

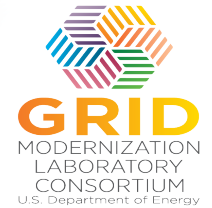
Technical Assistance for States: Grid-interactive Efficient Buildings

Natalie Mims Frick

July 23, 2020

Public Buildings Cohort Meeting

Public Buildings Cohort



Jocelyn Durkay (CO), Kim Burke (CO), Sean White (FL), Ashley Norman (HI), Eric Friedman (MA), David Herb (MI), Lindsay Anderson (MN), Hanna Terwilliger (MN), Joe Francis (NE), Rick Campana (SC), Norman Scarborough (SC), Catherine Reed (SC), Ryan Stanton (TN), Rick Kumar-Rathor (TN), Nam Nguyen (VA), Sarah Young (WY), Tom Nowakowski (WI)
 Rodney Sobin (NASEO), Ed Carley (NASEO), Natalie Frick (LBNL) | 2

Topics for our call today

- ▶ Department of Energy funding updates
 - Public Sector Field Validation Funding Opportunity Announcement
- ▶ Select action items that a state energy office or city (including municipal utility) can use to promote demand flexibility in public buildings
 - Benchmarking and transparency
 - Data collection
 - Building performance requirements and state energy plans
 - Demand response programs and time-varying electricity rates
- ▶ Next steps

Building Technologies Proving Ground – Public Sector Field Validation Funding Opportunity Announcement DE-FOA-00002324

- **\$10 million EERE Funding Opportunity on Technology Field Validation**
- **Released on June 26, 2020**
 - Concept Papers due July 27th, 2020; Full Applications due September 28th, 2020 5pm ET
- **Successful proposals will include:**
 - Near-commercial and emerging technology solutions (including operational/energy management solutions) that will be validated in occupied and operational buildings and can achieve:
 - A technical potential of at least 250 Trillion British Thermal Units per year (TBTU/yr.) of U.S. primary energy savings; or
 - Yield significant end use energy demand flexibility
- **Eligible entities**
 - State, local, and tribal governments must be the prime applicant
 - Preferred teams include technology providers, utilities, and building owners/operators
 - Focus on commercial and multifamily buildings
- **Apply Now: <https://eere-exchange.energy.gov> and search DE-FOA-0002324**

Benchmarking & Transparency



Building benchmarking and transparency (1)

- ▶ Benchmarking and transparency policies typically require public and/or private building owners to measure building energy use and make the data publicly available. Some policies include a building energy reduction requirement or goal.
- ▶ As of January [2019, 27 cities, one county and three states](#) have established benchmarking and transparency reporting requirements.
- ▶ New Jersey is one of the three states that established benchmarking and transparency reporting requirements state-wide. [By 2023, the Board of Public Utilities must require](#) commercial buildings over 25,000 square feet to benchmark energy and water use using EPA's [Portfolio Manager](#).
- ▶ Several cities located in states that are members of our working group have benchmarking and transparency requirements:
 - Colorado: Boulder, Fort Collins and Denver
 - Florida: Orlando
 - Massachusetts: Boston
 - Minnesota: Minneapolis



Report and analyze demand data

- ▶ Benchmarking and transparency requirements can be used to promote demand flexibility. Opportunities to expand the current requirements include:

Demand data. Many of the benchmarking and transparency policies use EPA's Portfolio Manager as the reporting tool, but only require building owners to report building energy savings. [Demand can also be tracked](#) in Portfolio Manager. Collecting demand data may be helpful to identify opportunities for bill reductions and demand flexibility.

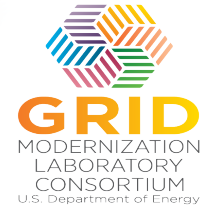
Demand flexibility data collection. Two metrics that are beneficial to understanding a building's demand flexibility are the *timing* and *duration* of load reductions or increase. Advanced metering infrastructure, building energy management systems and specific devices (e.g., smart thermostats) are able to measure the time and duration of a load reduction or increase. This type of data collection could be tested through a state owned building pilot.

Renewable energy generation and storage data collection. Collect data on when, and the quantity of energy that buildings with renewable energy are producing. Similarly, collect data on when energy storage systems are charging and discharging energy. This type of data collection could be tested through a state owned building pilot.

Some additional LBNL resources

- [Evaluation of U.S. Building Energy Benchmarking and Transparency Programs: Attributes, Impacts and Best Practices](#)
- Forthcoming SEE Action report, [Performance Assessments of Demand Flexibility from Grid-Interactive Efficient Buildings: Issues and Considerations](#)

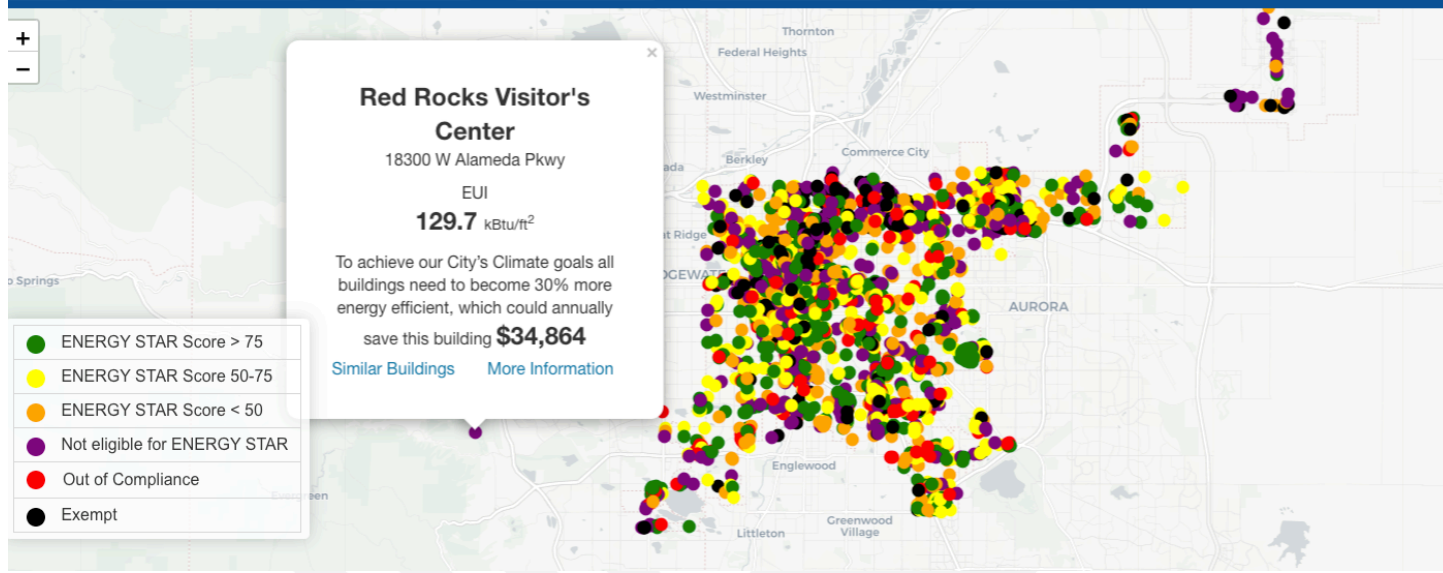
Energize Denver Benchmarking Map



Search for building by id, name, or address

[About Energize Denver](#) [About Benchmarking](#) [Resource Center](#)

Type: All | Building Size: 25000+ to 2000000 | ENERGY STAR: 0+ to 100 | EUI: 0+ to 2000+ | Neighborhood: All Neighborhoods | Year Built: 1850 to 2018



**HEALTHY BUILDINGS
HEALTHY PEOPLE**

51% OF DENVER'S GREENHOUSE GAS EMISSIONS ARE FROM BUILDINGS

BUILDINGS INCREASED ENERGY USE BY 1.2% ON AVERAGE ANNUALLY SINCE 2016

Data Collection

Status and opportunities

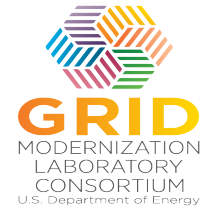


- ▶ States may track energy consumption in buildings for other purposes (i.e., reduce energy costs) absent a benchmarking and transparency policy.
- ▶ Massachusetts, Tennessee and Virginia track public building energy consumption using tools that provide online data visualizations.

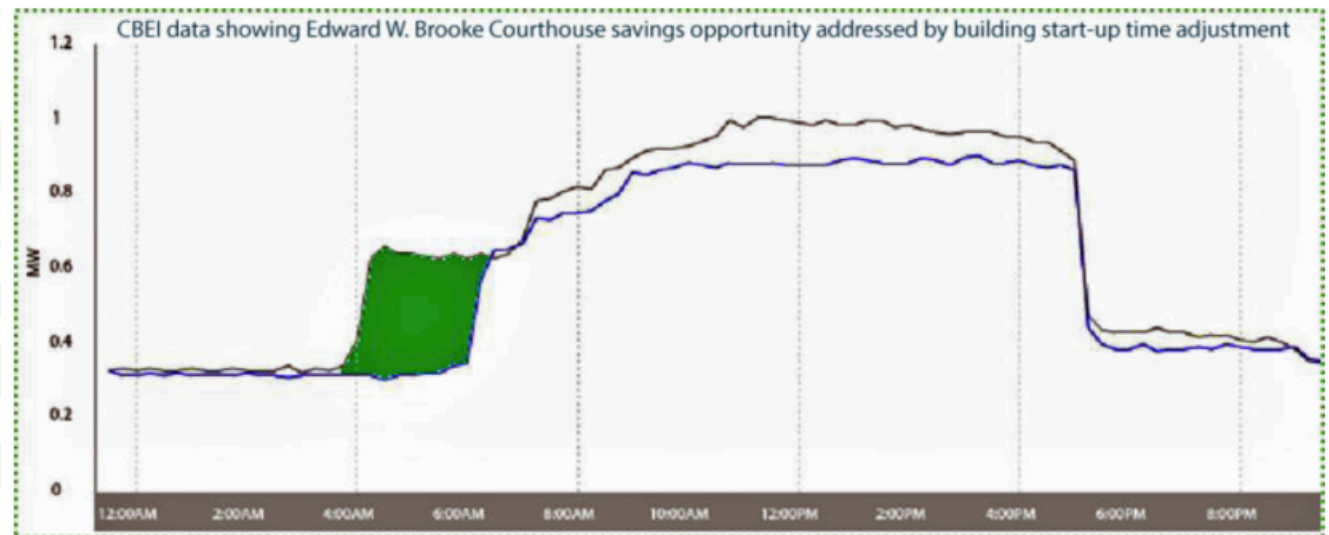
The data is not currently used to identify or implement demand flexibility, but is a starting point. To be responsive to grid signals, grid-interactive efficient buildings must have transparency regarding when electricity is being consumed and if the load is flexible.
- ▶ Most documentation or case studies on benchmarking/tracking building energy consumption focus on the energy and cost savings.

Tracking demand reductions increases visibility into opportunities for buildings to provide savings when grid needs are highest and install controls with communication capability to allow buildings to respond to grid needs. Often, demand reduction data exists but isn't being recorded in a central repository. Where applicable, collecting renewable energy generation and battery storage consumption and dispatch data may allow building operators to identify comprehensive solutions to meet grid needs.
- ▶ A [2018 report to GSA](#) suggested that adding energy use intensity, peak demand, [load factor](#), and energy costs as metrics could raise awareness of strategies that include other resources besides energy efficiency to increase emissions and cost savings.

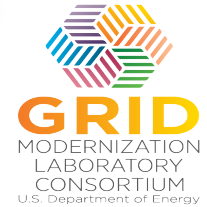
Massachusetts Commonwealth Building Energy Intelligence (1)



- ▶ [Massachusetts](#) Energy Savings Optimization Program
- ▶ The Commonwealth Building Energy Intelligence (CBEI) seeks to:
 - Improve building energy management practices
 - Drive operational efficiencies
 - Lower energy consumption and costs
 - Assist in identifying capital needs for energy-using equipment and/or systems

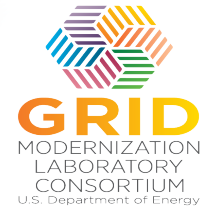


Massachusetts Commonwealth Building Energy Intelligence (2)

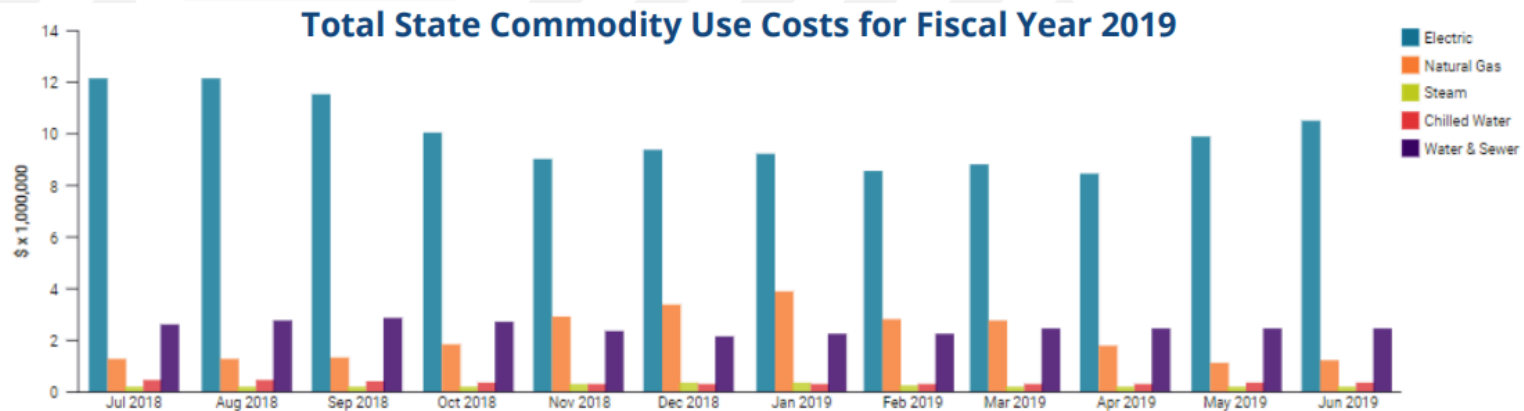


- ▶ The program began in 2010 with EnerNOC (now Enel X) using advanced energy metering and analytics to highlight opportunities for increased efficiency at state properties.
- ▶ The program provides whole building real-time energy metering and analytics on
 - 25 million square feet
 - 460 state buildings, including hospitals, prisons, universities, community colleges, trial courts, office buildings
 - 1200 meter streams of five minute data for electric, gas, steam, hot and chilled water and oil usage
- ▶ The implementation contract expires in 2021. The state issued a [request for information](#) in September 2019 that has questions that may be useful for other states interested in working with a vendor to use real-time energy metering or building energy management systems in state facilities.
 - “Does your solution offer measurement and verification (M&V); verify that an Energy/Water Conservation Measure (ECM) yielded the proposed savings/track and analyze project specific energy, both for findings from your system, as well as those from other energy projects at the buildings?
 - Does your solution offer benchmarking, through automated integration with energy star as well as supplementing for space/building types that are not in Energy Star (CBECs, for example)?
 - Does your solution provide the ability to automatically generate full, complete utility applications and supporting documentation for implemented efficiency recommendations, for all applicable programs (gas, electric, etc.) in the Commonwealth?
 - Does your solution use building-level data, connect to a Building Automation System, or connect to other more granular data points than the building level?”

Tennessee Utility Data Management



- ▶ The State of Tennessee owns and manages ~103 million square feet of facilities. In [February 2016](#), the state selected a vendor to provide utility bill management software and services to help reduce energy costs and consumption in state owned and managed facilities.
- ▶ The State Facility Utility Management team manages the [Utility Data Management](#) platform.
- ▶ The platform offers many reports to users to help reduce energy consumption and bills.
- ▶ An Energy Liaison Program is being developed. It will provide resources and training and create a network of best practices for state facility managers and maintenance staff.

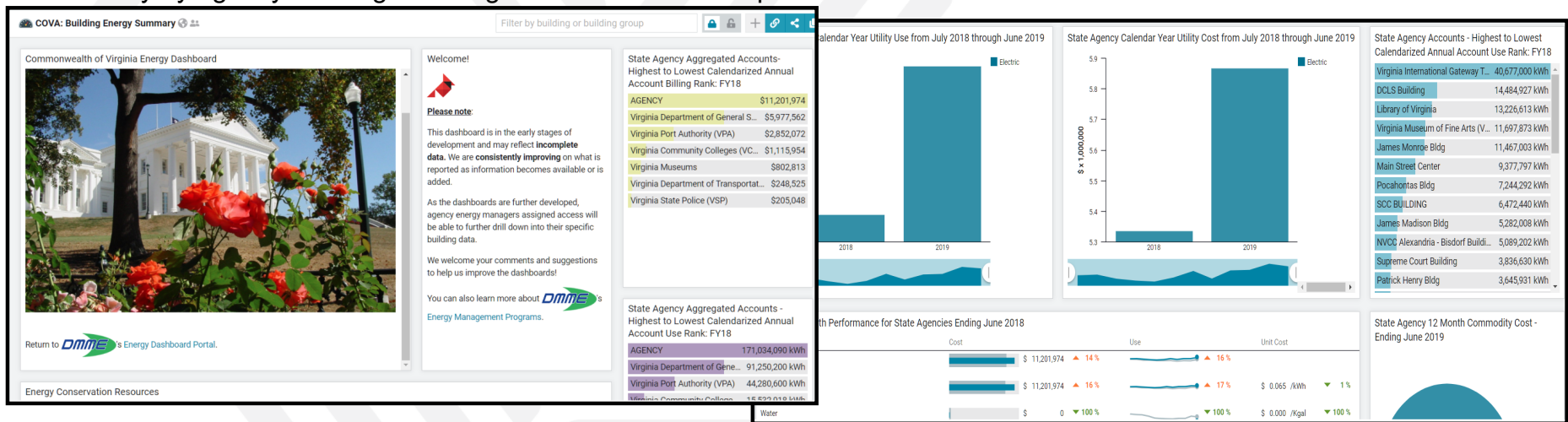


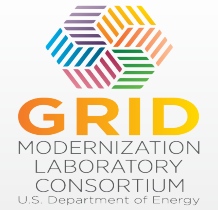
Source: [Office of Energy Annual Report 2019](#)

Virginia Energy Dashboard Portal



- ▶ Six agencies in Virginia are currently in the [Energy Dashboard Portal](#) (Department of General Services, Port Authority, Community Colleges, Museums, Department of Transportation and State Policy). More will be added.
- ▶ The goal of the Energy Dashboard is to compile, track and measure state agencies energy use, help identify efficiency champions and best practices, and identify buildings that will benefit from efficiency upgrades.
- ▶ The dashboard shows building energy cost and consumption per square foot, year-over-year electricity cost and consumption performance comparisons, cost at meters, month use and spending trends and a rolling three year energy use intensity by agency. Adding natural gas and water consumption in the future





Building Performance and State Energy Plans

Add demand flexibility to state building performance requirements



- ▶ Several states in the working group have executive orders or other guidance that require state-owned buildings to achieve an energy efficiency goal within a certain timeframe. For example:

CO: [Executive Order Concerning the Greening of State Government](#)

MA: [Lead by Example Executive Order](#) (2007)

- ▶ As these policies are updated or newly adopted, states may consider including demand flexibility in their goals

Allow additional credit for demand flexibility when quantifying goals

Add applicable metrics to state facility building performance goals to raise awareness of strategies that include other resources besides energy efficiency to increase emissions and cost savings.

- Demand data
- Timing of load reduction or increase
- Duration of load reduction or increase
- Renewable energy generation and storage charging and dispatch data
- Energy use intensity
- Load factor

Include demand flexibility in state energy plans

- ▶ Several of the cohort states have energy plans that seek to achieve a variety of energy, air pollutant emissions reduction and other goals.
- ▶ For example, New Jersey's 2019 Energy Master Plan identifies seven strategies to achieve state goal of 100% clean energy by 2050.

Two of the strategies specifically mention demand flexibility.

- Strategy 3.2.2: Pilot alternative rate designs to manage EV charging and encourage customer controlled demand flexibility
- Strategy 5.3.3.: Pilot and implement modified rate design to encourage customer-controlled demand flexibility, manage EV charging and support DR programs

Demand Response and Time-Varying Rates

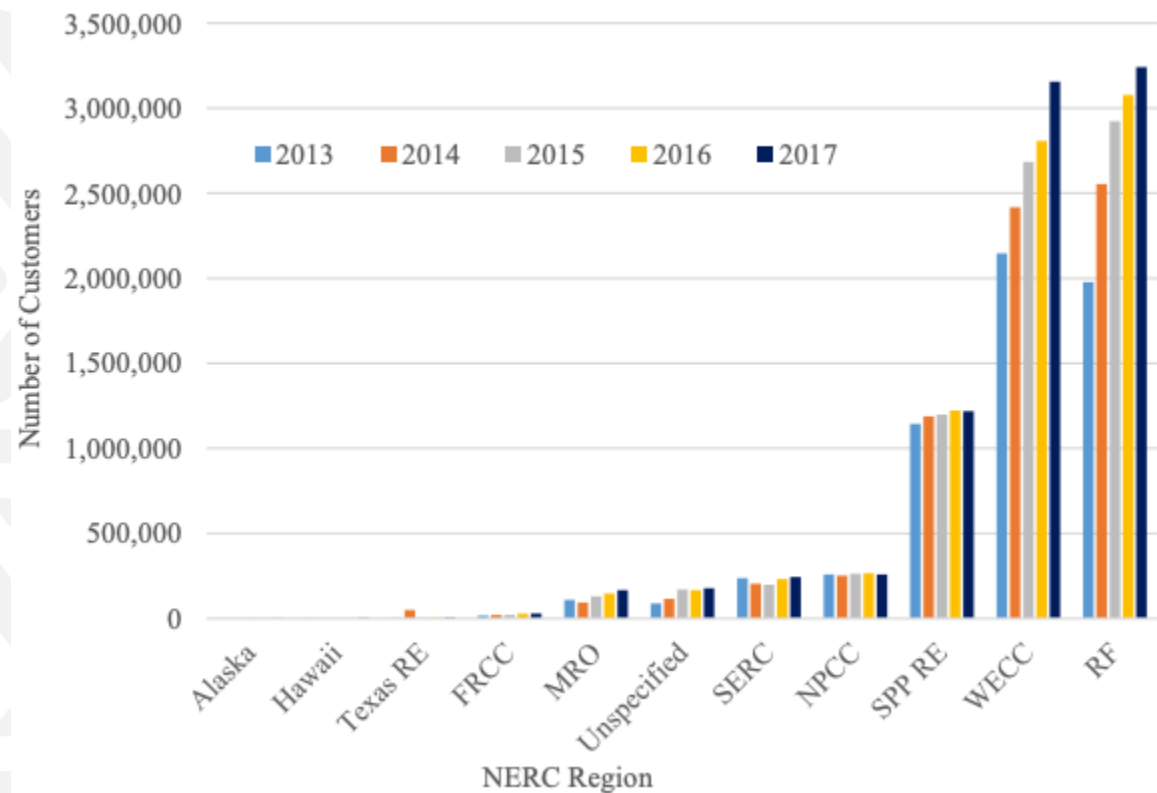


Participate in utility or market demand response programs (1)

- ▶ Demand response (DR) is the change in the rate of electricity consumption in response to price signals or specific requires of a grid operator. ([GEB Overview report](#))
- ▶ DR products can be grouped into two categories
 - Incentive payment programs include direct load control, interruptible, demand bidding/buyback, emergency, capacity market, and ancillary service programs.
 - Time-based or dynamic pricing programs include real-time pricing, critical peak pricing, critical peak rebate, variable peak pricing and time-of-use rates administered through a tariff. ([EIA](#))
- ▶ Participation in demand response programs or other time-based rates are an opportunity for state owned or managed buildings to reduce electricity bills and emissions and provide grid services.
- ▶ Automation and use of third party aggregators are opportunities to simplify participation in DR programs.
- ▶ ISO-NE and PJM offer several demand response products that state facilities can participate in (typically through an aggregator)
- ▶ The [2018 report to GSA](#) suggested collaborating with utilities and ISO/RTOs to “Conduct rate structure analysis, pilot projects, participate in the most cost-optimal electric rate structures available which ideally reflect the variable cost of generating electricity”

Participate in utility or market demand response programs (2)

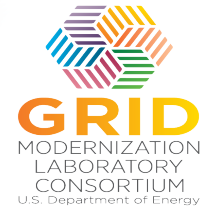
- ▶ Increasing [numbers of customers are enrolling](#) in retail time-based rates.
- ▶ More research is necessary to provide examples of state owned or managed facilities using dynamic rate structures.
- ▶ Several states in the cohort have state owned or managed facilities that participate in demand response programs.
 - Massachusetts, Virginia, Tennessee
- ▶ Examples of states outside of the cohort participating include California, New York City, Montgomery County, MD



Massachusetts: ISO-NE demand resources and capacity tag

- ▶ The Massachusetts Division of Capital Asset Management and Maintenance has a contract for three offerings to state, local or quasi-governmental to use to reduce their energy costs.
 - [Active demand capacity resources](#): electricity reductions that are bid into the forward capacity market and activated by the ISO. These resources can also participate in Day-Ahead and Real-Time markets.
 - [On-peak demand resources](#): electricity reductions from non-dispatchable passive sources (e.g., efficiency, distributed generation, CHP) that are bid into the forward capacity market and have a supply obligation.
- Capacity tag: During peak days, the amount of capacity used at a facility determines your capacity assignment. Reducing demand during those days reduces bills for the next capacity year. This opportunity is between the utility and facility and is not an ISO-NE product.
- ▶ A third party bids the savings into ISO-NE.
- ▶ Participating facilities in Massachusetts save about \$500,000/year using these programs.

Virginia: PJM emergency capacity performance demand response program



- ▶ Virginia: State agencies, [universities](#), [K-12 schools](#), local governments and [municipalities](#) can participate in PJM's [demand response](#) program.

The Department of Mines, Mineral and Energy (DMME) selected a state curtailment provider who assists departments with participation in the DR program. Participants in the Emergency must be able to curtail load when called by PJM (via CPower, the state curtailment provider)

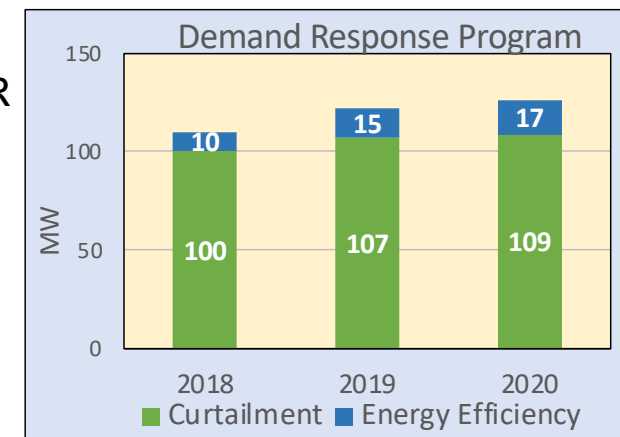
Examples of technologies that enable participation are building automation systems, emergency generation, lighting, HVAC, or shifting load.

- ▶ Agencies participate in PJM's emergency capacity performance DR and some are exploring [economic DR options](#), which includes ancillary services.

Synchronized Reserves require a reduction in consumption within 10 minutes of dispatch

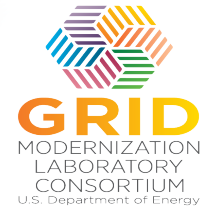
Day-Ahead Scheduling Reserves require a reduction in consumption within 30 minutes of dispatch

Regulation follows PJM's regulation and frequency response signal



Demand response enrollment

Tennessee: Demand charge bill reductions from demand response



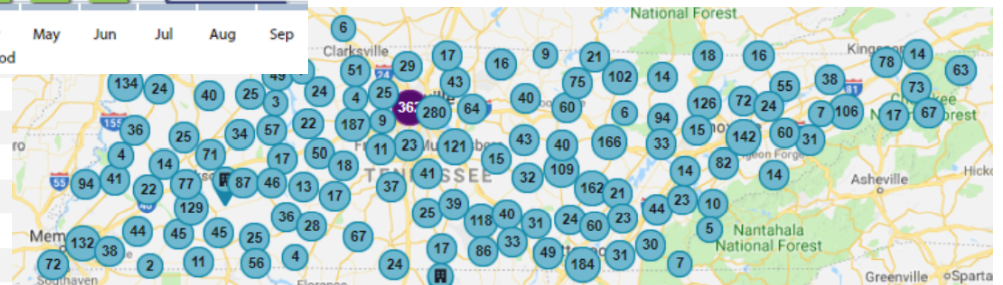
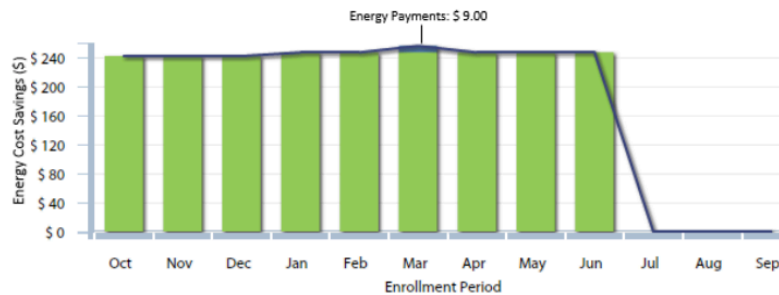
- ▶ Tennessee Department of General Services, Nashville Electric Service and Enel X work together to implement demand response programs in nine state office buildings.

All buildings have an Energy Management System with automated energy conservation measures. During a demand response event, the buildings can reduce their energy consumption by increasing or decreasing temperature set-points, shutting off non-essential lighting, manual curtailment of air-conditioning and voluntary reduction in lighting, fans and office equipment.

October 2018 - September 2019

Capacity Payments	\$ 2,205.99
Energy Payments	\$ 9.00
Adjustments	\$ 0.00
Total Payments	\$ 2,214.99

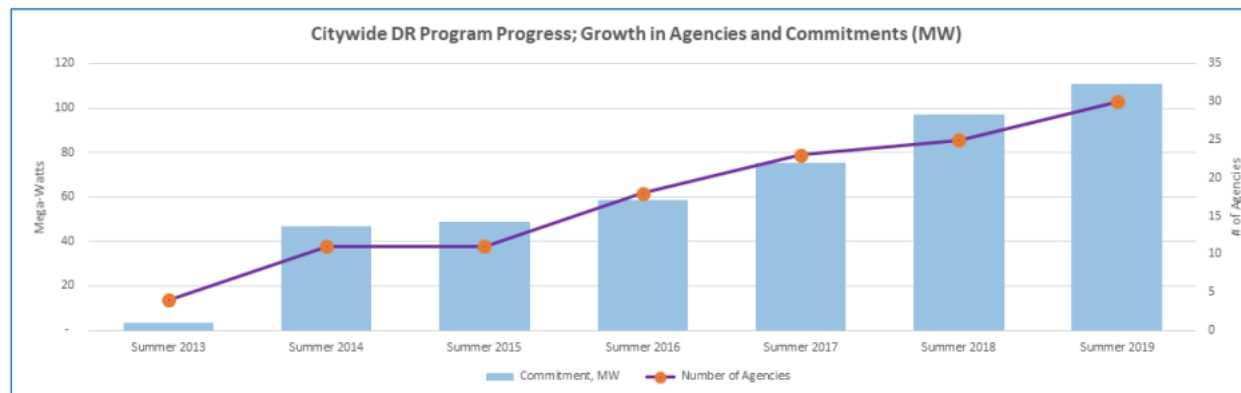
(US only payments)



Source: Office of Energy Annual Report 2019

New York City Department of Energy Management

- ▶ The New York City Department of Energy Management (DEM) launched a citywide DR program in 2013.
- ▶ From 2013-2018, City agencies earned more than \$50 million from DR revenues
- ▶ Each year additional agencies and capacity have participated in the program
- ▶ In summer 2019, estimated load reduction was 110 MW (see chart)
- ▶ DEM hired NuEnergen to implement the DR programs. Buildings must have real-time meters with communicating capabilities and have curtailable load.



California and Montgomery County, Maryland



- ▶ California requires state agencies to [participate in demand response](#) programs and suggests that facilities with [appropriate energy management systems](#) participate in Automated Demand Response.
- ▶ The Montgomery County Division of Facilities Management works with Enel X to reduce electricity consumption during PJM DR events.

The county also has automated energy management through the building automation system that controls HVAC and lighting to remotely adjust temperatures and schedules.

The Building Automation System also provides safety and operational efficiencies through control of fire alarm operations and troubleshooting mechanical system issues from the operations center which reduces calls that mechanics must respond to.



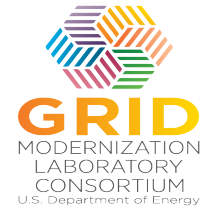
Next steps: GEB TA public buildings cohort

- ▶ Checklist that identifies technologies and/or technology characteristics to be considered in retrofit and new construction projects (e.g., enable control by a building energy management system)
- ▶ Action items that a state energy office (or city, including a municipal utility) could take
- ▶ Model language that identifies benefits of including demand flexibility toward meeting energy-related state (or city) goals and encourages or requires retrofit and new construction projects to enable demand flexibility (e.g., using building energy zones, participating in demand response programs or events, coordinating multiple distributed energy resources in an individual building). Example applications:
 - Governor's executive order
 - Administrative rule
 - State energy plan
 - Demonstration project
 - Model standard for data access and privacy
 - Building energy codes
 - Appliance standards

NASEO GEB Publications <https://www.naseo.org/buildings-publications>

GEB Working Group <https://www.naseo.org/issues/buildings/naseo-geb-resources>

Questions?



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