CESA State Projects and Policy Development

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Clean Energy States Alliance

Sandia National Laboratories

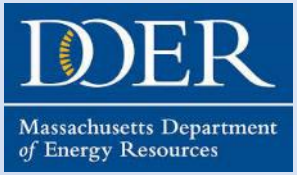
U.S. DEPARTMENT OF ENERGY

Agenda for this presentation:

- Introduction to CESA and ESTAP
- Current Work
  - Projects
  - Analysis
  - Policy
- Update: Sterling Municipal Light Department
- GMLC Project

Clean Energy States Alliance (CESA)
www.cesa.org

Renewable Development Fund

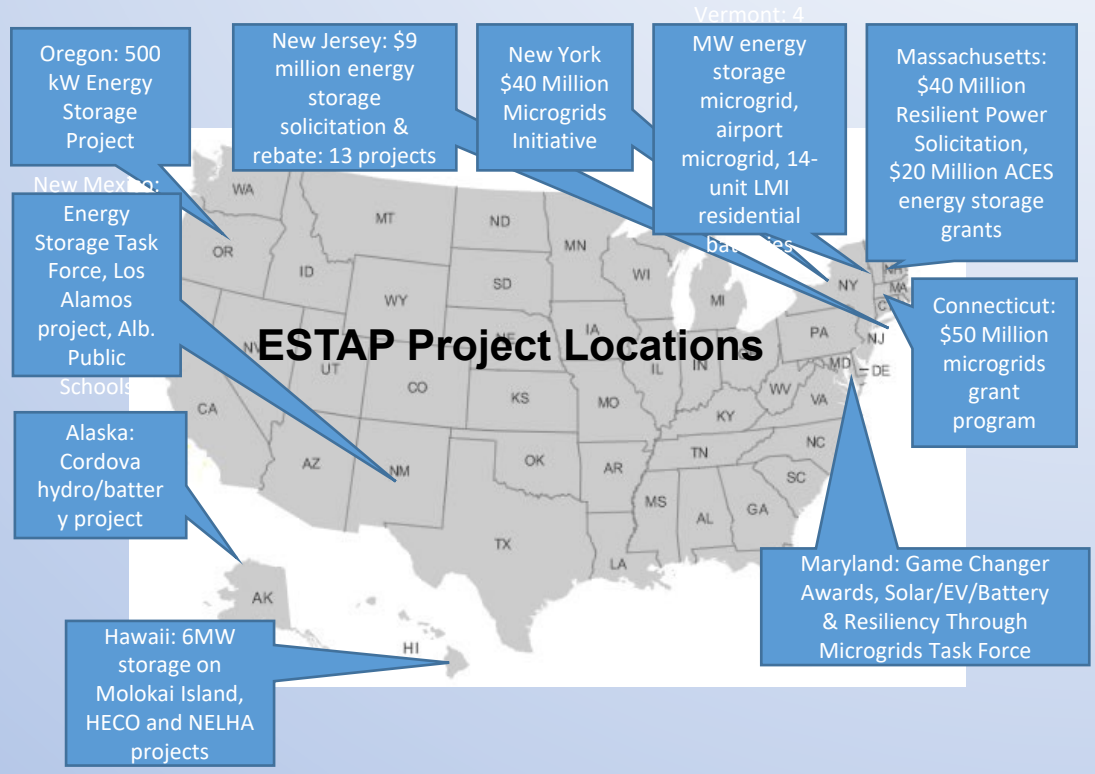


Energy Storage Technology Advancement Partnership (ESTAP)

- A project of Clean Energy States Alliance (CESA)
- Conducted under contract with Sandia National Laboratories, with funding from US DOE-OE

ESTAP Key Activities:

1. Disseminate information to stakeholders
   - Webinars, conferences, reports
2. Facilitate joint energy storage project deployment with state and municipal partners
3. Support project analysis
4. Support state and municipal energy storage efforts with technical, policy and program assistance



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ESTAP Current Work

Deployment

- **Vermont**: Green Mountain Power, Burlington Electric/Airport microgrid, McKnight Lane modular affordable housing
- **Massachusetts**: Sterling Municipal Light Department
- **Oregon**: Eugene Water & Electric Board
- **Alaska**: Cordova Electric Cooperative
- **New Mexico**: Albuquerque Public Schools
- **Colorado**: Gunnison Rural Electric Co-op

Analysis

- **Boston Medical Center**, Massachusetts**:** Major metropolitan hospital using battery storage with CHP to improve power quality, reduce demand charge costs, and maximize resilience
- **Gunnison Rural Electric Co-op**, Colorado: Rural electric co-op using battery to reduce costs and improve reliability
- **Albuquerque Public Schools**, New Mexico: Rio Grande High School using battery for demand charge management
- **Burlington International Airport**, Vermont: Microgrid providing resiliency and cost savings
- **Peaker plant replacement**: Analysis of the technical capability of energy storage to replace gas peaker plants for capacity provision and grid stabilization
- **EV fast chargers**: Analysis of economic opportunity for energy storage co-located with electric vehicle fast chargers, to reduce demand charges that present a barrier to EV adoption

State technical support

- **Connecticut**: Technical support to DEEP microgrid grant program
- **Massachusetts**: Technical support to MA Clean Energy Council ACES energy storage demonstration grant program
- **Vermont**: technical support to Vermont Dept of Public Service to write state energy storage study

Albuquerque Public Schools

Analysis for Rio Grande High School, optimizing battery for demand charge management

National survey of utility demand charge rates shows high demand charges in many parts of the country, including the Southwest

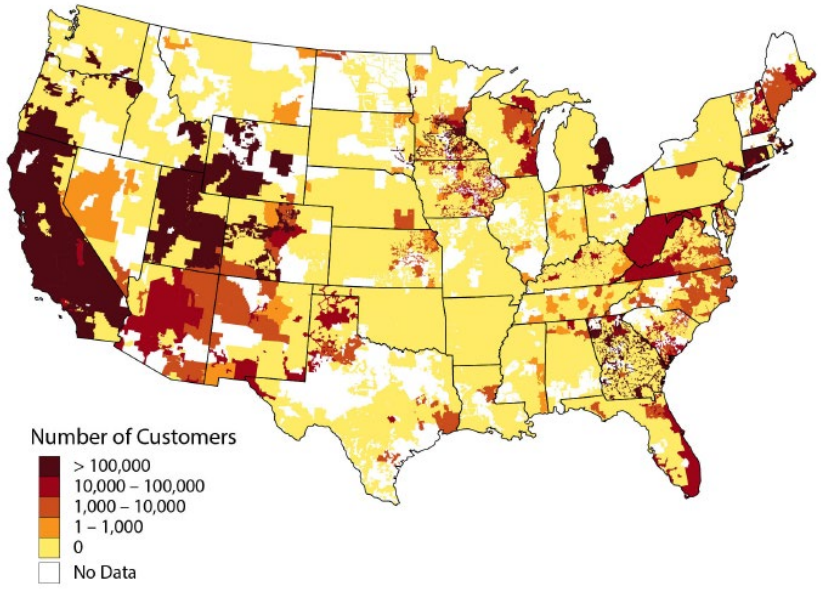


Figure 1. Number of commercial electricity customers who can subscribe to tariffs with demand charges in excess of $15/kW.

Boston Medical Center

1,060 kW / 2,120 kWh battery to be located on the roof of the Yawkey Ambulatory Care Center, next to existing CHP

Project goals:

- Resiliency
- cost savings
- power quality

<u>Baseline Capacity Charges</u>

Eversource T&D charge:
Summer = $24.82/kW
Winter = $18.86/kW

ISO-NE Capacity Cost (icap) charge:
$9.96/kW-month

Total: Hospital is currently paying **annual demand costs of $1,247,000**

<u>Project Economics:</u>

- Project Installed Cost: $1.5 M (high installation cost due to rooftop location)
- MassCEC Grant: $402,500
- **Annual Savings:** $200,000

Simple Payback: **7.5 years** (without grant)
5.5 years (with grant)*

Boston Medical Center analysis

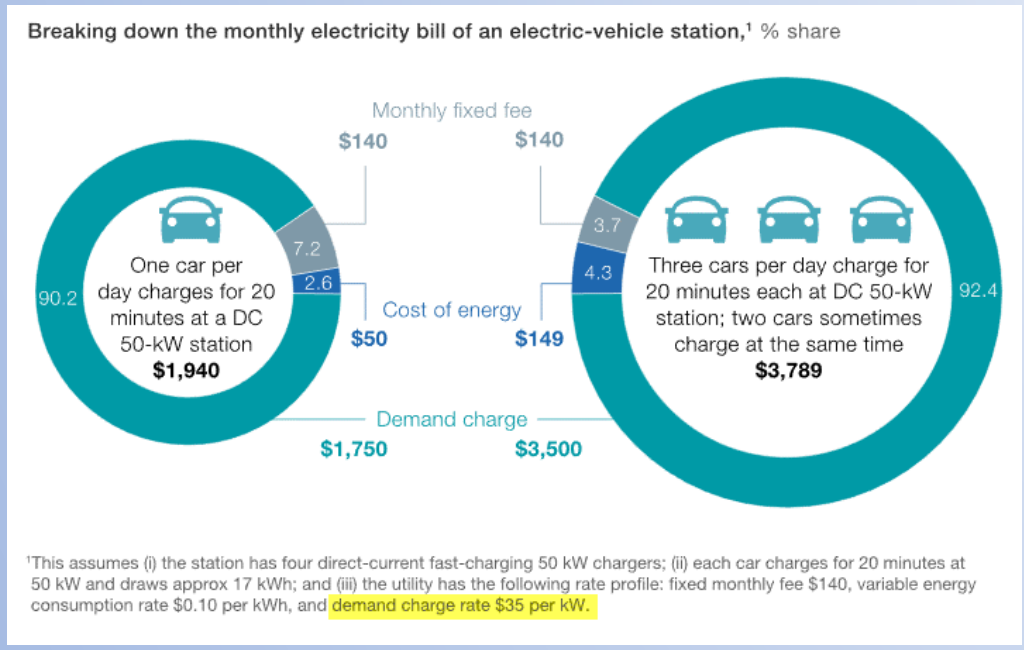
- Focus on optimizing the battery with the existing CHP plant
  - CHP can trip off due to voltage spikes from the grid OR sudden large load spikes from medical equipment
  - Each CHP trip can be very costly, as it creates a load spike for the facility (can cost $40,000 in demand charges)
  - When islanded, CHP trips impact mission-critical health outcomes
- Desired project outcomes:
  - Cost savings through demand management
    - $200,000 savings/year
  - improved power quality
    - Able to condition power from CHP when islanded to support high load hospital equipment
  - improved resilience
    - Backup power to critical communications and helipad
    - Improved black start

EV Fast Charger analysis

- A major goal for many states is to transition transportation sector from fossil-fueled to electric vehicles
  - **Forty-five states and the District of Columbia** offer an incentive for hybrid and/or electric vehicles
  - 8-state action plan: 3.3 million zero-emission vehicles on the road by 2025
  - Utilities in 8 states offered a $10,000 rebate for EV purchase

State and national EV goals cannot be met without the development of a network of EV fast charging stations

Utility demand charges are a major barrier for EV fast chargers



- Low utilization rates
- High power resulting in high demand spikes

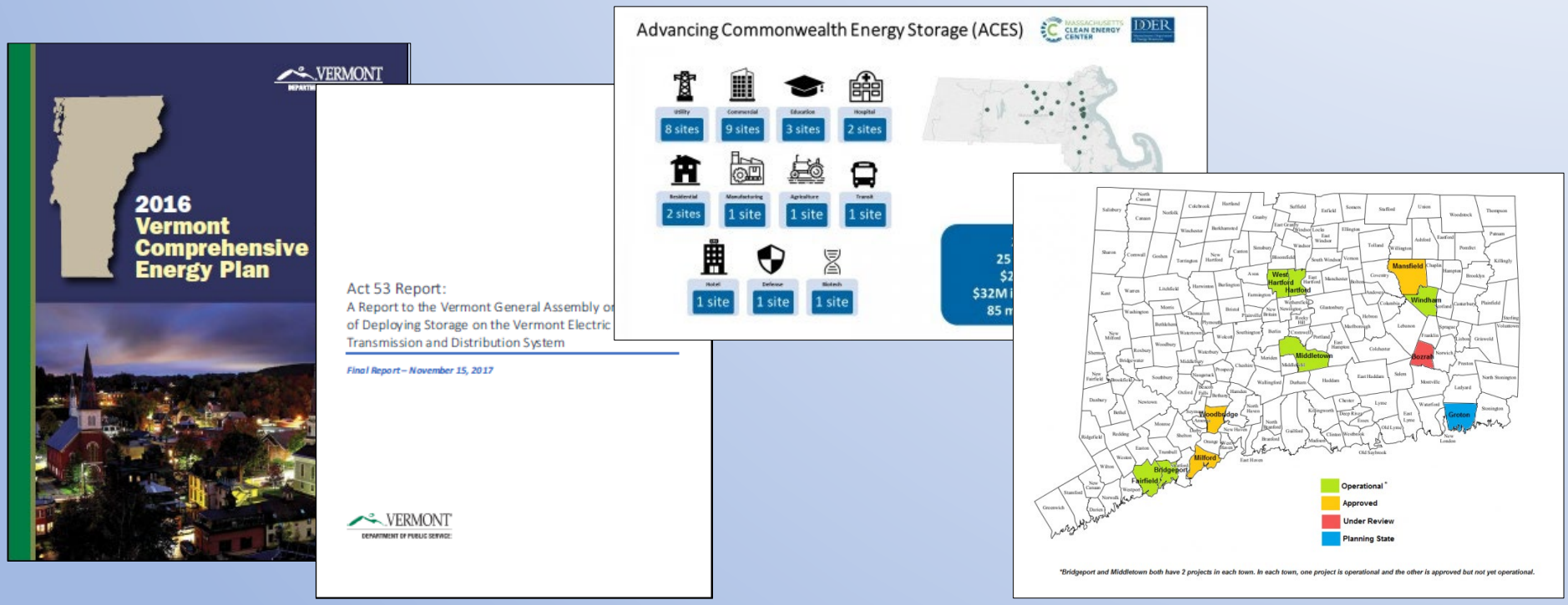
Placing a battery behind EV fast chargers could solve two problems:

- Demand charge management
- Resilient power for emergency charging during grid outages

Sandia analysis focuses on proving the economics of battery storage at EV fast charging stations and for electric fleets

State technical support

- **Connecticut**: technical support for DEEP microgrid grant program to review proposals
- **Massachusetts**: technical support for MA Clean Energy Council to help develop ACES energy storage demonstration grant program (Note: this program has awarded $20 million to support 26 energy storage projects demonstrating new applications, business models and economics in the state of Massachusetts)
- **Vermont**: technical support to Vermont Department of Public Service to write state energy storage study for the state legislature



Sterling, MA Municipal Energy Storage Project

Project Summary: 2 MW / 3.9 mWh lithium ion battery, connected with 4 MW solar PV; islanding capability to support municipal emergency facility

Project Economics:

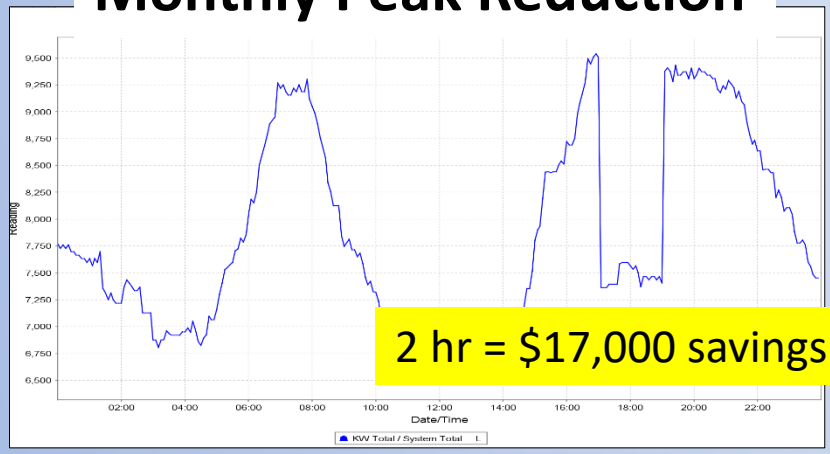
Cost = $2.5 million

Estimated savings = $400,000/year

Payback = 6.75 years (without subsidy)

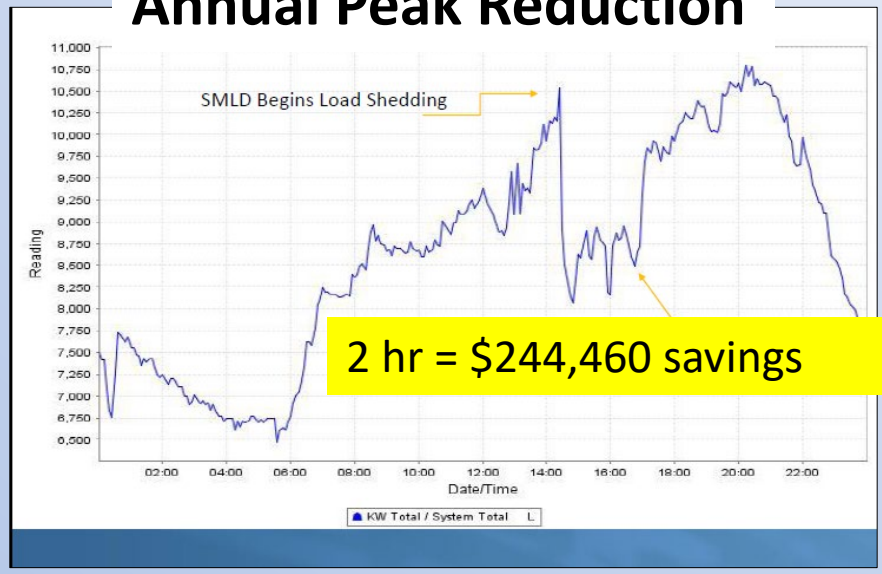
Project timeline: Groundbreaking in October 2016, commissioning by December 2016

Monthly Peak Reduction



2 hr = $17,000 savings

Annual Peak Reduction



2 hr = $244,460 savings

GMLC

Grid Modernization Initiative: Multi-lab project focused on four battery demonstration projects that covered a wide range of technologies and applications, in different geographical regions.

Goals:

- identify and quantify the value streams for each application
- Identify operational methods that could maximize those value streams.

(See poster)

Project Description

This is a multi-lab project focused on four battery demonstration deployments that covered a wide range of technologies and applications, in different geographical regions: Los Alamos County (NM), Salem Smart Power Center (OR), Green Mountain Power (VT), and Electric Power Board of Chattanooga (TN).

Expected Outcomes

Identify and quantify value streams for each application, as well as the corresponding operational methods that could maximize those value streams.

Progress to Date

VT, OR, and NM: Collection of operational data and analysis underway; preliminary results obtained. **TN**: Redox flow battery is undergoing testing.

Los Alamos County (LAC) - NM

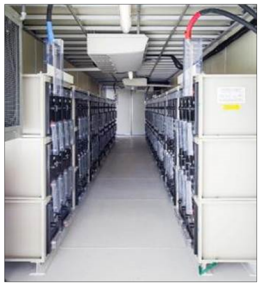


Figure 1: Lead Acid Battery 0.8MW/2.3MWh

Technology: 0.8MW/2.3 MWh Pb-acid and 1MW/6MWh NaS system

Project Description: Identify potential alternative uses for the LAC-owned battery energy storage system including: provision of operating reserves, arbitrage, peak shaving, PV firming, power quality provision, uninterruptible power supply, transmission and distribution deferral, and mitigating generation and energy delivery imbalances.

Findings: Frequency regulation has the highest net benefit, with estimated annual net revenues of $33,700 for the NaS alone, $28,200 the Pb-acid alone, or $83,900 if both NaS and Pb-acid battery systems are used together.

Salem Smart Power Center (SSPC) - OR

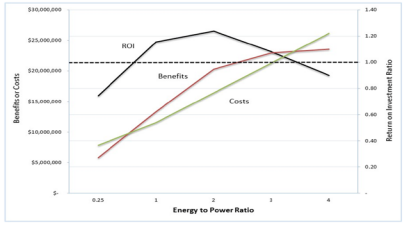


Figure 2: Optimal SSPC Energy to Power Ratio is 2

Technology: 5 MW/1.25 MWh lithium-ion battery

Project Description: Model battery operations to determine long-term financial benefits or value to electric utility.

Findings: Based on its initial design and cost, the SSPC does not generate positive net benefits; however, a modified design and operation could yield positive returns on investment with costs based on current day prices.

By upsizing the energy storage capacity from 1.25 MWh to 10MWh, the return on investment ratio yields a positive result at 1.24.

Green Mountain Power (GMP) - VT

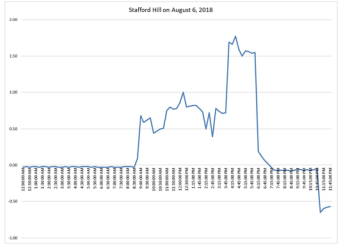


Figure 3: ISO-NE load peak and GMP battery output, August 2018

Technology: 4MW/3.4MWh of Pb-acid and Li-ion system

Project Description: Assess the financial value of energy storage operating on PV/storage microgrid within utility system. Monetizable services measured were peak shaving, grid services (frequency regulation and demand management), arbitrage, and transmission investment deferral.

Findings: Revenue and savings opportunities show promise for a good return on investment. In August 2018, during the regional annual capacity peak, GMP saved over $600,000 using this and other battery systems to reduce peak loads.

Electric Power Board of Chattanooga (EPB) - TN

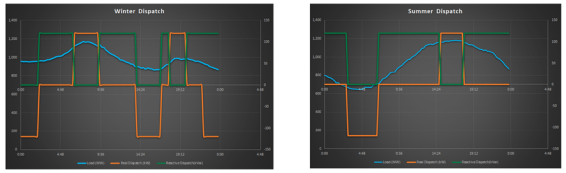


Figure 4: Real and reactive dispatch to meet winter and summer energy, demand, and voltage support functions

Technology: 100 kW/400 kWh redox flow battery system

Project Description: Obtain and install a flow battery system developed by UET, integrate with system, and evaluate the economic value proposition.

Findings: The flow battery was damaged. Replacement unit is undergoing testing.

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Thank You to:

Imre Gyuk, US DOE-OE

Dan Borneo, Sandia National Laboratories

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ESTAP Website: http://bit.ly/CESA-ESTAP

ESTAP Listserv: http://bit.ly/EnergyStorageList