



Energy Storage Technology Advancement
Partnership (ESTAP) Webinar:

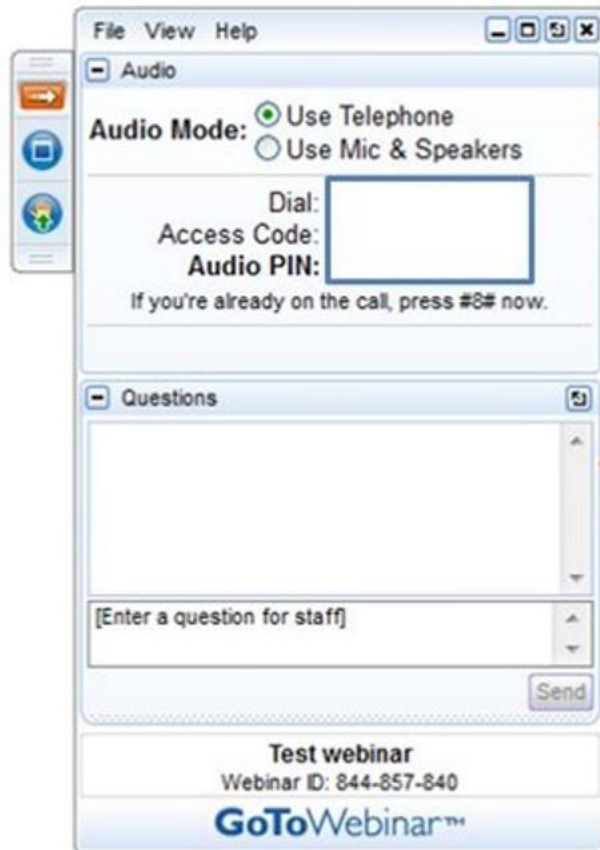
Upgrading Distribution Resilience: A DOE-OE Solicitation

Tuesday, April 7, 2015

**Hosted by Todd Olinsky-Paul
ESTAP Project Director, CESA**



Housekeeping



The screenshot shows the GoToWebinar interface. The top section is titled 'Audio' and contains the following options: 'Audio Mode:' with two radio buttons, 'Use Telephone' (selected) and 'Use Mic & Speakers'. Below this are fields for 'Dial:', 'Access Code:', and 'Audio PIN:'. A note at the bottom of the Audio section says 'If you're already on the call, press #8# now.' The bottom section is titled 'Questions' and contains a large text area for entering questions, a smaller text area with the placeholder '[Enter a question for staff]', and a 'Send' button. At the very bottom, it says 'Test webinar' and 'Webinar ID: 844-857-840'.

← All participants are in “Listen-Only” mode. Select “Use Mic & Speakers” to avoid toll charges and use your computer’s VOIP capabilities. Or select “Use Telephone” and enter your PIN onto your phone key pad.

← Submit your questions at any time by typing in the Question Box and hitting Send.

This webinar is being recorded.

You will find a recording of this webinar, as well as all previous CESA webcasts, archived on the CESA website at

www.cesa.org/webinars

State & Federal Energy Storage Technology Advancement Partnership (ESTAP)

Todd Olinsky-Paul
Project Director
Clean Energy States Alliance



Thank You:

Dr. Imre Gyuk

U.S. Department of Energy,
Office of Electricity Delivery and
Energy Reliability

Dan Borneo

Sandia National Laboratories



ESTAP is a project of CESA

Clean Energy States Alliance (CESA) is a non-profit organization providing a forum for states to work together to implement effective clean energy policies & programs:

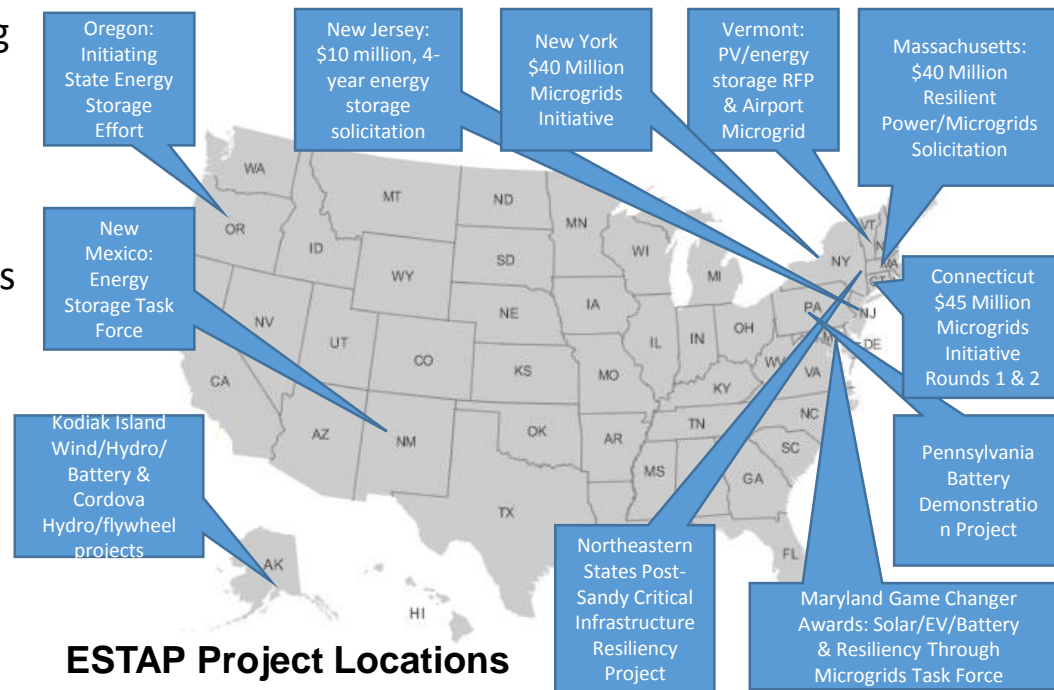
ESTAP is conducted under contract with Sandia National Laboratories, with funding from US DOE.

ESTAP Key Activities:

1. Disseminate information to stakeholders

- ESTAP listserv >500 members
- Webinars, conferences, information updates, surveys.

2. Facilitate public/private partnerships at state level to support energy storage demonstration project development





Energy Storage Technology Advancement Partnership

More CESA Projects

Overview

Energy Storage Events

Energy Storage News

Energy Storage Links

Energy Storage Listserv Signup

Energy Storage Resources and Webinar Archives

Project Director: Todd Olinsky-Paul

Contact: Todd Olinsky-Paul, Todd@cleanegroup.org

SIGN UP FOR THE LISTSERV

The Energy Storage Technology Advancement Partnership (ESTAP) is a federal-state funding and information sharing project, managed by CESA, that aims to accelerate the deployment of electrical energy storage technologies in the U.S.

Project Objective

The project's objective is to accelerate the pace of deployment of energy storage technologies in the United States through the creation of technical assistance and co-funding partnerships between states and the U.S. Department of Energy.

ESTAP conducts two key activities:

- 1) Disseminate information to stakeholders through:



NEW RESOURCES

May 1, 2014
The Economics of Grid Defection
By Rocky Mountain Institute

April 4, 2014
ESTAP Webinar Slides: Microgrid Technologies
By ESTAP

April 4, 2014
ESTAP Webinar Recording: Microgrid

UPCOMING EVENTS

May 20, 2014
ESTAP Webinar: Commissioning Energy Storage,

More Events

LATEST NEWS

April 30, 2014
NYSERDA Announces Opening of Battery and



Today's Guest Speakers

Ryan Watson, Engineer/ Project Manager, Energy Delivery Technologies Division, National Energy Technology Laboratory (NETL), US DOE

Dan Ton, Acting Deputy Assistant Secretary, Power Systems Engineering Division, Office of Electricity Delivery and Energy Reliability, US DOE

Dr. Imre Gyuk, Energy Storage Program Manager, Office of Electricity Delivery and Energy Reliability, US DOE

Dr. Carol Hawk, Program Manager, Cybersecurity for Energy Delivery Systems, Office of Electricity Delivery and Energy Reliability, US DOE





U.S. DOE Resilient Electricity Delivery Infrastructure (REDI) Initiative

Ryan Watson



The Resilient Electricity Delivery Infrastructure (REDI) Initiative

- A DOE action that focuses on technology transfer of smart grid advances to support the White House initiatives responding to the needs of communities nationwide that are dealing with the impacts of climate change.
- The DOE Office of Electricity Delivery and Energy Reliability (DOE-OE) is providing opportunities to deploy **smart grid technologies/tools** to improve climate preparedness and resiliency of the electricity delivery infrastructure.

REDI FOA Purpose

- The purpose of the REDI FOA is to deploy **smart grid technologies/tools** to advance climate preparedness and resiliency.
- These deployments must result in measurable and progressive improvements in robustness and recovery of electricity delivery services in their communities.
- The REDI FOA supports a larger DOE initiative to identify and showcase U.S. local and tribal governments that have proven to be climate leaders by pursuing opportunities to advance the Administration's policy goal of enhancing climate resilience.

REDI FOA Eligibility

- Opportunities for awards are available to any unit of “**Local Government.**”
 - Defined, for the purposes of this FOA, as a town, township, city, county, city-county government, federally recognized tribal government, or other municipality, including a U.S. territory municipality—located within a county (or county equivalent), that experienced a Presidentially Declared Major Disaster from (and including) 1984 to 2014.
 - Visit <https://www.fema.gov/disasters> to search for Presidentially Declared Disaster Declarations

REDI FOA Topic Areas

- Two topic areas are offered to accomplish the objectives of this initiative:
 - 1) implementation and deployment of the best, pre-commercial and/or commercial smart grid technologies/tools (**Topic Area 1: Industry Technologies**) and
 - 2) utilizing smart grid technologies/tools from the DOE National Laboratories (**Topic Area 2: Laboratory Technologies**).

Applicant Collaboration

- Topic Area 1:
 - Teaming with an electric utility is encouraged.
 - DOE National Laboratory participation is not permitted under Topic Area #1.
- Topic Area 2:
 - collaboration with National Laboratories for technical assistance on using the technologies/tools for in-field demonstration is encouraged, but not required.
 - If the Applicant includes a National Laboratory as a team member, DOE will directly fund technical assistance by that National Laboratory.

REDI FOA Funding and Awards

- **A total of 4 – 8 awards** are anticipated:
 - Topic Area 1: 2-4 Awards
 - Topic Area 2: 2-4 Awards
- The **Total Anticipated Award Size** includes:
 - Topic Area 1: \$600,000 - \$1,200,000
 - Topic Area 2: \$1,200,000 - \$2,000,000
- The **cost share** must be **at least 50%** of the total allowable costs.
- Maximum and Minimum Federal Funding:
 - Topic Area 1: \$300,000 - \$600,000
 - Topic Area 2: \$600,000 - \$1,000,000
- **Estimated Project Period** for each Topic Area: **2 years**

Smart Grid Technologies/Tools

- Projects selected under this FOA will implement smart grid distribution and customer-side technologies/tools for climate impact resilience.
 - Transmission technologies/tools are excluded from selection under this FOA.
 - Appendix A to the REDI FOA provides a non-inclusive list of example commercial and pre-commercial smart grid technologies/tools.
 - Appendix B to the REDI FOA provides a non-inclusive list of smart grid technologies/tools developed by National Laboratories for Topic Area 2 that meet the required readiness level and have a direct application for enhanced electricity delivery infrastructure resilience

REDI FOA Requirements for Topic Area 1 and 2

- **Smart grid technologies/tools** of interest must specifically relate to the electricity delivery infrastructure on the customer-side of the utility's electric meter and/or in the distribution system. Technologies/tools may serve one or more of the following applications:
 - risk assessments and management of climate change impacts,
 - preparedness for and recovery from climate change impacts, and
 - economic and societal impact analysis of smart grid technologies/tools for climate resilience.

REDI FOA Objectives

- The awards to be selected through this FOA must improve electricity resiliency to climate change within the county (or county equivalent) that experienced the Presidentially Declared Major Disaster from (and including) 1984 to 2014.
- Selected project communities will be expected to demonstrate significant improvements in robustness and recovery of electricity delivery infrastructure.
- The improvements must be measurable, tangible within 24 months of project start, substantial over a long period of time, accountable for resilience to environmental stressors (e.g., more frequent extreme weather events and other climate change impacts), and be implemented within the county (or county equivalent) that experienced the presidentially declared major disaster from (and including) 1984 to 2014.

Measuring Resiliency

- The Applicant should describe the proposed smart grid technology/tool, how it is used, the proposed data collected before and after deployment of the technology/tool in order to measure resiliency improvements, and how it improves resiliency long term, while making sure to comply with the Merit Criteria described in the FOA document.

Cyber Security

- Where applicable, Applicants proposing to deploy a technology/tool that is used to produce or move power for grid sensing, control, or communications must include in their Application narrative a cybersecurity approach that will provide reasonable assurance of preventing systematic failures in the electric grid in the event of a cybersecurity breach.

Applies to Topic Area's 1 and 2

Metrics

- Applications must include **metrics** for demonstrating the technology's/tool's capability for improvements in resiliency. Some suggested metrics include the following:
 - Institute of Electrical and Electronics Engineers (IEEE) reliability indices which include weather events;
 - Power quality during power disturbances when delivered power does not meet power quality requirements of the customer;
 - Customer minutes of interruption;
 - Number of customers impacted;
 - Cost impacts (including business and other economic losses); and
 - Societal impacts.

Applies to Topic Area's 1 and 2

Merit Review Criteria

Topic Area's 1 and 2

- **Criterion 1: Beneficial Impact (Weight = 40%):**
 - Degree that the project will result in the deployment of a commercial-grade technology/tool by the end of the project period.
 - Reasonableness of the estimated impacts of the project to produce measurable and tangible improvements in resiliency, robustness, and recovery of the electricity delivery infrastructure in the “Local Government,” as described by the data to be collected, the analysis to be conducted, and metrics to be reported.
 - Degree that the technology/tool is replicable and scalable for National deployment evidenced by a nationwide market assessment indicating the likelihood of progressive and substantial improvements spanning beyond the project period.
 - Completeness and reasonableness of the discussion of the costs associated with the deployment of the technology/tool, including a cost-benefit analysis, cost recovery, financial requirements, and responsibilities for widespread, long-term replication.
 - Adequacy of the Applicant's plan to share and exchange information to promote adoption of the technology/tool by other communities.

Merit Review Criteria

Topic Area's 1 and 2

- **Criterion 2: Technical Approach (Weight = 30%):**
 - Degree to which the selected technology/tool and its application will 1) address specific shortcomings experienced in electricity delivery infrastructure during Major Disaster Declaration event(s), and 2) result in improved climate preparedness and resiliency of electricity delivery infrastructure.
 - Reasonableness of Applicant's plan for design, procurement, installation, and operation of the technology/tool.
 - Appropriateness, rationale, and achievability of the Statement of Project Objectives (SOPO).
 - Adequacy and completeness of the Applicant's plan for addressing cybersecurity related to the ability to prevent systematic failures in the electric grid.
 - Degree that the Applicant will coordinate and collaborate the technology/tool deployment with key stakeholders in electricity delivery infrastructure resilience including electric utilities and other organizations overseeing energy infrastructure planning and operations.
 - Extent that the Applicant leverages relationships, funding, existing investments and any in-kind contributions from the private, public, and/or philanthropic organizations for the proposed project.

Merit Review Criteria

Topic Area's 1 and 2

- **Criterion 3: Experience and Capabilities of the Project Team (Weight = 20%):**
 - Credentials, capabilities, and experience of key personnel and team members in utilizing, implementing, and/or deploying new smart grid tools and technologies.
 - Demonstrated experience of the project team in analyzing metrics, cost, and benefits of deploying smart grid technologies/tools.
 - Demonstrated familiarity of 1) the smart grid technology/tools that yield improvements in resiliency to climate change and extreme weather conditions; 2) the implementation of such technology/tools; 3) the financial requirements to be incurred by the technology/tool owner or manufacturer for implementation.
 - Degree of commitment by the project team including letters of support from team members and collaborating stakeholders and confirmed cost share.
 - Demonstrated experience with recovery from natural disasters, evidenced by the recovery from a Presidentially Declared Major Disaster from (and including) 1984 to 2014, and discussion of similar, ongoing, and/or past work conducted by the project team.

Merit Review Criteria

Topic Area's 1 and 2

- **Criterion 4: Management of the Project (Weight = 10%):**
 - Adequacy of the strategies for project team management, communication, and oversight including a description of key project tasks, personnel assignments, and management structure.
 - Adequacy of Applicant's plan to manage the technical aspects, schedule/milestones, and budget of the project as outlined in the preliminary Project Management Plan.
 - Demonstrated understanding of potential risks including technical, financial, regulatory, or institutional risks, and the quality of the strategies to address them.

Additional Information

- REDI FOA Deadline: 05/04/2015 at 11:59 PM
- Visit FedConnect or Grants.gov and Search for Opportunity “DE-FOA-0001219”
- All Questions must be submitted through the FedConnect portal: www.fedconnect.net.



Office of Electricity Delivery & Energy Reliability



Microgrids for Resiliency

Dan Ton

Power Systems Engineering Research and Development

April 7, 2015

Resilient Electricity Delivery Infrastructure Initiative Webinar

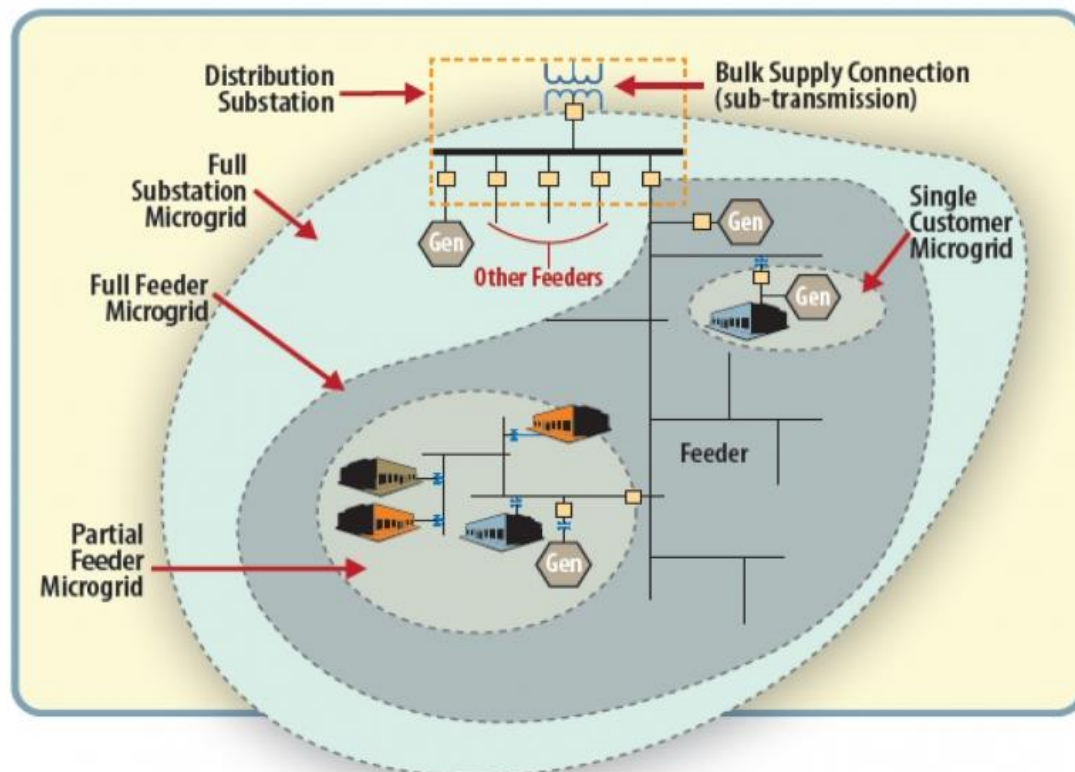


Defining Microgrids

A **microgrid** is a group of interconnected loads and distributed energy resources within clearly defined electrical boundaries that acts as a single controllable entity with respect to the grid.

It can connect and disconnect from the grid to enable it to operate in both grid-connected or island-mode.

Residential	Less than 10-kW, single-phase
Small Commercial	From 10-kW to 50-kW, typically three-phase
Commercial	Greater than 50-kW up to 10MW





Microgrids

Benefits and Technical Challenges

Benefits

- Enables grid modernization
- Integrates multiple Smart Grid Technologies
- Enhances integration of distributed and renewable energy sources
- Meets end-user needs by ensuring energy supply for critical loads, controlling power quality and reliability at the local level
- Promotes customer participation through demand side management
- Supports the macrogrid by handling sensitive loads and supplying ancillary loads to the bulk power system

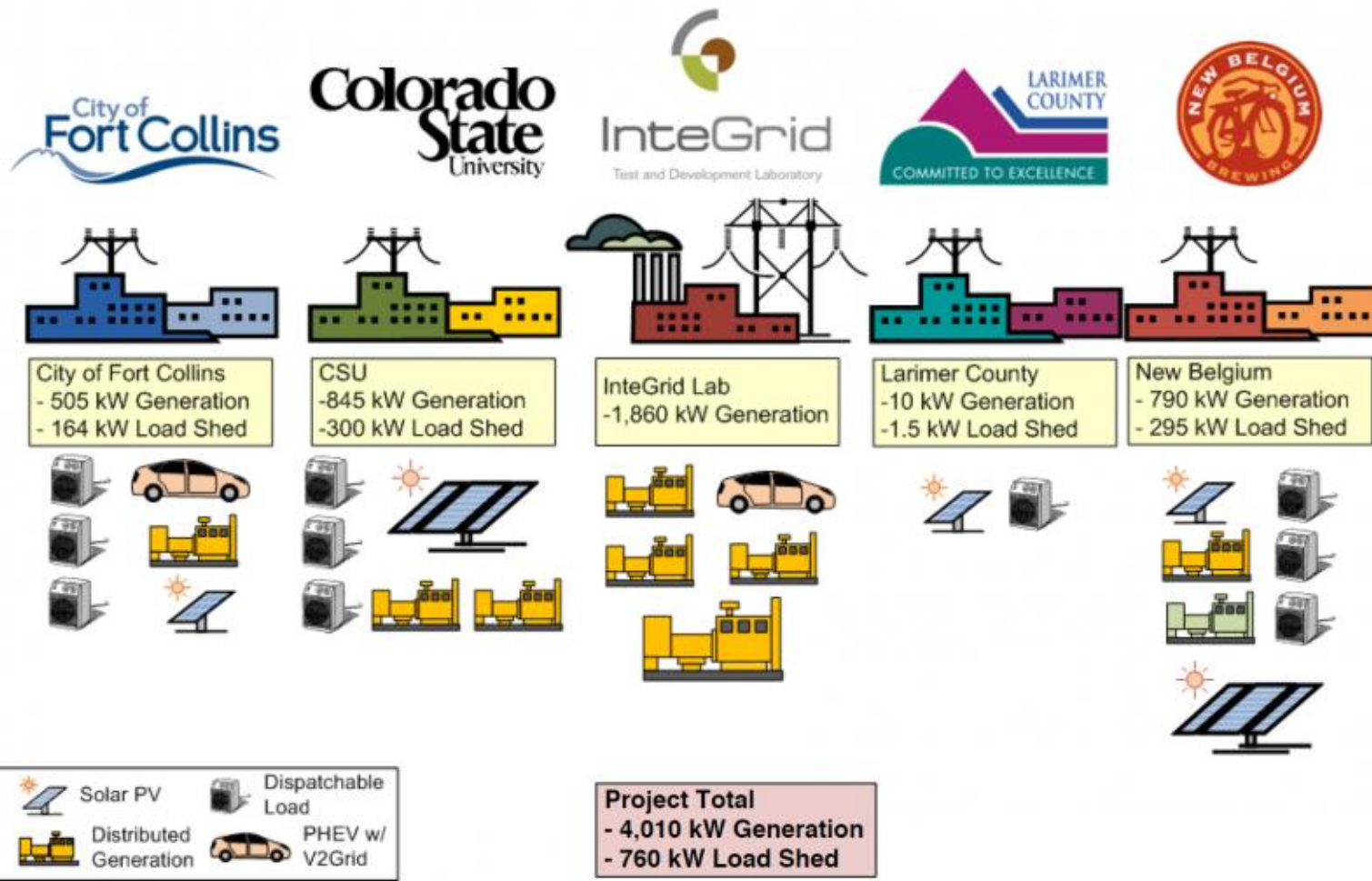
Technical Challenges

- Reliable Operations and Control
- Energy Storage
- Component Designs and Compatibility
- Analytical Tools
- Reliability
- Communications



Fort Collins Zero Energy District (FortZED)

Microgrid demonstrating a coordinated and integrated system of mixed distribution resources to achieve a 20-30 peak load reduction on multiple distribution feeders





Microgrids for Resilience



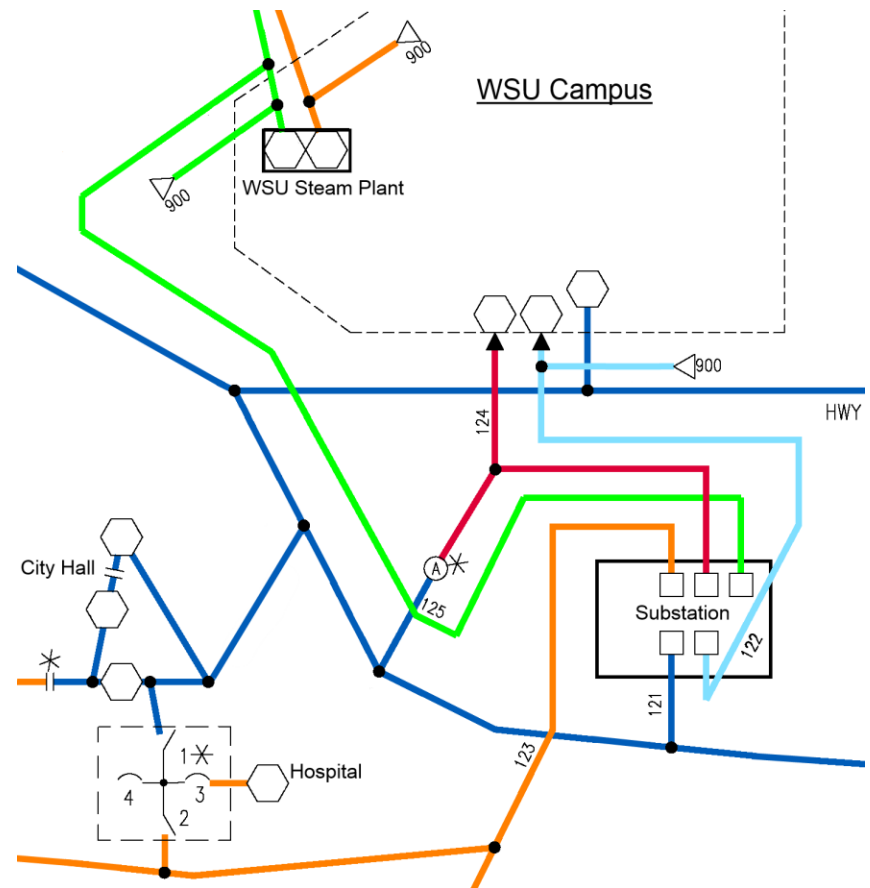
Brevoort Co-op, Manhattan

"CERTS microgrid-co-gen system from Tecogen comes through for Greenwich Village Co-op building during superstorm Sandy."

"The CERTS microgrid control technology is the most radical of all options-as well as the lowest cost-as it is embedded into a 100-kW CHP system offered by Tecogen"

Peter Asmus, Navigant

Utilizing WSU-Pullman microgrid to reduce switching operations for faster restoration and picking up more interrupted load during major outages





State Partnerships

NJ TransitGrid Project

- Microgrid to enhance grid-rail resiliency to serve over 900,000 riders/day
- Key evacuation service for Manhattan & N. New Jersey
- MOU between DOE and State of NJ
- **Completed the feasibility study of a microgrid to fortify the public transportation network**



Hoboken ESDM Project

- Provide electrical power to support critical functions up to 7 days for 52,000 residents in 1.2 sq. mi.
- Key evacuation route for Manhattan
- DOE-Hoboken-BPU-Sandia-PSEG Partnership
- **Completed a microgrid conceptual design for Hoboken, NJ, to enhance system resilience post-Sandy**



Energy Storage: for Resilience on the Grid, For Renewables Integration, for Flexible Microgrids

**IMRE GYUK, PROGRAM MANAGER
ENERGY STORAGE RESEARCH, DOE**

Stationary Energy Storage for Grid Applications:

Storage links Variable Load
with Variable Generation



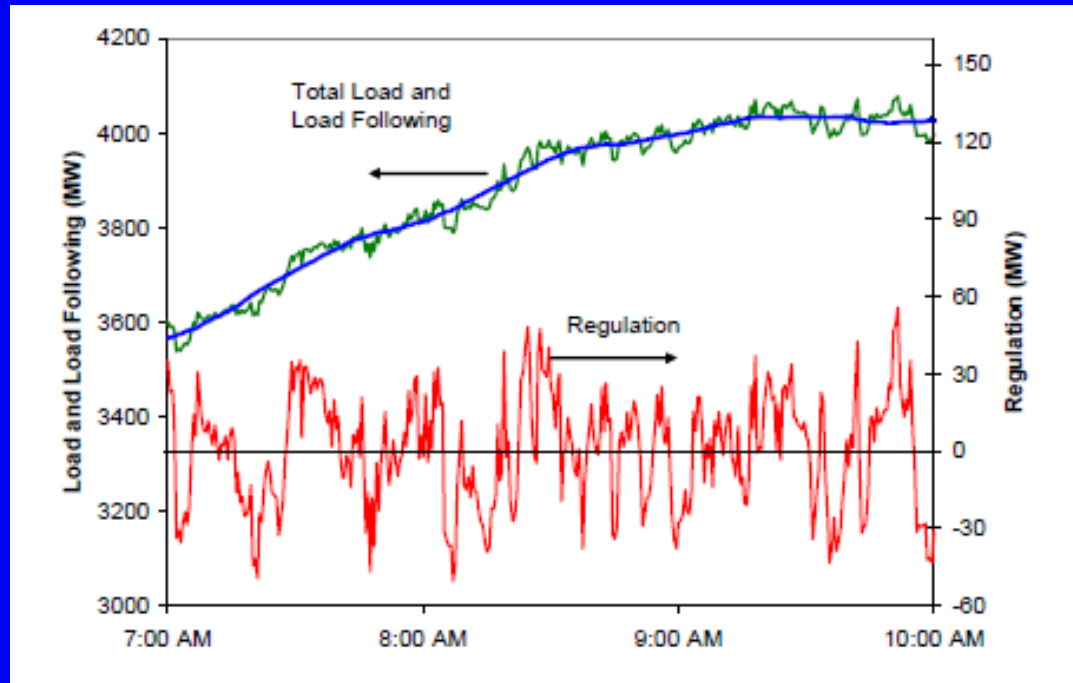
ARRA Stimulus Funding for Storage Demonstration Projects

Leveraged Funding: \$185M vs. \$585M

- Show technical feasibility
- Gather cost data
- Stimulate regulatory changes
- Generate follow-on projects

Power Systems for Frequency Regulation or Renewable Smoothing

Grid Frequency Regulation with Fast Storage:



Kirby 2004

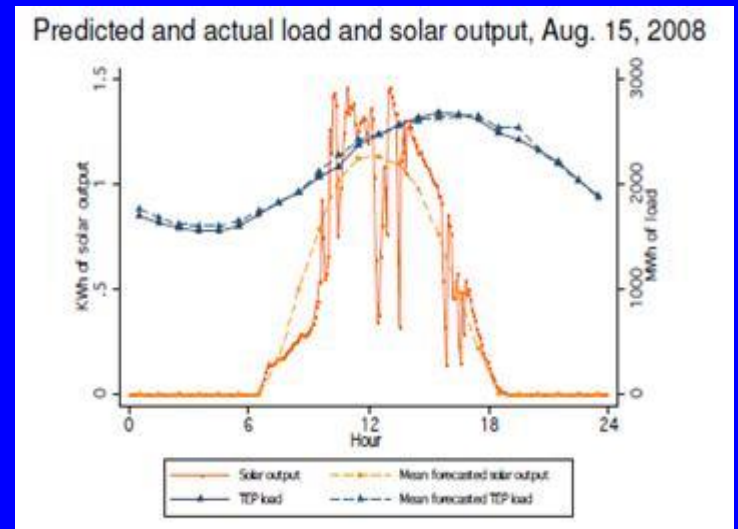
Old method to balance constantly shifting load fluctuation is to vary frequency and periodically adjust generation in response to an ISO signal. Fast storage can respond immediately and is 2x as effective!

ARRA – Duke Energy / Xtreme Power (Younicos)
With 153MW Wind at No-Trees, TX
36MW / 40 min battery plant
Smoothing, Frequency Regulation. Completed March 2013



Energy Systems for Peakshaving, Loadshifting, or Ramping

ARRA – Public Service NM:
500kW, 2.5MWh
for smoothing and load shifting
of 500kW PV installation; using
EastPenn Lead-Carbon Technology



Load & PV Output in Tucson, AZ

Commissioned Sep. 2011 Integrator: Ecoult

ARRA - Southern California Edison / LG Chem – Li-Ion:

8 MW / 4 hr battery plant for wind integration at Tehachapi, CA.



Tehachapi: 4,500MW Wind by 2015!

Commissioned: Sept. 2014
Integrator: ABB



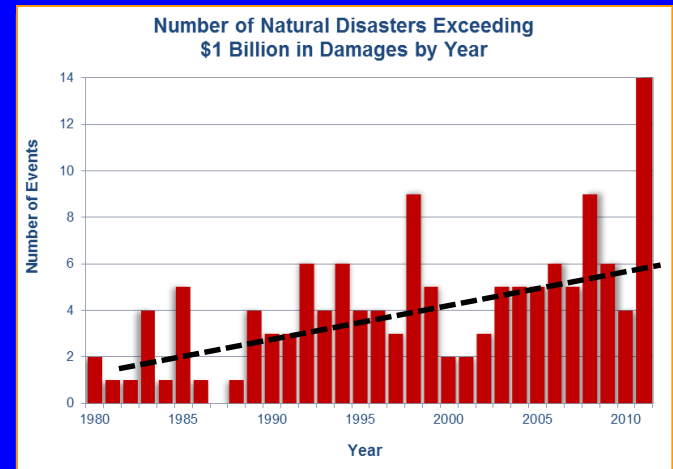
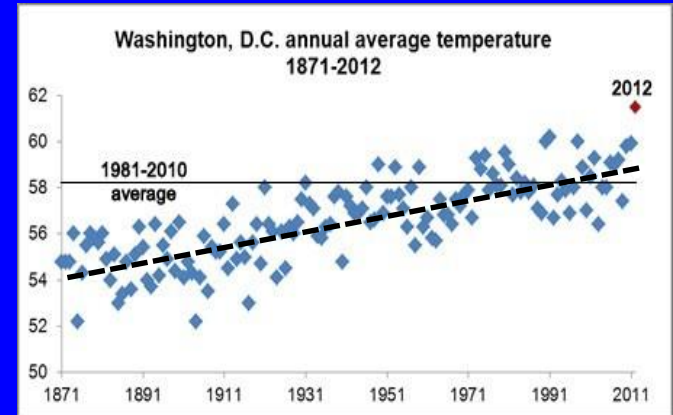
8MW / 32MWh Storage Plant

Energy Systems for Resiliency and Emergency Preparedness

DOE / State Initiatives

Energy Storage for Emergency Preparedness

Every \$1 on protection measurements
Can prevent \$4 in repairs after a storm!



Trends indicate the situation
will get worse not better!!

➡ Some 50% of Diesel Generators failed to start during the Sandy Emergency

- Storage combined with Renewables allows Microgrids to provide essential Services over an extended Time Period
- But during non-emergency Periods, Storage can provide Demand Management for the User and compensated Services to the Grid

Islands - Apartment Buildings – Campuses – Schools – Shopping Centers – Community Centers – Nursing Homes – Hospitals – Police Stations – Gas Stations – etc. etc

Vermont Public Service Dept. – DOE Green Mountain Power

Solicitation issued by VPS. Joint funding by VPS, DOE-OE, GMP

Rutland, VT

4MW / 3.4MWh of storage

Integrated with 2MW PV

Integrator: Dynapower

Groundbreaking: Aug. 12, 2014

Expected Completion: April 2015

Situated on Brown Field Area

Storage: Ancillary grid services, peak shaving during high load periods

System can be islanded to provide emergency power for a resilient microgrid serving a highschool / emergency center.



Washington State Clean Energy Fund:

Solicitation for \$15M for Utility Energy Storage Projects

Selected projects with UET vanadium flow battery:

- Avista (1MW / 4MWh) -- PNNL -- WA State U
- Snohomish (2MW / 8MWh) – PNNL -- 1Energy -- U of WA

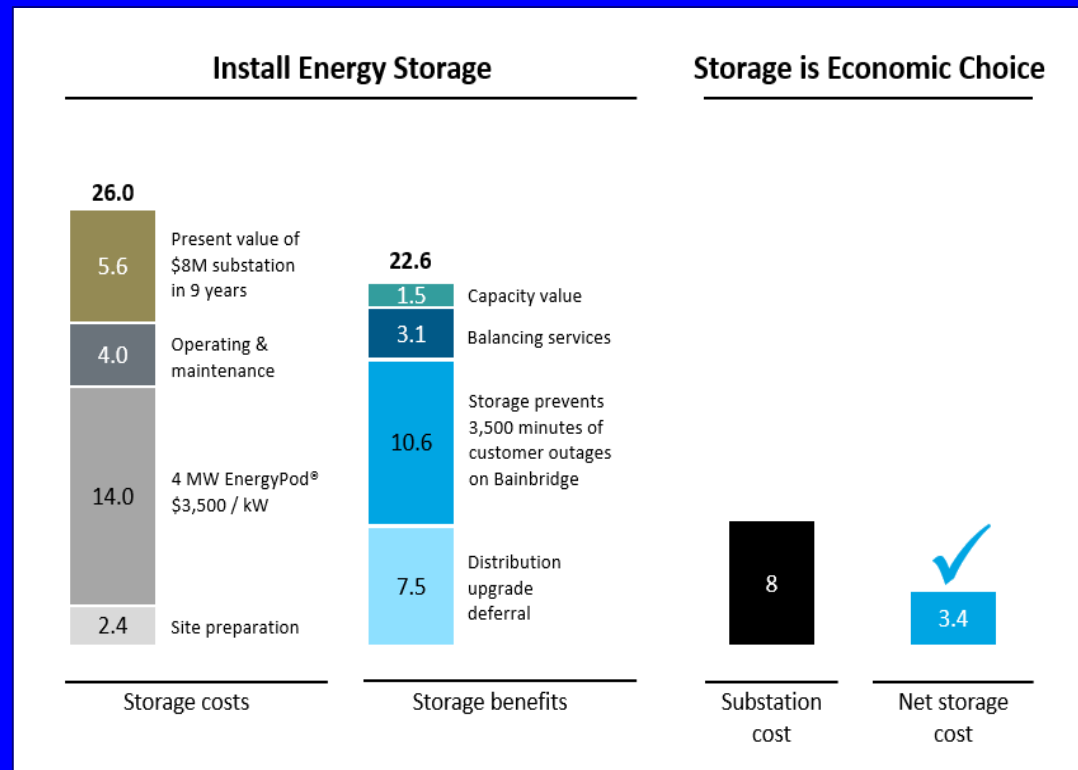
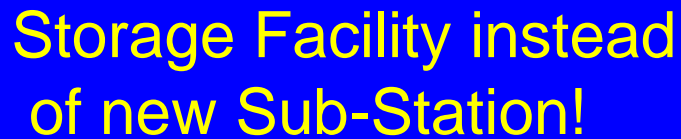
Avista Commissioning April 2, 2015

UET Vanadium technology
with 2x Energy density
developed at PNNL for DOE

Under a DOE / WA MOU,
PNNL will participate in both
Projects, providing use case
assessment and performance
analysis.



Primus Power, to install 500kW / 2MWh ZnBr Flow Battery, developed with ARRA funding



INDUSTRY TOOLS

Pacific Northwest Laboratory (PNNL)

- Provides Use-Case Analysis
- Evaluates Benefit Streams
- Assists Site Selection
- Helps choose correct scale

Sandia National Laboratories (SNL)

- Provides Technical Assistance
- Helps with Work Statements
- Assists with Commissioning
- Aids Performance Evaluation

SNL Energy Storage System Analysis Laboratory

Reliable, independent, third party testing and verification of advanced energy technologies from cell to MW scale systems



GS Battery at DETL



Energy Storage Test Pad (ESTP)



Milspray Deka Battery under testing

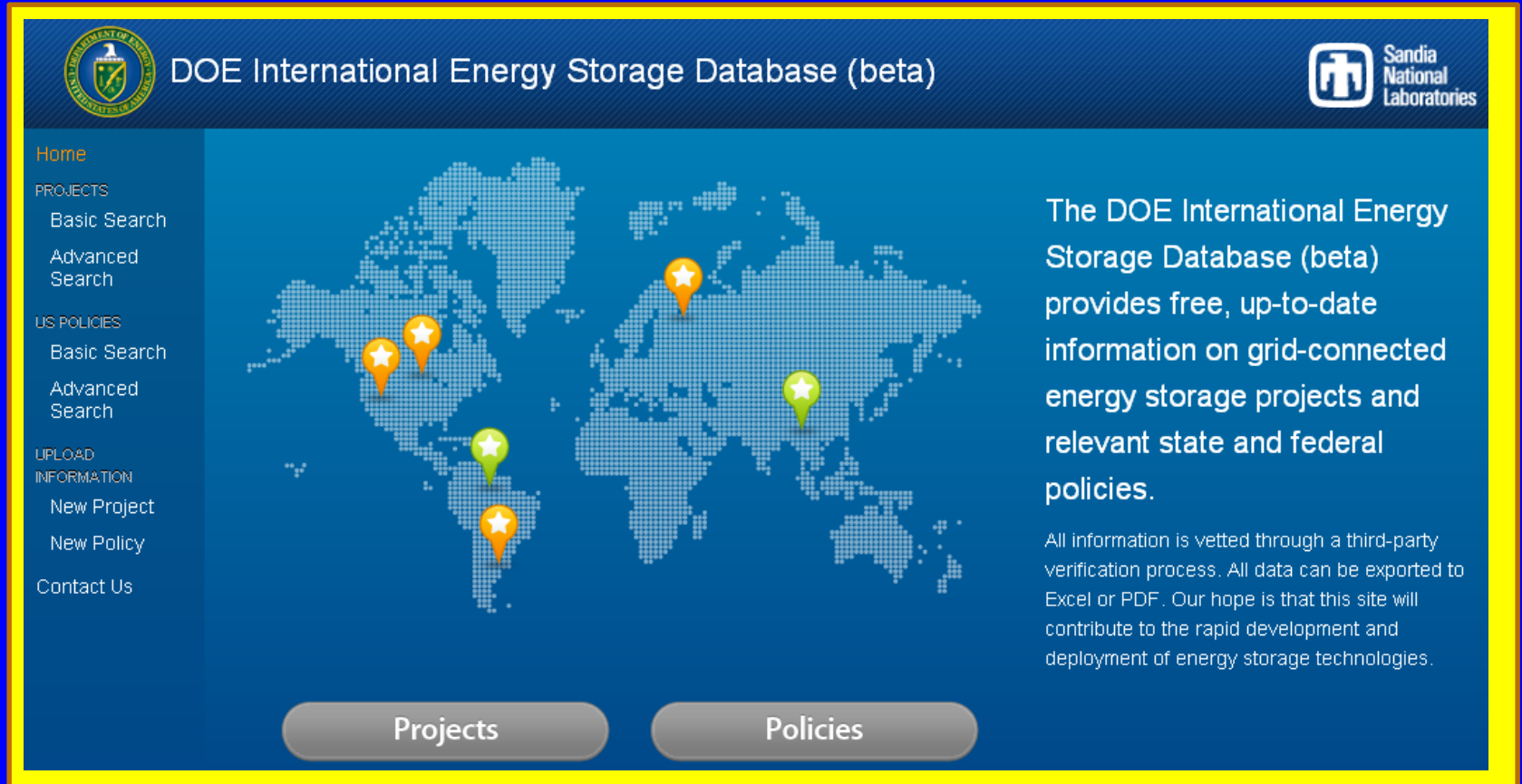
System Testing

- Scalable from 5 KW to 1 MW, 480 VAC, 3 phase, Both power and energy use tests.
- 1 MW/1 MVAR load bank for either parallel microgrid, or series UPS operations
- Subcycle metering in feeder breakers for system identification and transient analysis
- **Safety Analysis**

DOE International Energy Storage Data Base

energystorageexchange.org supported by Strategen

Over 1200 energy storage projects from 58 countries.
50 energy storage technologies are represented



The screenshot shows the DOE International Energy Storage Database (beta) website. The header features the Department of Energy logo on the left, the title "DOE International Energy Storage Database (beta)" in the center, and the Sandia National Laboratories logo on the right. A left sidebar contains navigation links: Home, PROJECTS (Basic Search, Advanced Search), US POLICIES (Basic Search, Advanced Search), UPLOAD INFORMATION (New Project, New Policy), and Contact Us. The main content area displays a world map with several location pins (orange and green) indicating project locations. To the right of the map, a text block states: "The DOE International Energy Storage Database (beta) provides free, up-to-date information on grid-connected energy storage projects and relevant state and federal policies." Below this text, a note mentions that all information is vetted through a third-party verification process and can be exported to Excel or PDF. At the bottom, there are two large buttons labeled "Projects" and "Policies".

DOE International Energy Storage Database (beta)

Sandia National Laboratories

Home

PROJECTS

- Basic Search
- Advanced Search

US POLICIES

- Basic Search
- Advanced Search

UPLOAD INFORMATION

- New Project
- New Policy

Contact Us

The DOE International Energy Storage Database (beta) provides free, up-to-date information on grid-connected energy storage projects and relevant state and federal policies.

All information is vetted through a third-party verification process. All data can be exported to Excel or PDF. Our hope is that this site will contribute to the rapid development and deployment of energy storage technologies.

Projects Policies

Energy Storage is Coming of Age!

New Cost Effective Technologies

New Benefit Streams opened

Major solicitations / Mandates in:

California (1.3 GW)

Hawaii (200 MW)

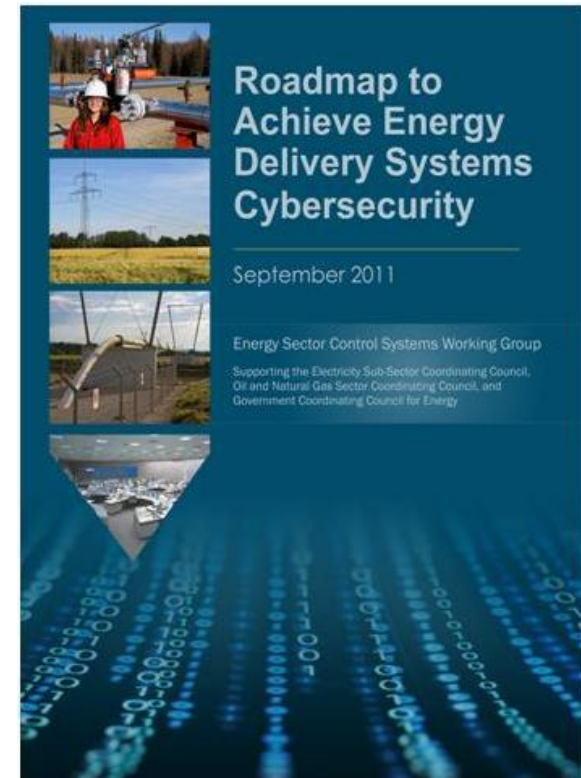
Ontario (50 MW)

Involvement of States: VT, WA, OR, MA

China, Japan, Korea, Australia

Cybersecurity for Energy Delivery Systems (CEDS) R&D

Following the Energy Sector's Roadmap



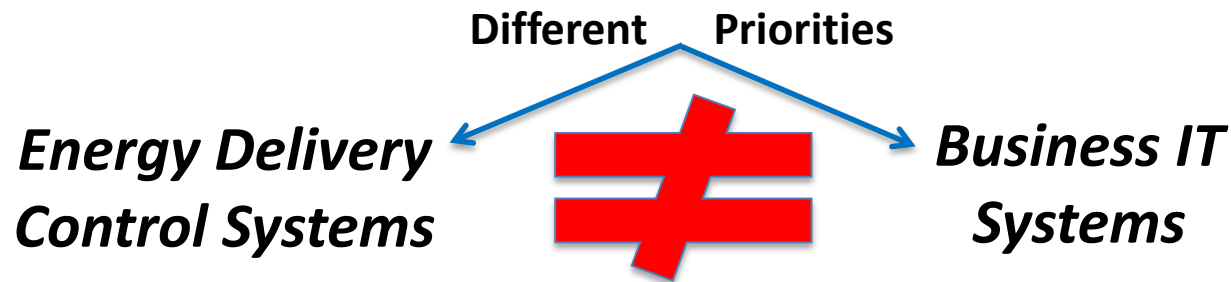
Carol Hawk
CEDS R&D Program Manager



U.S. DEPARTMENT OF
ENERGY

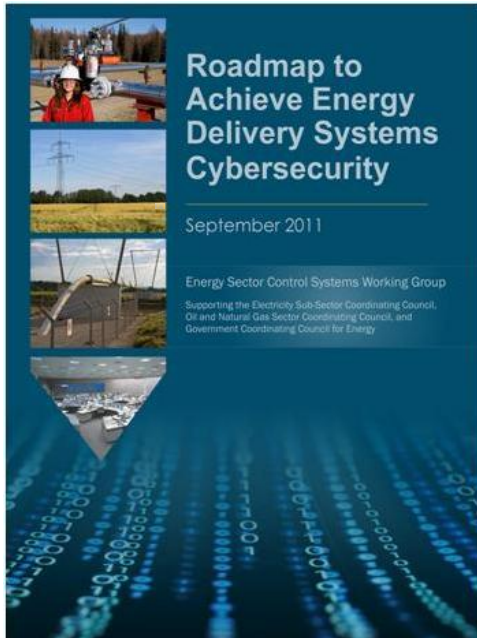
Electricity Delivery
& Energy Reliability

Energy Sector Cybersecurity



- Energy delivery control systems (EDS) must be able to survive a cyber incident while sustaining critical functions
- Power systems must operate 24/7 with high reliability and high availability, no down time for patching/upgrades
- The modern grid contains a mixture of legacy and modernized components and controls
- EDS components may not have enough computing resources (e.g., memory, CPU, communication bandwidth) to support the addition of cybersecurity capabilities that are not tailored to the energy delivery system operational environment
- EDS components are widely dispersed over wide geographical regions, and located in publicly accessible areas where they are subject to physical tampering
- Real-time operations are imperative, latency is unacceptable
- Real-time emergency response capability is mandatory

Roadmap – Framework for Collaboration



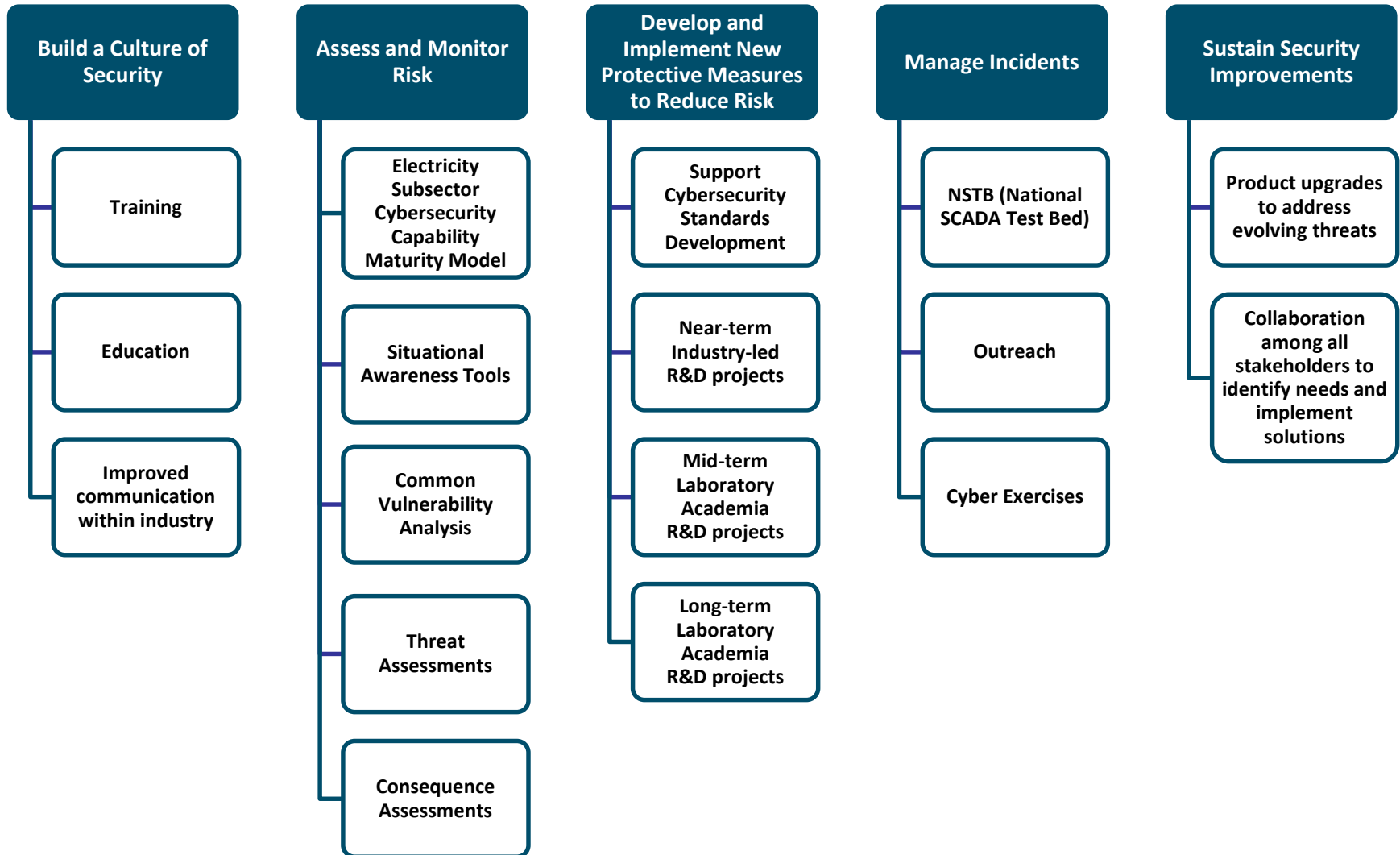
- *Energy Sector's* synthesis of energy delivery systems security challenges, R&D needs, and implementation milestones
- Provides strategic framework to
 - align activities to sector needs
 - coordinate public and private programs
 - stimulate investments in energy delivery systems security

Roadmap Vision

By 2020, resilient energy delivery systems are designed, installed, operated, and maintained to survive a cyber incident while sustaining critical functions.

For more information go to: www.controlsystemsroadmap.net

DOE Activities Align with the Roadmap



CEDS Alignment with the Roadmap

CEDS provides
Federal funding to:

- National Laboratories
- Academia
- Solution providers

To accelerate cybersecurity investment and adoption of resilient energy delivery systems

	1. Build a Culture of Security	2. Assess and Monitor Risk	3. Develop and Implement New Protective Measures	4. Manage Incidents	5. Sustain Security Improvements
Near-term (0-3 yrs)	1.1 Executive engagement and support of cyber resilience efforts 1.2 Industry-driven safe code development and software assurance awareness workforce training campaign launched	2.1 Common terms and measures specific to each energy subsector available for baselining security posture in operational settings	3.1 Capabilities to evaluate the robustness and survivability of new platforms, systems, networks, architectures, policies, and other system changes commercially available	4.1 Tools to identify cyber events across all levels of energy delivery system networks commercially available 4.2 Tools to support and implement cyber attack response decision making for the human operator commercially available	5.1 Cyber threats, vulnerability, mitigation strategies, and incidents timely shared among appropriate sector stakeholders 5.2 Federal and state incentives available to accelerate investment in resilient energy delivery systems
Mid-term (4-7 years)	1.3 Vendor systems and components using sophisticated secure coding and software assurance practices widely available 1.4 Field-proven best practices for energy delivery systems security widely employed 1.5 Compelling business case developed for investment in energy delivery systems security	2.2 Majority of asset owners baselining their security posture using energy subsector specific metrics	3.2 Scalable access control for all energy delivery system devices available 3.3 Next-generation, interoperable, and upgradeable solutions for secure serial and routable communications between devices at all levels of energy delivery system networks implemented	4.3 Incident reporting guidelines accepted and implemented by each energy subsector 4.4 Real-time forensics capabilities commercially available 4.5 Cyber event detection tools that evolve with the dynamic threat landscape commercially available	5.3 Collaborative environments, mechanisms, and resources available for connecting security and operations researchers, vendors, and asset owners 5.4 Federally funded partnerships and organizations focused on energy sector cybersecurity become self-sustaining
Long-term (8-10 years)	1.6 Significant increase in the number of workers skilled in energy delivery, information systems, and cybersecurity employed by industry	2.3 Tools for real-time security state monitoring and risk assessment of all energy delivery system architecture levels and across cyber-physical domains commercially available	3.4 Self-configuring energy delivery system network architectures widely available 3.5 Capabilities that enable security solutions to continue operation during a cyber attack available as upgrades and built-in to new security solutions 3.6 Next-generation, interoperable, and upgradeable solutions for secure wireless communications between devices at all levels of energy delivery system networks implemented	4.6 Lessons learned from cyber incidents shared and implemented throughout the energy sector 4.7 Capabilities for automated response to cyber incidents, including best practices for implementing these capabilities available	5.5 Private sector investment surpasses Federal investment in developing cybersecurity solutions for energy delivery systems 5.6 Mature, proactive processes to rapidly share threat, vulnerabilities, and mitigation strategies are implemented throughout the energy sector

Q&A

Please submit your questions using the “Questions” tab on your webinar console.

Applications for the REDI FOA are due May 4. For more information and to submit questions regarding the FOA, please visit

<http://www.netl.doe.gov/business/solicitations/details?title=9ffc4b38-2b18-4ce6-94a6-2da82c09126d>.

ESTAP Contact Information

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Webinar Archive: www.cesa.org/webinars

ESTAP Website: <http://www.cesa.org/projects/energy-storage-technology-advancement-partnership/>

ESTAP Listserv: <http://www.cesa.org/projects/energy-storage-technology-advancement-partnership/energy-storage-listserv-signup/>

