National Grid
New Energy Solutions (NES)

March 1, 2017
National Grid US

3.3 m electric and 3.6 m gas customers

13,672 employees

~$9B rate base
+$2B capital invest.
New Energy Solutions

Our Purpose

- Establish plans and strategies to modernize our electric and gas grids
- Expand the role of the utility
- Drive growth and customer value
- Bring commercial focus to a set of technology and regulatory issues

New Energy Solutions is an agile team focused on developing and launching innovative solutions and technologies that unlock value for National Grid’s customers and communities and accelerate progress towards a sustainable future.
The energy transformation is creating challenges and opportunities

Our shifting energy market …

Decarbonization

- Generation migrates from large central plant to smaller intermittent & flexible renewable assets

- Demand and supply profiles shift, causing peaks at different times (duck curve)

Decentralization

- Generation units decrease in size and move downstream, closer to consumption

New technology

- Rise of electricity assets like storage and new digital platforms

… creates challenges and opportunities …

- Price volatility increases
  - Renewables export at lower power prices
  - Expensive peaking generation plugs the gap

- Networks congested during peak periods

- Asset utilization reduced

- Forecasting becomes increasingly challenging

- Real time balancing & operations are difficult

… which drive the need for flexibility

Storage, and other flexibility tools, can help:

Improve asset performance & utilization

Support system balancing & ancillary services

Reduce wholesale energy and capacity costs
Modernizing the grid is foundational to achieve all environmental and efficiency objectives.

Key considerations when planning:
- Customer needs and wants
- Regulatory feedback and guidance
- Stakeholder feedback
- Learnings from previous pilots

Also market factors play a role:
- Technology advancements
- DER adoption levels
- Policy and Environmental targets and goals

This approach is the same one that we’ve used across our services area:
- AMF Deployment
- Grid Modernization
- Cybersecurity
- DSP Development
However the challenge is not just in making the investments and the technology

Partnerships and new business models will play a big role in the journey

Software as a Service
- Salesforce
- Concur
- Opower

Sharing of licenses
- Pandora
- Spotify

Unutilized capacity
- Priceline.com
- Reliant
- Airbnb

Surge Price
- Uber
- OpenTable
- National Grid
A lot of things coming together and we need to make sure that we’re leverage all assets.
NY DSP Demonstration

What are we doing

- Creating market opportunities and pricing models for investment in DER/DR capabilities that will lead to:
  - Optimized electric system distribution
  - Maximized customer energy assets
  - Motivating ROI
- 3 phase approach
  - Development of valuation model to unlock potential assets
  - Development of DSP platform
  - Integration of Points of Control (POCs) into the DSP

Why

- Test functional, operational and monetary benefits to the local electric distribution system and the DSP that flow from the node based on the capabilities of customer-owned DER.
- Test customers’ willingness to participate
- Determine if prevailing nodal values would provide sufficient financial motivation for customer investment in DER.
Electric vehicles will play a big in the energy space in the future

Customer Outreach and Education

Targeted Charging Station Expansion

Looking to enable the entire chain for EV infrastructure

Utility Distribution Infrastructure

Customer Site Infrastructure

EV Supply Equipment (EVSE)
National Grid has been active in the solar market since 2009…

- Received approval from Department of Public Utilities (DPU) in 2009 to own and operate Solar
- We have completed two solar deployments already (23 sites in total and 21 MW) in MA
- Building upon learnings from PH I/II, the filing includes plans to implement new technology:
  - Integrated inverters
  - Panel positioning for optimized output
  - Canopy solar
  - Sun tracking systems
Business case for storage often requires stacking benefits from multiple applications.

Illustrative Example of Cost-Benefit Analysis for IOU Use Case

- Reduced Peak
- Energy Cost Reduction
- Wholesale Market Cost Reduction
- Ancillary Services Cost Reduction
- Increased Renewable Integration
- Distribution Investment Deferral
- Distribution Voltage Support
- Capital Expenditure (Equity)
- Financing Costs (Debt)
- Operating Costs

System benefits including reduced peak, energy cost reduction, and wholesale market cost reduction.

Additional benefits from renewable integration.

Traditional distribution upgrade deferral.

Control systems to support the integration of storage will be critical to achieve positive economics.

Traditional T&D upgrade deferral may not be cost effective; however, stacking other benefits may make the business case positive.

National Grid has a pipeline of regulated storage projects in the U.S.

<table>
<thead>
<tr>
<th>Project</th>
<th>Location</th>
<th>Size</th>
<th>Status</th>
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</thead>
<tbody>
<tr>
<td>DOE ARRA Demo</td>
<td>Worcester and Everett, MA</td>
<td>[2x] 500kW, 6hr</td>
<td>Commission 2017, end YE 2018</td>
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<tr>
<td>MA Solar phase II</td>
<td>Shirley, MA</td>
<td>500kW, 2 hr.</td>
<td>Commission 2017</td>
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<tr>
<td>MA Solar phase III</td>
<td>MA</td>
<td>7 MW</td>
<td>Approved</td>
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<td>NY REV Demo: Neighborhood Solar, Fruitbelt</td>
<td>Buffalo, NY</td>
<td>TBD</td>
<td>Proposed</td>
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<tr>
<td>GridMod Renewable-Integrated Distribution Storage Demo</td>
<td>MA</td>
<td>1 MW, 6 hr.</td>
<td>GridMod filed; pending MA DPU decision</td>
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<tr>
<td>GridMod High Density Community Storage Demo</td>
<td>MA</td>
<td>[100x] 25 kw, 4 hr.</td>
<td>GridMod filed; pending MA DPU decision</td>
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“The electric light did not come from continuous improvement of candles”

(Oren Harari)
Questions