Reinventing resilience: Defining the model for utility-led renewable microgrids
The Dbriefs Power & Utilities series
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Extreme weather events are channeling the nation’s attention to the importance of electric grid resilience

- In the last few years the country has seen extreme weather events such as hurricanes, snowstorms and record low temperatures with increasing frequency and severity.
- 7 of the 10 costliest storms have occurred in the last decade, causing over $1 billion in damages per event.
- As a response to these events, the IOUs in the US have collectively invested an average of $35 billion per year from 2008-2016 in upgrading the electric T&D infrastructure.
Polling question #1

Agree or disagree: enhancing the resilience of the electric grid is a top priority for my company.

• Agree
• Disagree
• Don’t know
• Not applicable
The renewable microgrid market is growing as costs decline and demand for resilience increases

- Universities and military establishments were early adopters of microgrids—those two markets account for 53% of total projects and 72% of operational capacity (1192 MW)³.
- Today, demand for renewable microgrids is growing as:
  - The cost of distributed energy resources (DER) continues to fall
  - Regulated utilities explore deploying “non-wires” alternatives to traditional transmission and distribution (T&D) investments
  - Multi-stakeholder project ownership models emerge
  - Demand from large commercial users, military bases, and municipalities (community projects) continues to grow

Utilities see opportunity to develop renewable microgrids

³ GTM Research, “U.S. Microgrids 2016: Market Drivers, Analysis and Forecast”
Microgrids are comprised of a diverse set of technologies and resources.
Benefits and challenges of utility-led renewable microgrids

<table>
<thead>
<tr>
<th>Benefits</th>
<th>Challenges</th>
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<tbody>
<tr>
<td>• Reduce peak demand at substations and relieve congestion, ultimately deferring grid upgrades</td>
<td>• Attaining authorization for cost recovery of investments</td>
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<td>• Storage technologies provide distribution-level ancillary services</td>
<td>• Defining ownership structures that deliver optimal and cost-effective value to the grid</td>
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<td>• Deferral of transmission asset upgrades</td>
<td>• Offering attractive value proposition for all microgrid participants</td>
</tr>
<tr>
<td>• Compensation for ancillary services in certain markets such as PJM, CAISO, NYISO</td>
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</tbody>
</table>
Polling question #2

Agree or disagree: the benefits that microgrids provide are easily quantifiable.

- Agree
- Disagree
- Not sure
Oregon explores the value of solar-plus-storage solutions

• Oregon’s energy storage mandate: deploy a minimum 5 MWh by January 1, 2020

• Portland General Electric (PGE) views the mandate as an opportunity to explore what value streams a range of storage applications, including those tied to customer-owned solar systems, might provide to customers.

• PGE seeks to understand how solar-plus-storage systems can:
  − Help manage customers bills
  − Allow utility control over customer-sited systems when beneficial to utility
  − Provide ancillary services
  − Defer transmission and distribution investments
Commonwealth Edison proposes a path forward for public purpose microgrids

- Com Ed’s first testbed is the Bronzville neighborhood of Chicago
- Partnering with Illinois Institute of Technology (IIT) and others to deploy:
  - Master controller capable of facilitating the operation of microgrid clusters
  - Microgrid-integrated solar-storage technology (MISST)
- Demonstrate Com Ed’s vision for clusters of public purpose microgrids that can scale over time and potentially integrate customer-sited renewable generation
Polling question #3

I would be willing to pay a premium for a public purpose microgrid that would service my community in the event of a broad grid outage.

- Agree
- Disagree
- Indifferent
- I don’t know/Need more information
National Grid’s Community Resilience REV project
Testing the feasibility of a utility-led community microgrid

The project aims to prototype a **scalable** business model for a utility offered community microgrid with local distributed generation.

Considers four new utility services:
- Tiered recovery for storm-hardened, underground wires
- Central procurement for DER
- Microgrid control and operations
- Billing and financial transaction services

**Key Issues:**
- What are customers willing to pay for “Resiliency?”
- How to structure ownership of assets, rates from utility, operation and maintenance, and governance of microgrid
- How to entice primary stakeholders to invest in new DER in order to support microgrid load
Timeline of Potsdam microgrid programs

2014
- Test New Services Offered by Utility
- Detailed Engineering Design
- Develop Financial Business Plan and Service Agreements

2015
- Optimal Dispatch
- Renewable Integration
- Energy Storage Resources
- Fast Load Shed & Protection

2016
- Ancillary Service
- Day Ahead Bidding
- Performance Testing

2017
- Critical Services
- Additional Generation
- Economic Impact

NYSERDA, Concept Feasibility
- Human Factors Engineering
- Community Benefits
- Governance
- Smart Scheduler

NSF, Benefit to Community

DOD & GE investment

DOE, Microgrid Controller Development

NYREV, Detailed Design & Business Case

CU Clarkson University

GE GE Global Research

NG National Grid

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National Grid’s Community Resilience REV project
Business model options and considerations

Utility Model
- Tiered recovery option
- Utility runs the microgrid controller; provides billing services; central DER

DER Provider
- Microgrid owned by several entities, operated by utility, 3rd party, or customers
- DER market participation, aggregation of demand; separate billing

DER Energy Service Company (DESCO)
- Utility acts as DSP; entity acts as ESCO
- Utility provides metering and billing
- Bilateral agreements with customers
- Market participation

Community Special Utility District (CSUD)
- Entire Potsdam overhead distribution system as municipal district
- Community utility board report to PSC
- Transmission customer to utility

Feeder Special Utility District (FSUD)
- Similar to CSUD but operates on single feeder to supply microgrid
- Transmission customer to utility
- Assets owned and maintained by district

Innovation or Performance Based Pricing
- Owned, operated by utility subject to a regulated ROR
- Focus on reducing costs of assets or operation through innovation

Considerations
- Legal framework
- Insurance
- Taxes
- Regulatory
- Local Board
- Utility role
- Aggregate generation
- Aggregate demand
- Market interaction
National Grid’s Community Resilience REV project

Hybrid-utility business model

Distribution
(tiered recovery)

DER
(ESCO pricing)

Controller
(MaaS)

Settlement Service
National Grid’s Community Resilience REV project

Tiered recovery model

- Current tariff provisions
- Resiliency request
- Shared community investment
- Based on level of benefit from the microgrid
- Decreasing bill impacts

<table>
<thead>
<tr>
<th>Service Territory by Tier</th>
<th>Police Department</th>
<th>Wastewater Treatment</th>
<th>Water Treatment</th>
<th>Fire Treatment</th>
<th>Rescue Squad</th>
<th>Hospital</th>
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<tbody>
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</tbody>
</table>

Legend
- Village_of_Potsdam_tier2
- Town_of_Potsdam_tier3
- EMS_tier4
- Hospital_Tier5
- St. Lawrence county
Polling question #4

What aspect of National Grid’s hybrid-utility microgrid poses the biggest challenge?

• Recovery of underground wire assets
• Providing incentive for additional generation
• Developing a feasible business model
• Management of the microgrid controller
• Regulatory and rate change approval
• Potential market interaction and revenue streams
• I don’t know
National Grid’s Community Resilience REV project
Potential for NYISO participation

- Procure additional 4 MW of DER to island system
- Structured to enable market participation through aggregated generation
- Seeking seamless integration of DER into energy, ancillary services, and capacity markets
- Looking at hourly 2016 NYISO prices compared to DER marginal variable costs to predict dispatch rate

Integrating DER in Wholesale Markets

Source: DER Roadmap for New York’s Wholesale Electricity Markets, NYISO
National Grid’s Community Resilience REV project

Challenges

- NY PSC Microgrid Proceeding
- NY PSC Value of DER Order
- NYISO DER Roadmap
- National Grid rate case filing
- Current back up generation
- Existing generation agreements
- Village financial situation
Conclusion

Extreme weather events have led regulators and utilities to increase investments in innovative resilience solutions.

Utilities are exploring opportunities to enhance resilience through renewable microgrids.

Challenges remain in moving past the piloting phase, but business models are evolving to address market barriers.

By partnering with DER providers, investing in technology and working with regulators, utilities can position themselves to capture a share of the renewable microgrid market.
Question and answer
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Acronyms used in presentation

- **DER** - Distributed Energy Resources
- **DSP** - Distributed System Platform
- **IOU** - Investor Owned Utility
- **NYISO** - New York Independent System Operator
- **PSC** - Public Service Commission
- **REV** - Reforming the Energy Vision
- **T&D** - Transmission & Distribution
- **USDOE** - US Department of Energy
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