

EESDP

16

ELECTRICAL ENERGY STORAGE DEMONSTRATION PROJECTS 2016

SANDIA NATIONAL LABORATORIES DEMONSTRATION PROJECTS YEARBOOK



**Sandia
National
Laboratories**

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ABOUT THE EESDP YEARBOOK

The Electrical Energy Storage Demonstrations Projects (EESDP) Journal is a collection of selected technical summaries about current areas being explored by the U.S. Department of Energy (DOE) and Sandia National Laboratories' scientists, engineers, technologists and industry partners involved in the research and development and deployment (RD&D) of electrical energy storage materials, devices, equipment, systems and facilities through purposed demonstration projects.

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ACKNOWLEDGEMENT

We wish to express appreciation and gratitude to the U.S. Department of Energy's Office of Electricity Delivery and Energy Reliability and Dr. Imre Gyuk, Energy Storage Program Manager, for the vision, support, and encouragement to collaborate with industry, utilities, and academia to achieve the work of the demonstrations program.

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DEMONSTRATION PROJECTS: VISION AND PRACTICAL APPLICATIONS



DR. IMRE GYUK

Energy Storage Program Manager,
Office of Electricity Delivery and Energy Reliability

In 2009, the American Recovery and Reinvestment Act (ARRA) provided the U.S. Department of Energy (DOE) with approximately \$4.5 billion to modernize the electric power grid. The DOE Office of Electricity Delivery and Energy Reliability (OE) Energy Storage Program in turn provided \$185M in federal matching funds to support energy storage projects valued at \$177M. The ARRA funding resulted in nearly 538 MW of new energy storage added to the grid.

Energy storage can play a variety of roles in the effort to modernize the electric grid, including but not limited to:

- Maintaining a robust and resilient electricity delivery system
- Deferring transmission and distribution upgrade investments
- Ensuring high reliability
- Improving operating capabilities
- Providing backup power and grid stabilization as part of emergency preparedness

Energy Storage System (ESS) demonstration projects should be designed to answer one or more of the four challenges of the widespread deployment of energy storage systems: cost competitive energy storage technologies, equitable regulatory environment, validated reliability and safety, and industry acceptance.

The two largest initiatives resulting from the Recovery Act funding are the Smart Grid Investment Grant (SGIG) program and the Smart Grid Demonstration Program (SGDP). These programs were originally authorized by Title XIII of the Energy Independence and Security Act of 2007 (EISA), and later modified by the Recovery Act. DOE's OE is responsible for implementing and managing these five-year programs.

The SGDP is authorized by the EISA Section 1304 as amended by the Recovery Act to demonstrate how a suite of existing and emerging smart grid technologies can be innovatively applied and integrated to prove technical, operational, and business-model feasibility. The aim is to demonstrate new and more cost-effective smart grid technologies, tools, techniques, and system configurations that significantly improve on those commonly used today. SGDP projects were selected through a merit-based solicitation in which

DEMONSTRATION PROJECTS APPROACH

DOE provides financial assistance of up to one-half of the project's cost. SGDP projects are cooperative agreements while SGIG projects are grants.

The SGDP effort consists of 32 projects. Of these, 16 projects are focused on regional smart grid demonstrations and 16 are focused on energy storage demonstrations. The total value of SGDP projects is approximately \$1.6 billion. The federal portion is near \$600 million. The Smart Grid Energy Storage Demonstration Projects are being managed by the National Energy Technology Laboratory (NETL) for the DOE OE. The goal of this document is to provide a summary of the accomplishments for each of the ARRA energy storage demonstration projects, as well as recommendations for future efforts.

The information in this report comes largely from three sources: interviews with the project team, interim and final technical reports provided to DOE, and DOE peer review presentations. The authors are extremely grateful for the feedback received from the project team members listed in the acknowledgements section. The report features a brief overview of each project, followed by lessons learned for that project. An overall lessons learned section then summarizes common themes and makes recommendations for future investments in energy storage to help facilitate wider adoption of grid connected energy storage systems.

DANIEL BORNEO

Principal Investigator ESS Demonstration Projects
Sandia National Laboratories

Energy storage technologies provide several applications such as frequency regulation, voltage support, energy management, and back-up power. However, not every type of storage is appropriate for every type of application. Part of the job of managing the ESS Demonstrations Projects involves considering and sharing technical risk mitigation with developers, controlling early stage deployment uncertainties related to cost, thoroughly vetting operating processes, commissioning systems, and developing the means of collecting valuable data. The 20 Sandia demonstration projects for 2016 include partnerships with utilities, academia, industry, rural cooperatives, regional operators, and international research and development entities. They are at various stages of completion and are designed to address DOE's key challenge areas from cost-competitiveness to validated safety.



FY 2016 DEMONSTRATION PROJECTS

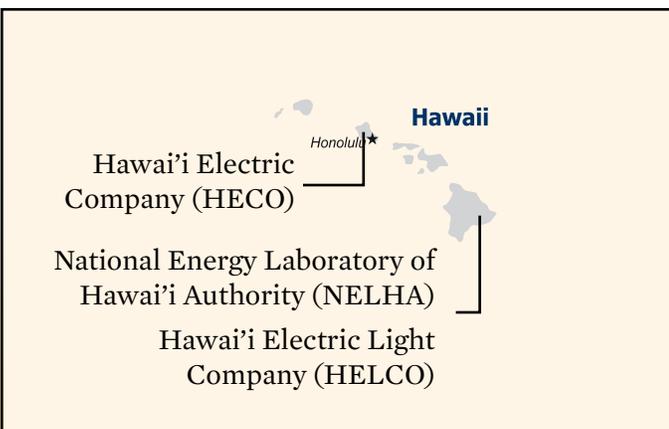
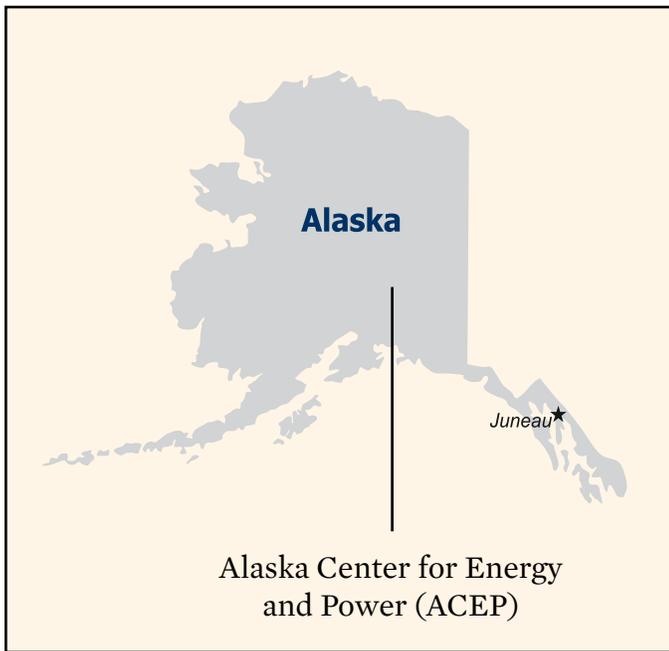


Eugene Water and Electric Board (EWEB)

California Energy Commission (CEC)

University of California San Diego (UCSD)

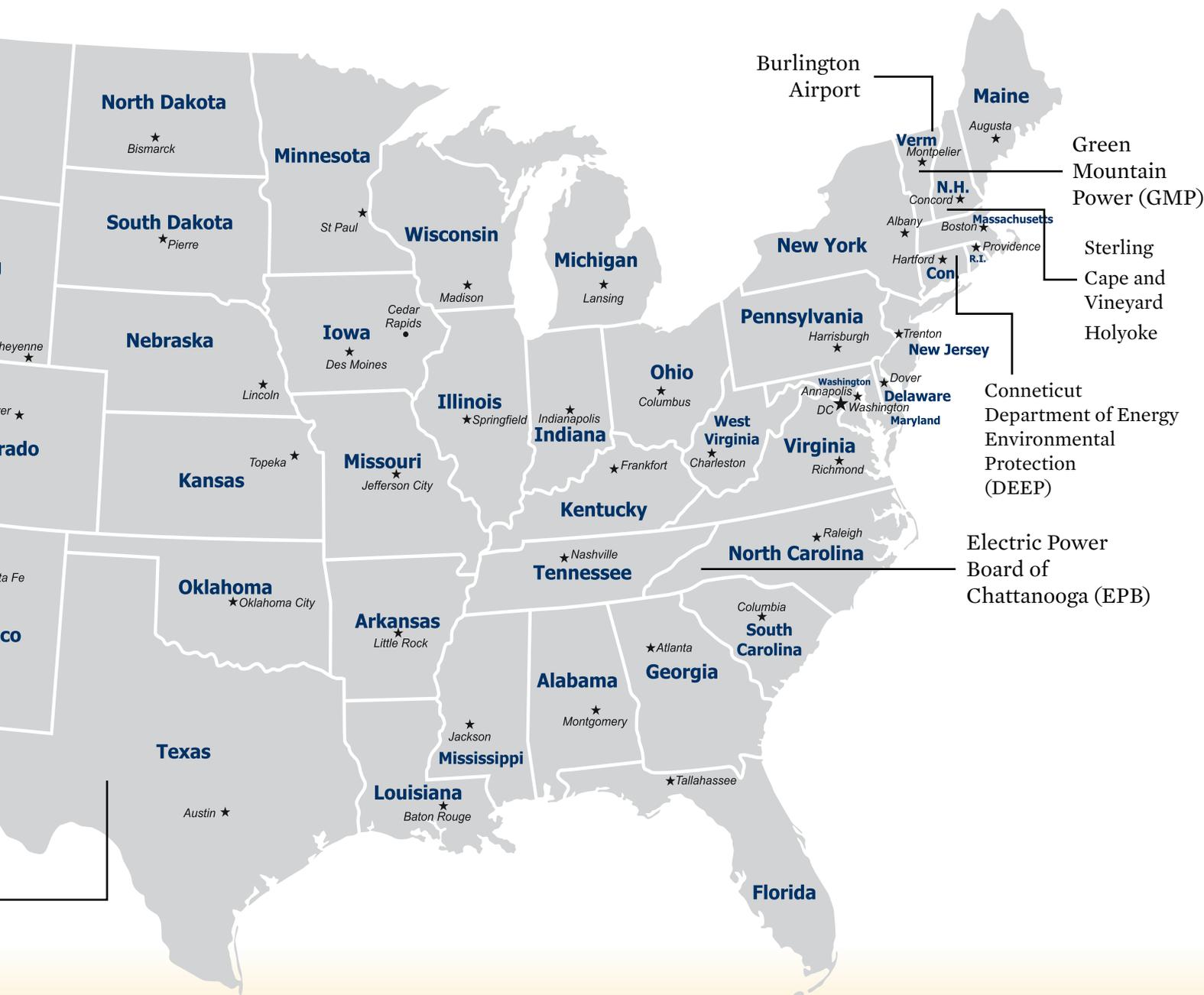
Poway



Los Alamos County (LAC)

Public Services of New Mexico (PNM)

Group NIRE



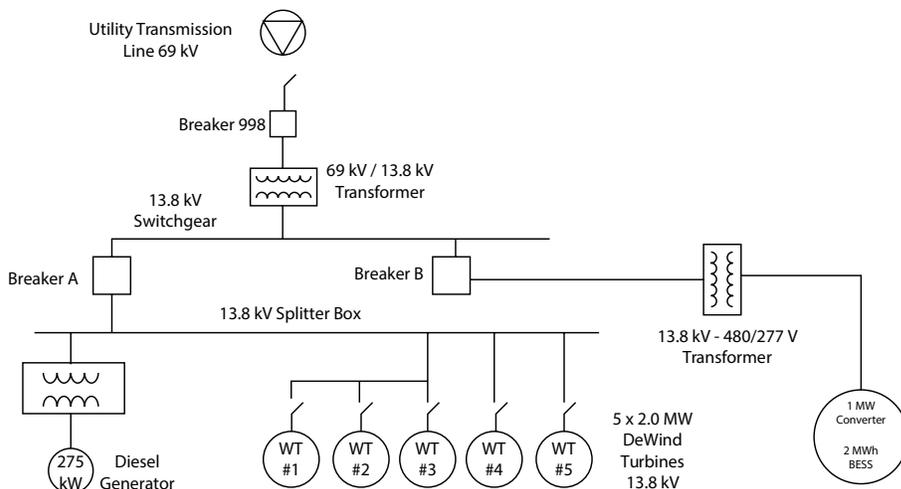
INTERNATIONAL PROJECTS:

Canada - WEICan
 Singapore

WEICAN: OPTIMIZATION OF GRID-TIED ENERGY STORAGE SERVICES

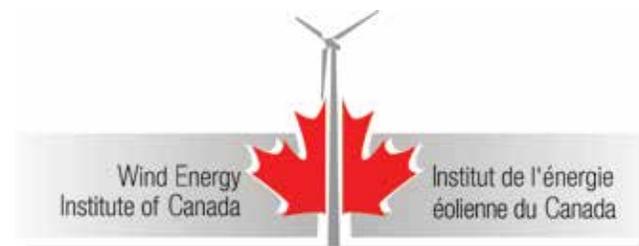
Project Description

The Wind Energy Institute of Canada (WEICan) is a not-for-profit organization whose mandate is to advance the development of wind energy across Canada through research, testing, training, and collaboration. WEICan received funding through Natural Resources Canada's Clean Energy Fund to build a Wind R&D Park. WEICan has been operating a 1 MW/2 MWh battery energy storage system (BESS), using General Electric's Durathon battery technology and S&C controls, in their 10 MW wind park since March 2014. The simplified one-line diagram of the Wind R&D Park is shown below.



WEICan views its Wind R&D Park with a BESS as a large lab that is available for experimentation by external users, including academics, national labs, and industry.

Sandia has technical expertise in the technical and economical evaluation of grid tied energy storage systems including an Energy Storage Test Pad (ESTP) able to evaluate performance of energy storage systems up to 1MVA. By leveraging the existing energy storage system at the WEICan Wind R&D Park, the models and algorithms developed by Sandia to optimize the use cases of energy storage can be validated and refined. This collaborative effort would lead to increased knowledge and improved services to the energy storage industry. Below are the tasks and deliverables as part of this project.



Tasks

1. Develop Initial Energy Storage Use Cases

- 1.1. WEICan will provide Sandia with reports describing use cases that have already been carried out with their energy storage system, including peak shaving, demand charge avoidance, diesel avoidance and frequency regulation.
- 1.2. Sandia will provide WEICan with initial use cases for the energy storage system for peak shaving and frequency regulation services based on MISO market and wind integration.

2. Evaluate Initial Energy Storage Use Cases

- 2.1. WEICan will perform tests and evaluate performance of energy storage system based on the initial energy storage use cases from Task 1.2.

3. Optimizing Energy Storage Use Cases

- 3.1. Energy storage use cases will then be optimized by Sandia and WEICan using PYOMO and production cost modeling in regards to percent of the time the energy storage system performs a certain service without compromising cycle life).

4. Publish Results

- 4.1. Sandia and WEICan will jointly publish a journal article or technical paper.

DOE OE Funding (Investment)

Estimated Total Project Cost =	\$400,000		
Funding Sources	DOE/Sandia	State/Municipal	WEICan
Previous Funding	\$0	\$0	\$0
Current FY Funding	\$0	\$0	\$0
Out Years Est	\$200,000	\$0	\$200,000
Totals	\$200,000	\$0	\$200,000



Partners/Collaborators

Wind Energy Institute of Canada (WEICan)

Project Status

Key Activities & Achievements this year:

- Start Project – November 2015
- Interim Report – May 2016
- Journal Submission – November 2016
- Continue R&D – No Time Line

Note: DOE and Sandia will benefit in validating the models that are created using the PYOMO and production cost models. By validating the models, a more accurate and higher level of confidence economical analysis can be performed when energy storage is to be installed at a particular utility or large entity. In addition to validating the models, this project will give Sandia and DOE insight on how to create a utility rate structure that energy storage can thrive in.



CORDOVA ELECTRIC COOPERATIVE ENERGY STORAGE PROJECT

Project Description

Background

Run-of-the-river (no water storage) hydro-diesel islanded microgrid operated by Cordova Electric Cooperative (CEC)

Periods of *low demand and high water availability*:

- Spills significant amounts of water (non-realized power production)

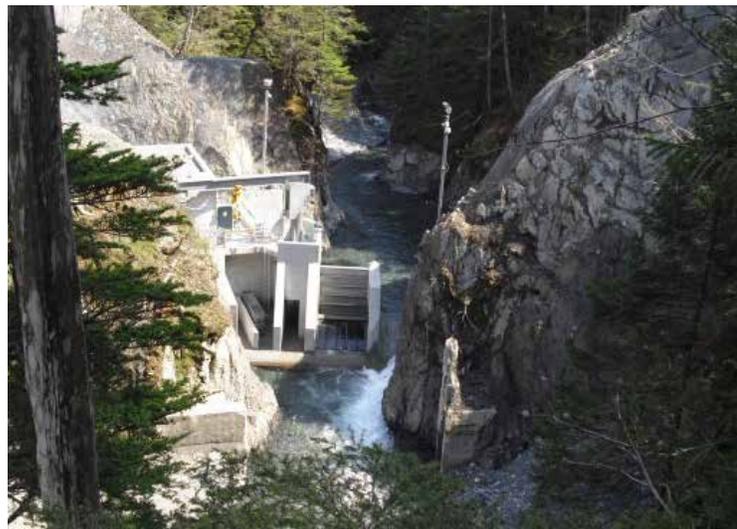
Periods of *high demand and low water availability*:

- Co-generate with diesel generators

Approximate cost of generation:

- \$0.90/kWh hydro
- \$0.40/kWh diesel

Project Goal: To provide an in-depth analysis that is detailed enough to develop a business case and technical RFP for an ES for Cordova.



DOE OE Funding (Investment)

Total funding for Phase 1:

- DOE/Sandia - \$140K to support analysis - ACEP (\$90K) and Sandia (\$50K)
- CEC - \$275K (Preliminary completed tasks)
- ACEP - \$15K (Preliminary completed tasks)

Estimated total funding for Phase 2:

- DOE/Sandia - \$110K for ES design and installation
- CEC - \$2-2.5M (Energy Storage System procurement and installation)
- ACEP - \$15K (Engineering support)



Partners/ Collaborators

US Department of Energy

- OE Stationary Energy Storage Program
- Sandia National Laboratories (Sandia)
- Clean Energy States Alliance (CESA)

Cordova Electric Cooperative (CEC)

Alaska Center for Energy and Power (ACEP)

Project Status

On Track

Key Activities/Achievements this year

PHASE 1 | MAY - SEPTEMBER 2016

Perform analysis for the use of an EES system on the CEC grid

CEC, DOE/Sandia, and ACEP will determine:

- The availability of excess hydropower
- Demand of supplemental generation to optimally size an energy storage system
- Additional services that an ESS may be able to support
- Potential sites for deployment of an ESS based on dynamic modeling

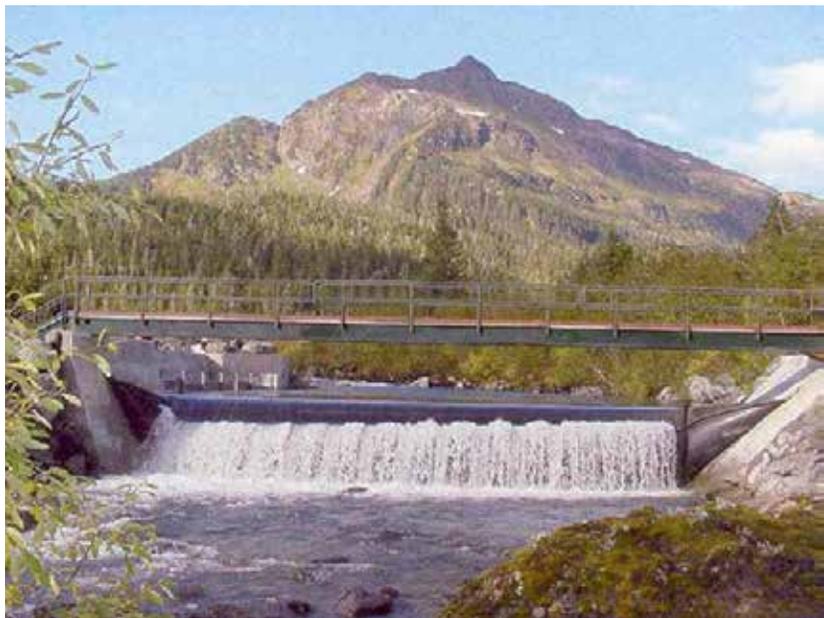
PHASE 2 | FISCAL YEAR 2017

Develop and issue Request for Proposal (RFP)

- Based on phase 1 analysis, CEC may develop and issue an RFP to procure and install an energy storage system

Install ES storage System

- Purchase and install an energy storage system at location determined in Phase 1



CLEAN ENERGY STATES ALLIANCE



Project Description

Clean Energy States Alliance (CESA) is a non-profit located in Montpelier, Vermont. CESA is a membership organization of state clean energy funds. CESA works with states to support their clean energy policy and programs.

Under contract to Sandia, CESA administers the Energy Storage Technology Advancement Partnership (ESTAP). ESTAP's primary function is to bring states to the table to partner with Sandia and DOE OE in the development and deployment of jointly-supported energy storage demonstration projects. CESA's additional key functions include information sharing through webinars, conference presentations, case studies, news releases and other avenues; maintenance of an email list; and technical assistance to states in developing energy storage policy and programs.

DOE OE Funding (Investment)

- \$50,000 contract with Grid Modernization Laboratory Consortium
- CESA also has a \$50,000 contract for reporting support under the Grid Modernization Laboratory Consortium

Partners/ Collaborators

- CESA
- Energy agencies of various states including Vermont, Massachusetts, Connecticut, New York, New Jersey, Alaska, Oregon, Washington, New Mexico, and Washington D.C.

Major Project Milestones

- In FY16, CESA helped to support program, policy, and project development in Massachusetts, Vermont, Washington, Oregon, Hawai'i, Alaska, Connecticut, New Jersey, and New Mexico
- CESA also continued its successful webinar series
- CESA entered into a no-cost contract with Massachusetts Department of Energy Resources (DOER) to provide technical assistance to CCERI grantees in Massachusetts

Key Activities/Achievements this year

- Completed 10 webinars, with 1,744 attendees, and 1,111 views of the webinar recordings
- Expanded of ESTAP email list to 3,052 subscribers
- Continued management of Green Mountain Power project in Vermont, including project commissioning and subsequent focus on data acquisition
- New projects include EWEB project in Oregon; Sterling, Cape & Vineyard, and Holyoke projects in Massachusetts; and Molokai project in Hawai'i
- In collaboration with Sandia and DOE OE, produced energy storage procurement guidance document for municipalities
- Contracted with engineers to provide additional engineering support to projects as needed



Photo: Jacquelynne Hernandez

HAWAI'I PROJECTS

National Energy Lab of Hawai'i Authority (NELHA) Collaboration

Sandia National Laboratories is collaborating with National Energy Lab of Hawai'i Authority (NELHA) in its effort to incorporate Electrical Energy Storage in its renewable energy, microgrid, and innovative energy projects. Sandia has and is providing technical consulting, system evaluation, and analysis services.

Agreed upon technical support includes but is not limited to the following:

- Provide technical expertise in the development of RFPs for distributed energy and energy storage projects
- Evaluate proposed energy storage systems for Technical Readiness Level (TRL), functionality, and applicability to project deliverables
- Perform technical reviews of project design documentation including complete system design, installation design, and data acquisition design
- Witness and/or verify installation and operation of systems including control algorithms and software, data acquisition system operation and remote access
- Verify start-up and commissioning of complete systems
- Remotely access, monitor, and analyze system operation and performance data for up to one year post commissioning
- Participate in education, outreach, and technology transfer as requested by NELHA and agreed upon by Sandia

Completed or in-process tasks:

- Provided support to NELHA during the installation and commissioning of the 10kW Aquion system. Presently evaluating system operation.
- Developing remote access to NELHA Data Acquisition System (DAS). This will allow Sandia access to system(s) operation.
- Part of team to develop a UET (Vanadium Flow battery) project. DOE/Sandia will contribute cost share to project.
- Identification of additional ES Project for FY17/18.



Hawai'i Electric Company (HECO) Project

In May, 2014, Hawai'i Electric Company (HECO) issued an RFP for one or more large-scale energy storage systems able to store 60 to 200 megawatts for up to 30 minutes. HECO approached DOE OE/ Sandia to assist in the selection, commissioning, and long term analysis of energy storage systems. Sandia has and is providing technical consulting, system evaluation, and analysis services.

Hawai'i Electric Company Project (continued)

Agreed upon technical support includes but is not limited to the following:

- Assist HECO in developing RFP selection criteria and reviewing proposals
- Assist HECO in determining optimum deployment sites and technology types
- Work with HECO and the selected companies in developing commissioning documents for systems > 20MW, including system acceptance best practices, safety and commissioning
- Perform long term monitoring and data analysis of deployed systems
- Publish analysis results

Completed or in-process tasks:

- NDA with HECO in place
- Provided guidance on the selection criteria
- Participated in the final review of those proposals and provide HECO with an opinion of the feasibility and value of the top ten
- Conducted production cost modeling of the Oahu grid to evaluate the benefits of energy storage for arbitrage and contingency reserves
- Modeled behind the meter PV generation variability using Sandia's Wavelet Variability Model (WVM)



Honolulu Authority for Rapid Transportation Project

The train will have the capacity for regenerative braking. 70% will be used by accelerating trains with 30% being lost to heat. Project will capture this 30% using energy storage. Honolulu Authority for Rapid Transportation (HART) is looking at a wayside energy storage system that was pioneered in Pennsylvania by Viridity with a grant from Pennsylvania energy authority. LA Metro is also using it as are a few other cities and internationally. HART, who will be the largest utility user in the state, is installing 2,000kVa transformers in each of 16 substations = about a 30 MW system. Peaks will be in morning and evening commute (6-8:30 a.m., 4-6 p.m.) which dovetails with residential electricity peaks. In order to move forward, they would like to do a feasibility study to understand if ES would work on their system and to understand the benefits.

Ikehu Molokai Energy Storage Project

This project is a two phase project: Phase 1 will add 6 MW PV and 6 mW/6 mWh energy storage resources to achieve 40% renewables penetration on the Molokai island grid, allowing retirement of a portion of the island's diesel generation; Phase 2 aims to achieve 100% renewable generation on Molokai. Partners include Princeton Energy Group in collaboration with HECO/MECO and the Hawai'i Energy Agency, with support from DOE OE.

Partners/Collaborators

NELHA, HECO, HART

STERLING MUNICIPAL LIGHT DEPARTMENT ANALYSIS & STORAGE SOLUTION

Project Description

Sterling, MA is roughly 31 square miles and has a population of 7,808. Sterling Municipal Light Department's (SMLD) average load is 8MW and the peak load is 13.4MW. SMLD serves its customers through one 115kV/13.8kV substation including two transformers and four feeder reclosers. Four main 13.8kV overhead feeders are used for medium voltage distribution throughout the town of Sterling. In addition to being connected to two National Grid-owned 115kV transmission lines, SMLD procures power from two solar power plants with a combined nameplate rating of 3MW. In a recent survey performed by Solar Electric Power Association (SEPA), the SMLD in 2014 was recognized as being third in the country for solar watts per customer and was a top five finisher in the rankings for public power utilities.

In December, 2014 the SMLD was awarded a grant by the Massachusetts Department of Energy Resources (DOER) Renewable and Alternative Energy Division under its Community Clean Energy Resiliency Initiative. This project looks to provide backup power for the Town of Sterling Police and Dispatch Center using battery technology. SMLD intends to install a utility scale Battery Energy Storage System (BESS) to support its distribution system in the event of an extended grid outage due to a natural disaster. SMLD has two solar generation plants connected to the distribution system which total 3MW. In the event of an extended grid outage the battery system can be used to power the local emergency response facilities. The BESS will act as a grid reference to the solar power plants so that they can generate power if solar resources are available. Excess energy supplied by the solar plants will be stored by the battery system to extend the amount of time that the battery system can be used to provide power to the emergency response facilities. The BESS shall be sized for a minimum 1MW capable of operating for 2 hours at nameplate rating. Sandia intends to provide SMLD with analysis to identify an optimal amount and type of energy storage within budgetary limits. Sandia intends to assist SMLD in crafting an RFP for the BESS system, vetting bids, installing and dispatching the system, and collecting and analyzing performance data. Separately, DOE OE may provide additional funding to assist SMLD in purchasing an optimal amount of energy storage.

Sterling Municipal Light Company intends to provide:

- Access, as needed, to all power flow and performance data generated by the deployed systems. Sandia will require utility operational data of all generation systems as well as pricing information. Detailed energy storage system data requirements will be identified in separate contracts as required.
- Inclusion of Sandia in Team meetings, planning, etc.
- Access, as needed, to relevant design manuals and specifications.
- Access, as needed, to all applicable electrical and construction drawings.
- Knowledge and expertise to Sandia and CESA. SMLD agrees to take part in webinars, conferences (including presenting at the DOE Peer Review). Sandia will also be reporting on this project, which requires SMLD participation based on Sandia needs and requests.

Sandia, under the support of DOE OE, intends to collaborate with SMLD through all stages of the project, with the intent to collect operational data and conduct analysis of the performance data of the deployed systems. Funding permitting, Sandia intends to:

- Assist SMLD in developing the RFP selection criteria and performing the reviews of the proposals

Project Description (continued)

- Through data collection and analysis Sandia will help SMLD oversee the operation of the BESS to optimally maximize economic returns while safeguarding SMLD's ability to provide resilient power.
- Provide technical assistance from Sandia or its agents.
- Through analysis, assist SMLD in determining the optimum deployment sites and installation type.
- Provide technical consulting to SMLD through contract implementation, design, construction, installation, commissioning and operation.
- Work with SMLD and the selected companies to develop Commissioning Documents for energy storage systems, which will include system acceptance best practices, safety, and testing protocols.

Partners/ Collaborators

- DOE OE
- Sterling Municipal Light Department (SMLD)
- Reynolds Engineering LLC
- Clean Energy States Alliance (CESA)

Key Activities/Achievements this year

MOU between Sandia and Sterling is in the final signature stages

Benefit to Sandia/DOE

This project would further the mission of DOE/Sandia/ESTAP by proving a number of important battery use cases that can be adopted by numerous municipal utilities and vertically integrated utilities. The primary use cases to be proved are resiliency, cost savings, and revenues as described above. Sandia will monitor BESS operations and collect operational data for one year post-commissioning, and this data will be used in analysis and to further DOE/Sandia's understanding of benefits and applications of battery storage in the utility context.



GREEN MOUNTAIN POWER ENERGY STORAGE DEMONSTRATION PROJECT

Project Description

Green Mountain Power (GMP) is the largest electricity utility in the state of Vermont. It positions itself as a progressive, customer-focused utility. It was the first utility in the country to be certified as a B Corporation, and it has invested in a number of innovative clean energy projects.

In 2014, Vermont Department of Public Service (DPS) issued an RFP for an energy storage system. The RFP was developed with support from DOE OE, Sandia and CESA, and was funded with \$40,000 in state funds and \$250,000 in matching funds from DOE OE. The state awarded the combined grant in August, 2014, and the project, which cost a total of \$12.5 million, was developed by GMP and project integrator Dynapower. The project consisted of 4 MW/3.4 MWh of battery storage (2 MW lithium ion, and 2 MW lead acid) integrated with 2.5 MW PV and was set up as a microgrid that would provide resilient backup power to a nearby school/emergency shelter.

One feature of the system is a multi-port inverter system provided by Dynapower Corporation, a partner in the project. The inverters are triple port-500kW Dynapower systems. They have 3 DC inputs: one each for the PV, the lead-acid batteries, and the lithium ion batteries. Each DC input can be discretely controlled or the inverter can be controlled as a complete unit, and additionally the site can be controlled as a master site (all 4 units together). A number of dispatch modes can be selected from to provide the best output at a given time.

The economic case for the project includes cost savings from reducing GMP's capacity and transmission obligations, from frequency regulation and from arbitrage. This was the first utility project to propose this business case, which has now been adopted by several municipal utilities in Massachusetts. The GMP project has also been cited in the Vermont state energy plan as an exemplary project that forward's the state's energy goals and should be replicated.

Attributes of the project include the following:

- It is one of the first exclusively solar-powered microgrids in the US, and the first to provide full back-up to an emergency shelter on the distribution network.
- It is the first solar + storage microgrid to be developed on a brownfield site, contributing to brownfield redevelopment efforts in Rutland, VT.
- It incorporates 7,722 solar panels capable of generating 2.5 MW of electricity, helping GMP to reach its goal of making Rutland, VT the Solar Capital of New England and helping Vermont to reach its renewable energy goal.
- It incorporates 4 MW of battery storage, both lithium ion and lead acid, to integrate the solar generation into the local grid and to provide resilient power in case of a grid outage.



Photo: Jacquelynne Hernandez

Project Description (continued)

- It incorporates innovative multi-port inverters designed specifically for this project by Dynapower, a local Vermont firm.
- It provides resilient power to a Rutland school that serves as a public emergency shelter (additional critical facilities may be similarly supported by this microgrid in the future).
- It provides clean, distributed generation and resilient power to an economically challenged, urban community that is targeted for revitalization and that suffers frequent power outages due to storms.
- It was partially funded through a joint federal/state partnership for deployment of energy storage technologies.
- It is part of Green Mountain Power's larger vision for transforming Rutland into "The Energy City of the Future."



Photo: Jacquelynne Hernandez

The microgrid was commissioned in September, 2015.

Subsequent work has focused on resolving data storage and remote access problems to allow operational and economic data to be collected and analyzed by Sandia.

DOE OE Funding (Investment)

- \$250,000 matching funds from DOE OE
- CESA manages a contract with GMP to disburse these funds and oversee project milestones
- The GMP project is one of four included in the Grid Modernization Laboratory Consortium (GMLC) project

Partners/ Collaborators

Clean Energy States Alliance; Vermont DPS; GMP; Dynapower

Major Project Milestones

The project was commissioned in September, 2015 and commenced operations. In FY16, CESA continued management of the project contract. Work focused on resolving data storage and remote access problems to allow data collection and analysis by Sandia.

Key Activities/Achievements this year

- Project operational
- Draft article on project economics underway
- Data access improved

SINGAPORE: ENERGY MARKET AUTHORITY COOPERATIVE RESEARCH AND DEVELOPMENT AGREEMENT

Project Description

The Energy Market Authority (EMA)/Sandia CRADA's purpose is to better understand the feasibility of deploying large-scale energy storage system (ESS) in the Singapore electric utility operating environment. This work will include technical advice for the design, joint development and operations of a large-scale ESS test.

Additional objectives of the ESS projects are to:

- i. Evaluate the performance of different ESS solutions to provide different types of grid applications under Singapore's operating environment;
- ii. Establish the standards and guidelines associated with the deployment of ESS – both at the product and system levels; and
- iii. Facilitate the development of the policy and regulation frameworks required to support the introduction of ESS into the electricity market.

DOE OE Funding (Investment)

- DOE Funding: \$100,000
- EMA match to Sandia: \$145,000

Partners/ Collaborators

- EMA

Key Activities/Achievements this year

- RFP issuance and selection
- Peak Shaving Analysis



HELIX POWER FLYWHEEL DEMONSTRATION PROJECT



Project Description

Helix Power is a development stage company developing a platform for the next generation of power management hardware using flywheel technology. The platform will be used to cost effectively enhance the energy efficiency & reliability of transit systems and integration of renewable energy resources into the electric grids and microgrids. The initial application is recycling regenerated braking energy from subway systems reducing propulsion energy required from substations by up to 50%.

DOE OE Funding (Investment)

We have been granted \$450,000 from the U.S. Department of Energy and received a \$2.5M award (requiring 1-1 matching funding) from NYSERDA to demonstrate the full scale 1MW-90 second platform.

Partners/ Collaborators

The NYSERDA project includes support from NYC Transit, and ConEd in providing interconnection support and data modeling. Sandia is providing technical support in for composite components. Cobham is a Composite manufacturer involved in design and manufacture of the flywheel rims.

Major Project Milestones

1. NYSERDA contract signed
2. Functional & interconnection requirements
3. Detail design
4. Hardware procurement
5. Build flywheel
6. System integration
7. Initial testing

Key Activities/Achievements this year

1. Contract signed with NYSERDA
2. Functional and interconnection requirements cpt.
3. Procuring matching NYSERDA funding -ongoing
4. Developing other metro working relationship

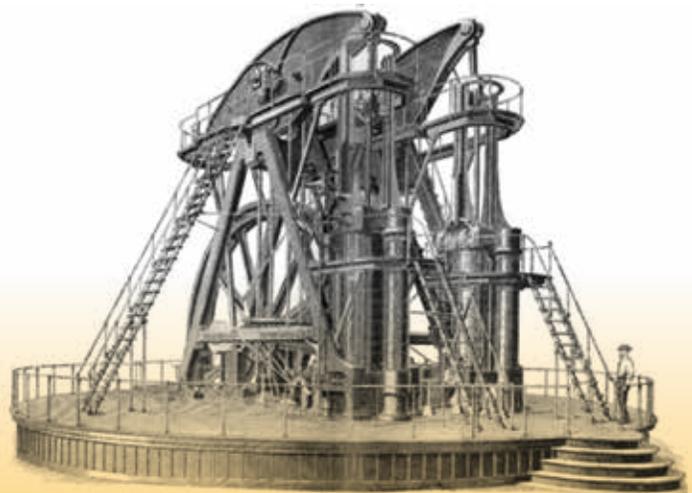


Photo: Donald Bender

SPECIAL FEATURE: GRID MODERNIZATION LABORATORY CONSORTIUM

(January 14, 2016) WASHINGTON – The U.S. Department of Energy (DOE) today built on its Grid Modernization Initiative – an ongoing effort that reflects the Obama Administration’s commitment to improving the resiliency, reliability, and security of the nation’s electricity delivery system. During his visit to a utility control center in Miami, FL today, Energy Secretary Ernest Moniz announced the release of DOE’s comprehensive new Grid Modernization Multi-Year Program Plan, a blueprint for modernizing the grid. The Secretary also announced the award of up to \$220 million over three years, subject to congressional appropriations, to DOE’s National Labs and partners to support critical research and development in advanced storage systems, clean energy integration, standards and test procedures, and a number of other key grid modernization areas. Additional programs, initiatives, and funding opportunity announcements related to the Grid Modernization Initiative will be announced in the coming days.

“Modernizing the U.S. electrical grid is essential to reducing carbon emissions, creating safeguards against attacks on our infrastructure, and keeping the lights on,” said Secretary Moniz. “Our Quadrennial Energy Review and Quadrennial Technology Review identified needs and opportunities to invest in the grid. This public-private partnership between our National Laboratories, industry, academia, and state and local government agencies will help us further strengthen our ongoing efforts to improve our electrical infrastructure so that it is prepared to respond to the nation’s energy needs for decades to come.”

The Grid Modernization Initiative represents a comprehensive DOE effort to help shape the future of our nation’s grid and solve the challenges of integrating conventional and renewable sources with energy storage and smart buildings, while ensuring that the grid is resilient and secure to withstand growing cyber security and climate challenges. Today’s announcements fall under the Grid Modernization Initiative’s framework.

- The Grid Modernization Multi-Year Program was developed by DOE in close collaboration with a wide range of key external partners. The program lays out a blueprint for the Department’s research, development, and demonstration agenda to enable a modernized grid, building on concepts and recommendations from DOE’s recently released Quadrennial Energy Review and Quadrennial Technology Review.
- The up to \$220 million in research and development funding falls under the Grid Modernization Laboratory Consortium. The consortium involves 14 DOE National Laboratories and dozens of industry, academia, and state and local government agency partners across the country. These funds are being awarded in response to a challenge to the National Laboratories to establish a comprehensive grid-related research and development effort to address a range of emerging challenges and opportunities in the nation’s power grid.

Find more information on the Grid Modernization Initiative at Energy.gov and on the selected National Lab partnership projects at <http://energy.gov/doe-grid-modernization-laboratory-consortium-gmlc-awards>.

2016 SANDIA ENERGY PROGRAM PROJECTS LIST:

1	Alaska Center for Energy and Power (ACEP) – ES in Run of River Hydro Application
2	Burlington Airport – PR to Develop a Microgrid incorporating ES
3	California Energy Commission (CEC) – Technical Consulting For ES Initiatives
4	Cape and Vineyard – ES Project Design Analysis
5	Connecticut Department of Energy Environmental Protection (DEEP) – ES Program Technical Support
6	Electric Power Board of Chattanooga (EPB) – ES Project in Resiliency Application with ORNL
7	Eugene Water And Electric Board (EWEB) - ES projects to Provide Resiliency to Critical Facilities
8	Green Mountain Power (GMP) – ES Optimization
9	Group NIRE – ES Analysis in Wind Application
10	Hawai'i Electric Company (HECO) – ES Project for Contingency Application
11	NREL – Support testing of ES system for military application
12	Holyoke- ES Design Analysis
13	Los Alamos County (LAC) – ES Optimization
14	National Energy Laboratory of Hawai'i Authority (NELHA) – ES Program at Development at Business Park.
15	Washington DC - ES Technical Support
16	New Mexico Energy, Conservation, & Management Division (NMECMD) – Technical Consulting to state Energy Office
17	Energy Market Authority of Singapore (EMA) – Technical Support and Analysis for ES project Initiative
18	Sterling Municipal Light District (SMLD) - ES Project To provide Demand Reduction and other Ancillary applications
19	Portland General Electric (PGE) – ES optimization with PNNL
20	Wind Energy Institute of Canada (WEICan) – ES in Wind Application Study

SANDIA RELATED PUBLICATIONS:

SAND2016-85440

Energy Storage Procurement - Guidance Documents for Municipalities

SAND2016-5977

Energy Storage Guide for Compliance with Safety Codes and Standards (Also published as PNNL SA-118870)

SAND2016-3078R

Protocol for Uniformly Measuring and Expressing the Performance of Energy Storage Systems

SAND2016-3636

Determination of Duty Cycle for Energy Storage Systems in a Renewables (Solar) Firming Application

SAND2016-3434

Determination of Duty Cycle for Energy Storage Systems in A PV Smoothing Application

SAND2016-2543R

PV Smoothing Duty Cycle PV Smoothing Duty Cycle

SAND2015-10759

Recommended Practices for the Safe Design and Operation of Flywheels

WHAT'S NEXT FOR EESDP 2017

- **Grid Modernization Laboratory Consortium Status Report Updates**
- **ESS Commissioning Guide**
- **Improvement in Codes & Standards/ ESS Safety Working Group Interaction**
- **Cooperative Research and Development Agreements (CRADAs)**
- **Technology Advances & ESS Commercialization Opportunities**



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