NECEC Strategic Partner Network (SPN)
Grid Modernization Innovation Summit

June 25, 2015, 1:30 - 5:30pm

Feedback Summary Report from Stakeholder Breakout Sessions

Completed August 11, 2015

Introduction

NECEC's Strategic Partner Network (SPN) Grid Modernization Innovation Summit grew out of discussions in NECEC's SPN Electricity System Innovations working group, and through collaboration with Eversource Energy, National Grid and Unitil (the three Massachusetts investor owned utilities). The session brought together 50 invited experts from across the energy and electricity sectors with expertise in utility systems, new technologies, R&D, investment, business development, policy, distributed energy resources, efficiency, and other relevant areas. The attendee list is presented as an appendix at the end of the document.

The goals of the Grid Mod Innovation Summit were to capture feedback and advice from facilitated stakeholder sessions on models for increasing innovation, demonstration, and partnering initiatives as input to the utilities preparation of their grid modernization plans.

The Massachusetts utilities sought input and advice from the SPN and NECEC innovation community on models for increasing innovation, demonstration, and partnering initiatives to inform their Grid Modernization plans that seek to include an expanded innovation role.

The Summit was designed as a discussion surrounding the portion of the Massachusetts' DPU grid modernization order that directs Massachusetts utilities to:

> "…propose research, development, and deployment ("RD&D") efforts that focus on the testing, piloting, and deployment of new and emerging technologies to meet our four grid modernization objectives." Source DPU 12-76B

The session was convened by executives from NECEC, Eversource Energy, National Grid, and Unitil, describing the goals and agenda for the Summit's interactive breakout exercises, and each organization's respective visions and observations of the grid modernization effort. The utility representatives expressed their desire for reliable, smart, integrated grids that enable integration of a variety of forms of distributed energy resources and provide system knowledge in real time. All of the utilities emphasized their overarching commitments to providing a reliable electricity service at a reasonable rate and the dearth of adequate R&D budgets with which to explore innovative projects. The agenda can be found in an appendix.

Following overviews from NECEC and the utilities on objectives for learning from the Summit and informing Grid Mod plans, the remainder of the Summit was divided into three segments, with participants divided into seven facilitated groups to consider innovation opportunities and related practices, models and roles that could include expanded utility RD&D functions and partnership initiatives. The core of the Summit agenda was:

- Breakout 1: (60mins): Roundtable exercise on innovation solutions & opportunities, impacts on Grid Mod objectives, timing considerations

- Breakout 2: (60mins): Roundtable exercise to build on project and innovation opportunities from the previous breakout, consider additional detail on selection processes, partnering approaches, co-funding models, how to ensure learning and acceleration to deployment
- Full group report backs & group discussion (60mins)

Throughout the Breakout exercises, the Summit's 50 participants were encouraged to consider one or more of the four grid modernization objectives laid out by the DPU, to;

1. Reduce the effects of outages;
2. Optimize demand, which includes reducing system and customer costs;
3. Integrate distributed resources; and
4. Improve workforce and asset management.

These breakouts are summarized below.

Breakout 1: Innovation Opportunities

Exploration of Innovation Opportunities, Technology Categories, Values & Impacts:
What impact does this have on the Grid Mod objectives?
What value does this solution have for the Utility?
What value does this solution have for the end customer?

Innovation opportunities can directly support all four objectives for grid modernization in Massachusetts. They will reduce outages, optimize demand, reduce customer costs and create a more instrumented network within the utility, thus improving asset and workforce management.

From the perspective of the utilities, innovation solutions can increase reliability, resiliency and lower energy costs. These projects will also improve system utilization, optimize demand and integrate distributed resources to ensure system efficiency. Ultimately, peak costs and overall energy use for both the utility and customer would be reduced.

Utilities and summit participants discussed innovating to add capabilities for real-time, flexible actions in management of the distribution grid. These capabilities would need more awareness and analytics across the system to the grid edge, including customer engagement.

The breakouts explored a range of innovation and applications areas, with a number of these opportunities falling into two important areas:

(1) ***Distributed Energy Resource*** management and integration, to consistently provide DER visibility and management to the distribution grid, and possibly including DER aggregator roles to manage value to the grid. This latter application opportunity was also described as a "Virtual Power Plant," that aggregated DER for more effective grid integration and electricity market value; and

(2) ***Microgrids*** (in particular at the Community level) that would combine resiliency, both thermal and electricity services, localized grid services with islandability, DER including integration of DG, storage, microgrid controllers and sensors, along with approaches and standards for integration with the distribution grid.

Additional project opportunities were discussed that could test time shifting of renewables and storage resources and help evaluate tradeoffs in supplies options for peak shaving during high-

demand times. RD&D project opportunities might test approaches for aggregating DER and customer loads to participate in ISO reliability, demand and capacity markets should the regulatory environment permit.

Cutting across specific technology and project opportunities, utilities expressed interests in innovation initiatives that developed approaches and systems that would better integrate, manage and derive value from new technologies. There was acknowledgement of the increasing pace of new technologies, resulting in the need to more rapidly test, pilot and integrate new technologies. Further, a comprehensive data communications infrastructure needs to be deployed to enable these and other smart grid features.

Several of the groups discussed innovation opportunities with new technologies that could enable utilities to develop probabilistic forecasting and modeling, yielding data analytics and customer data segmentation at the residential level. These innovation opportunities could explore how customers respond and learn from different signals, how to change customer behavior, and also explorations of impacts of greater customer control and choice across different population and customer segments. Better understanding of how different customer segments react to different signals could enable utilities and third parties to offer new, tailored services.

From the customer perspective, pilot projects could aim to inform options for increased grid reliability and resiliency, lower costs or create premium services, and provide information and tools to empower customers to choose energy solutions or take action. The goals of these types of innovations are to help customers reduce their energy use, lower costs and contribute to grid efficiency while also reducing their environmental impacts.

Exploring Innovation Project Scope & Implementation Issues:

How long might innovation projects take to complete?
What would be the implementation considerations for demonstration and full-scale deployment?

As the utilities develop their five (STIP) and ten (GMP) plans, they will consider projects that will yield learnings towards applying new technologies that meet the four objectives. Some of these projects could be tactical and be deployed in a relatively short timeframe while other projects could be multi-year efforts. Indeed, projects might range from paper studies to a full scale deployment of a Microgrid or some other DER device.

Several considerations should be made during the implementation stage of full-scale deployment. First and foremost, maintaining a safe and reliable system, complying with regulations, and the cost impact to customers are critical. The business process needs to be refreshed and alternative funding models beyond traditional R&D budgets should continue to be explored.

Utilities must consider customer selection and engagement. Cooperative customers who provide feedback are important in the pilot process, and approaches that enable quick customer engagement and feedback should be implemented. This may mean identifying groups of customers who are most likely to engage in the type of project being implemented at the pilot stage or customers in a certain geographic or demographic region.

Pilot and demonstration projects need to include analysis and testing of integration feasibility and site criteria to learn about considerations for broader deployments. Utilities need to include engineering system design and integration considerations. The geographic location and distribution grid feeder specifics need to be considered. There is generally a lack of real-time data from disparate points on the grid creating a need for real time, sensors, controls and modeling tools to provide analytics for the data collected. RD&D projects should configure and include test sites that are highly instrumented and enabled for two-way power flows along with a model of the grid and various regions and feeders, which in combination will allow for expedited test and piloting of new technologies and configurations.

Pilot and demonstration projects should be designed to be scalable. These projects should include an upfront planning step to analyze and confirm configurations and processes that need to be tested, and what results will need to be learned to be able to extrapolate from a pilot to larger-scale follow-on deployments.

Third parties developing new technologies need to understand the status of the distribution grid and the needs, opportunities and challenges for new technology integration to better consider and design their new solution functionality. The utilities could work with industry partners, nonprofits and universities to help third parties explore the technical requirements and then test on a grid-connected or simulated environment.

Utilities and third parties also need a common understanding of appropriate scale for pilots and demonstrations. Smaller technologies are most appropriately tested at the individual building or test site, behind a meter or on a simulated environment. Utilities can learn from the results of these projects conducted by technology companies and building owners and other third parties. Utilities are prioritizing lead or partner roles in innovation demonstration project opportunities at the 1MW scale and larger, often with impacts and modeling at the substation scale.

Both cyber security and traditional security need to be considered during the full-scale deployment of a project. Depending on the nature of the technology used, data security should be considered at both the utility level and customer level. Utilities have to test network protection schemes with new sensors and other equipment added to network. Physical security of high-value vulnerable assets could to be considered as well. The grid needs to be resilient against external threats.

The IOU's also need to develop more robust RD&D project management capabilities that include cross-functional integration with standard work procedures. These are needed to ensure that standard operations and maintenance functions are aware of RD&D projects and vice versa, so that changing conditions are appropriately managed for grid operations, customers and demonstration project learning. Utilities should develop better cross business unit sharing to understand needs and challenges to inform and coordinate effective pilots and demonstration projects. This includes the training of maintenance crews on how to interact with the pilot project when they conduct either routine or response work.

Breakout 2: Innovation Processes & Models

Successful Partnerships

What best practice options exist for selecting partners?

All participants in the workshop discussed the importance of partnerships that go beyond a supplier – customer relationship to enable collaborative projects where all parties learn and refine capabilities through collaboration in pilots, demonstrations and other research and planning stages. Successful partnerships are built on trust, open communication, mutual understanding and alignment of interests. There is a need for all parties to share risks, interests, goals and benefits throughout the pilot project to ensure success. Having defined outcomes and a process to collaborate on challenges as they arise are also beneficial, along with processes for status updates to ensure all parties stay aligned.

While utilities test and work with vendors and new technologies on an ongoing basis, their core expertise is oriented towards operations rather than innovation. Historically, RD&D has not been a core function for utilities. Utilities can bring outside innovation expertise into projects through partnering on those projects, and can also work to involve internal organizations more actively in demonstration projects.

As part of the Grid Modernization efforts, utilities have an opportunity to create and foster innovation partnerships. Successful utility partners tend to be organizations that already have a combination of technology RD&D, project management, business development and utility industry expertise, and have demonstrated the ability to develop and deploy technologies that solve real utility challenges.

Participants explored processes for selecting projects and partners. While there are many examples of projects that started from utility / vendor inbound proposals, there is increased interest in utility RFI's that call for ideas and new solutions to address specific problems and needs. Examples are grid reliability and congestion in specific regions, avoidance of alternative generation and/or distribution investments, etc. These RFIs can be developed by utilities with research partners from the private sector, quasi-publics such as MassCEC, and others. These RFP's should aim to provide more information to vendors on electricity system needs, including integration and system leverage goals, while being open to new approaches and solutions.

In addition to innovation project selection by utility-driven RFI, summit participants discussed ideas for selecting partners through topic and problem-specific summits with a diversity of stakeholders. Utilities, investors, large integrators, corporate suppliers and innovators would be able to explore possibilities for project teaming, and utilities would be better able to inform project needs and goals which considering partner and project selection based upon summit outcomes. These project exploration summits could be undertaken with nonprofit partners who bring stakeholder engagement and innovation process expertise.

There was also discussion of roles that public sector agencies, nonprofits and labs can play to help promote project opportunities, run challenge competitions, and/or provide assistance by vetting proposals, co-funding demonstrations, providing facilities and other assets as test sites, conducting joint R&D, reviewing and contributing to reports on project results, and conducting studies to verify market needs, identify sites, and describe solution attributes.

Examples of successful partnership formation through public sector or nonprofit led initiatives include competitions and programs such as:

- NY Prize Competition run by New York State Energy Research and Development Authority (NYSERDA) to select microgrid demonstration projects, with partnership strengths required among sites (often cities and towns), integrators, other vendors and utilities
- MassCEC's InnovateMass program that provides matches for demonstration projects that respond to specific challenges and which bring together partner teams to test and demonstrate new functionality
- Fraunhofer Tech Bridge program, which includes ideas solicited from the startup and innovation market, and enables and empowers small companies to interact with large corporations, with options for Fraunhofer lab development and testing resources
- Labs such as the Department of Defense's MIT Lincoln Lab, which participated in the Summit and has a microgrid test infrastructure they are interested in utilizing for pilot and demonstration projects with utilities and third parties
- Universities, which conduct modeling and innovation projects on their own and have the added benefit of long-term talent development

Funding Models & Scaling Projects

What funding models are available? What business models could be considered?
What best practice methods are available to ensure collaborative learning RD&D processes?
What is the best way to go from pilot to full-scale deployment?

While RD&D is a growing need for the utilities, there has been very limited funding support through the regulatory process As part of the Grid Modernization Plans utilities will look for co-funding opportunities for innovation projects. Approaches to be considered for co-funding include:

- Pooling or co-funding of projects across multiple utilities (including regionally, through a project-specific agreement or pooling through a third party nonprofit affiliation and RD&D consortium arrangement);
- Co-funding with public agencies such as MassCEC, NYSERDA, and federal DOE programs, including federal, state and local level subsidies and incentives, as well as grants and matching funds for specific research areas; and
- Private sector partners including vendors and investors (private funds and corporates). These private industry partners can sometimes take risks utilities find difficult to finance, but these project structures may add layers of complexity on intellectual property and rights and roles for follow-on, scale-up initiatives.

Collaborative Learning

There is a need for collaborative learning throughout the pilot, demonstration and deployment planning processes. At the national level, EPRI and EEI among others provide opportunities for utilities to learn from their peers through collaborative R&D initiatives. There are regional nonprofits and laboratories that could provide a similar function individually or jointly, including NECEC, the Energy Council of the Northeast (ECNE), the Connecticut Center for Advanced Technology (CCAT) and others, but there is no coordinated regional or local organization or consortium engaged in this focused effort today. A local or regional venue for utilities to focus

on challenges, best practices, pilot results and potential pitfalls would be valuable. A third party or non-profit association could possibly act as a convener or facilitator of this learning activity.

To enable collaborative learning, it is helpful to have a plan or process in place from the beginning of a project to collect data, lessons learned and distribute pilot results. This plan and related processes should include clearly defined expectations about what data can be shared, potential IP issues, and tools to communicate between partners.

Utilities need to budget and have rate recovery for investments in RD&D. While project selection processes should include prioritization of projects with significant potential value, pilots and demonstrations should not be optimized for initial cost-benefit but instead for assessment and learning for potential long-term cost-benefit. To ensure this learning function, projects that are focused on piloting and demonstrating new technologies and models need to include analysis and learning components that consider how those technologies and models might be scaled and integrated into the evolving electricity system, with assessment of potential value to individual customer classes and the overall distribution grid.

Within a large organization or utility, knowledge transfer needs to be a priority and include incentives at the organizational level. If an organization places significant value in the process of sharing knowledge across departments, the process itself will be more effective. Hosting quarterly meetings or presenting the results of a pilot project after close-out are two ways of bringing together an organization to share knowledge, but the importance and value of these meetings should be emphasized as part of a larger value proposition and organizational goals.

What is the best way to go from pilot to full-scale deployment?

Summit participants explored approaches and best practices to go from pilot to full-scale deployments. While these are complex processes and many initiatives have unique considerations, participants shared insights on (1) ensuring that pilots and demonstrations were appropriated designed from the outset to provide the speed, cost-effectiveness and learning to be able to assess larger follow-on deployments; and (2) how to develop shared infrastructure and processes to lower project costs and shorten project timeframes.

Pilots need to be broad enough to inform customer and grid cost-benefits. As mentioned above, participants felt that pilots should be multi-faceted, with most value if they include learning about impacts at the substation and modeling to inform the distribution and/or transmission network scale.

Beginning with a well-designed, scalable pilot project and establishing criteria to determine its success from the onset will lead to more successful full-scale deployment. Examples were cited of the preference to take time on a scalable pilot and complete the pilot process, than rush one that is not scalable. As part of the initial discussions, a clear plan on experiment design and dissemination of results should be created and used throughout the pilot lifecycle.

At the same time, pilots and demonstrations can be faster if there are upfront efforts to identify preconfigured sites, partners for co-funding and collaborating on projects, along with standardized models and tools for project analysis and cost-benefit assessment. Project and site partners can include cities with economic development and resiliency planning efforts, major campus sites such as hospitals, CHP and microgrid target locations, industry with initiatives to invest in efficiency, sites that need high-quality resiliency, etc.

To ensure effective pilots and demonstrations that can expedite potential scale-up, demonstration projects could consider inclusion of larger corporate partners who may provide system integration roles in demonstration projects. At the same time, these project partnerships should require multiple partners in most projects, including the ability to test multiple component technologies and configurations to model different deployment options. Multi-party project partnerships should be formed through processes that can consider inclusion of smaller companies developing new technologies and solution components.

Participants discussed the importance of analysis and assessment of results, cost, data, accomplishments, benefits and pitfalls coming out of pilot projects before moving to full deployment. This may include the solicitation of customer input, testimonials of participants and the preparation of a plan to meet new expectations created with full-scale deployment. Bringing in a third party vendor or multiple vendors to compare technological results may be a productive way to further analyze the pilot and results. As part of the feedback process, consider the depth of integration with utility core assets, the ability to minimize risk while scaling up, and the timeframe for cost recovery.

Following a successful pilot, full-scale implementation could be rolled out in stages depending on the nature of the project.

About NECEC (New England Clean Energy Council and NECEC Institute)
NECEC is a regional non-profit clean energy business, policy and innovation organization whose mission is to accelerate the region's clean energy economy to global leadership by building an active community of stakeholders and a world-class cluster of companies.

APPENDIX I: Grid Mod Innovation Summit Agenda:

- Welcome and introductions (15 minutes):
  - Peter Rothstein, President, NECEC

- Utilities objectives on learning from Summit, informing Grid Mod plans (30 minutes):
  - Camilo Serna, Vice President, Strategic Planning and Policy, Eversource Energy
  - Rob Sheridan, Director, Utility of the Future, National Grid
  - Kevin Sprague, Director of Engineering, Unitil

- Breakout 1: (60mins):
  - Table exercise on innovation solutions & opportunities, impacts on Grid Mod objectives, timing
    - Pick a topic from four Grid Mod objectives and explore innovation opportunities to address the objective
    - Don't analyze specific technologies in detail
    - Focus on using technology as input to discuss generic project models
    - Discuss 2 or 3 innovation opportunities to compare different models
    - Answer questions in template for each project:
      - What is the innovation opportunity and how would you test it?
      - What categories of technology could be part of the solution?
      - What value does this have for the Utility? and for the end customer?
      - What impact does this have on the Grid Mod objectives?
      - How long would this project take to complete?
      - What would be implementation considerations for full-scale deployment?
      - What would be the magnitude of possible innovations at pilot, demonstration or full-scale?

- Break (15 mins)

- Breakout 2: (60mins):
  - Tables take project and innovation opportunities from previous breakout, consider additional detail on selection processes, partnering approaches, co-funding models, how to ensure learning and acceleration to deployment
  - For each innovation opportunity discussed in Breakout 1, answer the following questions in the template:
    - What best practices exist for selecting partners?
    - What are the roles and models for a successful partnership?
    - What funding models and business models are available?
    - What best practice methods are available to ensure collaborative learning?
    - What is the best way to go from pilot to full-scale deployment?

- Breakout report backs & group discussion (60mins)

APPENDIX II: Attendee List - NECEC SPN Grid Modernization Innovation Summit

First Name	Last Name	Company	Title
Kyle	Allen	NECEC	Membership & Communications Intern
Janet Gail	**Besser**	**NECEC**	**VP, Policy & Government Affairs**
George	Bivens	Schneider Electric	Key Account Manager
Austin	Blackmon	City of Boston	Chief of EEOS Cabinet
Christopher	Bleuher	Schneider Electric	Business Development
Kerry	Britland	Eversource Energy	
Josh	Brumberger	Utilidata	Director of Business Development
Bob	Chatham	vCharge	VP Business Development
Michael	**Cooper**	**National Grid**	**R&D**
Justin	**Eisfeller**	**Unitil**	**Director, Energy Measurement & Control**
Babak	Enayati	National Grid	Lead R&D Enginner
Brian	Fitzsimons	Qado Energy	CEO
Peter	Fuller	NRG Energy	VP Market & Regulatory Affairs
Colin	Gault	Smarter Grid Solutions Inc.	Head of Products
Jack	Griffin	Veolia	VP & General Manager
Jarrid	Hall	Elster	Sales Director
Christian	Hoepfner	Fraunhofer CSE	Center Director
Henrik	Holland	Shell Technology Ventures	Venture Principal
Miles	Hovis	SolarCity	Senior Manager, Project Dev. - Energy Storage
Michael	Kaplan	Retroficiency	VP of Marketing
Gideon	Katsh	National Grid	Senior Analyst
Dax	Kepshire	SustainX	VP & GM
Paul	Krell	Unitil	Manager, Energy Systems Engineering
Matthew	Kromer	Fraunhofer CSE	Member of Technical Staff
Andrew	Lackner	GE Ventures	Senior Director, Investments
Melissa	Liazos	National Grid	Senior Counsel
Erik	Limpaecher	MIT Lincoln Laboratory	Assistant Group Leader
Michelle	Macaux	Fraunhofer CSE	Director, Strategy & Business Development
Dhiraj	Malkani	RockPort Capital	Partner
Jeff	McAulay	EnerNOC	Sr. Manager of Strategic Partnerships
Jeremy	McDiarmid	MassCEC	Senior Director, Innovation
Paul	McManus	Boston Univeristy	Senior Lecturer
Raanan	Miller	MIT Energy Initiative	Associate Director
Tom	Mimnagh	ConEdison	Acting General Manager - Energy Services
Galen	Nelson	MassCEC	Director of Market Development
Luis	Ortiz	Anbaric	Project Manager
Alistair	**Pim**	**NECEC**	**Business Development Executive**
Paul	Renaud	Eversource Energy	
Kurt	Roth	Fraunhofer CSE	Director, Building Energy Technologies
Peter	**Rothstein**	**NECEC**	**President**
Thomas	Scaramellino	Esses	CEO
Jennifer	Schilling	Eversource Energy	
Camilo	**Serna**	**Eversource Energy**	**VP Strategic Planning & Policy**
Travis	Sheehan	Boston Redevelopment Auth.	Energy Fellow
Robert	Sheridan	National Grid	Director, Utility of the Future
Jim	Simonelli	Gridco Systems	CTO
Kevin	Sprague	Unitil	Director, Engineering
Abbey	Strauss	NECEC	Senior Associate
Bradford	Swing	City of Boston	Director of Energy Policy and Programs
Mitch	**Tyson**	**NECEC**	**Board Chairman**
Austin	Whitman	FirstFuel Software	Director, Client Solutions & Regulatory Affairs
Lulu	Young	Qado Energy	CTO