside Relative Humidity
23.5° F 1.4 mph Wind Speed out of Northwest

- Home
- Whole Building
- Photovoltaics
- Plug Loads
- Mechanical

Plug Loads 65 kW

Mechanical 35 kW

Lighting 30 kW

Photovoltaics 600 kW

Whole Building -300 kW

Data Center 115 kW

Heating 1.5 kW

Cooling 15 kW

Update Timer

- Home
- Whole Building
- Photovoltaics
- Plug Loads
- Mechanical
- Lighting
- Data Center
- Heating
- Cooling

Heat Maps



Energy Tracker

5:00 PM 69.4 % Outside Realtime Humidity
23.5° F 1.4 mph Wind Speed out of Northwest

RSF 1, 1st Floor Temperature and Comfort



Map color by

Sensor Temp

Comfort

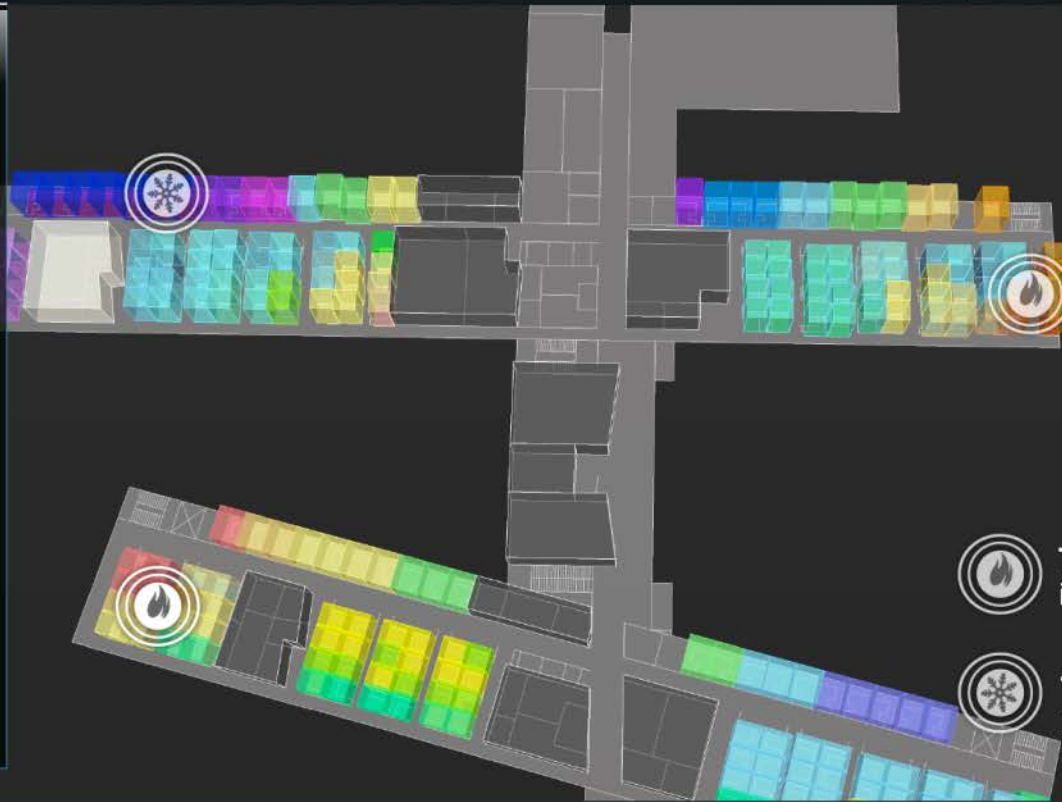
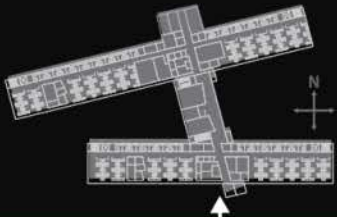
- Hot or Cold
- Humid or Dry
- Stale or Breezy
- Glare
- Quiet or Nolsy

Overlay


Sensor Temp

Comfort

- Hot or Cold
- Humid or Dry
- Stale or Breezy
- Glare
- Quiet or Nolsy



 **Too hot:** over 5 reports in area

 **Too cold:** over 5 reports in area



Home



Virtual Energy Tour

3D Orbit of Buildings and Walkthrus with Energy Data

