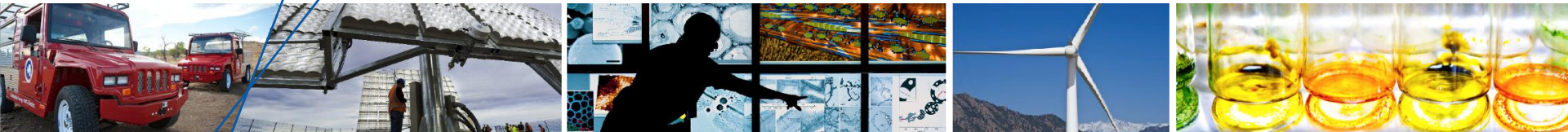


Cloud Based Applications and Platforms

Using the cloud to facilitate access, use, and
contribution of worldwide energy data and information



Cloud Computing East 2014

Debbie Brodt-Giles

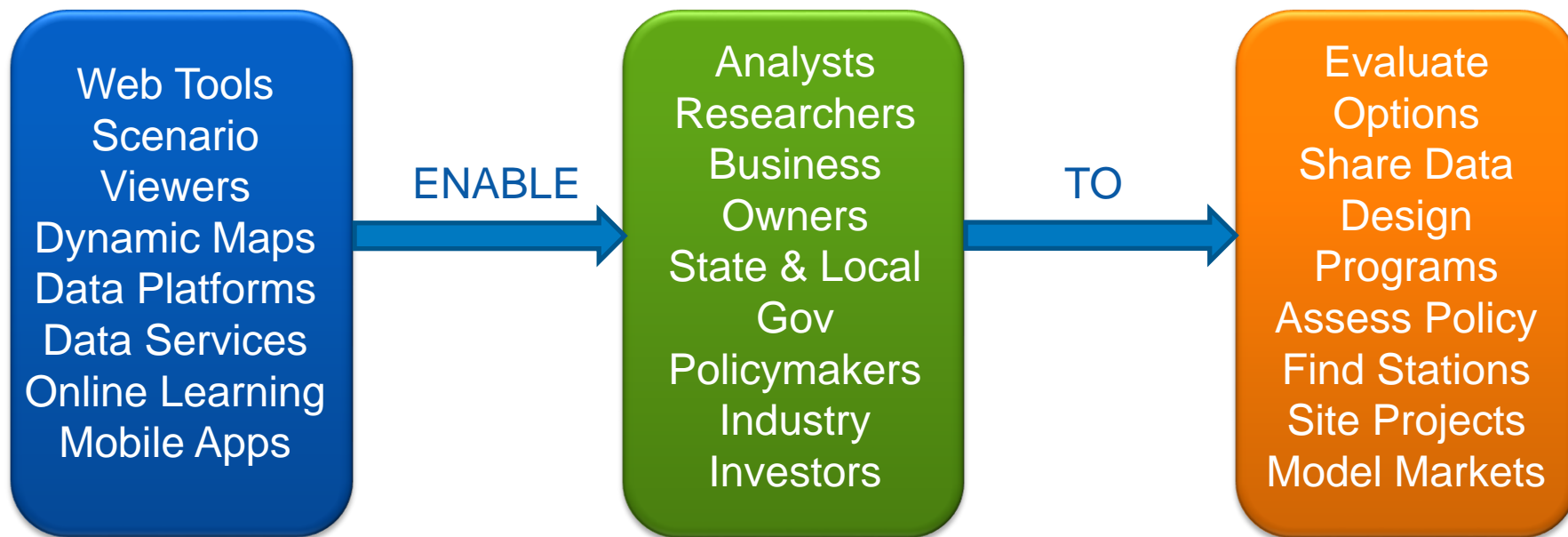
May 15, 2014

Discussion Areas

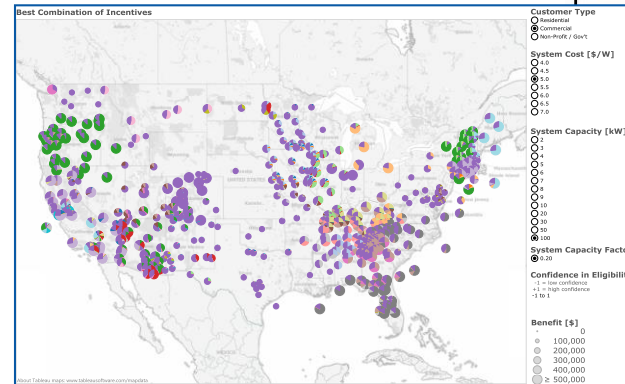
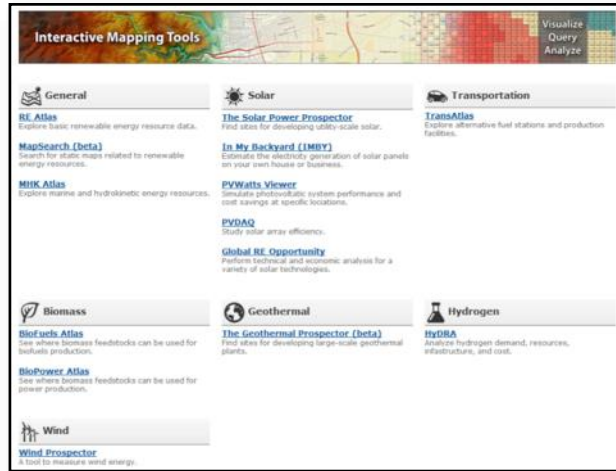
- **Background on NREL's Data, Analysis & Visualization Group in the Strategic Energy Analysis Center**
- **Why do we use the cloud?**
- **What types of projects make sense to have on the cloud?**
- **Lessons learned**
- **What is the process for getting applications on the cloud?**
- **General cloud strategy and next steps**

Data Analysis & Visualization Group Mission

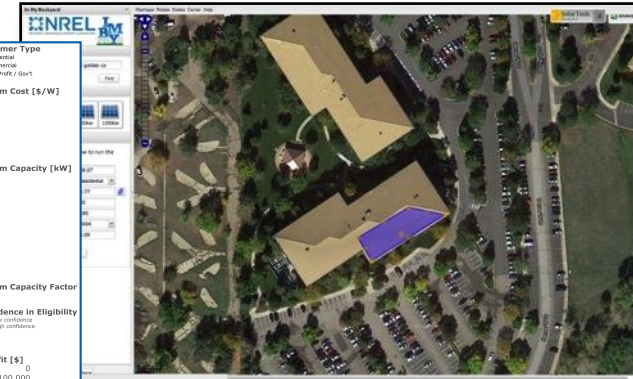
Enable transformation of energy systems and markets by providing tools and analysis to transform data to knowledge to decisions



Examples: Geographic Information Science

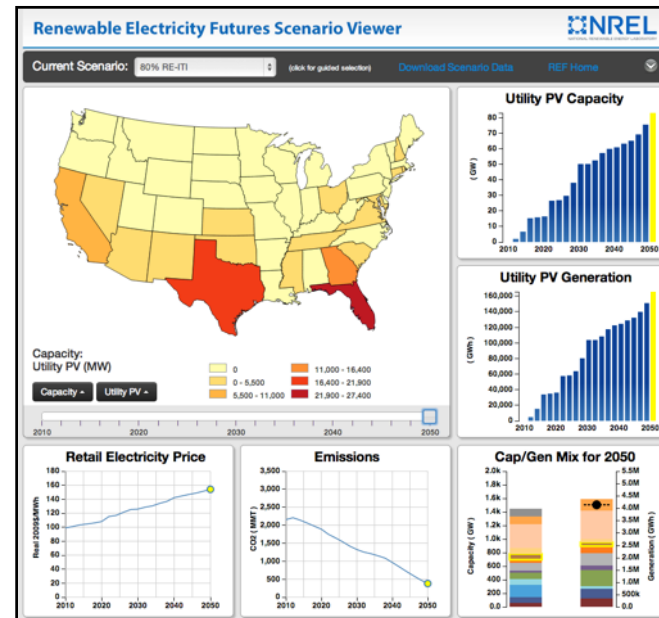


Logical Inference Analysis of Policies & Incentives

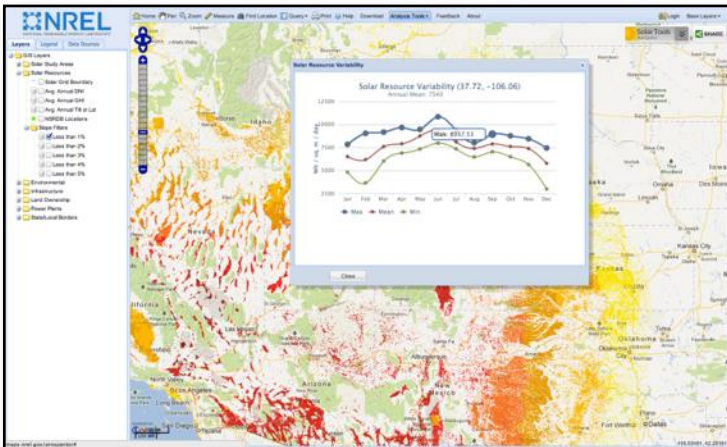


Geo-based Options Screening

NREL Geospatial Data Repository



Interactive Temporal/Spatial Viewer

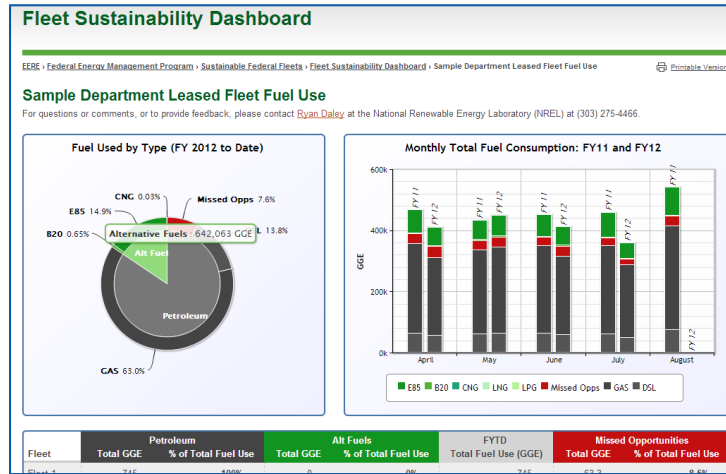


OpenCarto Geospatial Analysis Tool

Examples: Market Enabling Applications

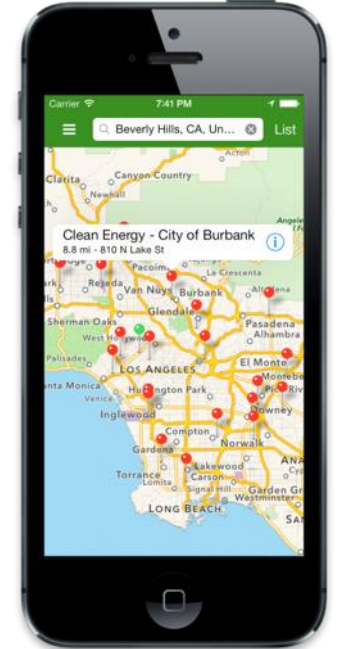


DOE's Alternative Fuels Data Center

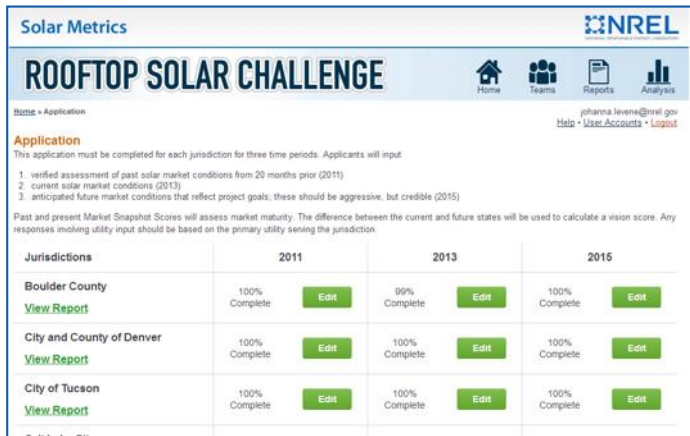


Fleet	Petroleum Total GGE	Petroleum % of Total Fuel Use	Alt Fuels Total GGE	Alt Fuels % of Total Fuel Use	FYTD Total Fuel Use (GGE)	Missed Opportunities Total GGE	Missed Opportunities % of Total Fuel Use
...	716	63.0%	138	13.8%	1134	88	7.6%

Decision Tools for Key Groups

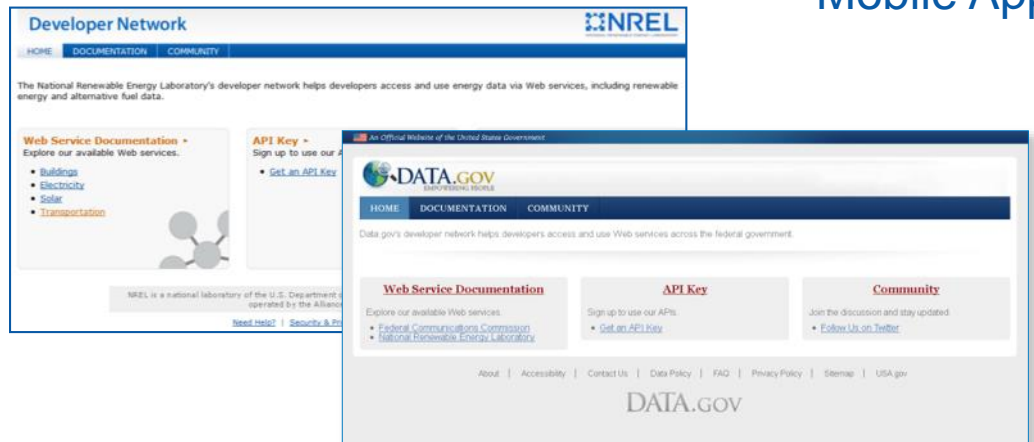


Mobile Apps



Jurisdictions	2011	2013	2015
Boulder County	100% Complete Edit	99% Complete Edit	100% Complete Edit
City and County of Denver	100% Complete Edit	100% Complete Edit	100% Complete Edit
City of Tucson	100% Complete Edit	100% Complete Edit	100% Complete Edit

Program Reporting & Metrics

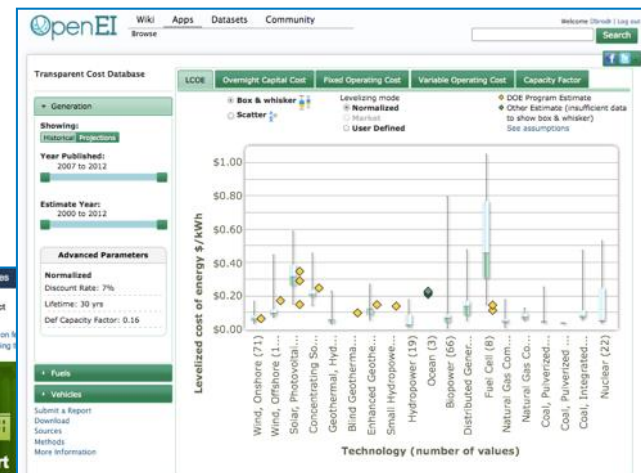


Data Services for NREL & data.gov

Examples: Digital Assets

DOE/EERE Open Data Platform

Geothermal Project Data Repository



Technology Cost Database



NREL Campus Energy Data

ARRA Smart Grid Project Data

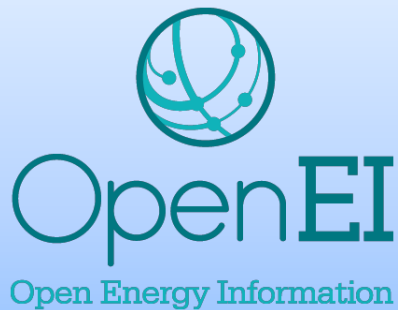
Why the Cloud?

- **Fast**
- **Reliable**
- **Scalable**
- **Controllable**
- **Easy to monitor**
- **Redundant**
- **Accessible**
- **Easy to implement**
- **High availability**
- **Energy efficiency savings**
- **Cost effective**
- **Continually upgraded**

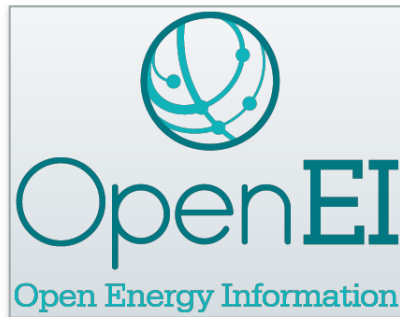
What goes on the cloud?

Potentially anything!

But what we have there now is:



“.org” sites



- Wiki-based open energy data sharing platform for the world
- DOE's Energy Efficiency and Renewable Energy (EERE) platform for providing open data to the public



Linked Open Data for Improved access to energy-related information



Assessments of information quality & provenance



Easy, legal, & scalable data sharing and ratings



Services for application development & derived data knowledge

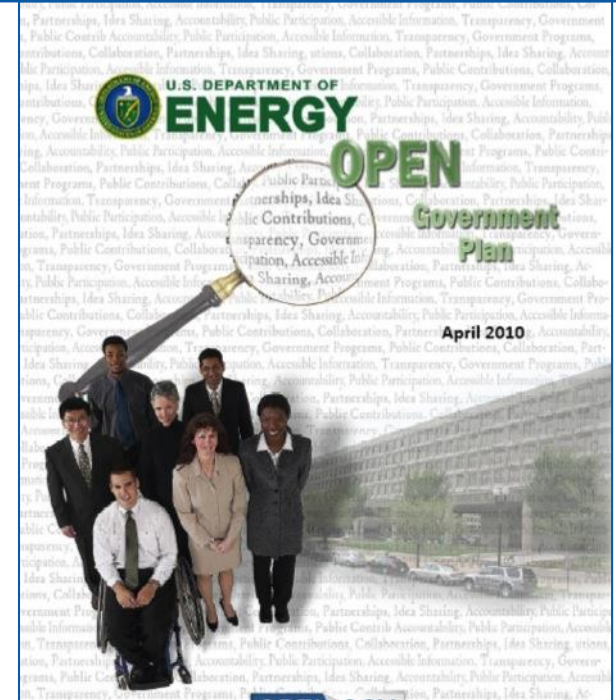


Community support for contributions and collaboration



Crowdsourced Dataset Generation

Open Government and Energy Data Initiatives	Date
DOE issued press release to launch OpenEI as its Open Government Initiative	12/09
DOE releases Open Government Plan , which highlights OpenEI	4/10
OpenEI recognized by the White House as a Flagship Open Government Initiative	4/10
OpenEI featured on White House Innovations Gallery	1/11
White House Announces Energy Data Initiative	5/12
OpenEI included in OMB Federal Digital Strategy	8/12
OSTP Open Access Memo Issued to Federal Agencies	2/13



Example LOD Functionality

Basic state info; semantically linked to external resources

Energy Data with source info

Tools/models/resources relevant to the U.S.

Access to hundreds of RE resource maps for the U.S.

REEGLE Policy and Regulatory Overview

United States: Energy Resources



Click on a state to view that state's page.

The United States of America (USA or U.S.A.), commonly referred to as the United States (US or U.S.) or America, is a federal republic consisting of 50 states and a federal district. The 48 contiguous states and the federal district of Washington, D.C. are in central North America between Canada and Mexico.

Energy Resources

Resource	Value	Units	Rank	Period	Source
Wind Potential	2,237,435	Area(km ²) Class 3-7 Wind at 50m	3	1990	NREL #
Solar Potential	24,557,081,451	MWh/year	6	2008	NREL #
Coal Reserves	260,551.00	Million Short Tons	1	2008	EIA #
Natural Gas Reserves	8,078,000,000,000	Cubic Meters (cu m)	6	2010	CIA World Factbook #
Oil Reserves	19,120,000,000	Barrels (bbl)	14	2010	CIA World Factbook #

Energy Maps featuring United States



reegle Policy and Regulatory Overview ^[1]

No Policy and Regulatory Overview Available



View the States Solar and Wind Energy Resource Atlas for United States <#>.

Country Profile	
Name	 United States
Population	Unavailable
GDP	Unavailable
Energy Consumption	99.53 Quadrillion Btu
2-letter ISO code	US
3-letter ISO code	USA
Numeric ISO code	840
UN Region ^[1]	Northern America
OpenEI Resources	
Energy Maps	1143 view #
Tools	94 view #
Programs	25 view #
Energy Organizations	9019 view #
Research Institutions	128 view #
References	
CIA World Factbook, Appendix D ^[2]	

25 Programs

- NREL State Clean Energy Policies Analysis Project (SCEPA)
- Enhancing Capacity for Low Emission Development Strategies (EC-LEDS) Program
- Climate Technology Initiative Private Financing Advisory Network (CTI PFAN)
- Sustainable Communities Leadership Academy (SCLA)
- US DDE Federal Energy Management Program (FEMP)
- [view all #](#) <#>
- [Add a Program](#)

94 Tools

- Interruption Cost Estimate Calculator
- BITES
- Energy Storage Computational Tool
- River Hydrokinetic Resource Atlas
- Smart Grid Computational Tool
- [view all #](#) <#>
- [Add a Tool](#)

9,019 Energy Organizations

- BLM
- A1 Sun, Inc.
- Resolute Marine Energy Inc
- SolarAMP LLC
- SolarAire LLC
- [view all #](#) <#>
- [Add an Organization](#)

4,478 Clean Energy Companies

- A1 Sun, Inc.
- Resolute Marine Energy Inc

Utility Portal

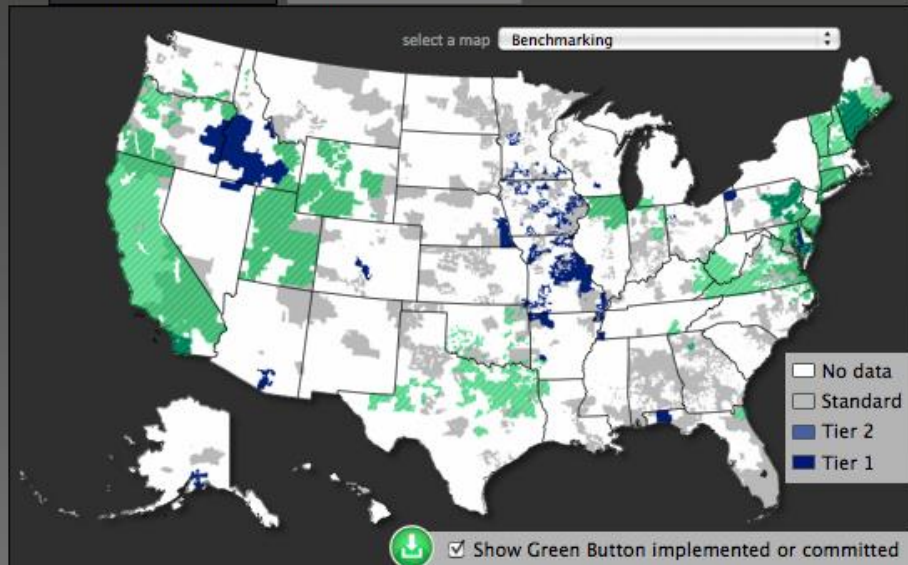
- U.S. Utility Rate Database
- Utility Access Map – Surveying utility connections to consumers and data access
- Green Button Data Collection

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



State summary information

California

Green Button implemented or committed

- PacifiCorp
- Pacific Gas & Electric Co
- San Diego Gas & Electric Co
- Southern California Edison Co
- City of Anaheim, California (California)
- City of Banning, California
- City of Burbank Water and Power, California

What do these colors represent?

Residential benchmarking

Benchmarking is the practice of comparing how efficiently a building is using energy, compared to its own previous use, to similar buildings, or to both. This data must be available going back 13 months in an electronic format, and in the case of multi-meter buildings, aggregated building data must be available.

Standard Access

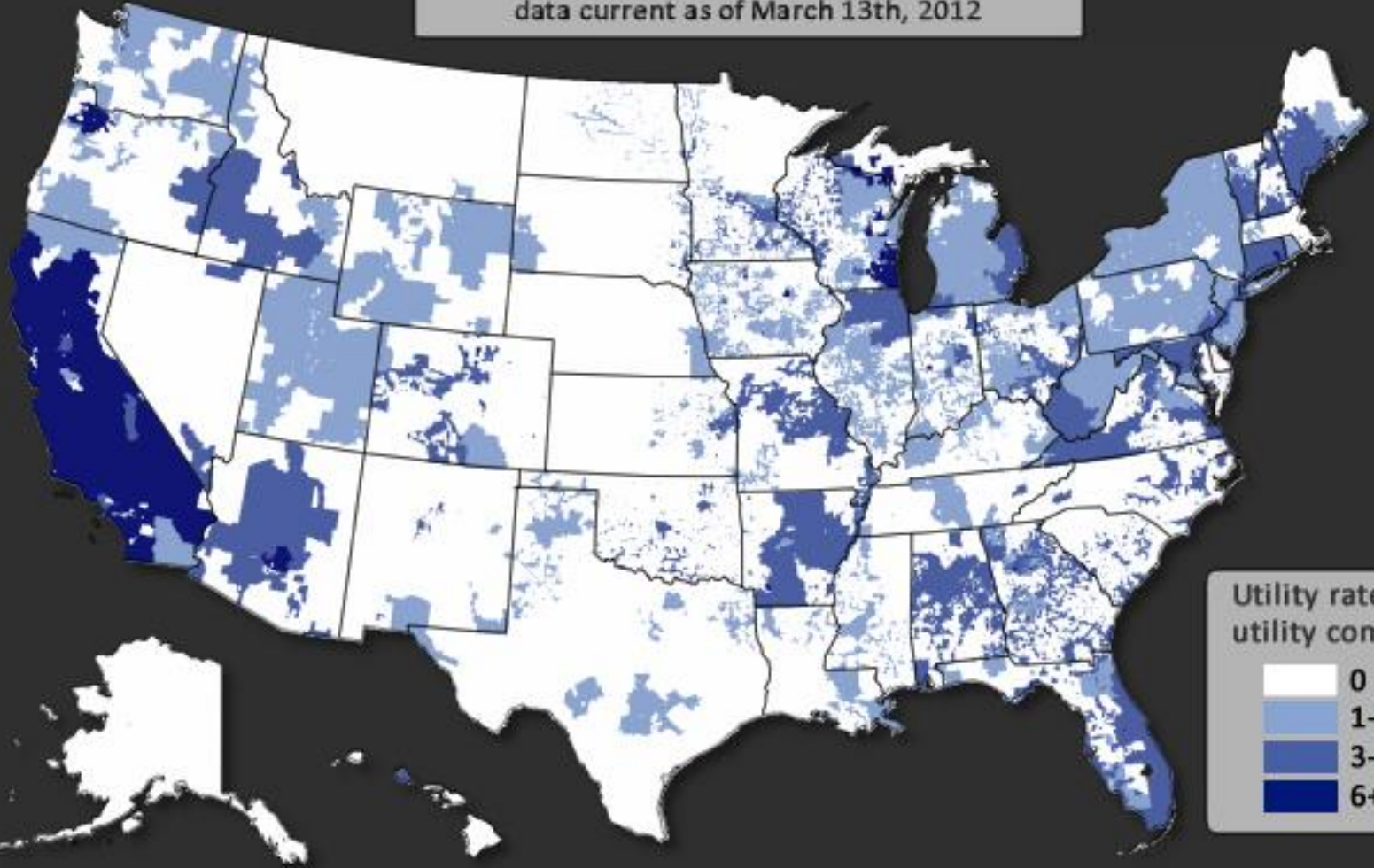
Customers have account-level access to their monthly data.



**Green Button
Download
My Data**®

Utility rate coverage on OpenEI

data current as of March 13th, 2012



Utility rates per utility company

- 0
- 1-2
- 3-6
- 6+

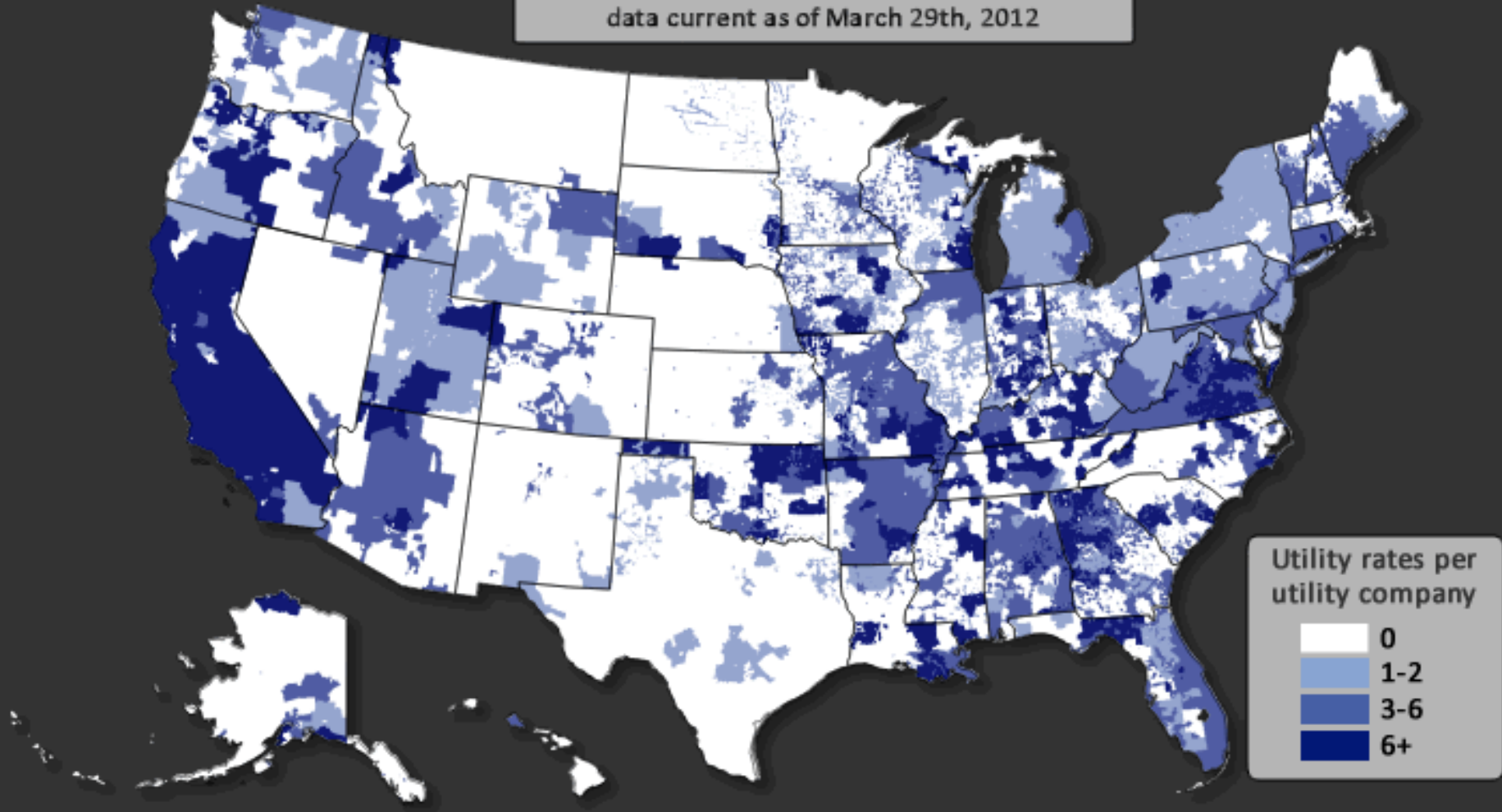


Utility service territory boundaries sourced by Ventyx Energy Velocity Suite, © 2012.

Source: <http://en.openei.org/wiki/Gateway:Utilities>

Utility rate coverage on OpenEI

data current as of March 29th, 2012



Utility rates per utility company

- 0
- 1-2
- 3-6
- 6+

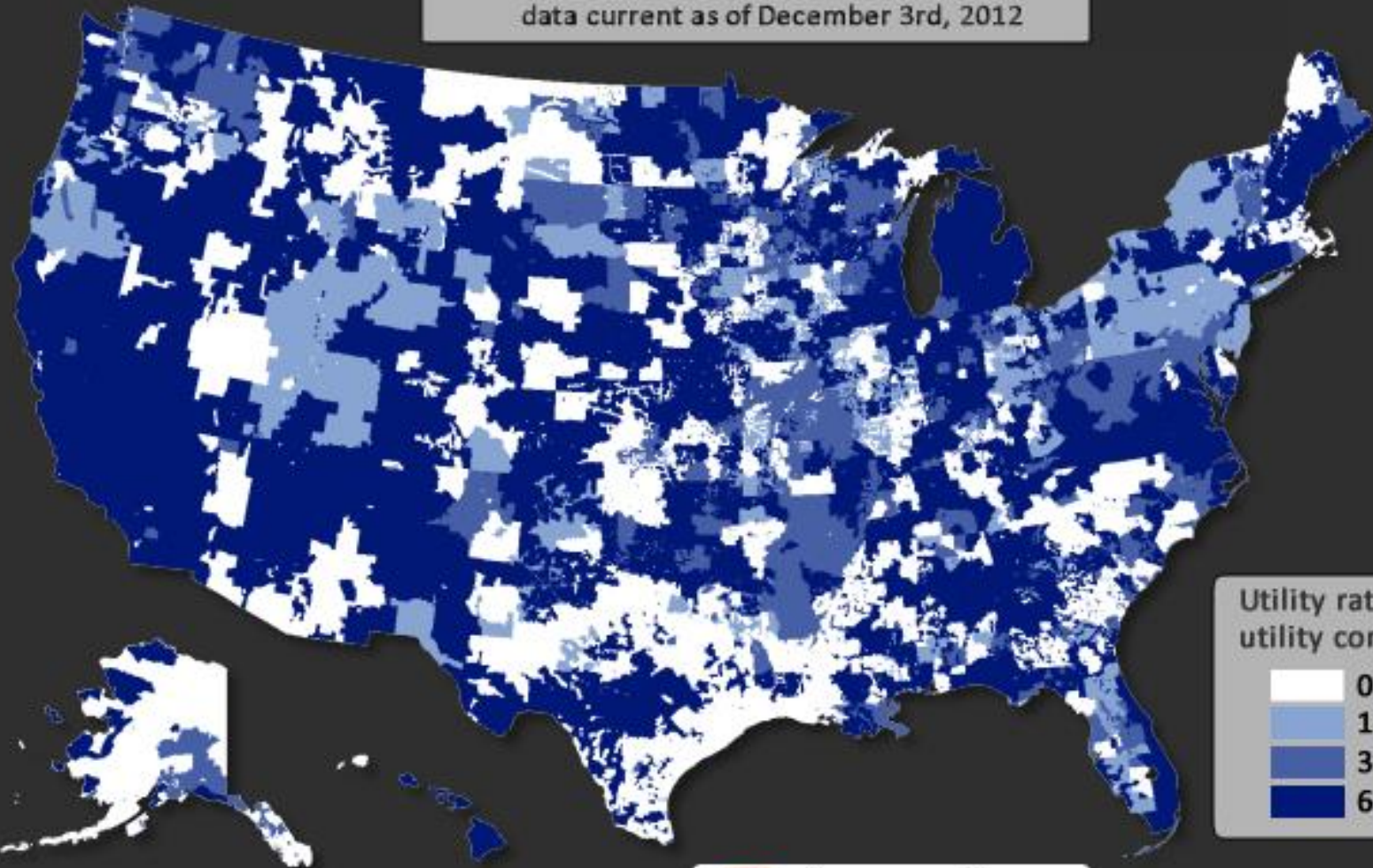


Utility service territory boundaries sourced by Ventyx Energy Velocity Suite, © 2012.

Source: <http://en.openei.org/wiki/Gateway:Utilities>

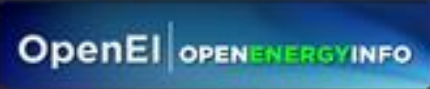
Utility rate coverage on OpenEI

data current as of December 3rd, 2012



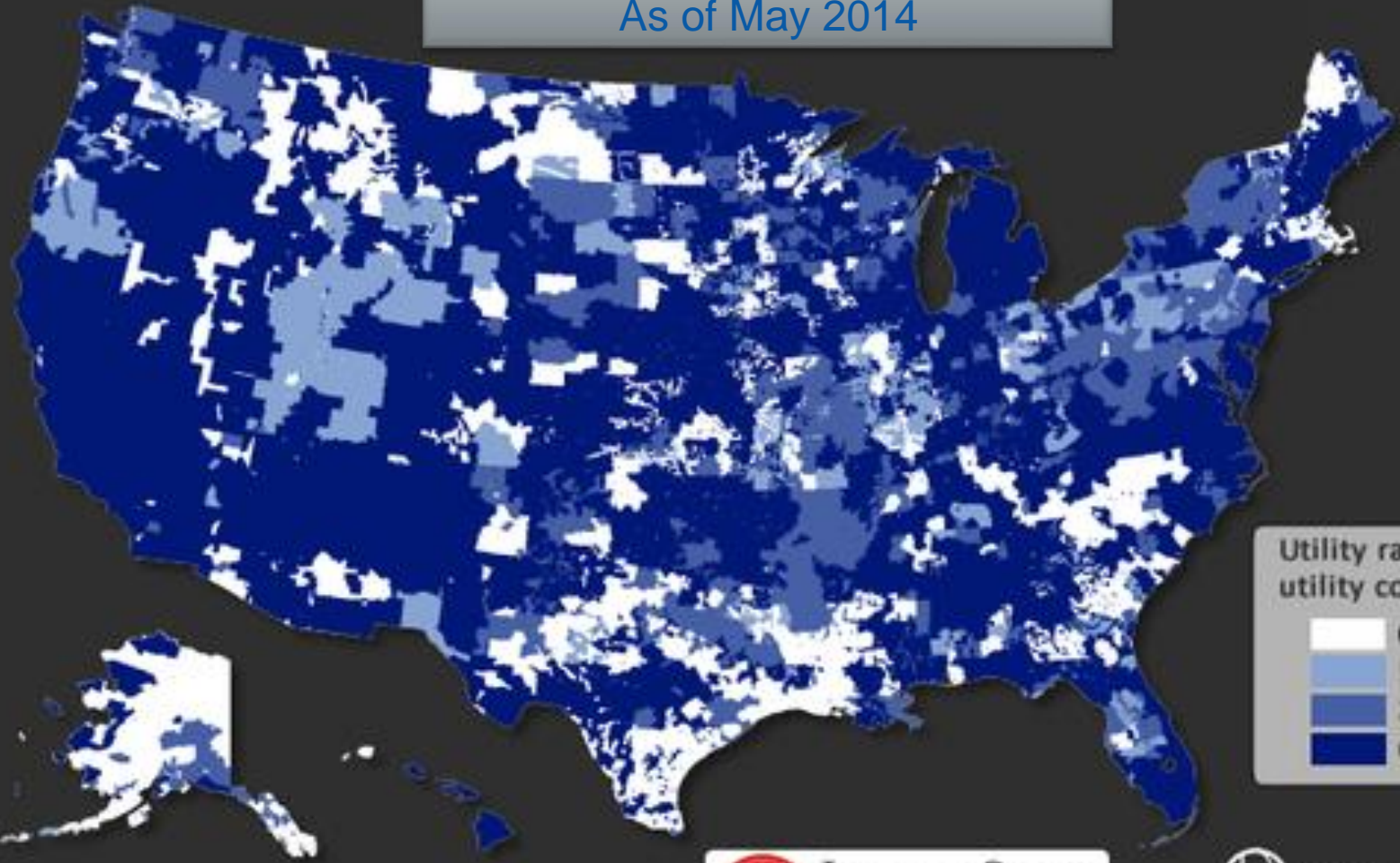
Utility rates per utility company

- 0
- 1-2
- 3-6
- 6+



Source: <http://en.openei.org/wiki/Gateway:Utilities>

Utility Rate Database Coverage As of May 2014



As of May 2014, over 43,000 utility rates

Source: <http://en.openei.org/wiki/Gateway:Utilities>

SmartGrid.gov Portal Page

What is the Smart Grid?

Recovery Act Smart Grid Programs

Federal Smart Grid Initiatives

Smart Grid Resource Center



[Home](#) | [About](#) | [News](#) | [Glossary](#) | [Contact](#)

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



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 Resource Center

Reports and Documents

BUILDING THE 21ST CENTURY GRID



Smart Grid Savings and Grid Integration of Renewables in Idaho

Idaho Power Company (IPC) serves customers in southern Idaho and eastern Oregon. IPC is vertically-integrated, manages power generation, transmission, distribution, and demand-side resources. Faced with grid modernization challenges from new wind power capacity, rising summer peak demands, and aging electricity delivery infrastructure, IPC's SGIG project covers all aspects of its electric operations.

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



NEWS

April 15, 2014

Cybersecurity for Energy Delivery Systems (CEDS) Research Call

January 16, 2014

Energy Department Launches Competition to Spur Creation of Innovative Energy Apps Built with Open Data

November 5, 2013

NIST Seeks Public Input on Updated Smart Grid Cybersecurity Guidelines

October 24, 2013

FTC to Hold Free Workshop: Internet of Things – Privacy and Security in a Connected World

[SEE MORE >](#)

[Sign up for SmartGrid.gov email updates >>](#)



Green Button Gives Millions of Consumers Access to Electricity Usage Information

Smart Grid ARRA Project Investments and Impacts

What is the Smart Grid?
Recovery Act Smart Grid Programs
Federal Smart Grid Initiatives
Smart Grid Resource Center


Home | About | News | Glossary | Contact

OVERVIEW OF PROGRAMS

PROJECT INFORMATION

DEPLOYMENT STATUS

PROGRAM IMPACTS

CONSUMER BEHAVIOR

RECIPIENT REPORTING

Deployment Status

➔

The U.S. Department of Energy is responsible for tracking the status of investments made through the Smart Grid Investment Grant (SGIG) Program and Smart Grid Demonstration Program (SGDP). The status and characteristics of the technologies deployed is reported in this section. Technology deployment analysis uses data from all of the projects and provides aggregated information on system costs, configurations, and lessons learned.

Smart Grid Investment Grant Asset Investments

Phasor Measurement Units (PMUs) Installed and Operational
Deployed as of March 31, 2014



Year	Q1	Q2	Q3	Q4
2010	0	29		
2011	77	116	141	
2012	221	305	445	546
2013	775	902	925	1,031
2014	1,031	1,031	1,031	1,031

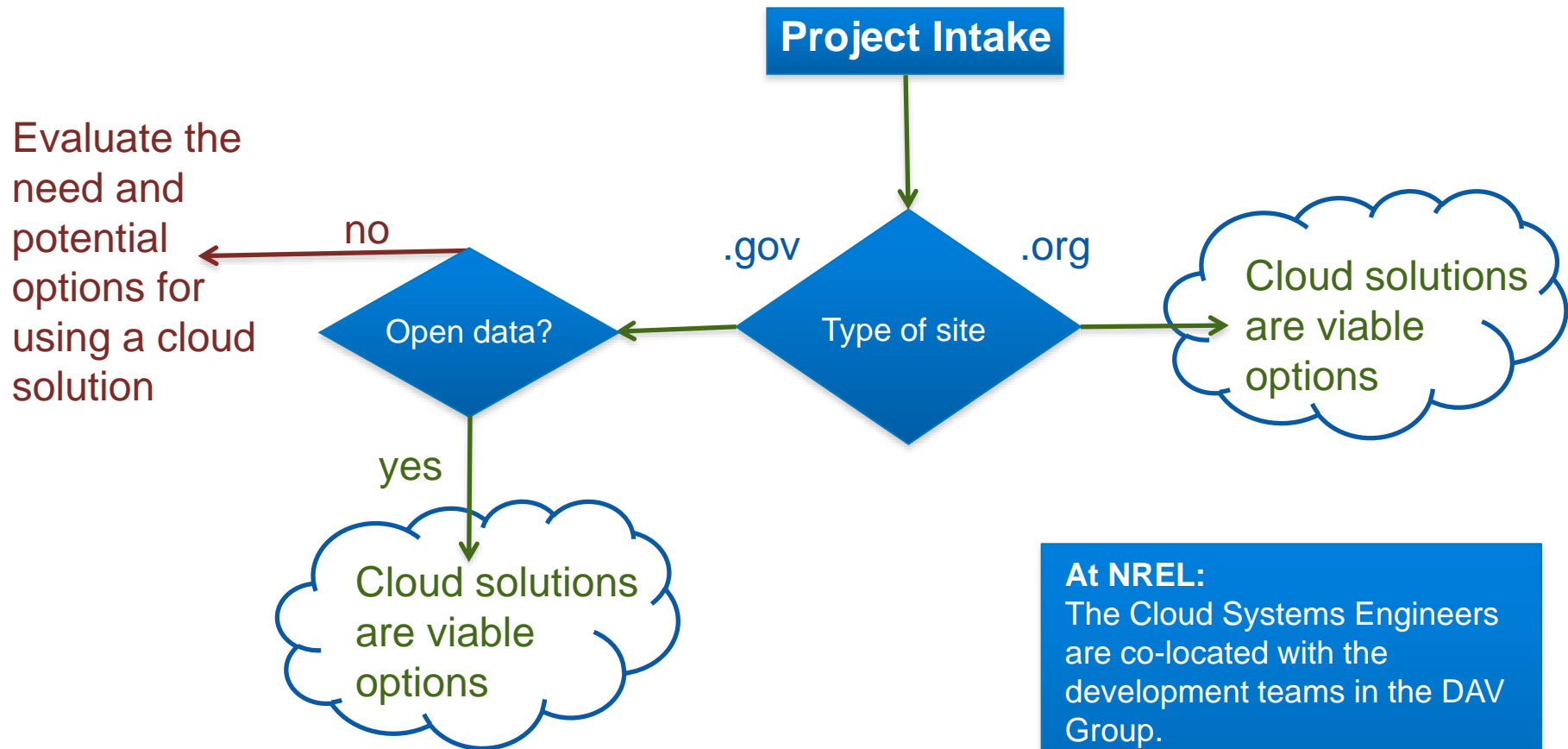
- Program Asset Investments
- Advanced Metering Infrastructure and Customer System Investments
- Distribution System Investments
- Transmission System Investments

** Number of entities reported: 12
Updated on May 2, 2014

Lessons Learned

- **Think on the cutting edge and embrace new technologies and tools**
- **Create an organizational strategy**
- **Cloud solutions must be viewed as critical to the success of .org and .gov web platforms**
- **Utilize the external cloud for what it is good for and don't over complicate the integration with internal architecture**
- **Leverage investments in cloud solutions when possible (FedRAMP, AWS Products)**
- **ATO requirements add complexity**
- **Enable DevOps partnerships between developers and cloud system engineers**
- **Moderate-level data access solutions are needed**

Cloud Solution Process



At NREL:

The Cloud Systems Engineers are co-located with the development teams in the DAV Group.

OCIO is a separate organization, but we work closely with them

Strategy and Next Steps

Utilize the key benefits of the cloud to build scalable and accessible data solutions and platforms to enable open data sharing, API data connections, collaboration, and 24/7 uptime. Leverage the tools and inherent strengths that the cloud provides, while maintaining reliable, secure, scalable, and cost-effective government solutions.

Next Steps:

Complete automation and monitoring tasks for the current ATO environment

Based on a DOE program need – Develop an ATO environment to house moderate data and provide access to DOE and other National Labs in an easy to access format

Enable a “turn key” process for getting other web sites and platforms on the cloud

Create an organization-approved cloud strategy

Tackle the big/complex data issues – affordable storage with quick access for analysis