THE CENTER FOR
OPEN DATA ENTERPRISE

Data for Our Energy Future: A Roundtable with the U.S. Department of Energy

TABLE OF CONTENTS

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INTRODUCTION

On April 29, 2015 the U.S. Department of Energy (DOE) and the Center for Open Data Enterprise co-hosted an Open Data Roundtable in Washington, DC bringing together data users with DOE data providers. The goals of the first-ever Energy Open Data Roundtable with DOE were to: (1) Gain a better understanding of the applications and successes in using DOE open energy data; (2) Identify areas for improvement and priorities for DOE open data; (3) Foster a dialogue about access and use of DOE and National Laboratories open data. This report combines individual participant observations, feedback and suggestions on the topics discussed at the event, including those that apply to specific projects within DOE, to DOE data more broadly, or to the U.S. federal data system as a whole.

Open data from government – free data, accessible online, that anyone can use and reuse without restrictions – is being recognized as a major public resource. Under the federal Open Data Policy, government agencies are releasing more and more valuable datasets, fueling collaboration across the public and private sectors. The Center for Open Data Enterprise, an independent nonprofit organization, conducts a series of Open Data Roundtables together with federal agencies to help make open government data more useful and usable through structured dialogue. [1]

The U.S. Department of Energy has had a longstanding commitment to developing and disseminating open data for use by the private sector, nonprofits, and academia. This has included the work of the Energy Information Administration, which provides data on electricity generation in the U.S.; new initiatives to make energy information easier to use; the Green Button Ecosystem, which provides consumers with their own energy usage information; and databases on a number of important energy-related topics. DOE has also reached out to its "data customers" in several ways to get input on their data needs and priorities. This Open Data Roundtable was part of that overall departmental effort.

The Energy Open Data Roundtable began with presentations from DOE's open data experts to provide context for the day's discussions, followed by three breakout sessions. Participants were placed into thematic groups focusing on the following areas:

- Building energy efficiency;
- Consumer energy conservation;
- Data analysis and technology tools;
- Integrated and urban systems;
- Renewables and clean technologies; and
- Technology transfer.

Each group included both DOE staff and external data users. The first breakout session focused on understanding the successes and challenges in accessing and using DOE's open data. The second identified priorities and opportunities for improvement, and in the final session participants discuss potential solutions, including short and long term goals, resources required and key stakeholders involved.

This report is based on these discussions, and is being released as a public document to encourage further input, dialogue, and improvements in open data. It does not necessarily reflect the views of DOE or of all users of DOE data. It is designed for the operating administrations and offices at DOE that collect, analyze, and disseminate data; officials in other government agencies working to improve their agencies' open data capabilities; individuals and organizations who use DOE's open data; and interested members of the media and the public.

1 The Open Data Roundtables were originally launched as an initiative of The GovLab at NYU.

A USER-CENTERED APPROACH TO OPEN DATA

To realize its promise, open data needs to be developed and managed in ways that meets the needs of the people and organizations that use it. However, there are currently few effective ways for data users to give input and feedback. Inclusive stakeholder engagement with data users is key to identifying gaps, priorities, and potential partnerships that can improve the department's return on its investment (ROI) in open data.

The Open Data Roundtable provided an opportunity for providers and users of DOE data to engage in a structured dialogue around energy data. The agenda for this Roundtable was informed by (1) research on current DOE open data policies and initiatives, users and providers; and (2) a questionnaire sent to all potential participants before the event to identify key uses of energy data and barriers to use. These include companies, nonprofit organizations, academic institutions, or other government agencies.[2]

Current DOE Initiatives

To date, DOE has undertaken a number of user-centered open data initiatives, several of which were presented at the Roundtable. Officials from the U.S. Energy Information Administration (EIA), Office of Technology Transitions, the National Renewable Energy Laboratory (NREL), as well as the Green Button Alliance reported on the following initiatives:

Making the EIA's open data easier to use. The Energy Information Administration has built an application program interface (API) that provides data and metadata on electricity generation in the U.S. with the dimensions of sector, geography, fuel, and time.[3] The new API and DOE's open-source tools make it easy to develop interactive maps, drill-downs, and charts that use all these dimensions, and embed them in third-party websites and other media.

Developing OpenEI (Open Energy Information) to make the DOE data catalog more accessible and usable. This open data platform for DOE includes:

- An OpenEI wiki[4] that enables crowdsourced data contributions and information development and is already home to numerous high-profile DOE tools such as the Regulatory and Permitting Information Desktop (RAPID) Toolkit, a cross-agency, collaborative effort to map regulatory and permitting processes.[5]
- A community section that enables energy data conversations and builds the user base.[6]
- A datasets section that catalogues DOE data assets with a focus on quality data management, data provenance, and providing access to the metadata for over 1,000 datasets in various open and machine-readable formats.[7] These datasets are federated to data.gov, the federal government's central repository for open data, increasing their exposure to the greater scientific community by an order of magnitude. Data that already have a home can be linked, providing a pathway for existing DOE investments to register their data on Data.gov.
- A searchable catalog of energy applications.[8]

Developing the Green Button Ecosystem: Green Button is a public-private initiative to give energy

2 See Appendix C for the Roundtable agenda and list of participants.
3 Energy Information Administration (EIA) Application Programming Interface (API). *http://www.eia.gov/beta/api*.
4 Open Energy Information (OpenEI) – Wiki. *http://en.openei.org*.
5 Regulatory and Permitting Information Desktop Toolkit, Collaborating on Regulatory Processes for Bulk Transmission and Renewable Energy Projects. *http://en.openei.org/wiki/RAPID*.
6 Open EI Community. *http://en.openei.org/community*.
7 Open EI – Datasets. *http://en.openei.org/datasets/dataset*.
8 Open EI – Energy App Catalog. *http://en.openei.org/apps*.

consumers secure data about their energy usage, now available to tens of millions of American households. The Green Button Ecosystem is a nonprofit, member-based organization that is the central authority for this initiative. Its activities include education and training, enhancing the Green Button Standard, and certification programs. The Green Button Ecosystem supports analysis of energy usage data, customized heating and cooling based on the data, analysis of energy costs, and more.[9]

Creating the Geothermal Data Repository (GDR): Built from the ground up with a focus on quality data management, the GDR collects, curates, and catalogues data from DOE-funded geothermal projects.[10] GDR data are housed securely during curation and once released, made openly available to dozens of external sites including the National Geothermal Data System (NGDS) – a catalog of documents and datasets that provide information about geothermal resources,[11] Data.gov,[12] and Office of Scientific and Technical Information (OSTI)'s DataCite index.[13]

Compiling the Utility Rate Database: Over 47,200 rates from utility companies for use by consultants, researchers, and the solar industry have been collected.[14]

Launching Sunshot Catalyst: Sunshot Catalyst is "an open innovation program that allows the public to rapidly create and develop products and solutions that address near-term challenges in the U.S. solar marketplace through prize challenges."[15]

Developing the Alternative Fuel Station Locator: This tool provides data in formats designed for both human interpretation and computer analysis (i.e. machine-readable formats), with a mobile application and a widely used API.[16] The Locator has 2.6 million views/web calls annually.

9 Green Button. *http://www.greenbuttondata.org*.
10 Geothermal Data Repository. *http://gdr.openei.org*.
11 National Geothermal Data System. *http://geothermaldata.org*.
12 Data.gov is the centralized home of U.S. government's open data. *http://www.data.gov*.
13 U.S. Department of Energy Office of Science and Technical Information, OSTI and DataCite – Easing Access and Reuse of Data. *http://www.osti.gov/home/data/datacite.shtml*. DataCite works with the research community to make data and other research objects visible and accessible (see *https://www.datacite.org*).
14 U.S. Utility Rate Database. *http://en.openei.org/wiki/Utility_Rate_Database*.
15 U.S. Department of Energy, Sunshot Catalyst. *http://catalyst.energy.gov*.
16 U.S. Department of Energy Office of Energy Efficiency & Renewable Energy, Alternative Fuels Data Center. *http://www.afdc.energy.gov/locator/stations*.

OPEN DATA ROUNDTABLE FINDINGS

Participants at the Open Data Roundtables have identified a number of ways government agencies can make their open data more useful and usable. The following sections summarize participants' observations on how DOE can help their data customers overcome obstacles in:

- ❖ Finding and Accessing Data
- ❖ Assessing Data Quality and Relevance
- ❖ Cleaning and Combining Datasets
- ❖ Engaging Users with Government Data Providers

Successes included the following DOE initiatives:

- DOE has participated in the statistical agencies' databook and published over 1100 datasets on Data.gov.
- The National Renewable Energy Laboratory (NREL) has an online energy information portal that shows all its reports.[17]
- The Office of Scientific and Technical Information (OSTI) provides search tools for public access to DOE's research and development results.
- The Database of State Incentives for Renewable Energy (DSIRE) provides a comprehensive resource of incentives and policies to support renewable energy initiatives.[18] DSIRE data is also made accessible via OpenEI.org.
- The Energy Star portfolio manager, an online tool that allows tracking of energy and water consumption and greenhouse gas emissions,[19] is considered to be very user-friendly.
- The Energy Information Administration (EIA) data makes analytics easily available through an "Independent Statistics and Analysis" section on its website.[20]
- DOE makes it possible to benchmark the energy efficiency of buildings through the Commercial Buildings Energy Consumption Survey (CBECS)[21] and the Building Performance Database (BPD).[22]
- Making DOE's data available in Excel has made it more usable for people without advanced technical skills.

Finding and Accessing Data

DOE can help data users find and access the data they need in order to encourage open data use. Participants noted the following as barriers to enabling greater and better access to DOE data:

- Inconsistent privacy and permission protocols for DOE datasets across offices
- Cybersecurity considerations in data release
- Inconsistent metadata across datasets
- Timeliness and punctuality of data release

17 U.S. Department of Energy Office of Energy Efficiency & Renewable Energy, Energy Innovation Portal. *http://techportal.eere.energy.gov/lab/NREL*.
18 North Carolina Clean Energy Technology Center, Database of State Incentives for Renewables & Efficiency. *http://www.dsireusa.org*.
19 Energy Star Portfolio Manager. *https://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/use-portfolio-manager*.
20 U.S. Energy Information, Independent Statistics & Analysis. *http://www.eia.gov*.
21 U.S. Energy Information, Independent Statistics & Analysis. Consumption & Efficiency. *http://www.eia.gov/consumption/commercial*.
22 Energy.gov, Office of Energy Efficiency & Renewable Energy, Buildings Performance Database. *http://energy.gov/eere/buildings/building-performance-database*.

Suggestions and opportunities

- Engage users to identify the data that is in highest demand, so that DOE can continue to ease access and provide more complete data for topics most relevant to users. As part of this effort, DOE could issue a Request for Information (RFI), as NOAA has done, [23] to assess private-sector interest in accessing and helping to enhance DOE data.
- Release data publication schedules that users can rely upon.
- Build off of existing best practice architectures and tools. For example:
  - Recognize OpenEI[24] as an open data management platform for all DOE Offices/Labs; built by the Office of Energy Efficiency and Renewable Energy (EERE), OpenEI is a free, available tool for all DOE Offices/Labs to use for uploading their datasets to data.gov, but most do not know it exists
  - Develop a publications database, using NREL[25] as a model
  - Adopt the DOE Geothermal Technologies Office (GTO) model for submissions to the Geothermal Data Repository, which requires funded researchers to submit their data as open data[26]
- Standardize metadata that can apply to multiple datasets. Involve industry early on when determining standards, whether for data or metadata.
- Improve visualization of data to engage new users and drive data usage.
- Open up data from research, especially from the National Laboratories, to further studies and push research forward.
- Make cybersecurity and open data equal and integral parts of data management processes, so that both are automatically considered and evaluated when publishing data.

Assessing Data Quality and Relevance

DOE can provide more value by providing higher quality data. In the words of one Roundtable participant, DOE needs "to be showing an information product rather than throwing datasets out there." All agencies should continue to improve quality of data by making it more complete, accurate, consistent, and timely. The key issues to be addressed include:

- Unclear processes for quality validation and certification
- Insufficient information on data provenance
- Identifying priorities for data improvement

Suggestions and opportunities

- Establish a data stewardship group for each office that is responsible for improving and providing information on the office's datasets.
- Provide support and funding for continued data maintenance over time. Curation, management, and maintenance of data are valuable and need to be funded properly. Currently data maintenance is contracted out externally in yearly contracts, which limits the ability to develop long-term strategies. For instance, there are no provisions for maintenance of DOE-funded projects such as the DSIRE database.
- Provide better information on data provenance and manage data over lifecycles: Develop a DOE tracking

23 Federal Business Opportunities, Big Data RFI from NOAA. *https://www.fbo.gov/index?s=opportunity&mode=form&id=d9844cb78b-4527fb11a6ac6d2b80a742&tab=core&_cvie.*
24 Additional information on OpenEI can be found in Appendix B.
25 National Renewable Energy Laboratory, Publications. *http://www.nrel.gov/research/publications.html.*
26 Energy.gov, Office of Energy Efficiency & Renewable Energy, Data Provision Instructions for all DOE Geothermal Technologies Office funds recipients. *http://energy.gov/eere/geothermal/data-provision-instructions-all-doe-geothermal-technologies-office-funds-recipients.*

system for changes to data made over time to clarify data provenance and ensure validity of the data.

- Scale OpenEI – develop a playbook to help others replicate and use the tools to deliver better data quality, improve metadata, and integrate usefulness scales and ratings of datasets.
- Devise incentives to improve data standardization and quality across the National Labs.
- Revise DOE's equipment performance data regulation, which was recently changed in a way that could decrease data quality. These should take into consideration industry programs such as those of the Air-conditioning, Heating and Refrigeration Institute (AHRI).
- Address gaps identified at the Roundtable by enriching existing datasets: add geography to utility data (important if a power outage occurs); provide cost-enhanced Green Button data.

Cleaning and Combining Datasets

Significant new insights come from combining and analyzing different datasets. Data interoperability – the ability to combine datasets – is a major goal across DOE. DOE should seek to make systems more interoperable so that datasets can be combined and analyzed against each other. While there are increasing examples of collaboration between different data-providing groups, such as EIA and the offices managing geothermal data, significant impeding factors remain:

- Data is siloed – data is managed in different ways in different DOE agencies.
- Conflicting metadata standards exist for different types of DOE data.

Suggestions and opportunities

- Connect EIA data with OpenEI (and possibly federate EIA data through OpenEI as part of DOE's data catalog).
- Ensure that National Environmental Policy Act (NEPA) data[27] is federated with OpenEI.
- Have EIA contribute to the DOE-wide open data crosscut/community with EIA widgets and relational metadata.
- Explore public-private partnerships that support "data democratization." DOE could engage with and leverage private sector tools that can provide better access to interoperable data for more people.

Engaging Users with Government Data Providers

Establishing ongoing engagement between data users and government data providers is critical to better understanding the ROI of data, identifying data gaps, setting data collection and publication priorities, and making both the public and other agencies aware of DOE resources. This includes communicating the value and potential impact of DOE's open data as it is reflected in the work of the Presidential Innovation Fellows, Project Open Data, the Green Button Initiative for standardized consumer energy usage data, and other programs. DOE has conducted many successful outreach initiatives, including user-friendly websites, open discussions with stakeholders, hearing sessions, datapaloozas,[28] and an EIA Conference.[29] However, participants at the Roundtable noted that communication between data stakeholders is impeded by:

- Lack of established channels or strategies to get feedback from users
- No clear person or office responsible for stewardship of data

27 NEPAnode, a web application for collaborating on data, maps, projects designed for non-GIS experts. *http://nepanode.anl.gov*.
28 Datapaloozas are events that focus on demonstrating and highlighting the uses of open data.
29 Energy.gov, Department of Energy Public Engagement. *http://energy.gov/data/public_engagement*.

Suggestions and opportunities

- Develop a communications and outreach strategy, including social media and other outreach. Use Office of the Chief Information Officer (OCIO), General Counsel (GC), and Public Affairs resources to promote success stories from EERE, NREL, Office of Electricity Delivery & Energy Reliability (OE), and the Office of Science beyond the technical audiences that are currently aware of them.
- Develop a series of short videos about datasets, use cases, etc. to encourage data use, as well as for onboarding of new staff.
- Implement a concierge service for DOE data with a routing/dispatching mechanism for queries (i.e. contacts for particular issues/datasets). There is a current need to provide a way to direct requests to the right place.
- Provide office hours for data users inside and outside DOE, perhaps over video hangout.
- Have a data evangelist to communicate with data science and developer communities as well as internal DOE data stewards.

PROJECT PROPOSALS FROM THE ROUNDTABLE

In addition to the suggestions from participants in the previous section, participants at the Roundtable brainstormed several solutions through the day's breakout sessions. This section outlines four project proposals on the following topics: (1) Technology transfer between DOE's National Labs and the private sector; (2) Building energy use data; (3) Innovation channels; and (4) Tech talent within DOE.

Enable better, faster sharing of research data from DOE's National Labs

This proposal speaks to the need for more effective technology transfer. The Labs' Intellectual Property (IP) offices have historically played the role of gatekeepers, with a higher priority on protecting federal IP than on facilitating technology transfer to the private sector. However, more open and rapid release of the Labs' IP would benefit both the private sector and the Labs themselves. Each Lab needs to know more about what the other Labs are doing so they can look for collaborative opportunities. Recently academic research centers, which have similarly protected their IP in the past, have been proactively negotiating with the private sector to apply their research. That kind of culture change could be encouraged in the National Labs as well.

Faster technology transfer from the Labs to the private sector can benefit DOE's Clean Energy Manufacturing Initiative (CEMI) as well. CEMI is "a DOE-wide commitment to innovation and breaking down market barriers in order to enhance U.S. manufacturing competitiveness while advancing the nation's energy goals." [30] Because CEMI relies on collaboration between experts from inside and outside of government, sharing open data between these groups can accelerate new solutions in energy technology, including geothermal, marine, solar, and energy storage systems.

Proposed solution
Build a portal connecting all National Labs, including the underlying datasets for their research. The portal should be designed to share data among the Labs initially, and then between the Labs and the public.

Purpose
Increase the ROI on government research and development (R&D) by accelerating its application; avoid redundant funding and overlaps in work; publish raw data early in standardized ways; improve the use of the Labs' data for national security.

Suggested next steps

- Begin top-down efforts to promote culture change in the role of IP offices.
- Examine UK legislation as a model.
- Include data-sharing requirements into grants.
- Produce software for data-sharing as open source and template contractual language for licensing federal IP.
- Provide early access to data for those within DOE; enable permissions protocols and authorizations to access and share.
- Enforce clearer, reliable scheduling on data release from project team.
- Develop more user-friendly formats for external users; make it easier to find data and tools; include meta-tags for discoverability.

30 Energy.gov, Office of Energy Efficiency & Renewable Energy, About the Clean Energy Manufacturing Initiative. *http://energy.gov/eere/cemi/about-clean-energy-manufacturing-initiative.*

Collaborate with the private sector to develop a record for data on a building's energy use throughout its lifecycle

Currently both the private sector and the public sector conduct independent assessments of buildings' energy-related characteristics. Developing incentives for companies to share data would reduce duplicative efforts conducted by government and the private sector, improve data quality, and lead to better building management and energy efficiencies by improving the ability to diagnose buildings and implementation of energy conservation measures. This could expand DOE's Building Performance Database31 and the Standard Energy Efficiency Data (SEED) Platform[32] to create a holistic record for each building.

Proposed solution
Create a tool that makes data collection for the private sector a lot easier (currently these are custom made by each company), and in return get public access to the data.

Purpose
Provide one canonical record for each building's energy-related characteristics throughout its lifecycle.

Suggested next steps

- Establish a private sector open data/open source consortium around commercial building energy data.
- Identify all relevant datasets, including those held by municipalities, nonprofit organizations and the private sector. Relevant data includes: basic information (age, size, location of buildings, occupational information), energy use information, codes, permits, changes to buildings over time.
- Work with open data initiatives in each municipality to mine the data that are important. As DOE cannot directly fund people to collect data, it would have to achieve this through civic engagement and local data science communities, and fund projects that analyze efficiencies in conservation strategies.
- Provide energy efficiency benefits on taxes if information is correctly entered.

Build new innovation channels

Currently, there are two main ways in which DOE can solicit ideas and solutions from external organizations and technologists. The Department can issue Requests for Information (RFIs), and it can hold hackathons.[33] By building additional, alternative innovation channels, DOE can implement more cost-effective ways to work with the private sector and develop solutions that incorporate outside feedback.

Proposed solution
DOE can provide grants or set up challenges to encourage innovation through a sequence of stages culminating in the development and roll-out of 'product pilots'. For example: after an initial call for submissions, select the top 10 to commit to develop a pilot over three months; select the top 5 for 6 more months; then pick the top 2 for 6-12 more months' development, with intermittent user testing/evaluation periods between each stage.

Purpose
Encourages feasible proposals from wide range of actors to develop and pilot solutions.

Suggested next steps
Determine the topic for the innovation challenge(s), and develop a timeline for development attached to the top solutions. Identify core stakeholders and conduct outreach.

31 Energy.gov, Office of Energy Efficiency & Renewable Energy, Buildings Performance Database. *http://energy.gov/eere/buildings/building-performance-database*.
32 Energy.gov, Office of Energy Efficiency & Renewable Energy, Standard Energy Efficiency Data Platform. *http://buildings.energy.gov/SEEDPlatform*.
33 A hackathon is an event where software developers, designers, project managers, entrepreneurs and others collaborate on projects.

Recruit and retain top tech talent

With the establishment of 18F,[34] the U.S. Digital Service,[35] and the Presidential Innovation Fellows program,[36] the federal government has made a commitment to recruiting technical experts into government. Many of these recruits have focused on open data. DOE has the opportunity to recruit technical experts, as well as using experts within the federal government, to help improve the Department's open data programs and data quality.

Proposed solution
Find new talent both within and outside of the federal government to address issues of data quality, access, and usability. Consider detail opportunities both within DOE and from other agencies into DOE. Include experts whose knowledge complements that of technical experts – for example, include policy and law experts from the General Counsel's office in proactive data policy interpretation with the Office of the Chief Information Officer (OCIO). Bring in outside expertise through the DOE's Excepted Service hiring authority and other means.

Purpose
Add new capacity within DOE to develop policies and practical approaches for improving open data.

Suggested next steps
Have DOE's Office of the CIO work with the Chief Human Capital Officer to explore options for increasing capacity as described above.

34 18F is an internal civic consultancy, housed within the U.S. General Services Administration, that works with agencies to rapidly deploy tools and services that are easy to use, cost efficient, and reusable. *https://18f.gsa.gov*.
35 The U.S. Digital Services team uses product design and engineering practices to transform the way government works. *https://www.whitehouse.gov/digital/united-states-digital-service*.
36 The Presidential Innovations Program brings principles, values and practices of the innovation economy into government. The program pairs diverse technologists and innovators with top civil servants and change-makers in the federal government to tackle national challenges. *https://www.whitehouse.gov/innovationfellows*.

OPPORTUNITIES FOR DOE LEADERSHIP: DEVELOPING AGENCY-WIDE RESOURCES

Participants at the Open Data Roundtable strongly encouraged DOE to put a higher priority on open data and innovation, particularly through lab-to-market/tech-to-market efforts and DOE-wide strategy. Following the Open Data Roundtable, the Department of Energy continued discussions to identify high-level opportunities for the agency to improve and apply open data.

Recommended Next Steps

It is recommended that DOE proactively create the following new, relevant policies and guidelines for all DOE offices and National Labs to promote use of the agency's open data:

- A DOE open data policy
- A DOE open source policy
- A DOE social media use policy
- Intellectual Property (IP) guidance for the application of data from the National Labs and other DOE data
- Privacy, Personally Identifiable Information (PII), and anonymization guidance for release and use of DOE/Labs data, including open data
- Data quality and lifecycle management guidance for DOE/Labs data, including open data
- Public-private partnerships guidance, including guidance on innovative and emerging business models using DOE /Labs data, including open data
- Simplification and streamlining of internal DOE communications and reporting on open data, especially in the Office of the Chief Information Officer (OCIO). This would include synthesizing information on open data programs from different OCIO divisions. Coordinating this information with reporting to OMB would also improve DOE's quarterly Project Open Data scores.
- Strategies to recruit and retain top tech talent to serve at DOE.

Resources

This work could be done in coordination with broader interagency efforts in open data. Within DOE, it could be done through collaboration between the General Counsel's office and OCIO, drawing on the results of this Roundtable and other policy recommendations, case-study examples, and best practices. With reasonable staff resources – for example, one staffer each from GC and OCIO – it could be possible to develop these policies and guidelines within a 12-month period.

Ongoing User Engagement

As DOE develops open data programs and initiatives, the department should continue to include DOE's internal and external data users. The Open Data Roundtable, like other stakeholder engagements DOE has undertaken, has shown the value and importance of ongoing input from the private sector, nonprofits, academics, and other nongovernmental organizations.

APPENDIX A: Acronyms

AHRI	Air-conditioning, Heating and Refrigeration Institute
API	Application Programming Interface
BEDES	Building Energy Data Exchange Specification
BPD	Buildings Performance Database
CBECS	Commercial Buildings Energy Consumption Survey
CEMACS	Clean Energy Manufacturing Analysis Center
CEMI	Clean Energy Manufacturing Initiative
DOE	U.S. Department of Energy
DSIRE	Database of State Incentives for Renewables and Efficiency
EDX	Energy Data Exchange
EERE	Office of Energy Efficiency and Renewable Energy
EIA	Energy Information Administration
GC	General Counsel
GDR	Geothermal Data Repository
GSA	U.S. General Services Administration
GTO	Geothermal Technologies Office
IP	Intellectual Property
KDF	Knowledge Discovery Framework
NEPA	National Environmental Policy Act
NGDS	National Geothermal Data System
NOAA	National Oceanic and Atmospheric Administration
NREL	National Renewable Energy Laboratory
OCIO	Office of the Chief Information Officer
OE	Office of Electricity Delivery and Energy Reliability
OpenEI	Open Energy Information
OSTI	Office of Science and Technical Information
PII	Personally Identifiable Information
RAPID	Regulatory and Permitting Information Desktop
R&D	Research and Design
RFI	Request for Information
ROI	Return on Investment
SEED	Standard Energy Efficiency Data
XML	eXtensible Markup Language

APPENDIX B: Featured Datasets & Data Repositories

Energy Efficiency & Renewable Energy Data Portal

Below is a select list of sources of data on energy efficiency and renewable energy technologies from throughout EERE and from the DOE national laboratories available on the data portal. These data resources provide information such as prices, savings, use, and state statistics by technology. Also included are links to more comprehensive data collections, policy data resources, and supply and demand forecasts. Featured EERE datasets and data portals include:

- Visual Patent Search: A searchable, sortable resource of patents from research funded by DOE.
- National Geothermal Data System (NGDS): This resource contains raw geoscience data that can help pinpoint elusive sweet spots of geothermal energy deep in the earth, enabling researchers and commercial developers to find the most promising areas for geothermal energy.
- Bioenergy Knowledge Discovery Framework (KDF): The Bioenergy KDF supports the development of a sustainable bioenergy industry by providing access to a variety of datasets, publications, and collaboration and mapping tools that support bioenergy research, analysis, and decision-making. In the KDF, users can search for information, contribute data, and use the tools and map interface to synthesize, analyze, and visualize information in a spatially integrated manner.
- Buildings Performance Database: The Buildings Performance Database lets users mine anonymous statistical data from real buildings that match a specific building characteristic profile, enabling real estate professionals, contractors, policymakers and lenders to incorporate real-world performance data into their decision making.
- Energy Data Exchange: EDX facilitates a more rapid and comprehensive utilization of key data needs that cross-cut multiple projects/program areas (CO2 storage, unconventional and conventional hydrocarbon systems, natural gas hydrates, etc.).

National Renewable Energy Laboratory Data & Resources

Databases, maps, and tools produced by the National Renewable Energy Laboratory can be found online. These resources are available to assess, analyze, and optimize renewable energy and energy efficiency technologies. NREL maintains a number of databases, visualizations, and portals. Some examples include:

- OpenEI.org: A knowledge-sharing wiki containing links to Department of Energy and other energy datasets, applications and articles. OpenEI is a collaborative open data platform that builds knowledge and datasets, connects and structures data via linked open data standards, and utilizes crowd-sourcing and partner collaboration to build data/content. It enables centralized data cataloging, dataset contributions by offices and their stakeholders, cross-laboratory participation/data connections, and dataset curation from subject matter experts. Program Data Repositories on OpenEI include the Geothermal Data Repository and the new Marine Hydrokinetic Data Repository. These data repositories are geared toward collecting project and technical data to enable reporting compliance and provide DOE with needed information and data about the projects that they fund.

  Another OpenEI resource, Energy DataBus, is used for tracking and analyzing energy use on NREL's Colorado campus. The system is open sourced and applicable to other facilities—including anything from a single building to a large military base or college campus—or for other energy data management needs. Key features include the software's ability to store large amounts of time series data collected at high frequencies—NREL collects some of its energy data every second—and rich functionality to integrate this wide variety of data into a single database.
- Smart Grid Data Hub and Smartgrid.gov: NREL created an enterprise-level data hub that was responsible for

collecting, managing, and storing the data generated through the Smart Grid Recovery Act Projects. Any open data was automatically fed to SmartGrid.gov so that key datasets for projects could be transparently displayed to the public.

- Developer.nrel.gov: NREL's developer network helps all developers access and use energy data via Web services, including renewable energy and alternative fuel data. The API umbrella used for this system is open sourced and has been made accessible for others to use. In fact, the U.S. General Services Administration (GSA) API umbrella utilizes this code base for all GSA related APIs.
- Maps.nrel.gov: NREL's custom OpenCarto framework enables online mapping tools to showcase layers of data to help with visualizing data and even high-level analysis of data. You can explore tools such as the RE Altas, PVWatts, PVDAQ, Geothermal Prospector, BioFuels Atlas, and more.

DOE Explorer

This portal, launched in 2013 by DOE's Office of Science, provides science, technology, and engineering research and data collections from DOE. The most-used data collections include the following (listed with their sources):

- Large-Scale Atomistic Simulations of Material Failure— Office of Science
- DOE Global Energy Storage Database— Office of Science
- Chart of Nuclides from the National Nuclear Data Center (NNDC)— Office of Science
- Engine Combustion Network Experimental Data—EERE
- Community Climate System Model (CCSM) Experiments and Output Data—USDOE
- GSOD Based Daily Global Mean Surface Temperature and Mean Sea Level Air Pressure (1982-2011) —Office of Science

Energy Information Administration's API

The U.S. Energy Information Administration collects, analyzes, and disseminates independent and impartial energy information to promote sound policy making, efficient markets, and public understanding of energy and its interaction with the economy and the environment. The EIA's open API can be found here.

Green Button Data

A set of RESTful API methods and an XML data standard allowing consumers to access their energy usage data and securely share that data with third-party web and mobile apps. To date, 48 utilities and electricity suppliers have committed to enable their customers with "Green Button" access. Over 42 million household and business customers already have access to their Green Button energy data. The industry-led Green Button Alliance was legally incorporated and launched in February 2015.

National Library of Energy

The library virtually integrates information from Energy.gov (the DOE website) and all DOE program offices, national laboratories and other facilities. The National Library of Energy search feature provides one-stop, easy access to information in DOE's broad mission areas: science and R&D; energy and technology for industry and homeowners; energy market information and analysis; and nuclear security and environmental management.

Federal Energy Regulatory Commission Datasets

Data from the Federal Energy Regulatory Commission, an independent agency that regulates the interstate transmission of natural gas, oil, and electricity.

APPENDIX C: DOE Roundtable Documents

Agenda

8:00 AM	**Registration**
8:30 AM	**Networking Breakfast with DOE Recognition Awards** Dr. DJ Patil, Chief Data Scientist, White House Office of Science and Technology Policy
9:20 AM	**Break**
9:30 AM	**Welcome and Introductions** Peter Tseronis, DOE Chief Technology Officer
9:40 AM	**Keynote** Dr. DJ Patil, Chief Data Scientist, White House Office of Science and Technology Policy
9:55 AM	**Structure of the Day** Joel Gurin, President of Center for Open Data Enterprise
10:00 AM	**DOE EIA Open Data with Relational Metadata** Mark Elbert, U.S. Energy Information Administration (EIA)
10:10 AM	**DOE Project Demonstrations and Innovation** Robert Bectel, Office of Technology Transitions Debbie Brodt-Giles, National Renewable Energy Laboratory (NREL) Jeremy Roberts, Green Button Alliance
10:30 AM	**Break**
10:40 AM	Breakout Session 1: **DOE Open Data Use Cases**
12:00 PM	**Lunch**
12:30 PM	**Future of DOE Open Data** Peter Tseronis, DOE Chief Technology Officer
1:00 PM	Breakout Session 2: **Responses and Opportunities**
1:45 PM	**Break**
2:10 PM	Breakout Session 3: **Turning Ideas into Action**
3:10 PM	**Ideas Exchange and Key Takeaways** Robert Bectel, Office of Technology Transitions
3:30PM	**Closing** Joel Gurin, President, Center for Open Data Enterprise
3:40PM	**Adjourn**
4:00 PM	**#EnergyOpenData Social Hour**

List of Participants

Government Agencies and Offices

U.S. Department of Energy (DOE)

The mission of the Energy Department is to ensure America's security and prosperity by addressing its energy, environmental and nuclear challenges through transformative science and technology solutions.

Office of the Under Secretary for Science & Energy

The Office of the Under Secretary for Science and Energy is responsible for driving transformative science and technology solutions through coordinated planning and management oversight of the Department's science and energy programs.

Robert Bectel

Office of Science (SC)

The mission of the Office of Science is the delivery of scientific discoveries and major scientific tools to transform our understanding of nature and to advance the energy, economic, and national security of the United States.

Carly Robinson
Lisa Streit

National Renewable Energy Laboratory (NREL)

NREL develops clean energy and energy efficiency technologies and practices, advances related science and engineering, and provides knowledge and innovations to integrate energy systems at all scales

Debbie Brodt-Giles
Austin Brown
Monisha Shah
Jon Weers

Lawrence Berkeley National Laboratory (LBNL)

The Lawrence Berkeley National Laboratory (LBNL, LBL), also known as the Berkeley Lab, is a United States national laboratory located in the Berkeley Hills near Berkeley, California that conducts unclassified scientific research on behalf of the United States Department of Energy (DOE).

Daniela Ushizima

Office of Energy Efficiency & Renewable Energy (EERE)

The Office of Energy Efficiency and Renewable Energy is at the center of creating the clean energy economy today. EERE leads the U.S. Department of Energy's efforts to develop and deliver market-driven solutions for energy-saving homes, buildings, and manufacturing; sustainable transportation; and renewable electricity generation.

Scott Hine
Kristen Honey
Bindu Jacob
Timothy Jones
Cody Taylor

SunShot Initiative

The DOE SunShot Initiative is a national collaborative effort to make solar energy cost-competitive with other forms of electricity by the end of the decade.

Bosco So

Office of Electricity Delivery & Energy Reliability (OE)

OE leads the Department of Energy's efforts to ensure a resilient, reliable, and flexible electricity system. OE accomplishes this mission through research, partnerships, facilitation, modeling and analytics, and emergency preparedness.

Christopher Irwin

The Office of the Under Secretary for Management and Performance The Office of the Under Secretary for Management and Performance is the Department's primary management organization, coordinating project management and the mission support functions of the Department and overseeing the cleanup of the legacy waste of the Cold War.	
Office of Chief Information Officer The Commerce Department's Office of the Chief Information Officer is responsible for ensuring that the Department's programs make full and appropriate use of information technology. It supports the increased use of leading edge technology to enable the Department to carry out its mission better, with improved products and services at the lowest cost.	*Paul Decheke* *David Dutton* *Jay Huie* *Nancy Russo* *Peter Tseronis*
U.S. Energy Information Administration (EIA) The U.S. Energy Information Administration collects, analyzes, and disseminates independent and impartial energy information to promote sound policymaking, efficient markets, and public understanding of energy and its interaction with the economy and the environment.	*Mark Elbert* *Gina Pearson* *Nanda Srinivasan*
Office of Congressional & Intergovernmental Affairs Our mission is to promote the Secretary's, Department's, and Administration's policies, legislative initiatives and budget requests; manage and oversee engagement activities.	*Judith Kargbo*
Office of General Counsel The General Counsel is charged by the Secretary of Energy with the authority to determine the Department's authoritative position on any question of law.	*John Jediny* *Rishi Sahgal*
Office of Energy Policy and Systems Analysis The role of the Office of Energy Policy and Systems Analysis is to deliver unbiased energy analysis to the Department of Energy's leadership on existing and prospective energy-related policies, focusing in part on integrative analysis of energy systems.	*Sandra Jenkins*
Office of Public Affairs The Office of Public Affairs develops communications campaigns to promote the Department of Energy's activities and programs.	*Atiq Warraich*
National Nuclear Security Administration NNSA is a semi-autonomous agency within the U.S. Department of Energy responsible for enhancing national security through the military application of nuclear science.	*Clarence Wardell*
Federal Reserve Board The Board of Governors of the Federal Reserve System, commonly known as the Federal Reserve Board, is the main governing body of the Federal Reserve System. It is charged with overseeing the Federal Reserve Banks and with helping implement monetary policy of the United States.	*Ed Lucio*
General Services Administration (GSA) The mission of GSA is to deliver the best value in real estate, acquisition, and technology services to government and the American people.	*Philip Ashlock*

National Aeronautics and Space Administration (NASA) NASA's vision is to reach for new heights and reveal the unknown so that what we do and learn will benefit all humankind.	*Ana Pinheiro Privette*
U.S. Department of Commerce, National Institute of Standards and Technology (NIST) NIST is a federal technology agency with a mission to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve our quality of life. As an example of its energy data activities, NIST has co-led the Green Button Initiative (with OSTP and DOE) including the development of the technology foundation for the Green Button ecosystem.	*Martin Burns* *David Wollman*
U.S. Department of Transportation (DOT) The U.S. Department of Transportation serves the United States by ensuring a fast, safe, efficient, accessible and convenient transportation system that meets our vital national interests and enhances the quality of life of the American people, today and into the future.	*David Winter* *Patrick Zhang*
White House, Office of Science & Technology Policy The mission of the Office of Science and Technology Policy is threefold; first, to provide the President and his senior staff with accurate, relevant, and timely scientific and technical advice on all matters of consequence; second, to ensure that the policies of the Executive Branch are informed by sound science; and third, to ensure that the scientific and technical work of the Executive Branch is properly coordinated so as to provide the greatest benefit to society.	*Dr. DJ Patil*

Companies, Nonprofit, Academic and Research Organizations

Amazon Web Services (AWS) Amazon provides cloud computing services through Amazon Web Services to a range of clients.	*Ariel Gold*
Baumann Consulting Baumann Consulting provides consulting services for sustainable and innovative building solutions for the US and international markets.	*Jonathan Lemmond*
Berkeley Institute for Data Science (BIDS) BIDS is a central hub of research and education at UC Berkeley designed to facilitate and nurture data-intensive science.	*Anthony Suen* *Daniela Ushizima*
Booz Allen Hamilton Booz Allen is a leading provider of management consulting, technology, and engineering services to the US government in defense, intelligence, and civil markets, and to major corporations, institutions, and not-for-profit organizations.	*Michael Miller* *Bryce Pippert*
Box Founded in 2005, Box provides a secure, scalable content-sharing platform. Box's dynamic, flexible content management solution lets users access and share content from anywhere, on any device.	*Sonny Hashmi*
Capgemini Capgemini is one of the world's foremost providers of consulting, technology, outsourcing services and local professional services.	*Matt Theall*
Collective IP The Collective IP platform provides technology transfer and corporate licensing professionals with a unique asset marketing platform, while simultaneously delivering an unprecedented search solution for business development professionals who focus on asset identification within companies and technology transfer organizations.	*Matt Brewer*
The Center for Open Data Enterprise The Center for Open Data Enterprise develops smarter open data strategies for governments, businesses and nonprofits by focusing on data users.	*Audrey Ariss* *Greg Elin* *Katherine Garcia* *Joel Gurin* *Laura Manley* *Julia McCarthy* *Tobias Thorsted*
EnerKnol Founded in 2011, EnerKnol is an innovative energy policy data and analytics company conceived to solve the problem of fragmented and confusing policy information that the financial market needs to make critical investment decisions in the energy industry.	*Erin Carson* *David Gifford* *Vincenzo Giordano*
Forum One Forum One is a digital agency that crafts solutions for influential problem solvers.	*Chris Wolz*

Genability Genability was founded with a simple goal, to enable New Energy Companies to include Smart Energy in their products and services.	*Eric Danziger*
Green Button Alliance The Green Button Alliance is the culmination of several industry-led efforts responding to a White House call-to-action: provide electricity customers with easy access to their energy usage data in a consumer-friendly and computer-friendly format.	*Jeremy Roberts*
Innovation Accelerator The mission of the Innovation Accelerator is to promote our nation's economic competitiveness in the global economy by promoting our nation's innovation.	*John Pyrovolakis*
Maalka Maalka provides a service that helps building owners comply with new sustainability regulations, realize lower building operating costs, and improve property values.	*Rimas Gulbinas* *Terry Hunley* *John Teeter*
Manifest Mind Manifest Mind advises companies and strategic investors who must understand clean and sustainable technologies.	*Carol L. Stimmel*
Microsoft Microsoft develops, manufactures, licenses, supports and sells computer software, services, devices and solutions that help people and businesses realize their full potential.	*John Drake* *Michael Scott*
Next Step Living Next Step Living is the groundbreaking company on a mission to make it easy, affordable and rewarding for homeowners to implement energy-saving solutions.	*Claire Broido Johnson*
NC Clean Energy Technology Center The N.C. Clean Energy Technology Center advances a sustainable energy economy by educating, demonstrating and providing support for clean energy technologies, practices, and policies.	*Brian Lips*
Potential Energy DC Entrepreneurs are at the heart of the Potential Energy DC mission - the people and teams with the vision and guts to take on the complex issues that will have a global energy impact.	*Dave McCarthy*
Urjanet Urjanet automates the collection and delivery of energy data. Better data gives you better insight, helping reduce energy spend and usage.	*Sanjoy Malik*
Verdafero Inc Founded in 2009, Verdafero provides utility management tools and services for some of the best known companies & brands in the world.	*Alastair Hood*

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The Center for Open Data Enterprise thanks its sponsors for their support of the Open Data Roundtables.

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APPENDIX D: About the Center

The Center for Open Data Enterprise is an independent nonprofit organization that develops smarter open data strategies for governments, businesses, and nonprofits by focusing on data users. Our mission is to maximize the value of open data as a public resource that anyone can use. We work to unleash this value through a better understanding of open data users and greater engagement of stakeholders.

What We Do

Our user-centered approach aims to improving the open data ecosystem in three ways. We **map** the uses of open data from around the world; **convene** data users and providers to identify challenges and opportunities; and **implement** solutions driven by user input.

We MAP.

The first global view of the uses of open data.

The Open Data Impact Map is a searchable, sortable database of the uses of open data, providing a deeper understanding of the demand for this resource.

We CONVENE.

Action-oriented dialogues for government agencies & their data users.

Our Open Data Roundtables in the U.S. and abroad help identify high-value datasets, find solutions to data problems, and establish new collaborations.

We IMPLEMENT.

Improving the management & quality of open data.

We work with public and private sector partners to develop solutions to key data challenges informed by user feedback.

Contact Us

For general inquiries, contact Katherine Garcia at katherine@odenterprise.org.

For partnership opportunities, contact Laura Manley at laura@odenterprise.org.

Learn more at opendataenterprise.org.

U.S. Open Data Roundtables

Description

The Open Data Roundtables (opendataenterprise.org/convene) are action-oriented dialogues that bring together government agencies and the organizations that use their data. By hosting the Roundtables, we offer a low-tech solution to a high-tech problem. The Roundtables are designed to:

- **Identify high-value datasets** so agencies can address them as a priority;
- **Develop solutions** to make data more accurate, complete, and easy to work with; and
- **Connect data providers** and users for ongoing collaboration

The Center for Open Data Enterprise develops the Roundtable agenda in collaboration with the agency. Preparation includes research and questionnaires to stakeholders inside and outside government. Each Roundtable combines presentations from agency officials and staff with breakout sessions that bring government and data customers together in groups of eight to ten.

After each Roundtable, the Center for Open Data Enterprise issues a public report summarizing the participants' discussion of data challenges and opportunities, their proposals for solutions, and agencies' commitments to action. The Open Data Roundtables were originally launched as an initiative of the GovLab at NYU and are now run by the Center for Open Data Enterprise.

Previous Roundtables

U.S. Department of Commerce and White House Office of Science and Technology Policy

U.S. Department of Agriculture and the White House Climate Data Initiative

U.S. Patent and Trademark Office

U.S. Department of Transportation

Participants

The Roundtable aims to bring together the agency's key data stakeholders, including representatives from companies, nonprofits, academic institutions, other government agencies using their data. Representatives include decision-makers with technical and/or business understanding of how the organizations use government data.

The Center for Open Data Enterprise is an independent nonprofit organization, based in Washington DC that develops smarter open data strategies for governments, businesses. Our mission is to maximize the value of open data as a public resource that anyone can use. Learn more at opendataenterprise.org.