Resilience through Microgrids

Trends and opportunities for states and communities

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Michael Burr, Director
Microgrid Institute
Presentation outline

1. Microgrid Institute intro. and current work
2. Defining and understanding microgrids
3. Community resilience drivers
4. Policies, strategies, and initiatives
1. What is Microgrid Institute?

Microgrid Institute is a collaborative organization that focuses on key factors affecting microgrids and distributed energy.

Our efforts address markets, regulation, financing, and project feasibility and development.

- Multidisciplinary collaboration with industry leaders
- Independent, objective thought leadership
- Studies, analysis, development support
Current projects and initiatives

- Minnesota CHP Stakeholder Engagement
- Olney Town Center microgrid R&D project
- Resilient Communities Initiative
  (June 2014 – Ongoing)
- Microgrid Finance Initiative
  (1Q 2015 – Ongoing)
A microgrid is a small energy system capable of balancing captive supply and demand resources to maintain stable service within a defined boundary.

A **community microgrid** provides resilient and stable energy supplies for vital community facilities and assets.
“A microgrid is a group of interconnected loads and distributed energy resources within clearly defined electrical boundaries that acts as a single controllable entity with respect to the grid. A microgrid can connect and disconnect from the grid to enable it to operate in both grid-connected or island mode.”

~DOE Microgrid Exchange Group, October 2010
Types of microgrids

- **Utility-integrated campus microgrids**: fully interconnected with a local utility grid, but can also maintain some level of service in isolation from the grid, such as during a utility outage. Typical examples serve university and corporate campuses, prisons, and military bases.

- **Community microgrids**: integrated into utility networks. Such microgrids serve multiple customers or services within a community, generally to provide resilient power for vital community assets.

- **Off-grid microgrids**: including islands, remote sites, and other microgrid systems not connected to a local utility network.

- **Nanogrids**: serving single buildings or assets, such as commercial, industrial, or residential facilities, or dedicated systems, such as water treatment and pumping stations.
Buildings and cities are getting smarter

- Increasing focus on efficiency, sustainability, performance
- Advanced automation and interoperability
- Modern customers require modern services

Eliminating energy poverty worldwide

- Electrifying remote and under-served communities and islands
- Saving costs by displacing diesel, kerosene, etc.
- Improving living standards and supporting economic development

Public mandate to achieve greater resilience

- Applying lessons from Superstorm Sandy
- Exploring models and approaches for improving community resilience while also serving other local objectives
3. Microgrids and the resilience mandate

Centralized utility grids are inherently vulnerable
- U.S. utility grids are highly reliable, but not highly resilient *(SAIDI ignores “events”)*
- Centralized T&D systems expose customers to regional outages
- Cybersecurity and EMF disruptions can have widespread effects

Distributed energy technologies provide new options to achieve resilience
- Rapidly advancing technologies improve the full suite of technologies that make microgrids work – from PV to software controls
- Federal, state, and local government agencies are pursuing various approaches to encourage innovation and development
Microgrid systems help communities to achieve local resilience for vital services and interdependent community assets:

- Lighting, street lights, traffic lights
- Pumping, refrigeration, HVAC
- City water and wastewater
- Cell towers, telecom, Internet
- Gas stations, grocery stores, pharmacies

Modern resilient communities support public safety, convenience, and economic growth.
Microgrid energy management systems help communities to integrate local energy resources to provide resilient power. Community benefits:

- Reducing dependence on energy that must be transported over long distances
- Supporting energy security, emergency management, and public safety objectives
- Conserving energy
- Shrinking environmental footprint
- Modernization and economic development
- Keeping more energy dollars local

Local energy for local benefits
4. Rates, regulation, and microgrid financing

*Key policy questions for financing resilient community microgrids:*

- What public objectives could microgrids address?
- How will all microgrid services be valued and monetized?
- How do current regulations and rate structures treat microgrids?
- Who can/will own microgrid assets and market services?
- How will microgrid investments and operating costs be financed?
- What costs may be appropriately socialized or financed as utility rate-base investments – and how?
- What costs must be borne by local microgrid customers – and how?
### Fostering community microgrids

<table>
<thead>
<tr>
<th>Strategies and Actions</th>
<th>Where They’re Being Implemented</th>
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| Study microgrids to understand challenges and options      | Maryland Resiliency through [Public Purpose] Microgrids  
Mass. Clean Energy Center study  
Minnesota Microgrids study  
New York REV proceedings, *etc.* |
| Provide public support for public benefits                 | New York (NY Rising, NY Prize)  
Massachusetts DOER grants for community resilience projects  
Connecticut DEEP Microgrid program  
California PON-14-301  
D.C. Dept. of Environment Green Building RFA  
**Federal FOA 997 program, etc.** |
| Provide access to low-cost, long-term capital              | PACE 2.0, green/resilience bonds (NY, NJ, CT), on-bill repayment (CA, HI, IL, NC, OH, TX)                                                                                                                                              |
| Monetize microgrid costs associated with regional resilience, public safety, grid modernization, environmental compliance | **TBD …**                                                                                                                                                                                                                         |
Olney Town Center microgrid control system R&D project

**DOE FOA 997 program awardee:**

- **Team**: Microgrid Institute, Pepco, Green Energy Corp., Schneider Electric, and N.C. State University
- **DOE/NETL Program**: $1.2 million over two years to research, develop, model, and test a community microgrid control system designed for Olney Town Center (Md.)
- **Design objectives** include improving reliability to SAIDI <2 min., increasing efficiency by >20%, and reducing CO2 footprint by 20%+

**Public Webinar:**
Feb. 5, 2015, 2:00 EST
To register: [www.microgridinstitute.org](http://www.microgridinstitute.org)
Mission Statement: Microgrid Institute formed the Resilient Communities Initiative to help communities plan, develop, and implement their resilience strategies. We assist communities as they strive to improve resilience for vital services, optimize local energy resources, increase energy efficiency, and reduce their environmental footprint.
## Resilient Community Development and Action Planning

<table>
<thead>
<tr>
<th>Questions</th>
<th>Resilience Strategies</th>
<th>Microgrid Solutions</th>
<th>Development Approaches</th>
<th>Feasibility Factors</th>
<th>Pitfalls and Lessons Learned</th>
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<tbody>
<tr>
<td></td>
<td>What do resilient communities do differently? What strategic approaches are most successful?</td>
<td>How do microgrids work? What are their limitations? What roles do they play in resilience strategies?</td>
<td>How do resilience projects get built? Who leads the effort and how? Who provides financing?</td>
<td>Which options are best for our community? What factors will determine success?</td>
<td>What mistakes can we avoid? What approaches have succeeded? What examples are most instructive?</td>
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<tr>
<td>Actions</td>
<td>Establishing a strategic vision to achieve multiple community goals</td>
<td>Setting project scope, priorities, and benchmarks</td>
<td>Project initiation, planning, and execution</td>
<td>Research, planning, and feasibility analysis</td>
<td>Integrating lessons and examples into strategic plans</td>
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**Resilient Community Development and Action Planning**

[Image: Microgrid Institute](www.microgridinstitute.org)
Avoid comparing apples and oranges

*A microgrid is to the utility grid as a Tesla is to a bus pass*

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<thead>
<tr>
<th>Transportation</th>
<th>Electricity Service</th>
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<tbody>
<tr>
<td>Public transportation</td>
<td>Central utility grid</td>
</tr>
<tr>
<td>Station/stop-to-station/stop, available per generic schedule</td>
<td>Door-to-door transportation when needed</td>
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<td>Zero capital cost for customers; costs supported by ongoing public subsidies</td>
<td>High up-front capital cost with no (or temporal) public subsidies</td>
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Let’s work together!

Contact Us
www.microgridinstitute.org
Michael Burr, Director
+1.320.632.5342
mtburr@microgridinstitute.org