

# Energy Storage in Massachusetts

MA DOER Director of Emerging Technology  
Will Lauwers

# What is Energy Storage

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- Energy Storage is the ability to absorb energy, store it for a period of time, and thereafter dispatch for consumption
- Energy storage provides the ability to move energy through time
  - Separation of time of generation from time of consumption
  - The ability to separate generation from consumption enables new strategies to optimize the efficiency and cost effectiveness of the entire energy system
- Examples of types of energy storage
  - Electrical
  - Chemical / Fuel
  - Thermal

# 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



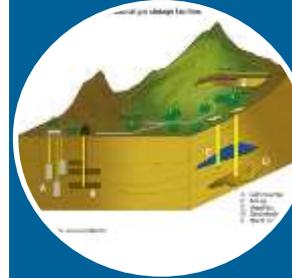
## GASOLINE

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

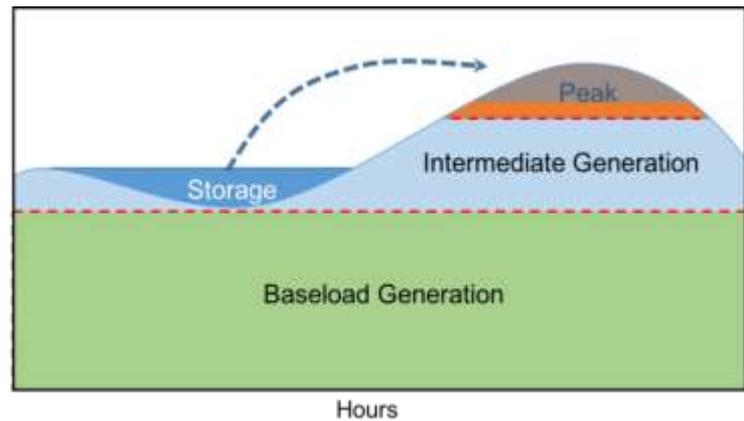
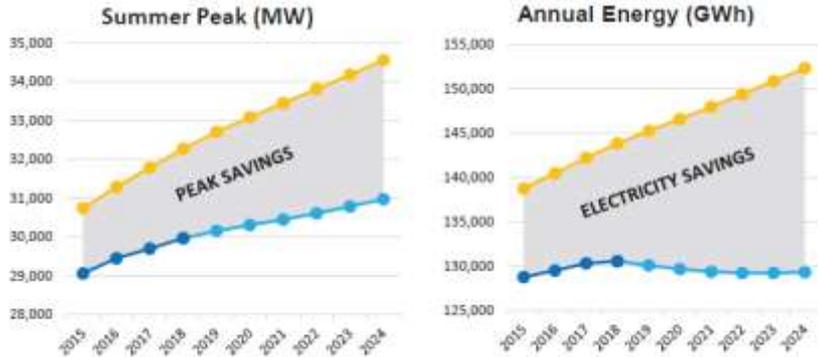
Currently less than 1% of daily electricity consumption for MA

Storage capacity more than 10% of daily consumption

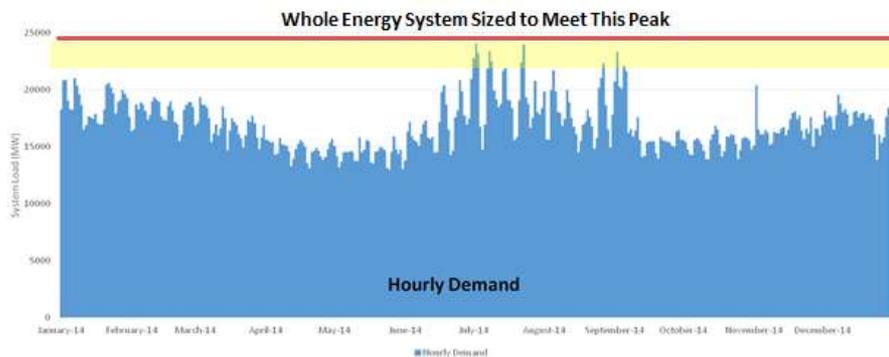
The electricity market has a fast “speed of light” supply chain and the least amount of storage. This lack of storage creates a need for additional infrastructure to maintain market reliability.

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

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



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



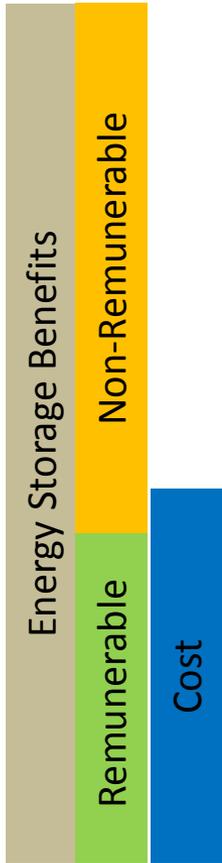
Energy storage is the only technology that can use energy generated during low cost off-peak periods to serve load during expensive peak.

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

# Model Results: Significant Benefits and Cost Savings from Optimized Storage

Benefit Categories	Benefit Description	
<b>Energy Cost Reduction</b>	Energy storage replaces the use of inefficient generators at peak times causing: 1) reduced peak prices which 2) reduces the overall average energy price. This also benefits the natural gas supply infrastructure.	<b>\$275M</b>
<b>Reduced Peak</b>	Energy storage can provide peaking capacity to 1) defer the capital costs peaker plants and 2) reduced cost in the the capacity market	<b>\$1093M</b>
<b>Ancillary Services Cost Reduction</b>	Energy storage would reduce the overall costs of ancillary services required by the grid system through: 1) frequency regulation, 2) spinning reserve, and 3) voltage stabilization	<b>\$200M</b>
<b>Wholesale Market Cost Reduction</b>	Energy storage can be a flexible and rapid tool that help generators operate more efficiently through: 1) less wear and tear, 2) less start up and shut down costs, and 3) reduced GHG emissions.	<b>\$197M</b>
<b>T&amp;D Cost Reduction</b>	Energy storage 1) reduces the losses and maintenance of system, 2) provides reactive power support, 3) increases resilience, and 4) defers investment	<b>\$305M</b>
<b>Increased Renewable Integration</b>	Energy storage reduces cost in integrating renewable energy by 1) addressing reverse power flow and 2) avoiding feeder upgrades	<b>\$219M</b>
<b>Total System Benefits</b>		<b>\$2,288M</b>

# State of Charge 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

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

- **600 MW of new energy storage by December 31, 2025**

# 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"> <li>• Clean Energy Procurement (~1,200 MW)</li> <li>• Off-shore Wind Procurement (1,600 MW)</li> </ul>	✓

**Governor Baker signed bi-partisan, comprehensive energy diversification legislation on August 8, 2016.**

### **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.
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SECTION 15. (a) On or before December 31, 2016, the department of energy resources shall determine whether to set appropriate targets for electric companies to procure viable and cost-effective energy storage systems to be achieved by January 1, 2020. As part of this decision, the department may consider a variety of policies to encourage the cost-effective deployment of energy storage systems, *including the refinement of existing procurement methods to properly value energy storage systems, the use of alternative compliance payments to develop pilot programs* and the use of energy efficiency funds under section 19 of chapter 25 of the General Laws if the department determines that the energy storage system installed at a customer's premises provides sustainable peak load reductions on either the electric or gas distribution systems and is otherwise consistent with section 11G of chapter 25A of the General Laws.

(b) The department shall adopt the procurement targets, if determined to be appropriate under subsection (a), by July 1, 2017. The department shall reevaluate the procurement targets not less than once every 3 years.

(c) Not later than January 1, 2020, each electric company entity shall submit a report to the department of energy resources demonstrating that it has complied with the energy storage system procurement targets and policies adopted by the department pursuant to this section.

# 200MWh Target

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## DOER solicited Stakeholder Comments

- DOER received unanimous support to adopt a target
- DOER received more varied responses on the format and size of 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

# Next Steps

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Achieve the 200 Megawatt-Hour energy storage target Achievement by January 1, 2020

- Annual reporting by electric companies on achievement progress
- In addition to the target adoption, DOER announced:
  - Up to \$10 million in additional funding for demonstration projects
  - Examining including additional energy storage technologies in the Alternative Portfolio Standard (APS)

Continue progress on comprehensive suite of energy storage policies and programs

- Launch the SMART program which includes an incentive for energy storage paired with new solar installations
- Review Clean Energy and Off-shore Wind procurement bids
- Continue with Community Clean Energy Resilience Initiative demonstrations, which include pairing energy storage with solar and CHP
- Supported the energy efficiency plans which include energy storage

# MA Energy Storage Policy Review

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- Energy Storage Initiative
  - State of Charge Study published September, 2016
  - \$10M for broadly replicable demonstrations
  - Additional \$10M programmed for storage demonstrations
- Utility Energy Storage Target
  - 200 MWh by 1/1/2020
- Energy Storage Can Be Paired in Clean Procurements
  - 1,600 MW offshore wind procurement, bids may be paired with ES
  - 9,450,000 MWh clean energy procurement, bids may be paired with ES
- Energy Storage in Other Programs
  - SMART Program includes adder for ES paired with Solar
  - Review potential of ES in the Alternative Portfolio Standard
  - Energy Efficiency Peak Demand Reduction Grant
  - Community Clean Energy Resiliency Program

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**THANK YOU**