

What's Happening
@ EERE

Amped Up!

U.S. DEPARTMENT OF
ENERGY

Energy Efficiency &
Renewable Energy

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Grid Modernization Initiative and the MYPP

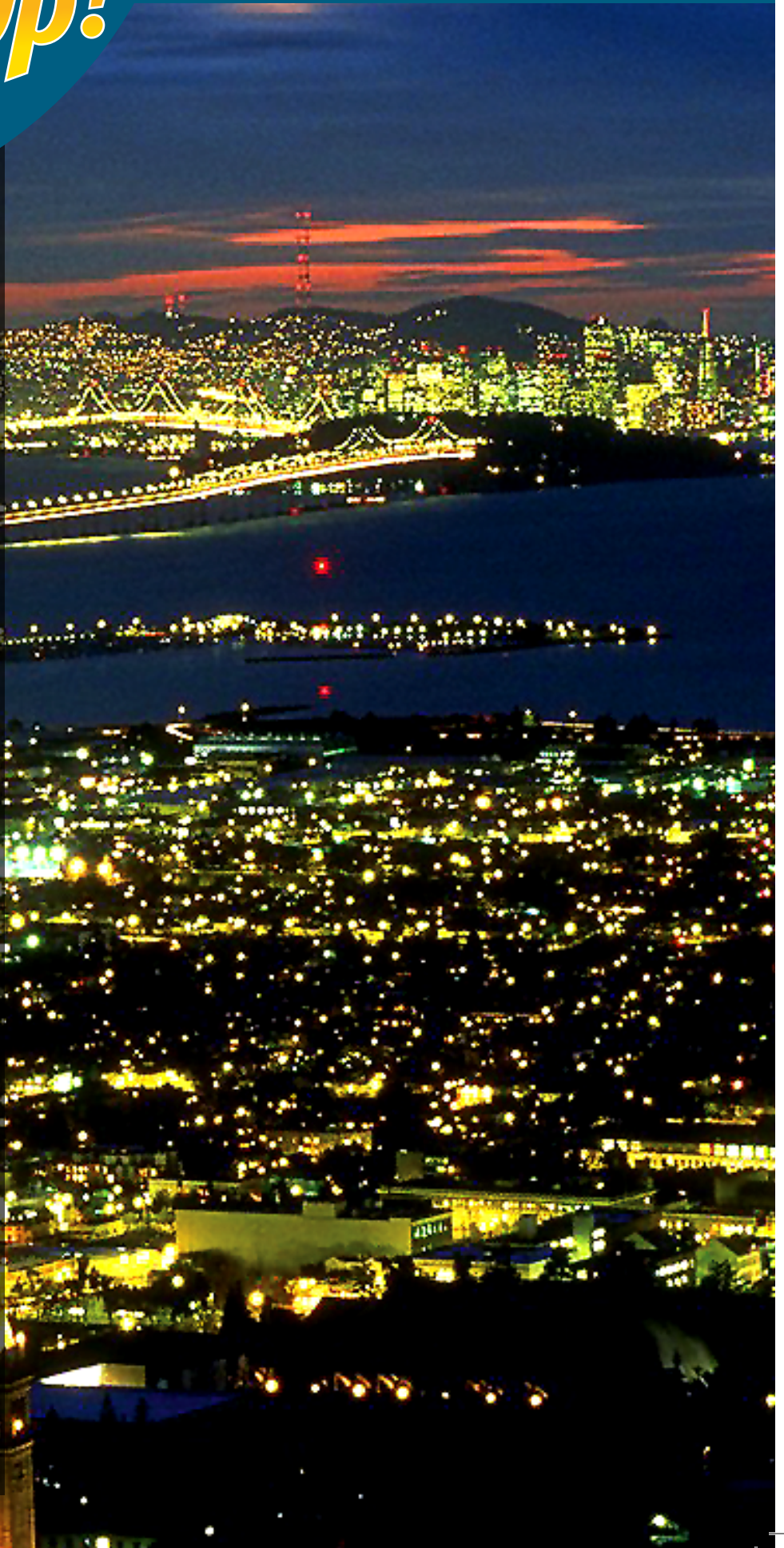
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A Message from Dave

Dear EERE Family,

Emerson told us that history is a fight between the conservators and innovators. Conservators want to protect the status quo, while innovators want to push it. Here at EERE, we're innovators, and we know that business as usual will not achieve our goals of advancing the clean energy economy, especially as we look to transform the 20th century grid to meet 21st century energy demands.

We also know that successful innovation can bring new opportunities and sometimes, new challenges. As EERE has successfully driven down costs of individual technologies, the need has increased to address the challenges of integrating the grid to allow greater deployment of clean energy technologies, benefitting more consumers. That's why the Grid Modernization Initiative was created and is one of my top priorities for 2015. I'm thrilled to announce that a Grid Modernization Multi-Year Program Plan (MYPP) was finalized this spring in coordination with the Office of Electricity, the Office of Energy Policy and Systems Analysis, other Energy Department offices, and 13 of our national labs. The MYPP streamlines the approach to grid research funding and describes the research, development, and demonstration (RD&D) activities the Energy Department will focus on over the next five years.



EERE is already making incredible progress modernizing the grid. One great success story takes place in Hawaii where, until earlier this year, there were more than 2,000 solar-powered homes that were unable to connect to the grid because they collectively would have prevented minimum daytime distribution load requirements from being met. Thanks to SunShot Initiative funding, Hawaiian Electric and SolarCity formed a partnership to test advanced power inverters at the National Renewable Energy Laboratory's Energy Systems Integration Facility (ESIF). The project used advanced computer modeling software to analyze and address high-penetration solar scenarios, leading to new load specifications. The project's success means more Hawaiian Electric customers can now connect their solar power systems to the electrical grid.

Since its dedication by Secretary Moniz in 2013, ESIF remains the nation's premier facility to help both public and private sector researchers test how clean energy technologies interact with each other and the grid at utility scale. This is why ESIF has received a number of incredible awards including R&D Magazine's 2014 Laboratory of the Year Award and a 2014 R&D 100 Award.

And EERE's efforts to modernize the grid don't stop there. Since 2006, the Wind and Water Power Technology Office has announced more than \$25 million in awards for 41 projects, which help industry partners understand how to incorporate large quantities of wind into system operations and improve the quality of the grid.

These and other successes that have contributed to modernizing the grid are detailed in this issue of Amped Up. I hope you're as excited as I am to read about them, as well as our strategy to secure a clean, reliable grid.

I'm proud to work with an incredible team of innovators who are never satisfied with the status quo and are always looking forward.

Onward,

Dave

Amped Up is a bimonthly newsletter on the latest developments within EERE and is brought to you by EERE's Communications Office; do not cite or release without prior approval. If you have any suggestions or comments about what you would like to see in this newsletter, please contact internalcommunications@ee.doe.gov.

Grid Modernization Initiative

NOT BUSINESS AS USUAL

An extensive, reliable power grid has fueled the nation's growth since the early 1900s. Access to electricity is an essential part of daily life and is considered the greatest engineering achievement of the 20th century by the National Academy of Engineering. Today's grid is still largely a 20th century structure, but advancements in clean energy technologies have provided an opportunity to transform the grid into a 21st century structure.

The Energy Department developed the Grid Modernization Initiative (GMI) specifically to address this opportunity. This initiative is an aggressive, five-year grid modernization strategy that includes alignment to current activities, new technologies that fill the major gaps in our existing portfolio, and the development of a laboratory consortium with core scientific abilities and regional outreach. "The purpose of the Initia-

tive is to organize the important grid modernization work occurring across the Department into one coordinated, coherent effort," said Kevin Lynn, vice chair of the GMI for the Energy Department.

Through the GMI, the Energy Department recently drafted a Multi-Year Program Plan (MYPP) to coordinate a portfolio of activities to help modernize the grid. The MYPP draws upon the Energy Department's work in the recently released Quadrennial Energy Review and the soon-to-be-released Quadrennial Technology Review, as well as Department program activities and numerous private sector inputs over the past few years.

The MYPP describes the research, development and demonstration (RD&D) activities the Energy Department will focus on over the next five years to help meet grid modernization challenges, including opportunities for public-private partnerships. It was developed by the Grid Modernization Lab Consortium, a combined effort between the national labs and

the Department of Energy to bring together leading experts and resources to collaborate on the goal of modernizing the nation's grid.

The MYPP not only defines the vision, mission and objectives for success in grid modernization over the next five years, but it also outlines how program offices across the Department participate in supporting that mission," said Lynn.

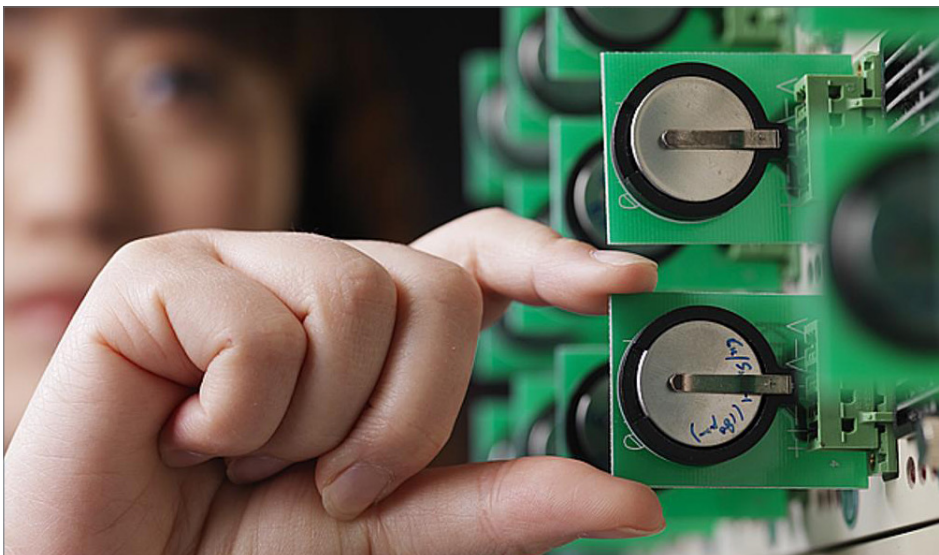
To accomplish the MYPP, the Energy Department is targeting three national outcomes:

- A 10 percent reduction in the economic costs of power outages by 2025
- A 33 percent decrease in cost of reserve margins while maintaining reliability by 2025
- A 50 percent decrease in the net integration costs of distributed energy resources by 2025

In the MYPP, the GMI will assess its progress not only by looking at RD&D efforts in individual technical areas, but also in three integrated demonstrations called the Energy Department Major Technical Achievements:

- A transmission and distribution system that operates reliably on a lean reserve margin
- Resilient distribution feeders with high percentages of low-carbon distributed energy resources
- An advanced modern grid planning and analytics platform

The MYPP outlines an integrated approach to grid research funding across the GMI's three stewards – the offices of Electricity Delivery and Energy Reliability, EERE and Energy Policy and Systems Analysis. Other Energy Department grid programs



Research at Pacific Northwest National Laboratory (PNNL) includes development of materials and batteries for stationary energy storage applications. Stationary energy storage will be vital to adding renewables (wind, solar, etc.) to the power grid in order to make the smart grid a reality. (Photo courtesy of PNNL)

such as Fossil Energy, Advanced Research Projects Agency-Energy and the Office of Science are also making contributions to the plan.

This new, crosscutting approach ensures that research and development (R&D) investments are fully coordinated and capabilities across the national labs are fully leveraged. Technical teams comprised of 65 leading scientists and engineers from 13 national labs align in six technology activity areas:

1. Devices and integrated systems
2. Sensing and measurements
3. System operations
4. Power flow and control, design and planning tools
5. Security and resilience
6. Institutional support

In addition, the labs are working with Energy Department program offices to link and leverage existing programs as well as engage respective regional stakeholders to aid in implementing the new R&D investments. The labs also provide institutional support to states, local communities, tribes and other groups to develop new regulations needed to tap into the potential of the modern grid.

SIX TECHNOLOGY ACTIVITY AREAS

Supporting the Energy Department Major Technical Achievements in the MYPP are six specific technical areas. They are the core of the Energy Department's GMI.

1. Devices and Integrated Systems Testing

Develops devices and integrated systems, coordinates integration standards and test procedures, and evaluates the grid characteristics of both individual devices and integrated systems to provide grid-friendly energy services.

2. Sensing and Measurements

Focuses on tools and strategies to determine the type, number and placement of sensors to improve system visibility from individual devices to feeders, distribution systems and regional transmission networks.

3. System Operations, Power Flow and Control

Develops power flow controllers that will permit fine adjustment and multi-directional power flow, as well as flow control devices that can optimize transmission flows. Also develops system architecture and control theories and coordinated grid system controls, as well as improved analytics and computation for grid operations and control.

4. Design and Planning Tools

Develops the next generation of modeling and simulation tools needed for power system planning. These new tools will handle emerging needs driven by changing technologies and operational capabilities, larger and more complex models, and more challenging forecasting, as well as new types and sources of data.

5. Security and Resilience

Focuses on the ever-increasing natural and man-made threats to the electric grid, including high-impact and low-frequency events, severe storms and fuel delivery failures, as well as more frequent physical and cyber threats.

6. Institutional Support

Provides technical assistance to key decision makers so that they can address the high-priority grid modernization challenges and needs identified by electric power industry stakeholders.



The molten salt test loop (MSTL) at Sandia National Laboratories' National Solar Thermal Test Facility in Albuquerque, New Mexico. AREVA's solar team and Sandia's molten salt technology experts have developed an innovative approach to energy storage that combines the MSTL with AREVA's Compact Linear Fresnel Reflector applications. (Photo by Randy Montoya, Sandia Labs)

EERE'S KEY ROLE FOR GRID MODERNIZATION

Within the GMI, EERE's grid activities focus on ensuring seamless integration of energy efficiency, renewable power and sustainable transportation technologies into the electrical power system. Clean energy technologies connect through the grid and form power systems at a variety of levels—from individual buildings to distribution systems to regional systems that can stretch across the nation. Increasing interaction and communication between these clean energy technologies can have a profound impact for the reliability of the grid.

EERE technologies required for successful grid integration includes: improved approaches to renewable power forecasting; application of energy storage technologies; advanced power electronics; grid responsive building technologies; vehicle-to-grid technologies; and new approaches to grid-sensing, control and operations.

EERE's Buildings Technology Office has recognized that smart building technology is a significant new opportunity for energy efficiency. Smarter buildings utilize information technology to identify energy efficiency opportunities. They also manage distributed electrical generation, thermal electrical storage systems and electric vehicle charging systems developed by other EERE offices. Smarter buildings contribute significantly to a more reliable grid and take advantage of the flexibility offered by multiple energy resources connected to a building.

Collaboration with industry and other stakeholders is also essential to producing the consistent communication and procedures necessary to enable these devices to successfully connect to the grid at the lowest cost possible – all while maintaining or improving its reliability.

EERE has identified several challenges to address over the next five years that will enable clean energy technologies to successfully contribute to our nation's clean energy goals.

BUILDING ON THE FOUNDATIONS OF EERE'S PRIOR SUCCESSES

Grid Integration of Solar Power

On Sept. 1, 2011, the Energy Department announced \$25.9 million to fund eight solar projects that are targeting ways to develop power electronics and build more interactive systems so solar energy can be integrated into the electric power distribution and transmission grid at high levels. Part of the SunShot Systems Integration efforts, the Solar Energy Grid Integration Systems – Advance Concepts projects will help advance a smart grid that will handle two-way flows of power and communication.

Grid Integration of Wind and Water Power (WWPTO)

From 2006 to 2014, WWPTO announced awards totaling more than \$25 million for 41 projects focused on integration, transmission, resource assessment and characterization. These projects help industry understand how to reliably incorporate large quantities of wind energy into system operations, and develop capabilities that enable these new wind installations to improve the quality of the grid.

ENERGY DEPARTMENT'S NATIONAL LABS WORKING TOWARDS NEW GRID VISION

More than six months into the Grid Modernization Lab Consortium, several labs are flexing their research muscles with exciting new projects in electricity integration and energy storage system performance. With additional emphasis on bringing new technologies to market, these leading researchers are collaborating with regulators, policy makers and industry leaders to modernize and secure our grid.

The National Renewable Energy Laboratory's (NREL) Energy Systems Integration Facility (ESIF) in Golden, Colorado, is the first Energy Department facility completely dedicated to integrating renewable energy technologies into the grid. Some researchers at ESIF focus on distributed grid integration projects in order to accommodate the increasing amount of renewable energy into the grid, while others test and evaluate integrated systems that enable high-penetration and large-scale deployments of distributed renewable energy systems, controllable loads and sustainable transportation technologies. Projects in this area include testing services for microgrids at the Sacramento Municipal Utility District (SMUD) and Portland General Electric, as well as the Hawaii Clean Energy Initiative (HCEI) – a project that has one of the most aggressive clean energy goals in the nation.

Microgrids

Microgrids, often referred to as “distributed energy resource systems,” have significant advantages over conventional power systems. Conventional systems are centralized, typically utilize a single source of energy,



NREL Associate Lab Director Bryan Hannegan shows Deputy Secretary Elizabeth Sherwood-Randall a grid simulation during a tour of the Energy Systems Integration Facility on Dec. 2, 2014. (Photo by Dennis Schroeder, NREL)

and often require electricity to be transmitted over longer distances. By contrast, the microgrids being developed are decentralized and modular, and incorporate more flexible technologies that can potentially utilize several power sources.

In collaboration with NREL, SMUD is testing and demonstrating a microgrid at their corporate headquarters to see how it performs with real customers in a real-world operating environment. Additionally, there is also testing to see how the microgrid interacts with the main utility grid by integrating a demand response. This is a situation where, in reaction to time-based rates or other forms of financial incentives, customers are provided an opportunity to reduce or shift their electricity usage during peak hours.

NREL is also working with the Hawaiian Electric Company in order to meet the HCEI goal of 30 percent renewable power generation by 2030. This distributed grid integration project connects large amounts of renewable energy – mainly solar and wind – to the grids on the islands of Oahu and Maui, ideal testing grounds

for renewable energy development. Technical analysis of available renewables, including solar photovoltaic (PV), biomass, geothermal, wind and demand-side management, is currently underway, as well as the development of mitigation strategies for operational challenges that could affect grid reliability.

New Powerful Flow Batteries

Pacific Northwest National Laboratory (PNNL) is also playing a role in grid modernization. PNNL scientists have developed a new zinc-polyiodide redox flow battery with higher energy density than any other battery in the market. The batteries are virtually fire-proof, won't corrode, and contain electrolytes that allow them to operate in extreme climates.

Under the leadership of the Energy Department's Office of Electricity Delivery and Energy Reliability, PNNL also worked with Sandia National Laboratories to create a new set of evaluation guidelines for how large batteries and grid-scale energy storage systems work. This protocol is currently under revision

to add smoothing, which uses battery systems to even out sharp fluctuations when passing clouds cause short-term changes in PV solar generation. The new protocol also makes renewable energy more predictable and consistent by determining the average power available over the course of an hour and maintaining power along the grid within an acceptable voltage range.

INTEGRATE

Most recently, a new inter-lab collaboration between NREL and Idaho National Laboratory (INL) successfully demonstrated the ability to connect grid simulations at the two labs for real time interaction. The NREL-INL virtual connection is funded by the Integrated Network Testbed for Energy Grid Research and Technology Experimentation (INTEGRATE) project, which is sponsored by EERE and managed by NREL.

This testing provided meaningful data on the grid's response time to sudden changes in power caused by the loss of a generator or sudden increase or decrease in demand. The ESIF at NREL has the capability to merge these computer-based simulations of the grid with actual energy system hardware including wind turbines, solar panels, batteries and electric vehicles. INL also operates the National Electric Grid Reliability Test Bed, which features a utility-scale transmission and distribution system that can be customized for multiple power grid configurations.

QER/QTR HIGHLIGHTS

Supporting the Grid Modernization Initiative

The Grid Modernization Initiative Multi-Year Program Plan builds on the work laid out in two Energy Department reports – the Quadrennial Energy Review (QER) and the Quadrennial Technology Review (QTR). The QTR examines technology research, development, demonstrations and deployment opportunities across energy technologies to effectively address the nation's energy needs. The QER focuses on energy infrastructure and government-wide energy policy.

QER

Released April 21, the first-ever QER examines how to modernize our nation's energy infrastructure including energy transmission, storage and distribution. These are the networks of pipelines, wires, waterways, railroads and other facilities that contribute to our energy system. The report proposes policy recommendations and investments on a variety of topics including modernization of the electric grid in order to maintain economic competitiveness and energy security.

Recommendations for Modernizing the Electric Grid:

- Provide grid modernization research and development, analysis, and institutional support
- Establish a framework and strategy for storage and grid flexibility
- Conduct a national review of transmission plans and assess barriers to their implementation
- Provide state financial assistance to promote and integrate TS&D infrastructure investment plans for electricity reliability, affordability, efficiency, lower carbon generation, and environmental protection
- Coordinate goals across jurisdictions
- Value new services and technologies
- Improve grid communication through standards and interoperability
- Establish uniform methods for monitoring and verifying energy efficiency

[Read the full QER here](#)

Forging Ahead

The Geothermal Technologies Office is one step closer to creating a field laboratory dedicated to cutting-edge research on enhanced geothermal systems (EGS). In April, the Energy Department announced a total of \$2 million in funding for five projects selected for Phase I of the Frontier Observatory for Research in Geothermal Energy (FORGE) initiative. The multiphase project could provide access to a carbon-free energy source capable of powering up to 100 million homes and businesses in the United States.

EGS are man-made geothermal reservoirs created beneath the earth's surface where hot but relatively impermeable rock resides. Small amounts of fluids are injected into the rock to increase the size and connectivity of pathways that allow hot water to flow safely through the hot rock, carrying heat to the surface to generate energy. EGS could provide up to 100 gigawatts of electric generating capacity in the continental U.S. – roughly 10 percent of the nation's energy production.

The FORGE initiative consists of three phases. The five selected teams will spend the next year completing an analysis of their proposed sites and develop plans for Phase 2.

FORGE TEAMS

Idaho National Laboratory

- Location: Snake River Plain, Idaho
- Field site is located along the Yellowstone Hotspot – an area with potentially high subsurface temperatures and mechanical rock characteristics favorable for EGS reservoir stimulation

Pacific Northwest National Laboratory

- Location: Newberry Volcano, Oregon
- Newberry Volcano may be one of the largest geothermal heat reservoirs in the western United States; AltaRock Energy has developed and applied EGS technologies at this site for the last four years

Sandia National Laboratories

- Location: Coso, California
- Located near the Coso geothermal production field within the Naval Air Weapons Station China Lake, data suggests the potential presence of high subsurface temperature with little fluid and permeable rock at depth

Sandia National Laboratories

- Location: Fallon, Nevada
- Located on the Naval Air Station Fallon, previous analysis has revealed its suitability for research and development of an EGS reservoir; the team will also develop additional scientific data and generate a 3-D model and plan for potential development of the Fallon site for the FORGE EGS demonstration

University of Utah

- Location: Milford City, Utah
- May have large underground volumes of high temperature granite, potentially conducive to EGS development

Next year, as many as three teams will be selected to move into Phase 2 of the project and receive up to \$29 million in funding. This is to further characterize the proposed sites and complete all environmental and permitting requirements. Pending appropriations, Phase 3 is anticipated to fully fund implementation of FORGE at a single site, managed by one operations team.

[For more information click here.](#)



ENERGY THAT *Works* AROUND THE CLOCK

EGS is a reliable, baseload energy source. It can provide power **24** hours a day, **365** days a year, independent of weather conditions and with the flexibility to meet consumer demand.



GREEN TECHNOLOGY FOR A *Greener* WORLD

Power plants built for EGS emit **very** little CO₂ over their lifetime.

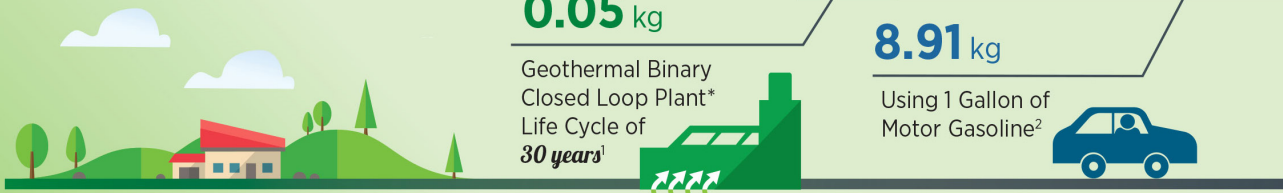
CO₂ Emissions

0.05 kg

Geothermal Binary Closed Loop Plant* Life Cycle of **30 years**¹

8.91 kg

Using 1 Gallon of Motor Gasoline²



^{1&2} For more information about the references visit: energy.gov/FORGE/Information-resources

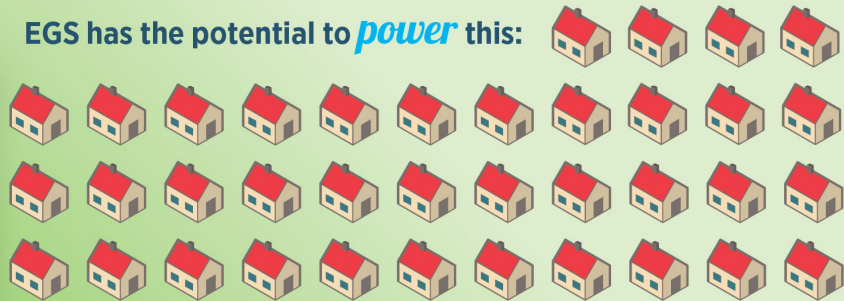
* A plant using moderately heated geothermal and secondary fluid that pass through a heat exchanger. The geothermal fluid causes the secondary fluid to flash to vapor driving turbines to power generators.

CLEAN ENERGY FOR AMERICA'S HOMES

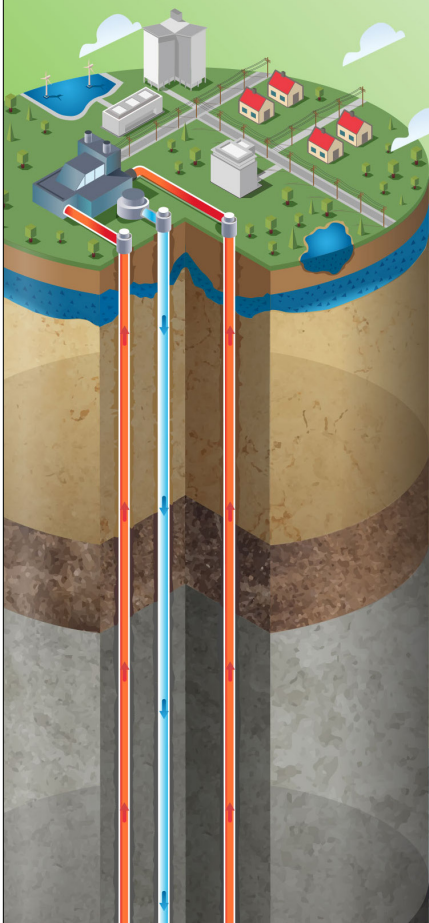
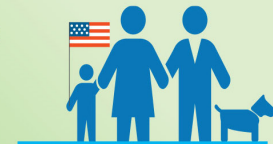


If this house represents **all** the households in Chicago,

EGS has the potential to **power** this:



EGS could provide more than **100 GWe** for the American people; the equivalent of **100,000,000 homes!**



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For more information visit: geothermal.energy.gov

DOE/EE-1212 • April 2015

Highlighting the Success, Potential of Hydropower

On April 27, Assistant Secretary Dr. David Danielson announced the re-release of the 2014 Hydropower Market Report at the National Hydropower Association Annual Conference in Washington, D.C. The first-ever report quantifies the current size, scope and variability of our nation's hydropower supplies.

The [98-page report](#), developed by Oak Ridge National Laboratory researchers, details the United States hydropower fleet which provides about 7 percent of the nation's electricity. It also describes key features of hydropower resources and trends that have influenced the industry.

Highlights include:

- Hydropower remains a major contributor to the power system with a total capacity of nearly 80 gigawatts
- At least 84 percent of the fleet supports more than just the power system; most installed hydropower is also connected to reservoirs that provide recreation, flood control, irrigation, navigation and/or water supply
- Hydropower capacity experienced an increase of 1.48 gigawatts from 2005 to 2014; capacity additions to existing projects accounted for 86 percent of the increases
- At least \$6 billion has been invested toward modernizing and upgrading existing hydropower plants since 2005
- Electricity generation has averaged 288 terawatt-hours from 2011 to 2013, accounting for 7.1 percent of U.S. electricity generation during that period
- In 2014, the Federal Energy Regulatory Commission approved the first original license for pumped storage hydropower in more than 15 years: the Upper American River Project in California
- Federal regulatory reforms have altered the permitting and licensing process for smaller projects, lowering the cost and time to obtain federal permits

Hydropower can also be rapidly integrated with other renewable energy sources into the electric grid, contributing to the Administration's goal of doubling our nation's renewable energy supply by 2020.



Pacific Northwest Laboratory researchers are looking at environmental sustainability and energy production issues involving hydroelectric dams. (Photo courtesy of Pacific Northwest National Laboratory)

WAVE ENERGY PRIZE

EERE's Water Power Program announced on April 27 the sponsorship of its first-ever Wave Energy Prize. The 18-month prize challenge is designed to encourage the development of more efficient wave energy conversion (WEC) devices that would double the energy captured from ocean waves. The Energy Department believes this competition will achieve game-changing results to WEC devices and establish a pathway for wave energy to become cost-competitive with traditional sources of fossil fuel energy.

Please visit waveenergyprize.org

Winds of the Future

On May 19, Secretary Ernest Moniz discussed the latest Wind Vision Report at WINDPOWER 2015 in Orlando, Florida – the nation’s largest wind industry event of the year.

According to the report released by EERE’s Wind Program, wind power currently generates 4.6 percent of U.S. electricity. That number is expected to grow over the next several decades – potentially accounting for 35 percent of electricity production by 2050.

The analysis explores the environmental, economic and health benefits of wind energy and highlights advancements in wind turbine technology that could lead to economic wind opportunities for all 50 U.S. states.

Key findings in the report include:

Reaching New Heights

Taller wind towers with larger rotors will make it possible to generate power from more consistent winds found at higher altitudes. This enables states, particularly in the Southeast, without strong winds to build new wind farm projects in areas that have not benefitted from this clean energy source before.

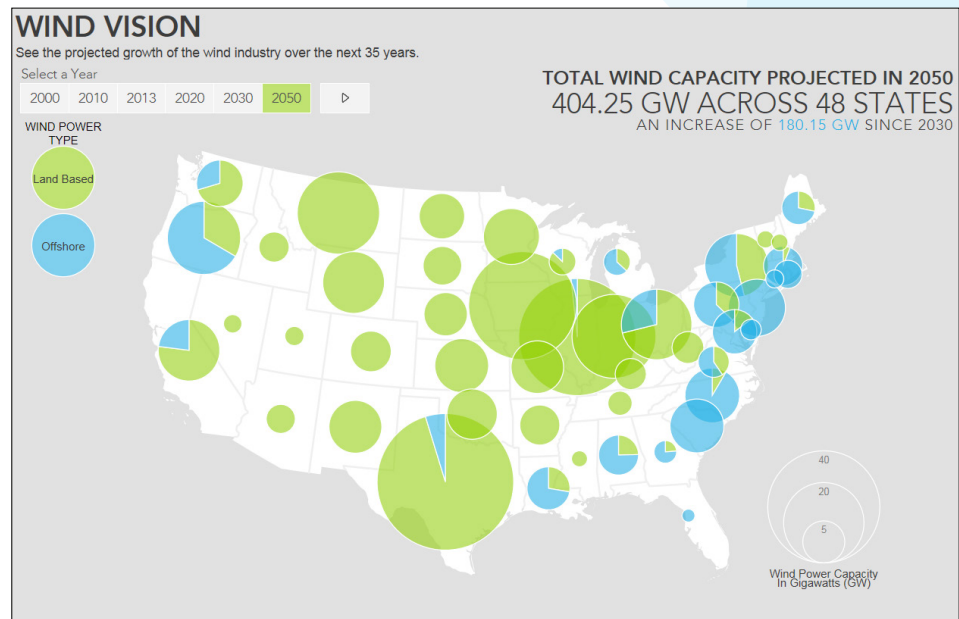
Offshore Development

Offshore wind has the potential to become a major source of clean, renewable energy for coastal communities. America already has a number of ports that could be modified to support offshore wind development.

Adding Even More

Wind power could grow significantly in states with strong wind resources like Texas, Illinois, Iowa, Indiana and Montana as wind technologies improve and become more efficient with continued investments in research and development.

To read more about the findings of the Wind Vision Report, download the [full report](#).



A wind map graphic illustrating the projected growth of the wind industry in 2050. Based on the findings in the Wind Vision Report the total wind capacity projected in 2050 is for 404.25 GW across 48 states. (Graphic by Daniel Wood, Energy Department Public Affairs)

Washington D.C. Hosts 2015 Energy Efficiency Global Forum

The Energy Department sponsored the 8th edition of the Energy Efficiency Global Forum (EE Global) at the Walter E. Washington Convention Center in Washington, D.C., May 12-13. The invitation-only forum brought together hundreds of energy efficien-

cy executives and policy makers from across the globe to discuss the latest technologies, develop best practices and strategies, and integrate policies and business practices into actionable plans for the next generation of energy efficiency.

EERE Principal Deputy Assistant Secretary Mike Carr (left) participates in plenary session on accelerating energy productivity at the 2015 Energy Efficiency Global Forum.



Over two days, key members of EERE leadership participated in the Executive Dialogue Sessions on Energizing Leadership. Participating leaders included: EERE Principal Deputy Assistant Secretary Mike Carr, Building Technologies Office Director Roland Risser, and Advanced Manufacturing Office Director Mark Johnson.

Hosted by the Alliance to Save Energy, EE Global was founded in 1977 to promote energy efficiency in order to achieve a healthier economy, a cleaner environment and energy security. EE Global is the premier forum dedicated to energy efficiency.

EERE's Advanced Manufacturing Office Director Mark Johnson in an executive dialogue session at the 2015 Energy Efficiency Global Forum.



Moniz Highlights EERE Successes on "The Daily Show"

On May 6, Secretary Ernest Moniz made a guest appearance on Comedy Central's "The Daily Show." He spoke with host Jon Stewart on a number of topics including his recent role in helping to secure a nuclear agreement between the U.S. and Iran. Moniz then shifted the focus to energy efficiency where he talked about grid modernization and the need to improve energy infrastructure, plugging the [Quadrennial Energy Review](#) as a resource. Moniz also stated that we are in the midst of



Secretary Ernest Moniz talks with "The Daily Show" host Jon Stewart on May 6. (Image courtesy of "Daily Show")

an energy revolution and used a couple of EERE successes as examples: LED lights (Building Technology

Office) and the SuperTruck (Vehicle Technologies Office). [Watch the entire interview here.](#)

For the Record

	Daimler Trucks North America	Cummins and Peterbilt
Year	2015	2014
Engine Efficiency	50.2 %	51%
Freight Efficiency Increase	115 %	76 %
Miles Per Gallon	12.2 mpg	10.7 mpg

Daimler Trucks North America

The Vehicle Technologies Office's (VTO's) SuperTruck project set another efficiency record for Class 8 tractor trailers in March. Daimler Trucks North America (DTNA) achieved 115 percent freight efficiency improvement, measured in ton-miles/gallon. The original goal set by VTO was 50 percent compared to a 2009 baseline vehicle. DTNA is the second SuperTruck team to exceed this goal (Cummins and Peterbilt was the first to do it in 2014). VTO is also working with Volvo and Navistar on separate project schedules.

Helping to Revitalize American Manufacturing Competitiveness

ADVANCED MANUFACTURING RELOCATES TO OAK RIDGE

In March of this year, high-tech metal powder processing firm, CVMR Corp., announced it is moving its global headquarters from Toronto to Tennessee due in large part to the technical resources provided through the Energy Department's Oak Ridge National Laboratory (ORNL). The move is a clear testament to the value of the labs and can serve as an example of how powerful collaborations can be in helping to revitalize American manufacturing.

“The proximity of Oak Ridge National Laboratories and their willingness to cooperate on a number of projects with us was a contributing factor to our final decision,” said Kamran M. Khozan, Chairman and CEO, CVMR USA Inc.

The [Manufacturing Demonstration Facility](#) (MDF) at ORNL is an ideal fit to support CVMR USA. The MDF successfully printed the world's first 3-D printed car in 2014 and recently produced this [3-D printed Shelby Cobra](#). CVMR USA will team up with scientists at ORNL to further advance 3-D printing technology and address market demands for manufacturing, powder metallurgy parts production and high performance coatings in the U.S.

“By leveraging unique resources like ORNL, Tennessee is in an extraordinary position to support long-term growth of advanced manufacturers like CVMR,” Tennessee Economic and Community Development Commissioner Randy Boyd said. “The Centre of Excellence for Innovation in Powder Metallurgy sets the stage for future innovation and makes a real statement about the strength of Tennessee's workforce.”

CVMR USA plans to begin operations by the end of July. Production includes advanced metal materials for a variety



Tennessee Governor Bill Haslam announces the relocation of the Toronto-based company CVMR to Oak Ridge National Laboratory. (Photo courtesy of Tennessee State Photographic Services)

of industries, including aerospace, energy, automotive and medical devices. CVMR USA plans to invest more than \$330 million over the next four years, bring more than 600 jobs to the area and begin construction of an additional facility.

NEW MANUFACTURING INNOVATION INSTITUTE ON COMPOSITES

In addition, the Clean Energy Manufacturing Initiative and the Advanced Manufacturing Office had another big win in the region with the successful launch of the Institute for Advanced Composites Manufacturing Innovation in Knoxville, Tennessee earlier this year. The consortium, made up of more than 120 partners nationwide, is developing next-

generation composite materials that are lightweight and durable, which will have a cross-departmental impact on manufacturing for a number of EERE offices such as:

- **Vehicle Transportation Office:** advancements for light-weight vehicles
- **Wind and Water Power Technologies Office:** advancements for next generation wind turbine blades
- **Fuel Cell Technologies Office:** advancements in high pressure cylinders for natural gas/fuel cell vehicles

The \$259 million private-public partnership is just another example of EERE's effort to revitalize the American manufacturing industry and its competitiveness.



Oak Ridge National Laboratory (ORNL) researchers demonstrate emerging building technologies to Assistant Secretary Dr. David Danielson on one of his lab tour stops to promote the National Lab Impact Initiative. Dr. Danielson toured ORNL's Building Technologies Research and Integration Center and was briefed on the lab's new technologies for refrigeration and building insulation applications. (Photo courtesy ORNL)

Race to Zero Student Design Competition

The second annual Race to Zero Student Design Competition took place April 18-20 at the National Renewable Energy Laboratory in Golden, Colorado. The event hosted 33 teams from 27 U.S. and Canadian universities to design cost-effective, zero energy homes for mainstream builders.

The Race to Zero Competition, formerly known as the Challenge Home Student Design Competition, is based upon a real-world scenario where a builder needs to update an existing house floor plan, or create a new high-performance home product line where the mandatory performance target is the [Energy Department Zero Energy Ready Home](#) specification. The competition encouraged students to work with builders, developers, community leaders and other industry partners to meet stringent design requirements and create marketable, affordable concepts.

Sam Rashkin, the program manager for the competition and chief architect for the Building Technologies Office, said this competition is trying to transform the educational process of building homes.

“There’s not a consistent curriculum that integrates building science with structural and mechanical design. Your design has to include air flow and thermal flow. Just to create the technology is not enough,” he says. “We have to make sure that our strategy is complete.”

The 2015 grand prize winner was the team from the University of Minnesota that partnered with a local organization called Urban Homeworks to create their “Opti-MN Impact House.” The overarching goal was to create a flexible, high-performance, energy-efficient and affordable house that can be easily built by Urban Homeworks and purchased



Thirty-three teams from U.S. and Canadian universities competed to develop cost-effective zero energy ready homes for mainstream builders at the Energy Department Race to Zero Student Design Competition held at the National Renewable Energy Laboratory (NREL) in Golden, Colorado, April 18-20. (Photo by John De La Rosa, NREL)

by eligible low-income residents of North Minneapolis through the Green Homes North program.

Some of the design strategies included a high-performance integrated space and water heating system with an inverter heat pump for cooling/dehumidification, a small duct distribution system

and exterior foundation insulation. Students also included an indoor air quality design strategy focused heavily on pollution avoidance, source-point exhaust, continuous ventilation and consistent distribution of fresh, filtered air to all habitable rooms.

BUILDINGS: NEXT GENERATION HVAC

Big Savings Expected

The Buildings Technology Office announced nearly \$8 million to advance the research and development of next-generation heating, ventilating and air conditioning (HVAC) technologies. With air conditioning using growing amounts of energy in the U.S. and worldwide, these new solutions are expected to offer significant energy and cost savings in new and existing buildings.

Two new technologies have been identified as the most promising: advanced vapor compression and non-vapor compression. Advanced vapor compression systems use highly efficient versions of current HVAC system technologies, but use refrigerants that will have minimal effects on the environment. Non-vapor compression systems will employ new technologies that use refrigerants with no impact on the environment.

Currently, HVAC systems are the largest energy end-use in buildings, accounting for nearly 30 percent of all energy used in U.S. commercial and residential buildings. Non-vapor compression HVAC systems have the potential to save as much as 40 percent of the energy used by current systems.

Office Roundups

Solar Energy Technologies Office (SETO)

On April 3, President Obama announced the expansion of the SunShot Initiative's Solar Ready Vets program to a total of 10 military bases. This helps meet the goal of training 75,000 solar workers by 2020 by providing hundreds more veterans with no-cost training to prepare them for careers as solar installers, sales representatives, system inspectors and other solar-related occupations.

Fuel Cells Technologies Office (FCTO)

In April, Deputy Assistant Secretary for Sustainable Transportation Reuben Sarkar and FCTO Director Sunita Satyapal attended a ribbon cutting ceremony at the FedEx hub at the Memphis International Airport to celebrate the development and demonstration of 15 zero emission fuel cell-powered cargo tractors.

Vehicle Technologies Office (VTO)

Through the Clean Cities National Parks Initiative, VTO announced projects at five new national parks as well as efforts to expand alternative fuel use at three other parks. Oak Ridge National Laboratory, supported by VTO, published the 2014 Vehicle Technologies Market Report, which describes trends over the last year in light-, medium- and heavy-duty car and truck markets.

Bioenergy Technologies Office (BETO)

Scientists from the University of California San Diego, with funding support from BETO, successfully created surfboards made from algae. These sustainable "surfboards of the future," made with algal oil and manufactured by California-based biotech firm Solazyme, are a "perfect ten" according to early surfer reviews of the initial prototype.

Geothermal Technologies Office (GTO)

The Hydrothermal Program within GTO invested in 11 projects nationwide that are using "Play Fairway Analysis" – a technique adapted from the oil and gas sectors – to improve success rates for exploration drilling by more accurately pinpointing geothermal systems hidden beneath the earth's surface. GTO is also exploring the potential for mineral recovery from geothermal brines, a proposition that could increase the value of geothermal energy production through the extraction of rare earths and other critical materials, like battery-grade lithium.



A FedEx zero emission fuel cell-powered ground support equipment cargo tractor funded by a \$2.5 million grant from the Energy Department. (Photo courtesy of FedEx)



Cal-CAB and Arctic Foam create the first algae-based surfboard. The first three boards were produced in Arctic Foam's surfboard blank factory in Ensenada, California on April 14. (Photo courtesy of the California Center for Algae Biotechnology)

Federal Energy Management Program (FEMP)

FEMP leadership visited the Air Force, Naval, and U.S. Military Academies in April and May to present student teams with the Energy Department’s Excellence in Energy Awards for exceptional capstone energy and engineering projects.

Weatherization and Intergovernmental Programs Office (WIPO)

WIPO participated in the Better Buildings Summit May 27-29 by hosting several sessions for attendees, including three separate State Energy Program cohorts of states implementing competitive awards: Leadership by Example in States, Sustainable Financing for Public Facility Retrofits, and Industrial Energy Efficiency/Combined Heat and Power.

Advanced Manufacturing Office (AMO)

Oak Ridge National Laboratory Manufacturing Demonstration Facility researchers recently used a highly controllable electron beam melting additive manufacturing process to design and fabricate a net-shape component made from a complex nickel alloy with a controlled microstructure. AMO project researchers demonstrated that, by selectively melting the metal powder at precise temperatures during both the print and cooling process, they could produce parts with complex geometries, and control the key micro-scale properties of the finished metal product.

Building Technologies Office (BTO)

Grocery stores are responsible for approximately 9 percent of the total energy consumed by commercial buildings in the United States. To reduce this energy impact, BTO recently released an [Advanced Energy Design Guide for Grocery Stores](#). It provides guidance to cut typical energy use in half, conserving approximately 8 billion British thermal units of energy per year, per store – equivalent to the energy used by 148 homes over the same period.

EERE International

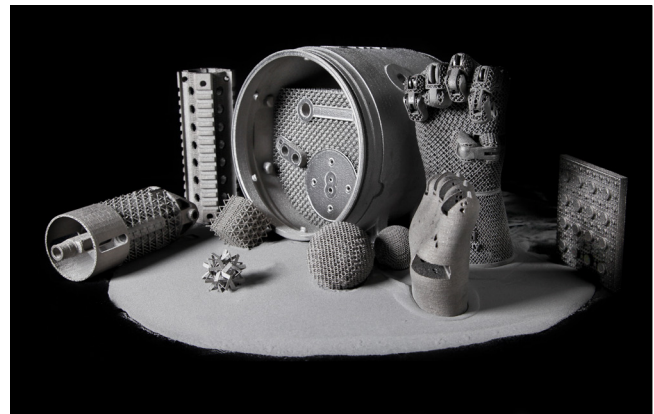
EERE International is working with EERE Technology Offices and the Energy Department’s International Affairs Office to shape activities undertaken by the new U.S. -Mexico Clean Energy and Climate Policy Task Force, co-chaired by Secretary Moniz. The taskforce builds off of existing collaborations between EERE and the government of Mexico on topics related to energy management systems, electricity modeling, and market assessments for geothermal and combined heat and power.

Tech to Market

On April 23, Erin Twamley and Paul Phongsavan from the Technology to Market Office held an energy information session with kids on the Energy Department’s Take Your Sons and Daughters to Work Day. Using an energy bike, kids learned first-hand how much energy it takes to power different lightbulbs.



Federal Energy Management Director Dr. Timothy Unruh (fourth from left) with Air Force Academy staff and students. The Air Force Academy team won an Energy Department Excellence in Energy Award for their microgrid design that featured two biomass-fired combined heat and power facilities, fuel cells, and complex load management scheme. (Photo courtesy of Air Force Academy)



Electron-beam additive manufacturing produced the fully functional lightweight robotic hand and other parts pictured here, which were made from titanium powder. (Photo courtesy of Oak Ridge National Laboratory)



Combined Federal Campaign Awards Ceremony

EERE was recently recognized for its efforts in the Combined Federal Campaign (CFC) – the largest employee campaign in the world. EERE received the Chairman’s Award for having 67 percent employee participation, equivalent to a \$225 per capita gift. All CFC keyworkers were awarded a Certificate of Appreciation for their assistance, while Darrell Beschen and Ted Donat both received a Special Service Award for coordinating the effort across all of EERE. In 2014, EERE’s participation rate grew 33 percent and actual donations increased 20 percent to more than \$93,000. EERE currently represents 10 percent of all Energy Department contributions.

Ted Donat poses with the Chairman’s Award Plaque for employee participation.



EERE Recognized at First-ever Energy Open Data Roundtable

Assistant Secretary Dr. David Danielson, along with several EERE and National Renewable Energy Laboratory employees, received Energy Innovation Awards for their commitment to open data. They were recognized at the Energy Open Data Roundtable on April 29. The first-ever event was hosted at Energy Department headquarters and included more than 60 energy data leaders from the public and private sectors. The goals of the roundtable were to better understand, connect and foster dialogue on the access and use of Energy Department and national lab open data.

Dr. David Danielson talks with the Energy Department’s Chief Technology Officer in the office of Chief Information Officer Peter Tseronis at the Data Open Round Table.



Jon Weers (left), Debbie Brodt-Giles (center), and Kristen Honey were among the 16 recipients of Energy Innovation Awards at the networking breakfast before the first-ever Energy Open Data Roundtable on April 29 in Washington, D.C.

FEMP Assists White House in Determining GHG Target Efforts

By now, we've all heard about the President's ambitious goal of cutting emissions 26-28 percent from 2005 levels by 2025. But what you may not know is that the federal government is leading by example. An [Executive Order](#) (EO) on March 19 pledges to reduce the government's targeted greenhouse gas (GHG) emissions by 40 percent from a 2008 base year and boost its renewable electricity use to 30 percent.

But where do these numbers actually come from?

EERE's [Federal Energy Management Program](#) (FEMP) provided key data and analytical support to the White House Council on Environmental Quality to determine the government-wide GHG reduction target. As the scorekeeper for federal agency energy performance data, FEMP is uniquely positioned to project the government's future path in a clean energy economy. In its support to the White House, FEMP assessed the GHG mitigation impact of achieving the key goals for 2025 contained in the EO including:

- 25 percent facility energy intensity reduction from 2015
- 25 percent of facility energy use from clean energy sources and technologies
- 30 percent renewable electricity goal
- 30 percent reduction of vehicle fleet per-mile GHG emissions

The EO directs federal agencies to commit to reductions in 2025 of targeted Scope 1 and 2 GHG emissions contributing to the government's overall 40 percent goal. FEMP assisted more than 30 federal agencies in Determining Agency Reduction Targets with a tool that considers each agency's baseline and current GHG emissions and then projects potential reductions based on the above goals. Agencies can further refine their estimates by inputting expected operational changes for 2025.

A key contributor to the targeted GHG reductions is improving the energy efficiency in facilities. FEMP's support of the President's Performance Contracting Challenge of \$4 billion in efficiency investment is a key driver of this critical goal.

In 2014, the federal government reduced its targeted [Scope 1 and 2 GHG emissions](#) by more than 17 percent.

USDA WASHINGTON CARVER CENTER RIBBON CUTTING

Secretary of Agriculture Tom Vilsack and Assistant Secretary Dr. David Danielson celebrated Earth Day in Beltsville, Maryland, for the grand opening of the U.S. Department of Agriculture's (USDA) first solar array project. The 1.6 megawatt solar farm, located at the Washington Carver Center, has more than 5,000 American-made solar modules and is the largest solar array on federal property in the capital region.

Several EERE programs were connected to this project. The Federal Energy Management Program provided agency-wide planning for renewable energy deployment. The [National Renewable Energy Laboratory](#) developed screening tools used for the initial site assessment, and SolarWorld, the panel manufacturer, is an awardee of the [SunShot Initiative](#).

The new solar farm is expected to save taxpayers more than \$300,000 in energy costs each year and positions the USDA to meet the President's pledge to boost the federal government's renewable energy use to 30 percent by 2025.



Dr. David Danielson (left) assists Secretary of Agriculture Tom Vilsack in the ribbon cutting ceremony at the USDA's George Washington Carver Center in Beltsville, Maryland. (Photo courtesy of USDA)

INNOVATION AND TECHNOLOGY TRANSFER AWARDS

On May 7, Assistant Secretary Dr. David Danielson took part in the Innovation and Technology Transfer Awards at the National Renewable Energy Laboratory (NREL) in Golden, Colorado. NREL staff turned in a record-breaking year in Fiscal Year 2014 issuing 43 U.S. patents – the largest number in lab history.

The annual event acknowledges NREL's commercialization and partnering successes and the researchers and engineers who made it happen. Min Zhang, an NREL engineer for the last 25 years, received the Distinguished Innovator Award. Zhang has

worked to support the Bioenergy Technologies Office by engineering advanced microbes to further the adoption of cellulosic biofuels. She has contributed to 80 peer-reviewed papers, numerous meeting abstracts, and 21 issued patents.

Chuck Booten and John Simon were also recognized as Rising Star innovators.



Dr. Danielson speaks at the Innovation and Technology Transfer Awards at the National Renewable Energy Laboratory (NREL). The annual event acknowledges NREL's commercialization and partnering successes as well as the researchers and engineers responsible. (Photo by Dennis Schroeder, NREL)

CLEAN CITIES ASSISTS WITH BioCNG RIBBON CUTTING

Grand Junction, Colorado, celebrated Earth Day by completing a 10-year biogas project, partially funded by the State Energy Program (SEP). The project converts digester gas (methane) from the city's wastewater treatment facility and transports the converted natural gas to a SEP-funded fueling station using an underground pipeline that is nearly six miles long. The Compressed Natural Gas (CNG) is used to fuel nearly 40 CNG vehicles in Grand Junction. The Clean Cities program also assisted with technical and promotional support. According to Grand Junction, the project will prevent three million pounds of carbon monoxide each year and is the first of its kind in the country.



BioCNG purification installation at the Persigo Wastewater Treatment Plant jointly owned by the City of Grand Junction and Mesa County, Colorado. (Photo courtesy of the State Energy Program)



Better Buildings Challenge Showcase Tours

The Energy Department recognized Better Buildings Challenge partners in Texas for committing to improve energy use for their entire building portfolios by 20 percent in 10 years. Deputy Assistant Secretary for Energy Efficiency Dr. Kathleen Hogan toured Fort Worth's water treatment facility on April 14 and San Antonio Housing Authority's Marie McGuire Lofts, along with Macy's Ingram Park store, the following day. Fort Worth's Village Creek Water Reclamation Plant saved more than 39 percent in energy annually – saving the city an estimated \$2.5 million each year. In San Antonio, Macy's saved 43 percent annually in energy costs and the Housing Authority's Marie McGuire Lofts saved more than 10 percent.

(Photo by Darren Abate/AP Images)



2015 National Science Bowl Competition

From April 30 through May 4, the Energy Department hosted 68 high school and 48 middle school teams for the 25th annual National Science Bowl (NSB) testing the students' knowledge in all areas of science and mathematics. The Electric Car Competition is a featured event at the national finals for middle school students to design, build, and race battery-powered model cars. This competition tests the students' creative engineering skills as they gain hands-on experience in the automotive design process and with electric battery technology. By nurturing students' interest in science and technology, the NSB helps ensure the Energy Department has a sustained talent pool of science, technology, engineering, and mathematics workers.

(Photo by Jack Dempsey, the Energy Department Office of Science)



Solar Rooftop Tour

Solar rooftop tours are currently underway at the Energy Department's Forrestal Building in Washington, D.C. Hosted by the EERE front office, employees can sign up for the same tour President Barack Obama received back in March. Originally installed in 2008, the 205-kilowatt system generates about 230,000 kilowatt-hours of electricity per year, saving an estimated \$26,000 annually. It includes a main array of 891 individual solar panels and four small, one-kilowatt arrays that all feature a different type of solar technology. For more information on all current energy reduction initiatives at the Energy Department, [click here](#).

Energy Saver Series




ENERGY SAVER – COOLING SEASON


It's almost summer, and that means the start of cooling season. Two-thirds of all U.S. homes have air conditioners that, combined, use about 5 percent of our nation's electricity production. This costs homeowners more than \$11 billion annually. As a result, roughly 100 million tons of carbon dioxide is released into the air each year – that's about two tons for each home with an air conditioner.

One alternative to air conditioning is ventilation. This graphic shows a few cheap tricks to keep you cool and energy-efficient.

Ventilation

Ventilation is the least expensive and most energy-efficient way to cool a home.

 <p>NATURAL VENTILATION</p> <p>Natural ventilation relies on the wind to create a "chimney effect" to cool a home. A simple natural ventilation strategy is opening windows to create a cross-wise breeze.</p> <p>ENERGY-SAVING TIP: If you live in a cooler climate, take advantage of the wind to naturally cool your home.</p>	 <p>FANS</p> <p>Fans circulate air in a room, creating a wind chill effect that makes occupants more comfortable. Fans for cooling come in a variety of options, including ceiling, table, floor and wall-mounted.</p> <p>ENERGY-SAVING TIP: Turn off your fans when you leave the room -- fans cool people, not rooms.</p>	 <p>WHOLE HOUSE FANS</p> <p>Whole house fans pull air in through windows and exhaust it through a home's attic and roof. To ensure proper sizing and safety, professionals should install whole house fans.</p> <p>ENERGY-SAVING TIP: In many climates, a whole house fan can provide cooling needs even on the hottest days.</p>
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ELEMENTARY SCHOOL LETTERS

Educating the Youth of Tomorrow


Isaac Emler is a fifth grade science teacher at Park Place Elementary in Houston, Texas. Back in January, he was teaching his students about the use and benefits of renewable energy. Providing them with a few guidelines, Emler's students wrote sentences about clean energy from their own perspective on what they learned. Here are the students' letters. They wanted to say thank you to everyone who works on research and planning the development of the innovative technologies that utilize clean energy resources. Emler's letter said, "Thank you for all that you do to provide us with a cleaner future. It is truly appreciated."

To whom it may concern: I think renewable energy (alternative energy) such as solar energy and hydroelectric energy are very significant, because we need to use a easy renewable energy and stop using fossil fuels and hydroelectric energy is easy to use to harness electricity, so is solar energy all we need are some solar panels mainly, many people use solar panels because it saves money.

Sincerely
Benjamin Arzaga Gallia

To whom it may concern:
I think renewable energy (alternative energy) such as wind and solar power is helpful because both make electricity is renewable cause it won't run out and is better then oil, Natural Gas, and coal.

Sincerely,
My Quyen Nguyen



To whom it may concern: I think renewable energy (Alternative Energy) such as wind, geothermal, and solar power is necessary because we can use it again and again and again, if it is not renewable then we going to use nature more than we have to. Also, it will kill plants and animals if you use more of nature than usual.

Thank you, Sincerely
Lucila

To whom it may concern: I think renewable energy (alternative energy) such as geothermal, wind, solar power, biofuel, and hydroelectric is necessary because if they are renewable then we will never run out of these items. Also, these items cause very little pollution, so they are safe in our society.

Yours Truly,
Martha Nguyen

U.S. DEPARTMENT OF
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Energy Efficiency &
Renewable Energy

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