

Status and Hopes for Storage as a Component of the Electric Grid

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Energy Storage Initiative

- **\$10 million** initiative launched in 2015
 - *State of Charge* study
 - Demonstration projects
- Robust stakeholder engagement
- Study details:
 - Technology and market landscape
 - Comprehensive modeling of the cost and benefits of deploying storage
 - Economic use cases of specific storage applications
 - Economic development opportunities
 - Policy and program recommendations to grow storage deployment and industry in MA

“Massachusetts will continue to lead the way on clean energy, energy efficiency, and the adoption of innovative technologies such as energy storage.”

- Governor Baker, Feb 2016, Accord for a New Energy Future Press Event

“Given the recent advances in energy storage technology and cost-effectiveness, it is hard to imagine a modern electric distribution system that does not include energy storage.”

Utility stakeholder perspective

Storage In Commodity Supply Chains



FOOD

Warehouses
Grocery stores
Freezers & refrigerators



WATER

Reservoirs
Above-ground tanks
Water bottles



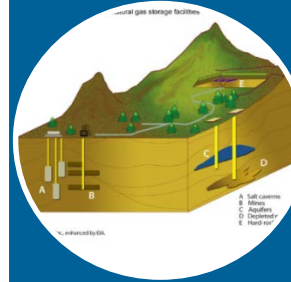
GASOLINE

Underground tanks
Above-ground tanks
Tank trucks
Portable fuel tanks



OIL

Above-ground tanks
Piping



NATURAL GAS

Depleted fields
Aquifers
Salt caverns
Pipelines
Above-ground tanks



ELECTRICITY

Energy Storage Technologies

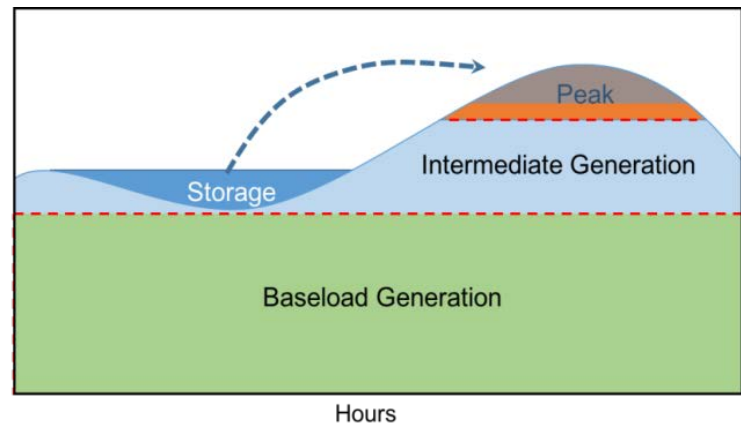
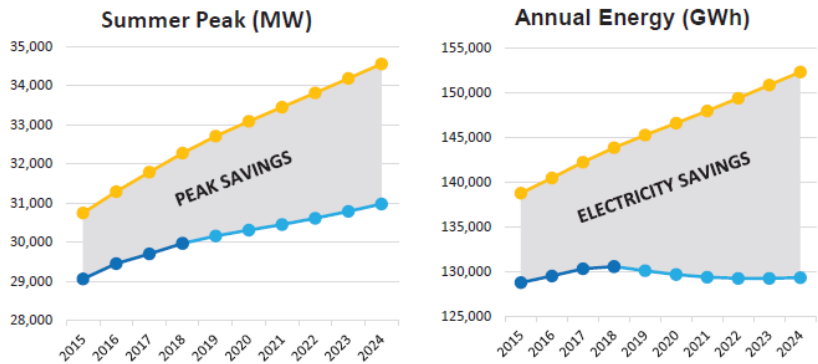
Currently less than 1% of daily electricity consumption for MA

Storage capacity more than 10% of daily consumption

In most commodities storage is key to mitigating of the impact of a supply disruption. Due to the low amount of electric storage currently on the grid, the system is sized with sufficient redundancy for generation and transmission to meet peak demand.

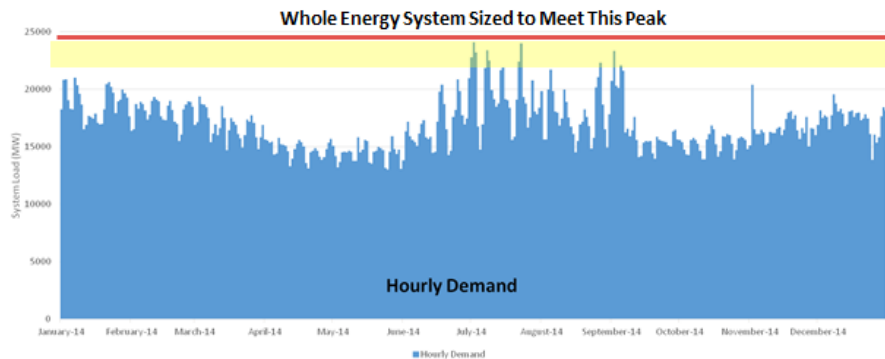
Massachusetts Energy Challenges: Storage is “Game Changer” for Meeting Peak

ISO-NE State of the Grid 2016 and System Annual Hourly and Weekly Demand



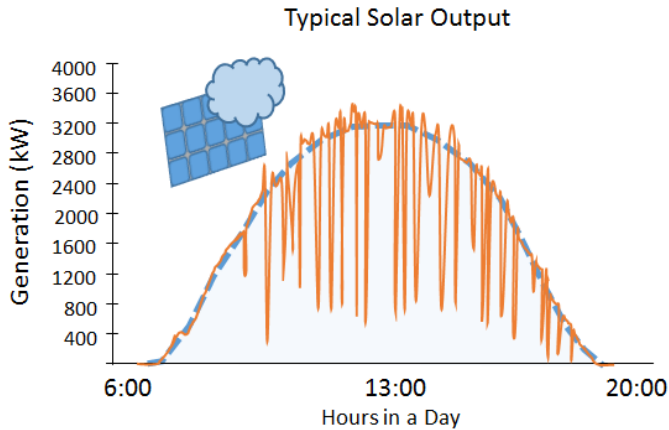
Energy storage is the only technology that can use energy generated during low cost off-peak periods to serve load during expensive peak.

The need to size grid infrastructure to the highest peak usage results in system inefficiencies, underutilization of assets, and high cost



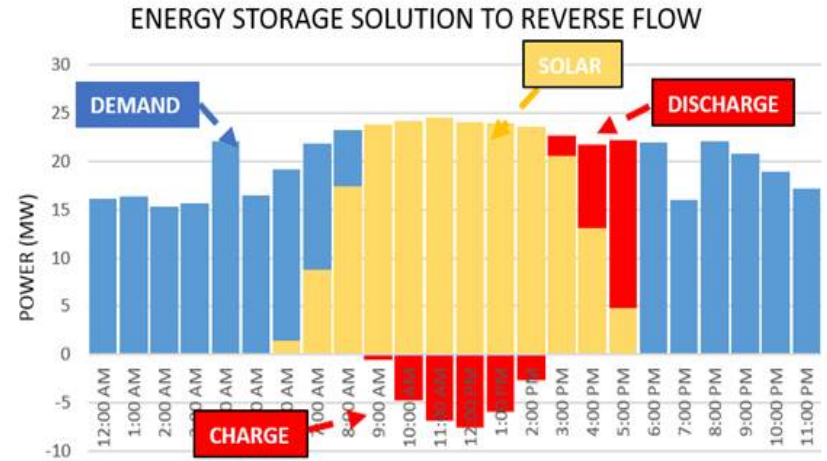
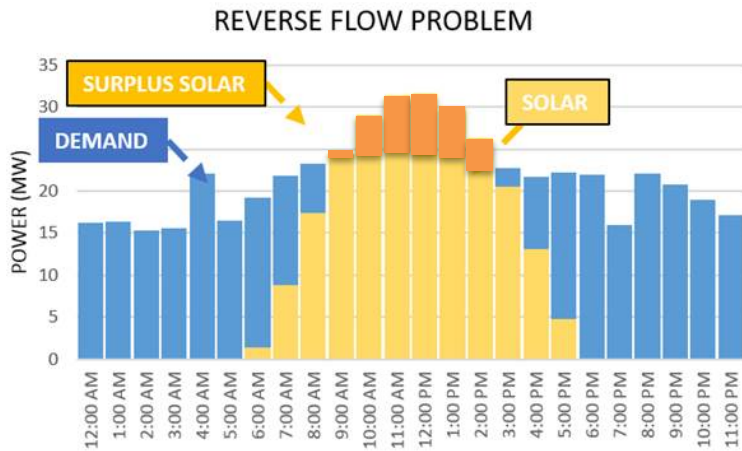
**Top 1% of Hours accounts for 8% of MA Spend on Electricity
Top 10% of Hours accounts for 40% of Electricity Spend**

Massachusetts Energy Challenges: Storage reliably integrates more Renewables



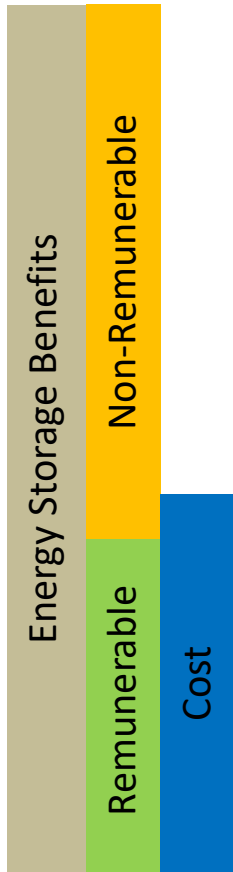
According to ISO-NE “State of the Grid – 2016” more fast and flexible resources will be needed to balance intermittent resources’ variable output.

Storage can provide this flexibility.



With 75,000+ distributed solar projects and growing, storage can manage reverse power flow at substations

Study Findings



Opportunities:

Energy Storage has potential to provide benefits to the Massachusetts ratepayers, including:

- Reducing the price of electricity
- Lowering peak demand and deferring investment in new infrastructure
- Reducing the cost to integrate renewable generation
- Reducing greenhouse gas (GHG) emissions
- Increasing the grid's overall flexibility, reliability and resiliency
- Generating nearly \$600 million in new jobs

Barriers:

- Business models for storage in very early stages
- Energy storage systems need a way to be compensated for a greater portion of their cost benefit in order to achieve market viability

Study Recommendations

The Commonwealth can nurture the energy storage industry and grow the deployment of storage in Massachusetts through programs and initiatives

- Funding for Demonstration projects
- Establish and Clarify Regulatory Treatment of Utility Storage
- Grant and Rebate Programs
- Storage in State Portfolio Standards
- Paired with Clean Energy procurements
- ISO Market Rules
- Initiatives to Grow Companies

If adopted, the Study recommendations have the potential to yield:

- **600 MW of new energy storage by 2025**
- **\$800 million in cost savings to ratepayers**
- **350,000 metric tons reduction in GHG emissions over a 10 year time span**
- **Equal to taking over 73,000 cars off the road**

Status of ESI and State of Charge Study

Recommendations		Status
Grants and Rebates	ESI Funding for Storage Demonstrations - \$10 million	✓
	Increase demonstration funding from \$10m to \$20m	✓
	Resiliency Grants	✓
	Solar Plus Storage Feasibility Studies	✓
	Peak Demand Reduction Grants	✓
	Storage in Green Communities and Leading by Example grants	✓
	MOR-Storage rebates	TBD
RPS/ APS	Include Storage in the new SMART Solar Program	✓
	Add Storage (beyond Flywheels) to the Alternative Portfolio Standard	✓
Regulatory Treatment	Energy Efficiency Programs for Peak Demand Savings	✓
	Clarify regulatory treatment of Utility ownership of energy storage (rate case, solar ownership, grid mod)	✓
	Energy Storage in Renewable Procurements <ul style="list-style-type: none"> Clean Energy Procurement (~1,200 MW) Off-shore Wind Procurement (1,600 MW) 	✓

Clean Energy Legislation

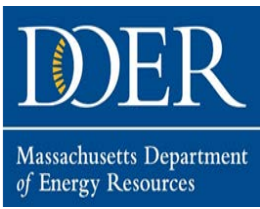
Storage

The bipartisan energy diversification legislation signed by Governor Baker in 2016 also included several developments on energy storage:

- Provides a definition for energy storage;
- Clarifies utility ownership of storage;
- Allows storage to be paired with clean energy procurements;
 - 1,200 MW hydropower, 1,600 MW offshore wind
- Authorizes DOER to set an energy storage target.

On June 30, 2017, DOER adopted a **200 Megawatt-Hour** energy storage target for the three electric distribution companies.

- Achievement by January 1, 2020
- Annual reporting by electric companies on achievement
- In line with 600MW State of Charge goal by 2025
- Up to additional \$10 million in demonstration funding
- Committed to adding storage to the Alternative Portfolio Standard



Energy Storage Initiative

Advancing Commonwealth Energy Storage

\$10M Advancing Commonwealth Energy Storage (ACES) Grant

Objectives include:

- Demonstration of broadly replicable use cases and business models for energy storage in Massachusetts
- Quantification of non-monetizable benefits provided to all ratepayers through the deployment and operation of energy storage in various use cases
- Inform state policy and stakeholders on best practices for energy storage development in MA

Schedule

- Anticipate awards in November and operational within 18 months

Storage in Energy Efficiency

Energy Efficiency Programs

- Peak Demand Reduction was one of 3 key priorities negotiated by DOER in the 2016—2018 Three Year Plan
- All four electric utility partners have submitted proposals to the DPU to pilot peak demand reduction offerings
- Goal to include at scale demand reduction programs as part of next three year plan 2019 – 2021

Peak Demand Reduction Grant

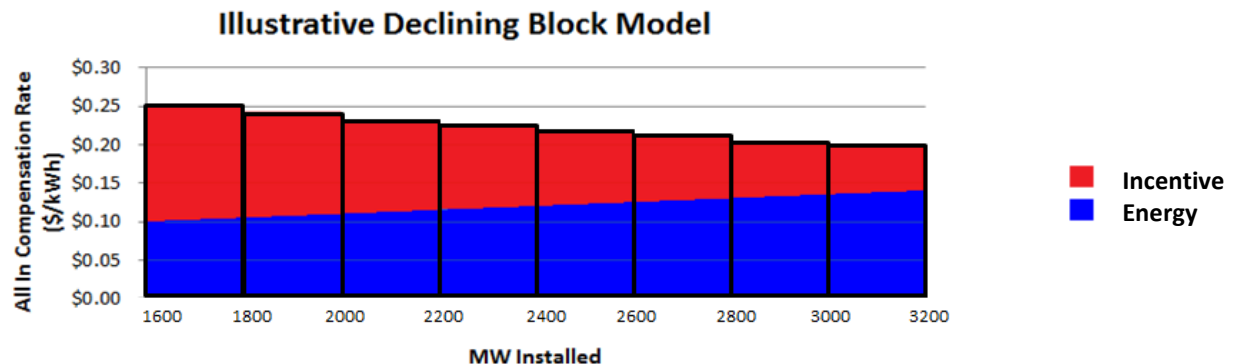
- In June, DOER awarded \$4.6 million to 9 projects

SMART – Solar Massachusetts Renewable Target

Governor Baker signed legislation in 2016 directing DOER to develop a new incentive program that creates a stable and equitable solar market at a reasonable cost to ratepayers.

4 Major Objectives of New Program

1. Cost Reductions for Ratepayers
2. Protect Land Conservation as Solar Deployment Grows
3. Develop an Additional Option for Solar Development when Net Metering Caps are Hit
4. Provide an Orderly Transition with Minimal Market Disruption

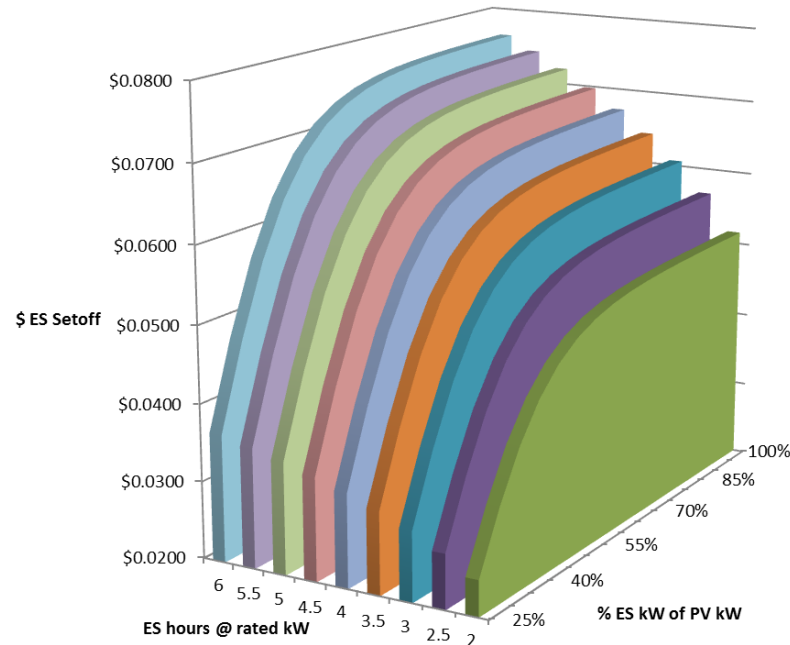


Energy Storage Adder Formula

$$\text{Energy Storage Adder} = \left[\frac{\left(\frac{ESkW}{PVkW} \right)}{\left(\left(\frac{ESkW}{PVkW} \right) + \exp \left(0.7 - \left(8 * \left(\frac{ESkW}{PVkW} \right) \right) \right) \right)} \right] * \left[0.8 + \left(0.5 * \ln \left(\frac{ESkWh}{ESkW} \right) \right) \right] * \text{Base Adder}$$

Where ESkW represents the nominal rated power of the energy storage system and ESkWh represents the nominal rated useful energy of the energy storage system

Formula Outputs



Community Clean Energy Resiliency Initiative

\$40 Million Initiative

- > 7MW / 13 MWh energy storage supported
- **Round 1 (\$7.4M)**
 - 27 Technical Assistance awards to assess energy resiliency for municipalities
 - 6 Implementation awards
- **Round 2 (\$19.4M)**
 - 13 Implementation projects for municipal energy resiliency.
 - Projects include energy storage paired with solar
- **Round 3 (\$14M)**
 - 3 programs:
 - Resiliency Feasibility Studies for 12 State Medical Facilities
 - Resiliency Demonstration Projects at public and private hospitals
 - \$11.5 million Program Opportunity Notice Posted on 12/5/2016
 - Resiliency Tool development for community planners and administrators



Sterling, MA
2 MW / 3.9MWh Energy Storage

Electric Vehicles

Massachusetts has a goal of 300,000 ZEVs by 2025

Massachusetts Offers Rebates – Electric Vehicles (MOR-EV)

- Rebates up to \$2,500
- Over \$11 million in rebates for over 5,500 electric vehicles to date
- In 2016, the Baker-Polito Administration invested \$14 million into the MOR-EV program - more than doubling it's historic funding

Plug In America Pilot

- Partnership with New England states to host public and employer sponsored EV test drive events
- Will arrange EV test drives at offices



THANK YOU