MASSACHUSETTS CLEAN ENERGY CENTER

DOER
Massachusetts Department of Energy Resources

Massachusetts Energy Storage Initiative

Stakeholder Update Webinar
December 15, 2015

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EPRI ELECTRIC POWER RESEARCH INSTITUTE

Sustainable Energy Advantage, LLC

DAYMARK ENERGY ADVISORS

Today's Agenda

- Opening Remarks
  - Commissioner Judith Judson, DOER
  - Kavita Ravi, MassCEC
- Introduction – Study Overview
- Stakeholder Engagement Update
- ES Study Tasks – Status Update
- Next Steps

Presenters:

- Mark Tinkler, Customized Energy Solutions
- Michael Berlinski, Customized Energy Solutions
- Giovanni Damato, EPRI
- Cedric Christensen, Strategen
- Ed Toppi, Customized Energy Solutions

Energy Storage Study Overview

- Co-sponsored by the Department of Energy Resources (DOER) and the Massachusetts Clean Energy Center (MassCEC)
- Contributes to the goals of the Massachusetts Energy Storage Initiative (ESI), to advance the energy storage segment of the State's clean energy industry
- Two-part study to:
  - analyze the storage industry landscape
  - review economic development and market opportunities for energy storage
  - examine potential policies and programs that could be implemented to better support energy storage deployment in Massachusetts
  - provide policy and regulatory recommendations along with cost-benefit analysis for state policy makers

Study Part 1

- Addresses:
  - Industry landscape (technologies, economics, companies)
  - Economic development opportunities
  - Applications and market opportunities in MA
  - Current industry focused programs
  - Demonstration opportunities for storage
  - Economic modeling
- Result:
  - Pathways to create a larger storage industry in Massachusetts
- Delivery:
  - End of January 2016

Study Part 2

- Addresses:
  - **How storage can be used to address Massachusetts energy challenges, i.e. the benefits of storage for solving state and regional issues**, such as:
    - Storage to mitigate large-scale generator retirements
    - Benefits of pairing storage with large-scale renewables
    - Storage in Grid Modernization
    - Benefits of storage paired with behind-the-meter solar
    - Role of storage in reducing peak demand
  - **How much storage is needed?**
    - Modeling to identify how much storage would need to be deployed
  - **Policy roadmap to achieve the target amount of storage**
    - Recommend possible policy, market and regulatory tools to promote energy storage, based on potential applications and cost benefit analysis

Study Part 2 (cont'd)

- Results:
  - Identify a **target for the amount of megawatts of storage** that would be **cost-effective** for Massachusetts ratepayers, and lay out a policy **roadmap** to achieve that target
  - Program design recommendations for the DOER's $10 million energy storage demonstration fund.

- Delivery:
  - March 2016

Stakeholder Engagement

- Strongly informed by Stakeholder feedback
- October 30th Stakeholder Workshop with breakout sessions:
  - Wholesale Markets/Transmission
  - Utility Applications – Distribution
  - Behind-the-Meter/DER
  - Energy Storage Technology Developers
- Questionnaires, One-on-one interviews
- Webinars
- Two-Way Communications

Stakeholder Engagement Update

- Wholesale Market Perspective
- Utility Perspective
- Behind-the-Meter / DER Perspective
- Competitive Supplier Perspective
- Technology Developer Perspective

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Wholesale Market Perspective

Wholesale Market Perspective – Activities

- Participants include:
  - ISO-NE
  - Utilities
  - IPPs / developers
  - Equipment/service suppliers
  - End users / aggregators
  - NGOs
- Process:
  - Oct 30 Workshop break-out session
  - Post-Workshop Surveys:
    - Wholesale and DER leads sent surveys to Oct 30 Workshop breakout session participants and other parties
    - Reviewing responses received so far
  - One-on-one interviews
- Observations so far:
  - Market opportunities exist, but limited by barriers

Wholesale Market Perspective – Preliminary Observations

- Market Opportunities
  - Current ISO-NE market products: Capacity, Energy, Ancillary Services, Demand Response
  - Other ISO-related opportunities: Transmission Planning, Variable Renewable Generation Firming / Shifting
  - New ISO-NE market products: Frequency Response market not planned; Ramping product under consideration

- Key Barriers
  - Lack of clarity in ISO-NE market rules for energy storage
  - ISO market rules limit full participation / valuation
  - Prices not sufficient
  - Uncertainty of ISO and state rules with regard to storage as both generation and T&D asset

Market Products / Transmission Planning

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Utility Perspective

Utility Perspective – Activities

- Small group follow-up conference calls with utilities:
  - Utility stakeholder priorities for energy storage
  - Potential barriers & solutions
- Requests for written comments and utility-specific data
- Suggestions for analysis approach
- Examples of energy storage demonstration projects
- IOU participation:
  - Eversource
  - National Grid
  - Unitil
- Municipal Light Plant participation:
  - Holyoke Gas & Electric
  - Wellesley Municipal Light Plant
  - Sterling Energy
- Review of IOU's Grid Modernization Plans

Utility Perspective – Preliminary Observations

- Priority Opportunities for Storage:
  - Reliability & Resiliency
  - Capacity & Transmission Payment Reduction
  - Renewables Integration
  - Deferred T&D Upgrades

- Key Barriers to Storage Adaption in MA:
  - Understanding the sources of value for energy storage and the ability to clearly quantify and monetize that value
  - Tools and infrastructure for grid communication and control, as well as modelling which can support both planning and operations of energy storage systems
  - General acknowledgement of a lack of commercial operating experience for energy storage in the field to-date

Utility Perspective – Preliminary Observations
(Cont'd)

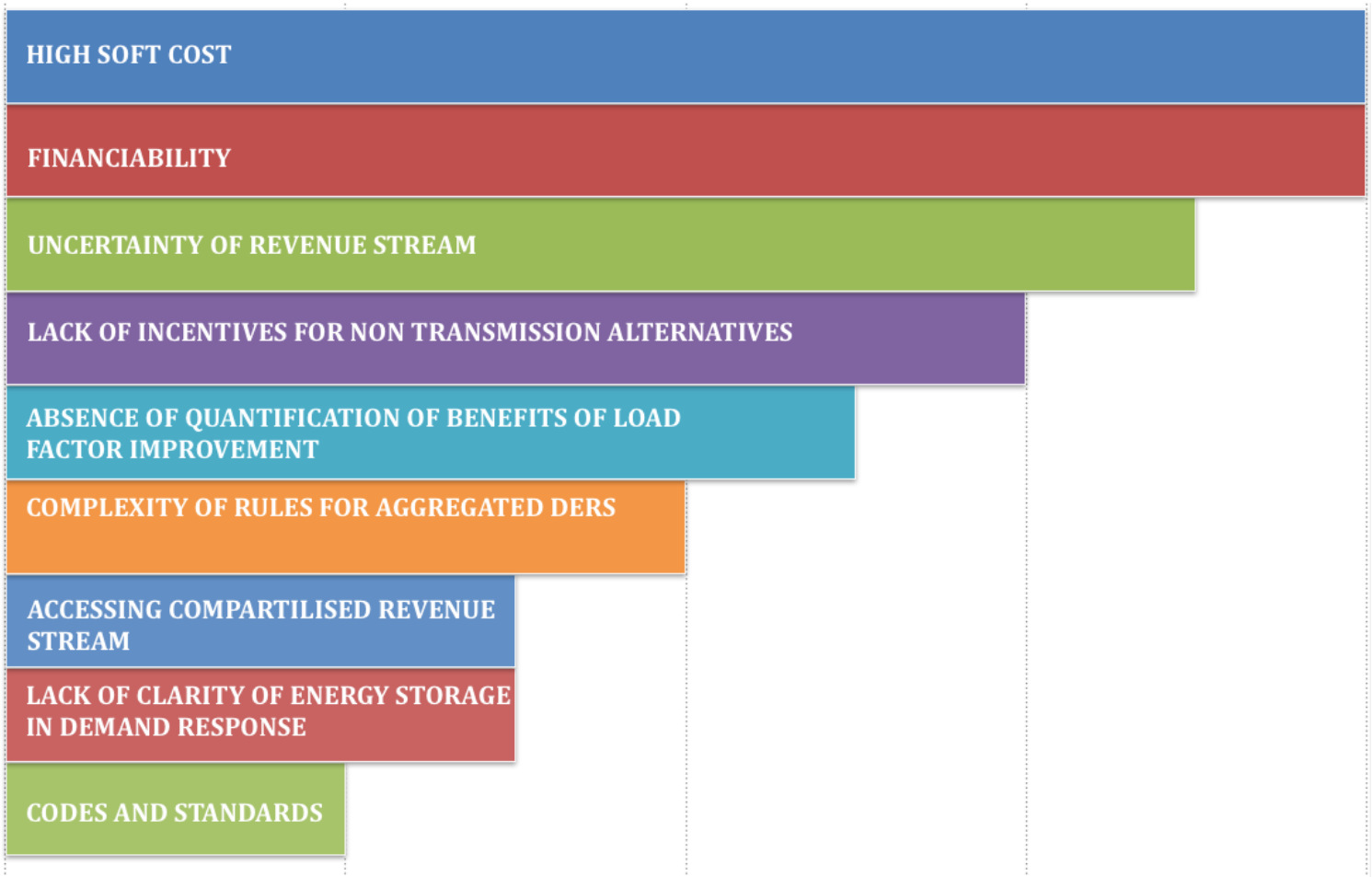
- Potential Barrier Mitigation:
  - Clarify the definition of energy storage and how to value it
  - Resolve regulatory and legislative ambiguity of storage as an asset class
  - Successful implementation of the Massachusetts Grid Modernization Plans
  - Clear determination that storage as well as other DERs will not be reconstituted as loads (critical issue for MUNI stakeholders)

Behind-the-Meter / DER Perspective

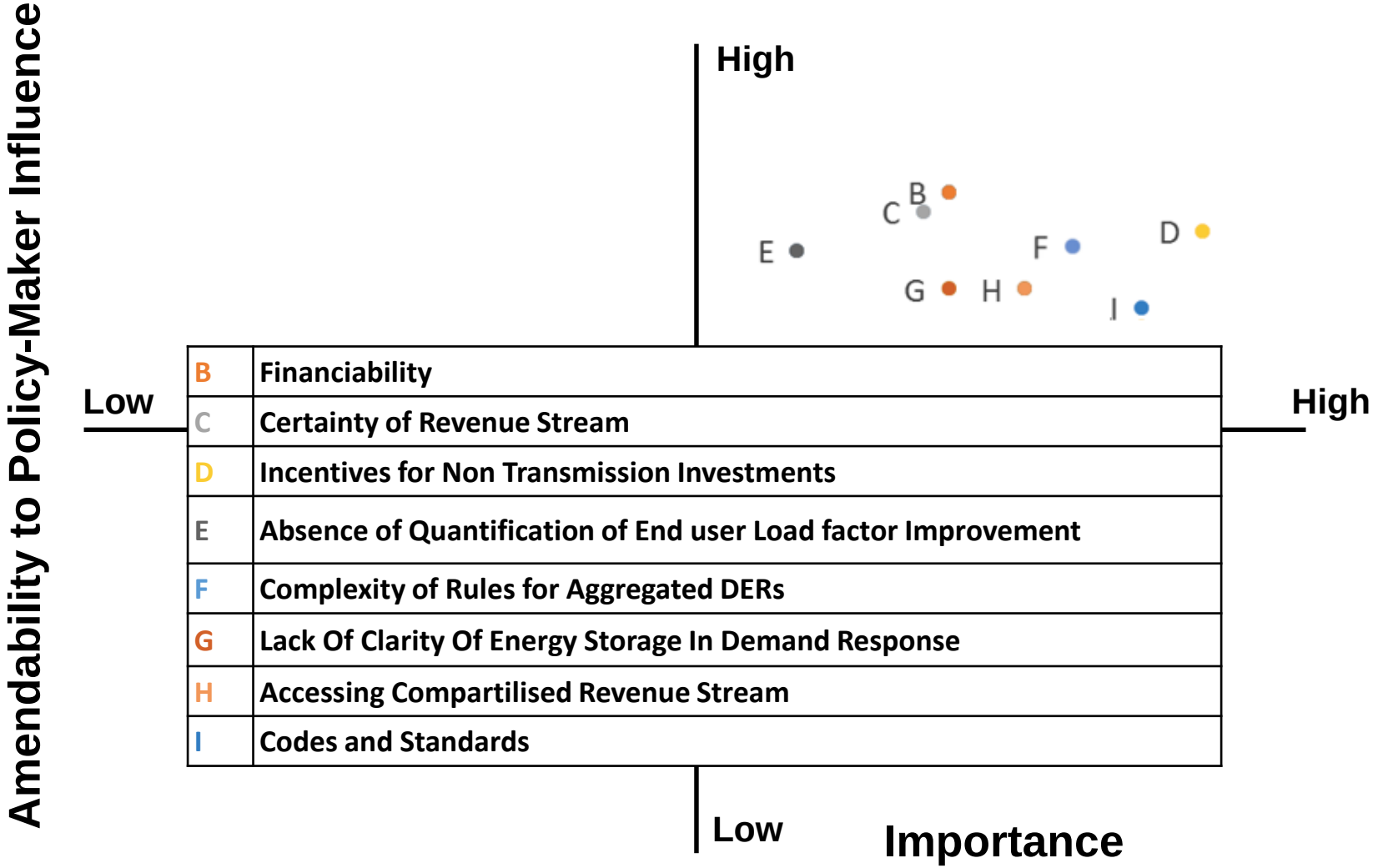
Behind-the-Meter / DER Perspective

- In-Person Workshop on 30th October, 2015
- Breakout Sessions were organized with the following goals:
  - Identify challenges/ system needs
  - Identify market opportunities through energy storage deployment
  - Barriers and challenges for energy storage participation
  - Solutions / mitigation strategies
- A follow up online survey was submitted to DER stakeholders to:
  - Rank barriers and challenges for energy storage
  - Gauge the influence of policy on identified barriers
  - Rank solutions and mitigation strategies
- 10 individual interviews were conducted to gather additional information on:
  - Project finance challenges
  - ISO-NE rules for DERs
  - Interconnection processes and challenges
  - Information gaps and desired regulatory focus

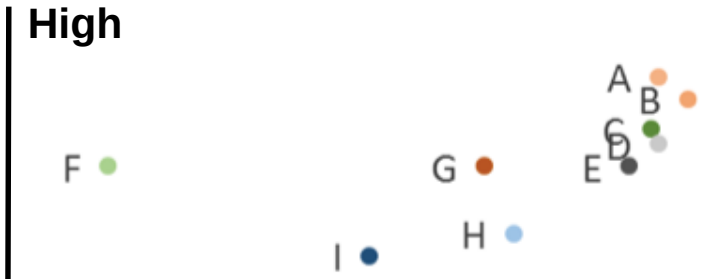
Ranking of Barriers and Challenges for Energy Storage



Barriers
(Preliminary Findings)



Potential Solutions
(Preliminary Findings)



A	Require EDCs to consider non-wires market based solutions to T&D needs
B	Coordinate ES initiatives with DPU's grid modernization
C	Offer an ES deployment incentive program
D	Give EDC's incentives to adopt storage as alternative to T&D solutions
E	Establish clear and understandable rules for interconnection
F	Alter ISO rules to allow aggregation/participation in wholesale markets
G	Enable ES partnerships with EDCs and 3rd-party providers
H	Create specific ES incentives designed for municipal utilities' needs
I	Establish codes, standards and/or regulations at the state/local level

Amendability to Policy-Maker Influence

Low

High

Low

Importance

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Competitive Supplier Perspective

Competitive Supplier Perspective – Activities

- Direct contact with workshop invitees
  - Email solicitation for feedback via web survey
  - Follow-up calls
- Discussion with stakeholders
  - Opportunities for storage in the competitive supply space
  - Barriers currently preventing adoption and deployment of energy storage
  - Measures which could mitigate or eliminate current barriers
- Competitive Supplier participation
  - Lower than ideal response rate
  - Responses have been varied
  - Responses still pending from some invitees

Competitive Supplier Perspective – Preliminary Observations

- Priority Opportunities for Storage:
  - Peak Demand Shaving / Management
    - Monthly demand charges
    - Capacity peak load contribution
  - Behind the meter renewable generation optimization
  - Reliability
  - Portfolio risk management
  - Demand response participation
- Key Barriers to Storage Adaption in MA:
  - Understanding the sources of value for energy storage and the ability to clearly quantify and monetize that value
  - Infrastructure for accessing and analyzing customer usage data
  - Lack of viable demand response programs
  - Limited access to customer bill, e.g., for financing value added programs and services

Competitive Supplier Perspective – Preliminary Observations
(Cont'd)

- Potential Barrier Mitigation:
  - Clarify the definition of energy storage and how to value it
  - Resolve regulatory and legislative ambiguity of storage as an asset class
  - Clear determination that storage will not be reconstituted as loads
  - Clarity regarding future of Net Energy Metering
  - Development of Demand Response programs (resolution of FERC Order 745 issue)
  - Metering technology/usage information accessibility upgrades, e.g., AMI mass deployment
  - Allowance for on-bill financing/value added products and services for third party on the customer utility bill

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Technology Developer Perspective

Technology Developer Perspective - Activities

- Breakout Session at October 30th Workshop
  - Emerging storage technology developers, system integrators, project developers
  - Seen by developers as a positive and promising opportunity
- Key challenges and barriers identified:
  - Hard to get the first demonstration
  - Locational and regulatory differences affecting storage valuation
  - Financing for technology and project development
- Follow-up online questionnaire sent to 80 storage technology developers and university researchers in MA
  - Awaiting responses to undertake analysis (December)
- Plan to interview companies in other jurisdictions

Tech Developer Perspective – Preliminary Observations

- Potential Barrier Mitigation:
  - Provide incentives to commercial or other partners willing to locate technology demonstrations
  - Encourage state/federal collaborations
  - Utilize government backstopping power to leverage private financing (loan guarantees)
  - Support proposed grid modernization plans and data collection
  - Locational value assessment for identifying market opportunities
  - Create a RPS equivalent for energy storage
  - Augment efficiency programs to support peak load reduction
  - Offer investment tax credits for storage
  - Augment InnovateMass funding (and/or create storage-specific funding program)

ES Study Tasks - Status Update

- Ongoing:
  - Foundational Database
  - ES Market Opportunities
- Next Steps

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Foundational Database

- Energy Storage (ES) Applications Overview
- ES Technologies: Scale, Costs, Outlook
- Database of ES Companies in MA
- Government Programs that Benefit Storage Today

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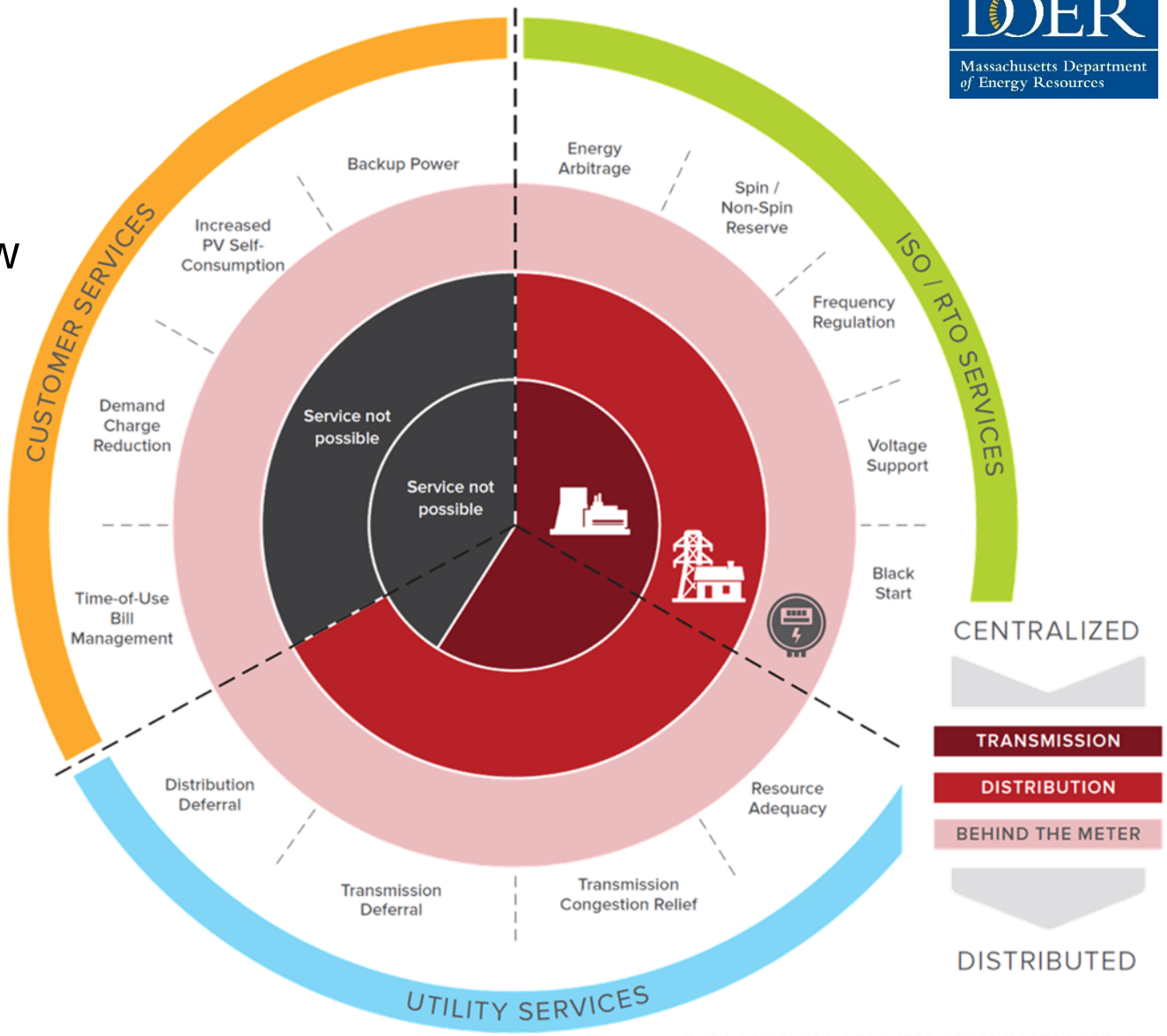
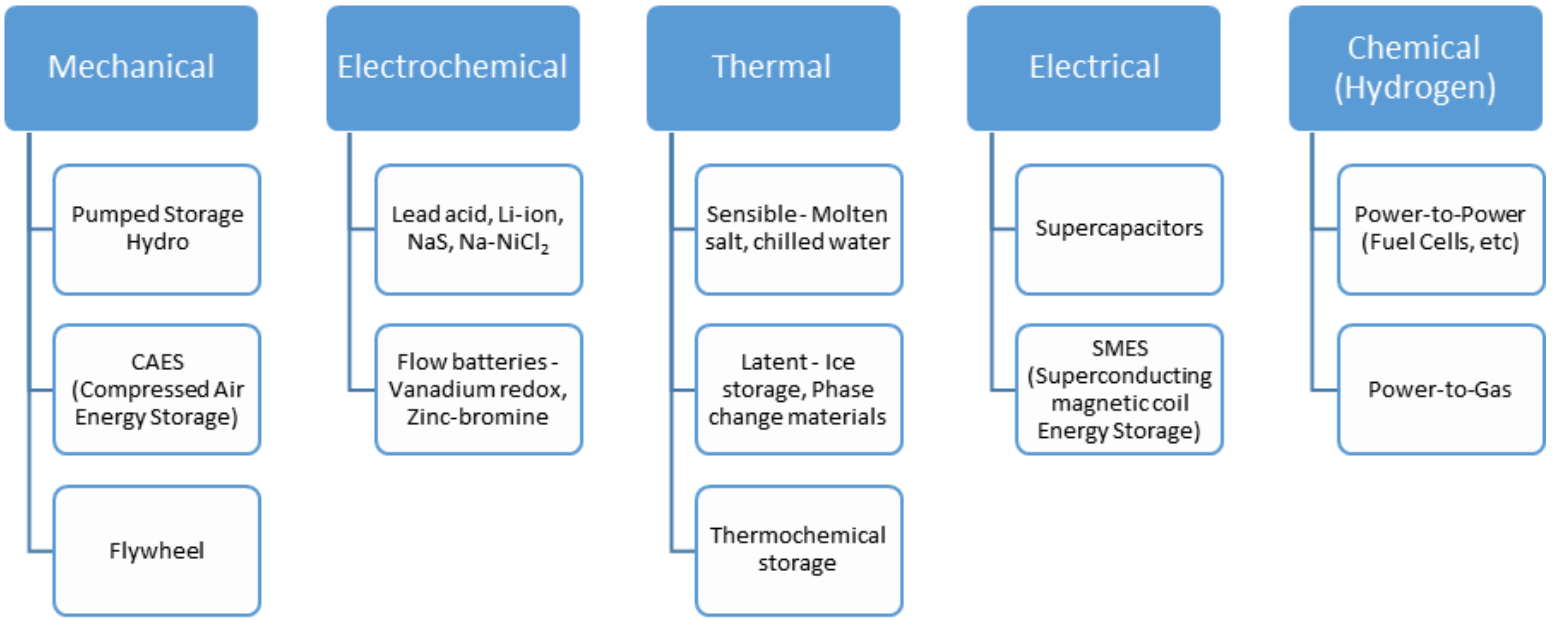
Energy Storage Applications Overview



Source: http://www.rmi.org/electricity_battery_value

ES Technologies Overview



- Technology Status / Maturity
- Performance Parameters
- Pricing / Pricing Outlook
- Applications Matching

Matching ES Technologies to Application & Location

APPLICATION	USE CASE LOCATION ON THE GRID				TECHNOLOGY						
	Generation	Transmission	Distribution	Behind the Meter	Lead Acid	Li –Ion	NaS	Flow Batteries	Flywheel	CAES	Pumped Hydro
Energy Arbitrage	☑	☑	☑	☑	1	1	1	1	0	1	1
Electric Supply Capacity / Resource Adequacy	☑	☑	☑	☑	1	1	1	1	0	1	1
Synchronous / Non-Synchronous Reserve	☑	☑	☑	☑	1	1	1	1	0.5	1	1
Renewables Energy Smoothing (short duration < 1 Hr)	☑			☑	1	1	1	1	0	1	1
Renewables Capacity Firming / PV Self consumption (long duration > 1 Hr)	☑			☑	0.5	1	1	0.5	0	1	1
Frequency Regulation	☑	☑	☑	☑	0.25	1	1	0.25	1	1	1
Voltage Support	☑	☑	☑	☑	1	1	1	1	1	1	1
Frequency Response	☑	☑	☑	☑	0	1	1	0	1	1	1
Black Start	☑	☑			1	1	1	1	0	1	1
Transmission Congestion Relief		☑	☑	☑	1	1	1	1	0	0.5	0
Transmission Deferral		☑	☑	☑	0	0.5	1	0.5	0	0	0
Distribution Deferral			☑	☑	1	1	1	1	0	0	0
Time-of-use Bill Management				☑	1	1	1	1	0	0	0
Demand Charge Reduction				☑	1	1	1	1	0	0	0
Backup Power / UPS				☑	1	1	1	1	1	1	0
Resiliency			☑	☑	1	1	1	1	1	0	0

Database of Energy Storage Companies in MA

- Purpose:
  - Capture characteristics such as the company technology, service, products, number and type of employees, location and revenue level.
- Deliverable:
  - An Excel based spread sheet
- How it Fits in:
  - Understand which programs and market opportunities have been successful in attracting companies.
  - Capture NAICS codes and use them to derive economic impact of storage deployment scenarios.
  - Serve as a baseline to track progress of the industry.

Programs That Benefit Storage Today in MA

- Purpose:
  - This task provides a summary of the current MA programs (grants, rebates, etc) that may already involve energy storage
  - This is an information gathering task to concisely express what programs exist today
- Deliverable:
  - Includes a comprehensive table of the existing MA programs
  - A discussion of which program-specific criteria can be specified to encourage use of energy storage
  - Stakeholder feedback is included
- How it Fits In:
  - Information gathered in this task will feed into subsequent tasks where programmatic actions for energy storage are being considered

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MASSACHUSETTS ENERGY PROGRAMS				
PROGRAM / INCENTIVE	PROGRAM ADMINISTRATOR	PROGRAM TYPE	ELIGIBLE TECHNOLOGIES	APPLICABLE TO ES?
AccelerateMass	MA CEC	Investment	Clean Tech	Yes
Alternative Energy and Energy Conservation Patent Income Tax Deduction (Corporate)	MA DOR	Tax credit / deduction	Solar, Geo, Wind, Biomass, Hydro, MSW, Fuel Cell	Potentially
Alternative Energy and Energy Conservation Patent Income Tax Deduction (Personal)	MA DOR	Tax credit / deduction	Solar, Geo, Wind, Biomass, Hydro, MSW, Fuel Cell	Potentially
AmplifyMass	MA CEC	Investment	Clean Tech	
Berkshire Gas - Commercial Energy Efficiency Rebate Program	N/A	Rebate	Equip insulation, water heaters, furnaces, boilers, steam sys upgrades, programmable thermostats, duct sealing, building insulation, windows, other EE	No
Berkshire Gas - Residential Energy Efficiency Rebate Program	N/A	Rebate	Equip insulation, water heaters, furnaces, boilers, steam sys upgrades, programmable thermostats, duct sealing, building insulation, windows, other EE	No
Business Energy Investment Tax Credit (ITC)	Federal	Tax credit / deduction	Solar, geo, wind, MSW, CHP, Fuel Cell, Tidal, Microturbines	Potentially
Cape Light Compact - Commercial Energy Efficiency Rebate Program	N/A	Rebate	Water heaters, lighting, lighting controls, chillers, furnaces, boilers, heat pumps, air conditioners, CHP, compressed air, EMS, building insulation, motors, motor VFD, equipment, LED lighting	Potentially
Cape Light Compact-			Refrigerators, dehumidifiers, water heaters, lighting, furnaces, boilers,	

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ES Market Opportunities

Market Opportunities – Preliminary Organization

- Objective: Identify current and near-term market opportunities for energy storage in MA, barriers, and ways to overcome those barriers
  - Focusing on revenue-generating or cost-avoiding activities more so than more general benefits-producing
  - Discussion of market size, ability to stack services, relative value of opportunities
- Method: Gather feedback from stakeholders and supplement with knowledge of markets, both in MA and elsewhere
- Status: Initial draft report in process of being sent to CEC/DOER for review
- Observations: Organizing into three categories:
  - Wholesale
  - Retail
  - Utility

Market Opportunities – Preliminary Observations

- Wholesale
  - Current ISO-NE market products
  - Other ISO-related opportunities
  - New ISO-NE market products
- Retail
  - Customer Bill Management: Time-of-Use rates and energy price arbitrage; Demand charge management
  - Distributed PV Integration / Solar Balancing / Increased PV Self-Consumption
  - Backup Power / Uninterruptible Power Supply (UPS) / Power Quality
  - Enablement of the "Prosumer" Model
- Utility
  - Transmission
    - Upgrade Deferral, Equipment Life Extension, Voltage Support, Congestion Relief
  - Distribution
    - Upgrade Deferral, Resiliency, Voltage Control / Power Quality, Backup Power, Microgrid
  - Customer
    - Similar services listed above for a system that can be utility-controlled

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NEXT STEPS

ES Study Tasks - Next Steps

- Pathways to creating a larger energy storage industry in Massachusetts
  - Policies or programs to foster storage industry growth in MA
- Storage Cost/Benefit Analysis
  - Use ES Valuation Tool (ESVT) to analyze a range of storage applications, quantifying potential value streams against costs
- Vision of the Future of ES in Massachusetts
  - Analyzing the potential amount of cost-effective storage that would provide benefits to Massachusetts ratepayers
- Policy & Program Recommendations
  - Possible policy, market and regulatory tools to promote energy storage, based on potential applications and cost benefit analysis.
  - Program design recommendations for the DOER's $10 million energy storage demonstration fund.

Continuing Stakeholder Engagement

- We continue to welcome input from stakeholders to help inform and guide our work
  - Please contact us via email at: energystoragema@gmail.com
- Stay informed at the mass.gov website:
  - http://www.mass.gov/eea/energy-utilities-clean-tech/renewable-energy/energy-storage-initiative/
- The next Stakeholder Update will take place in Q1 of 2016 – stay tuned!

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Thank You!

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