



*NASEO Fuels and Grid Integration Committee
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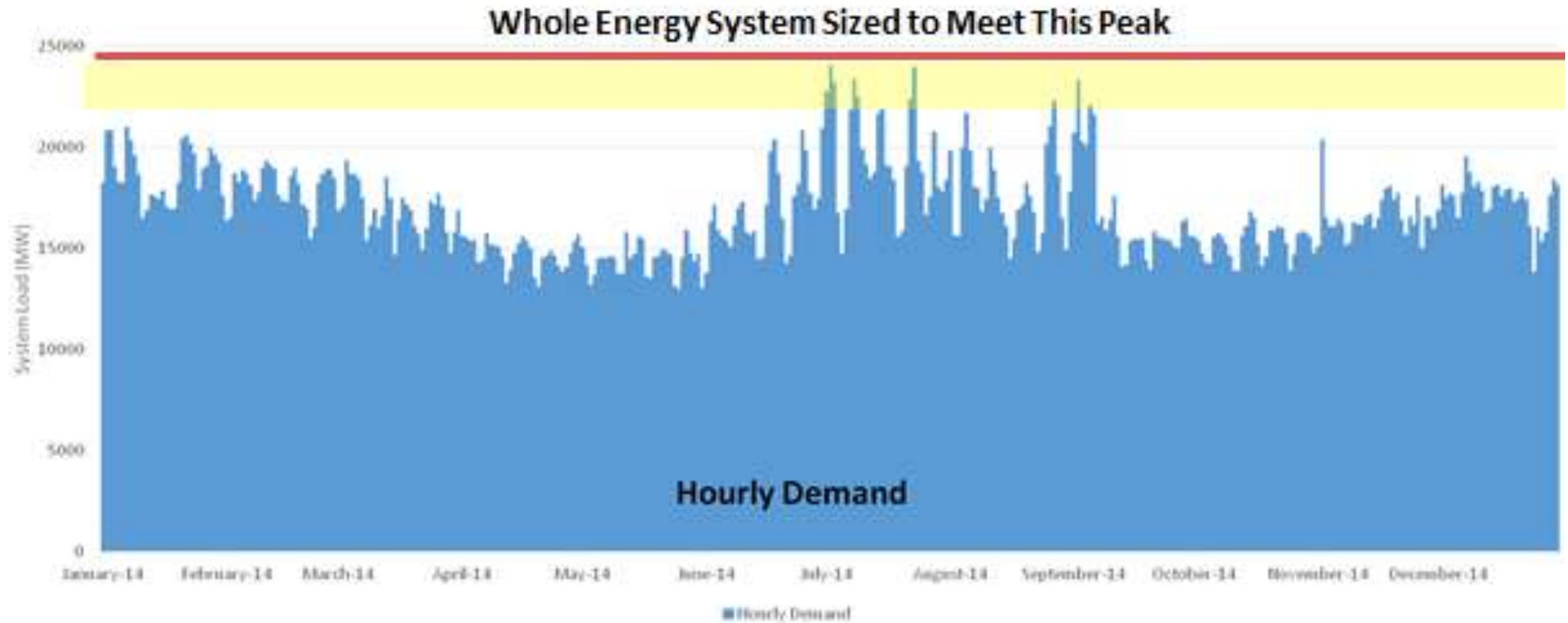
- Storage is a game changer that can play a part in solving our energy challenges
- \$10 million Energy Storage Initiative includes a study as well as funding for demonstration projects
- Robust stakeholder engagement

“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 Release

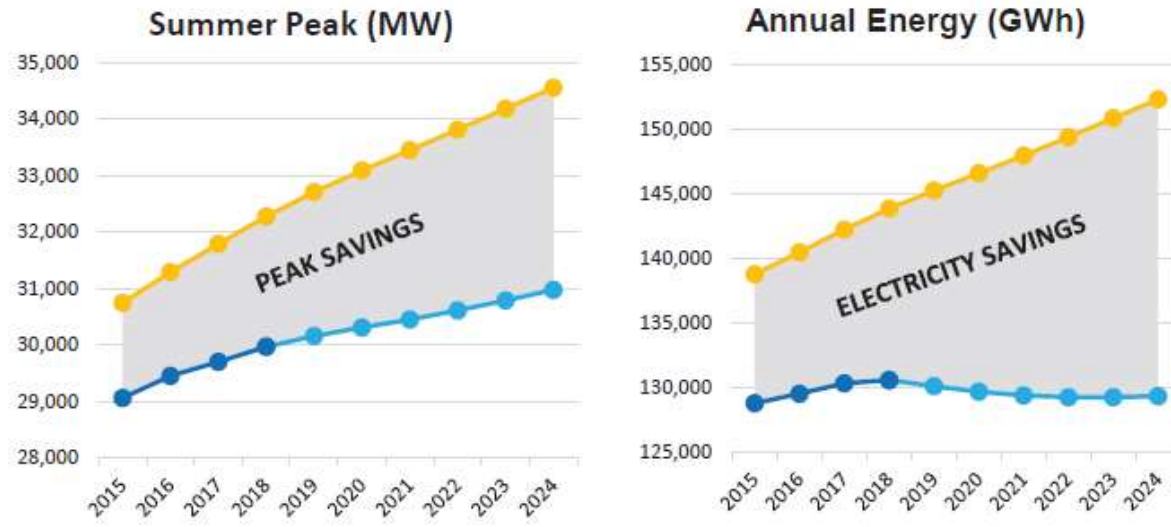
“Given the recent advances in energy storage technology and cost-effectiveness, it is hard to imagine a modern electric distribution system that does not include energy storage.” Utility stakeholder perspective

Electric Grid is Sized for Highest Hour of Demand



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

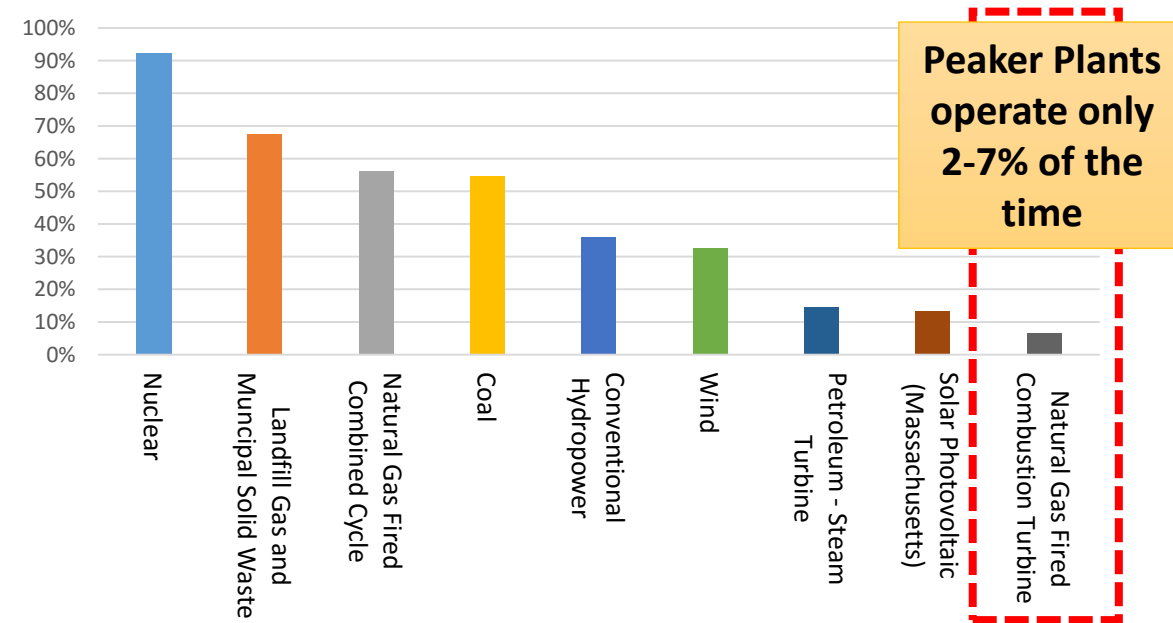
While Energy Efficiency has Decreased Average Energy Consumption, Peak Continues to Grow (1.5% per year)



Source: ISO-NE State of the Grid- 2016

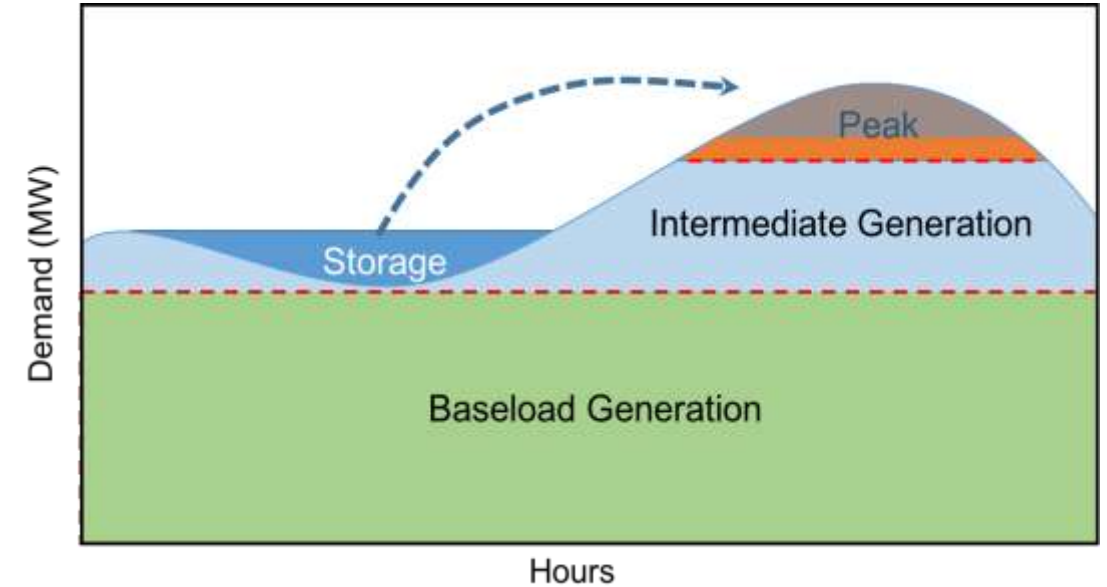
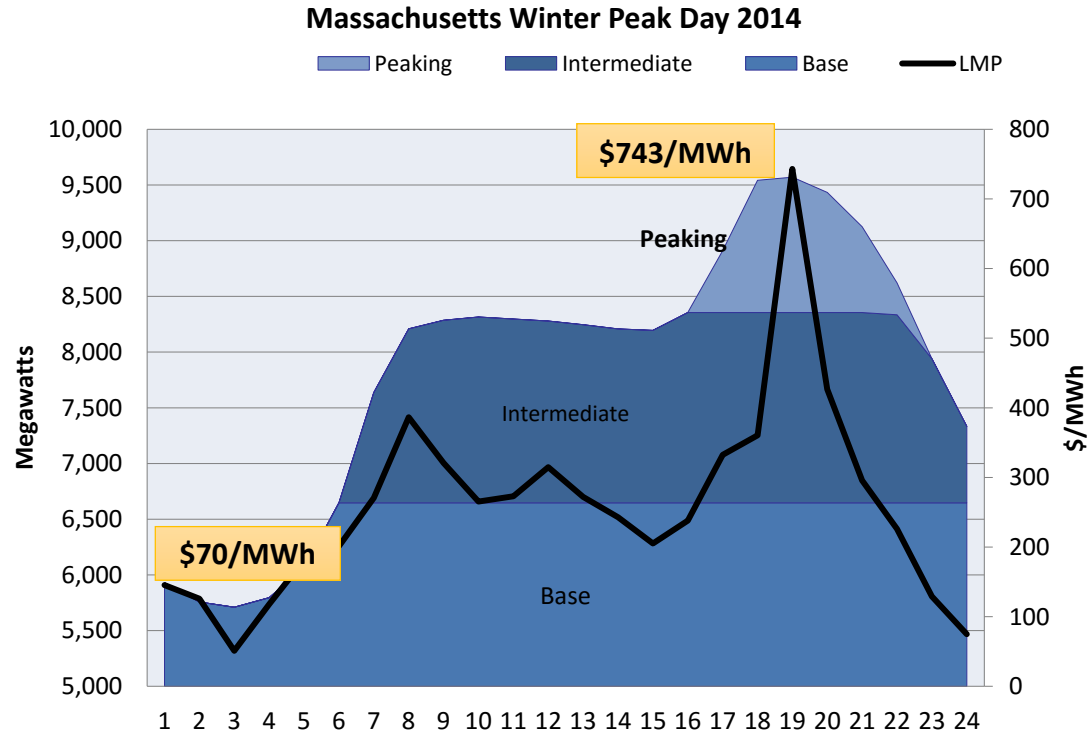
● The gross forecast of peak demand and energy use
● The forecast minus the impact of EE participating in the Forward Capacity Market (FCM) to date
● The forecast minus anticipated EE growth beyond FCM years

Capacity Factors of Generating Resources
National Monthly Average, January 2013 – January 2016 (EIA)



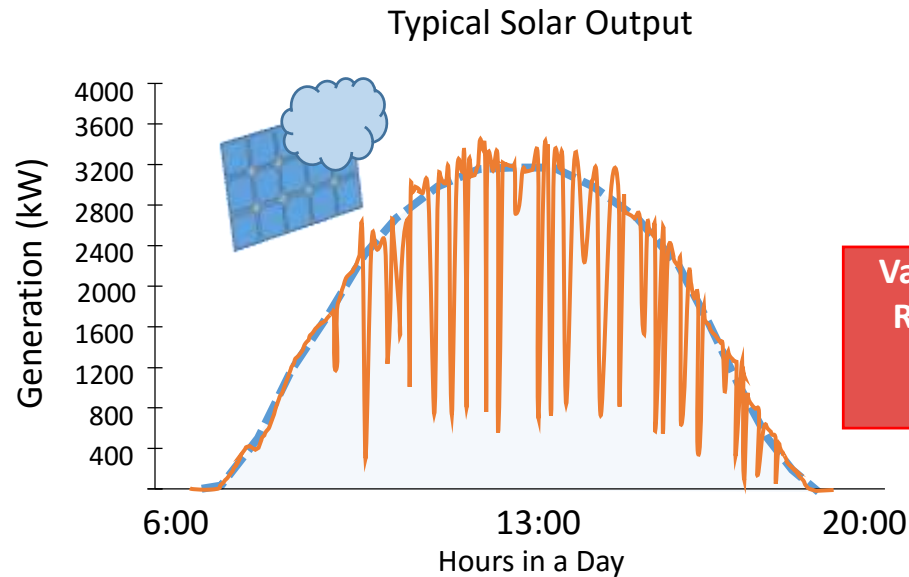
Growing peak results in inefficient use of grid assets, including generation, transmission and distribution, increasing the cost to ratepayers

Storage is “Game Changer” for Meeting Peak



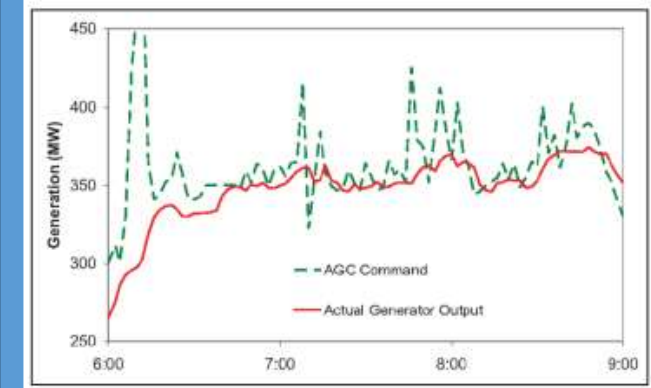
Energy storage is the only technology that can use energy generated during low cost off-peak periods to serve load during expensive peak.

Increased Renewables Requires Grid Flexibility to Manage Intermittency

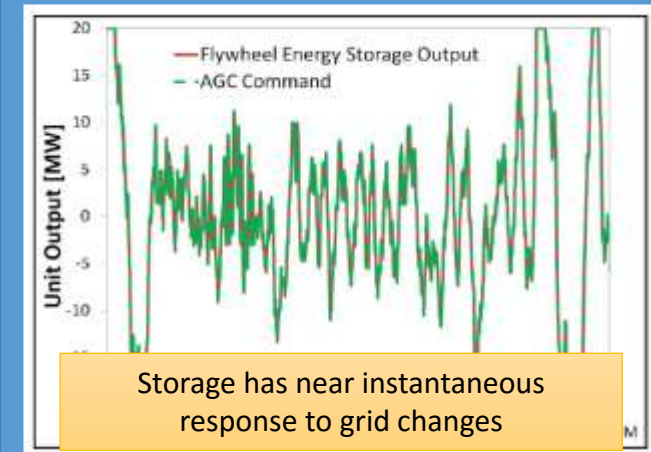


Renewable resources, such as solar, can have variable generation

Variable Output Generators Requires Fast and Flexible Resources to Maintain Balance and Reliability



Slow-ramping Generator



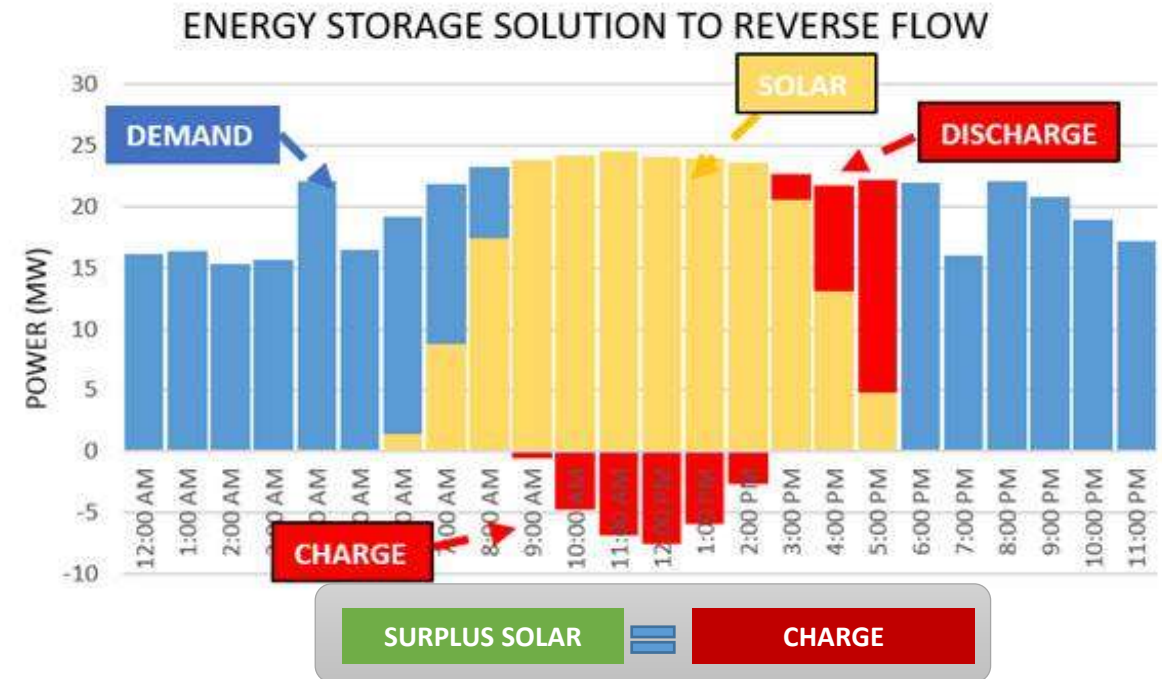
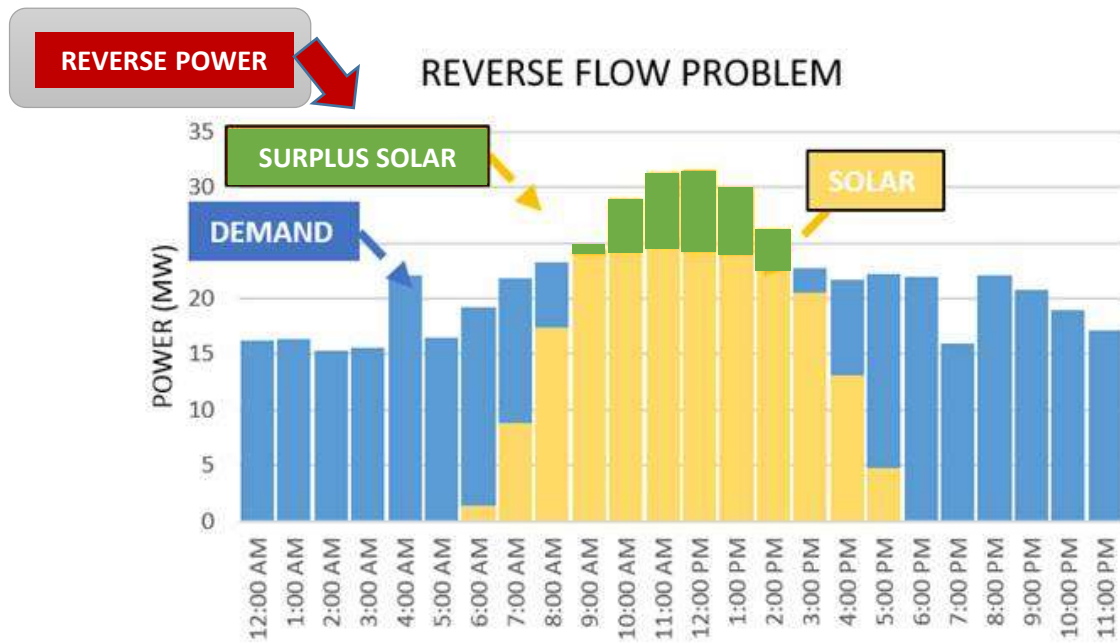
Storage has near instantaneous response to grid changes

Fast-responding Energy Storage

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

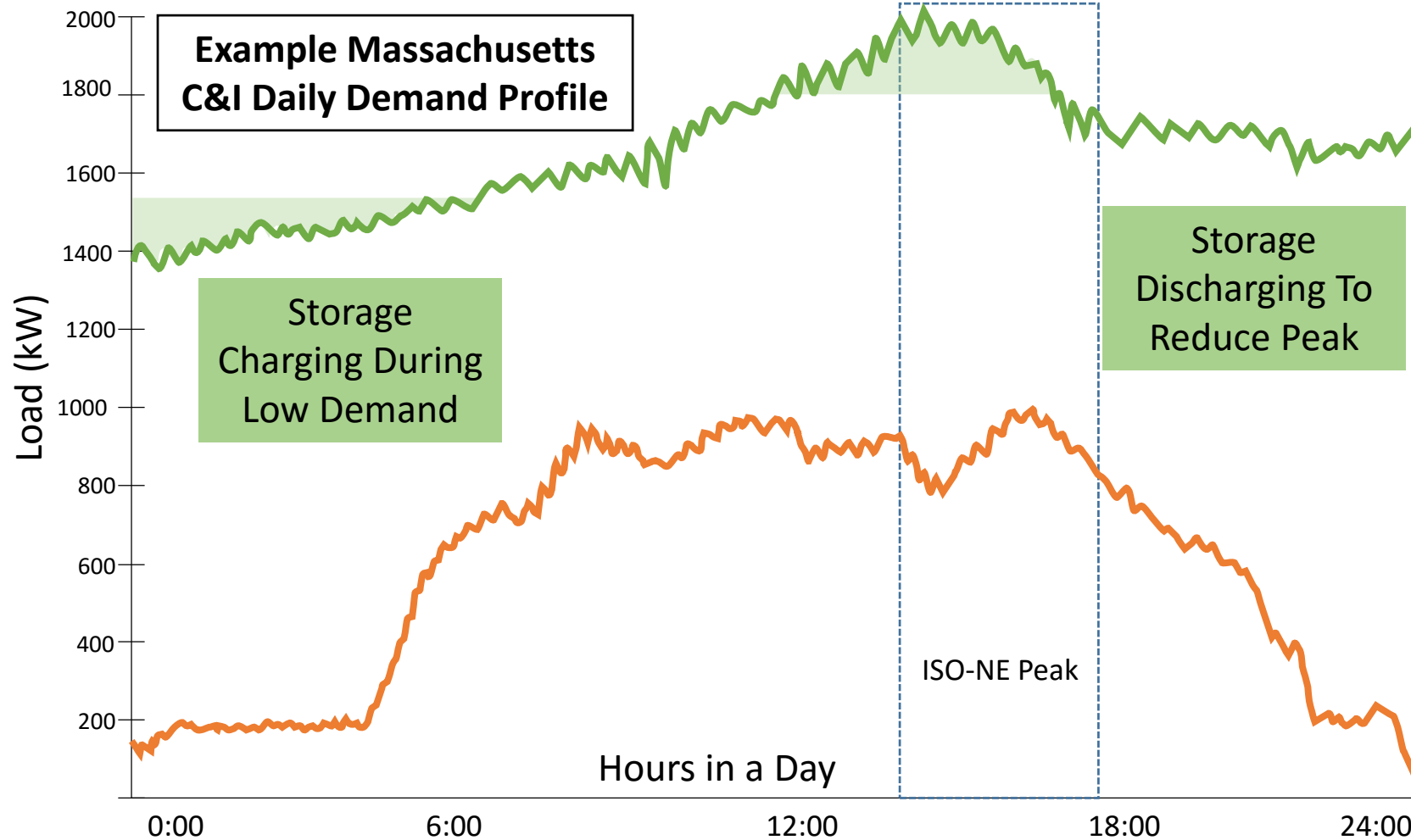
Amount of Distributed Generation has Skyrocketed

- There are over 40,000 distributed solar projects in Massachusetts
- Distributed generation is growing at rate of 400 installed projects per week



As distributed generation increases, utilities are challenged to manage reverse power flow at substations. Distributed storage can manage and optimize power flows.

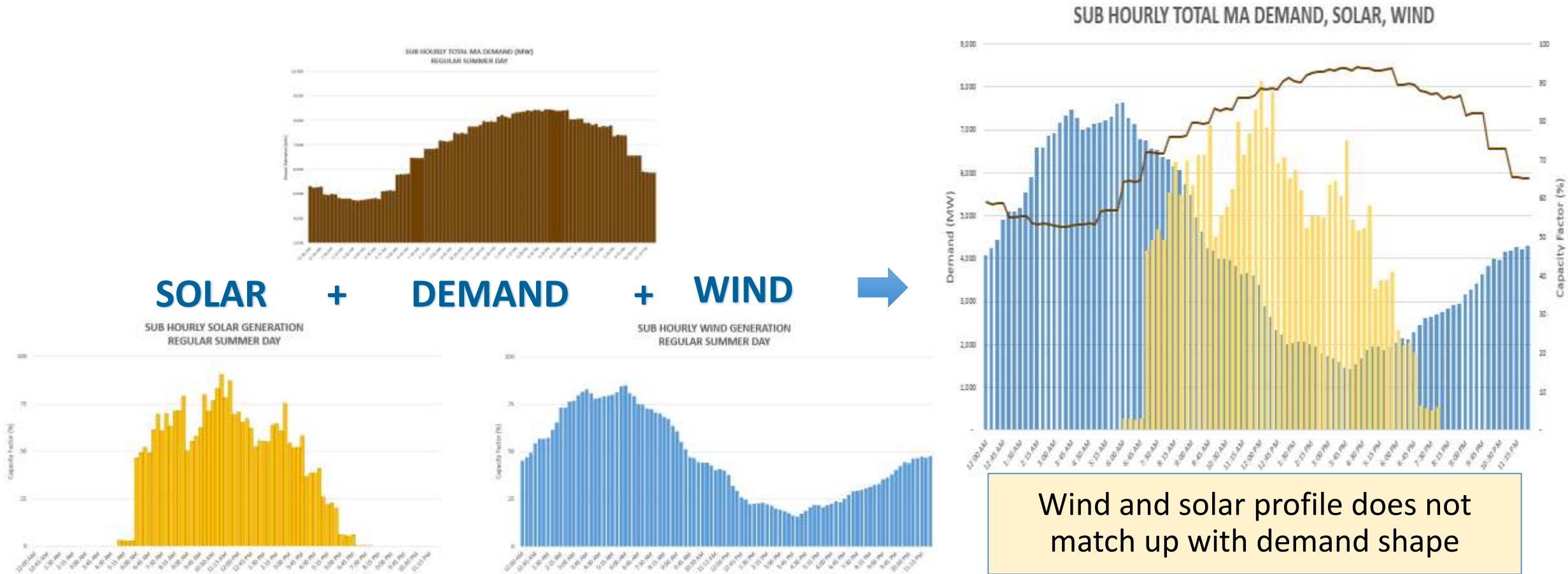
High Electricity Costs Impact Massachusetts Businesses



- Massachusetts has one of the highest electricity rates in the nation
- Commercial electricity customers pay utility demand charges based on customer's peak hour

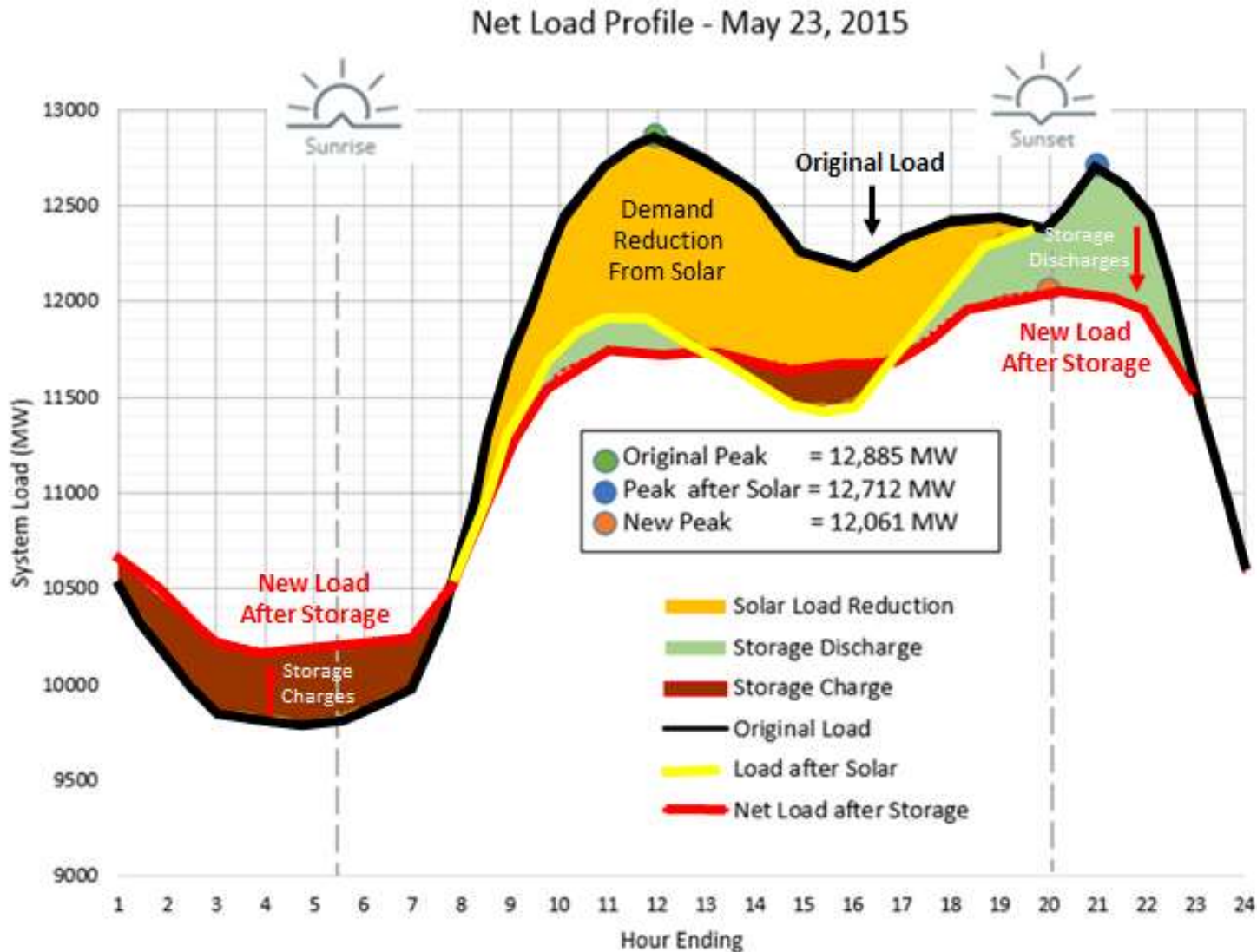
Massachusetts businesses, especially those with high electricity use, could use storage to better manage their peak and reduce electricity costs

Energy Storage Helps Renewable Integration



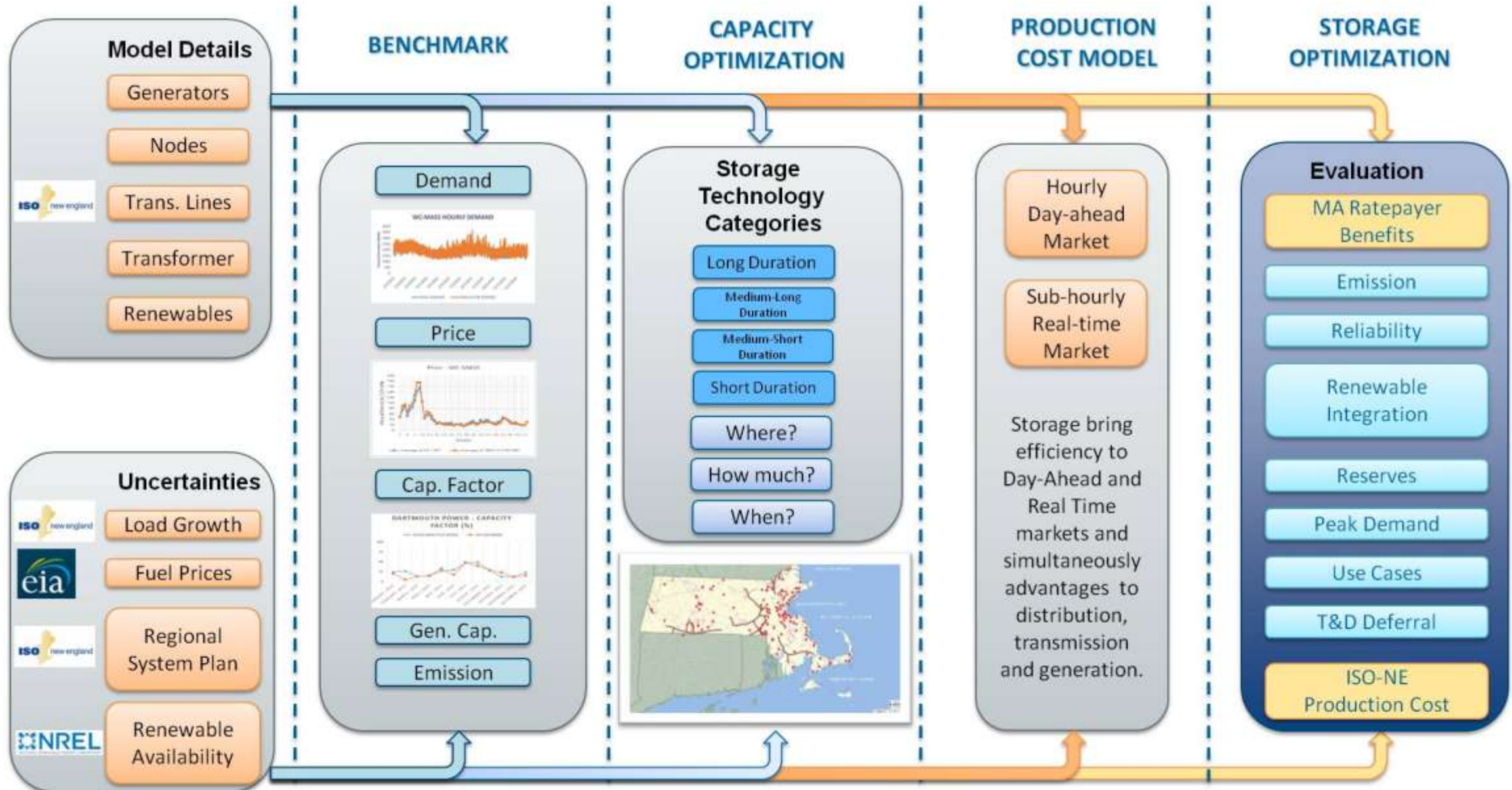
Energy storage can charge at low demand with cheap renewable energy and discharge at high demand period when energy cost is high.

Time Shift Of Renewables And Peak Reduction

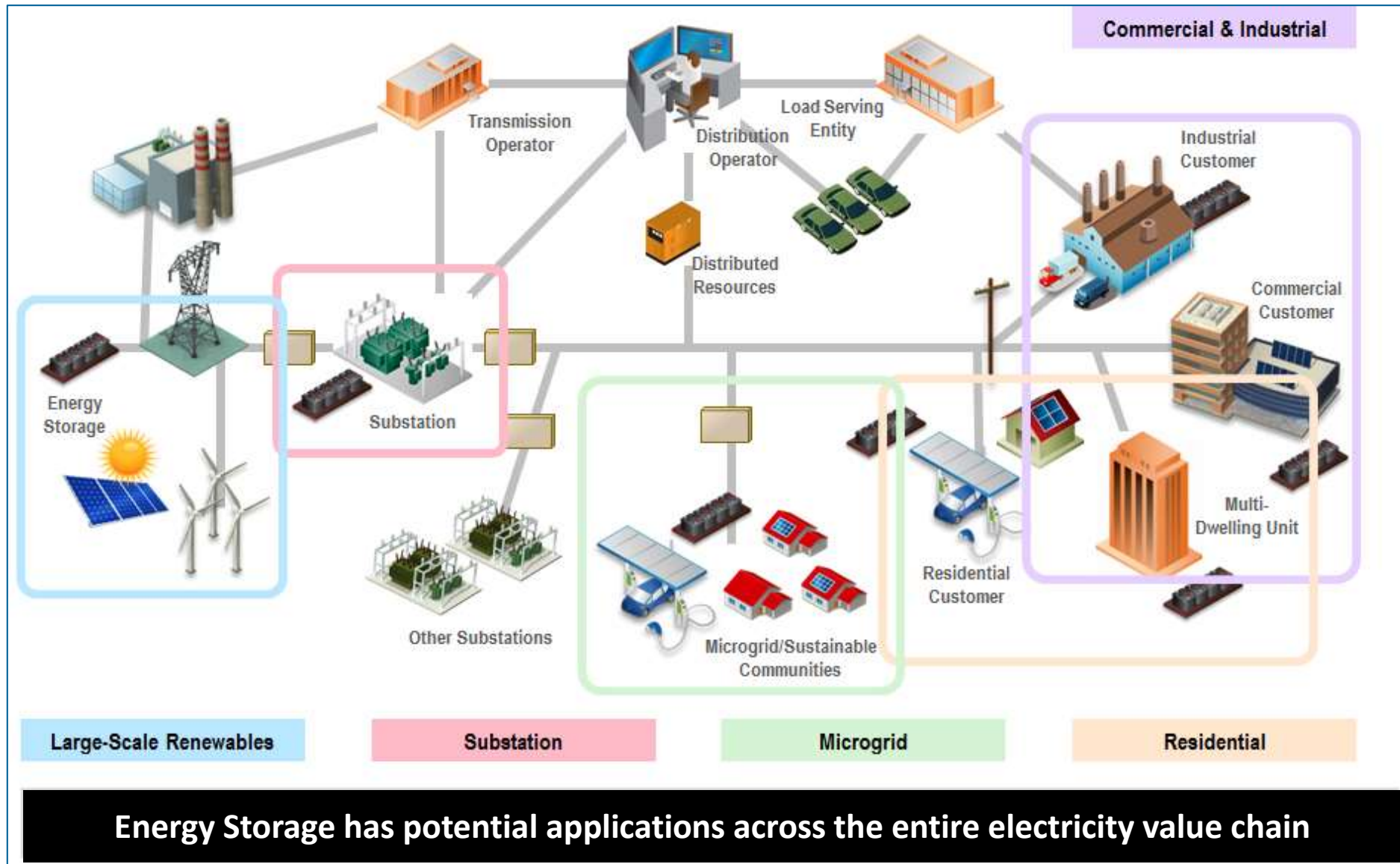


- Solar reduces system peak and storage can provide additional peak reduction after sunset
- Time shift of renewables
- Relieving distribution constraints
- Helps increase solar penetration and effectively utilize current solar resources.

Advanced Storage Optimization Model



Storage Use Cases



Energy Storage has potential applications across the entire electricity value chain

Next Steps

- Storage Study is in its final stages – expect release in the coming weeks
- Following the release of the study, DOER and MassCEC will issue an RFP for demonstration projects