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# Workshop on Microgrid Technologies and Applications

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# Overview

- National Grid current investment strategy
- Microgrid issues

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# On-going and Advanced T&D Investments

- Annual capital expenditures of $450 million
  - Used to provide safe, reliable service to our customers for added resiliency
  - Installed 12 phasor measurement units and 286 MVAr of capacitance to improve power flows, reduce losses, and free generation capacity on the transmission system
- Working with NYSERDA and EPRI on research projects
  - Impacts of solar generation on the network, substation automation, equipment testing, and LED lighting
  - Microgrid study just completed for Wethersfield, Orangeville area

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# Current DG

- 75 MWs of DG have been interconnected since 2009
  - DG interconnection is not new
    - Forecast of another 240 MWs through 2015
  - State subsidies driving installations
  - Challenge of intermittent resources
    - From utility perspective in terms of voltage regulation
    - From customer perspective to provide sustained energy needs
  - Most DG > 500 kWs requires some level of utility construction to interconnect

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# DOE's Definition of a Microgrid

- 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 and that connects and disconnects from such grid to enable it to operate in both grid-connected or "island" mode.
  - *This definition of microgrids has been adopted by the U.S. Department of Energy (DOE) as well as EPRI.*

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# Microgrid Costs and Benefits

- Could be at least three distinct potential benefits from a microgrid.
  - First, economic benefits are one reason as customers attempt to lower total costs by increasing the efficiency of the microgrid for thermal and electrical requirements.
  - Second, customers can build a microgrid for resiliency requirements to retain service to facilities during electric system events.
  - Third, customers can build a microgrid for environmental benefits.

    In reality, microgrids will likely try to use all three elements to some degree into their eventual design.

- Balancing the desire for enhanced environmental benefits that a microgrid may provide with low/no emission generating sources versus the resiliency needs of a group of critical facilities can be challenging since the amount and type of generation needed for resiliency may or may not be able to provide similar levels of environmental benefit.

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# Microgrids of All Shapes and Sizes

**For the majority of microgrids, this involves combining a bulk energy source (such as a PV array), energy storage, and dispatchable generation (such as diesel or CHP).**

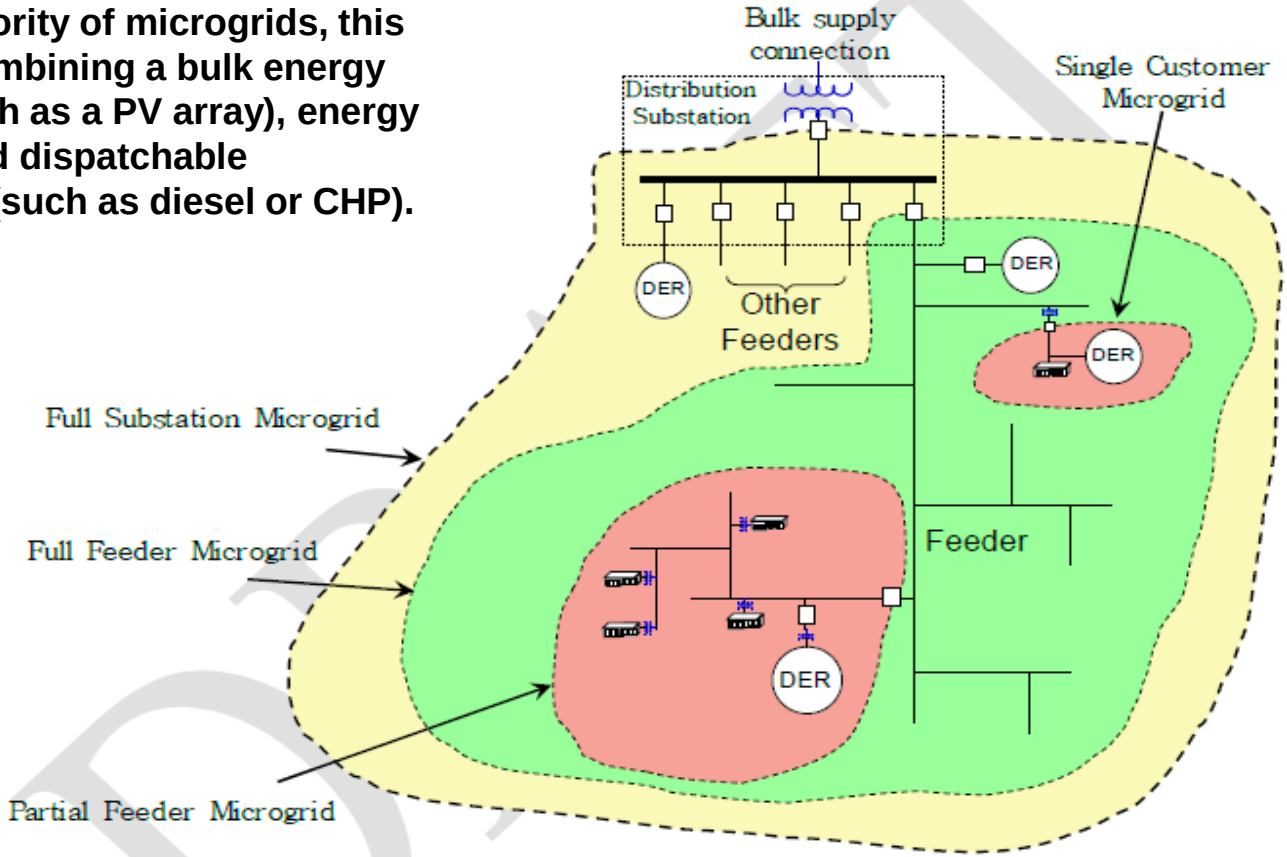


Figure 4: Examples of Microgrid Architecture on a Radial Distribution System – From Single Customer upto the Entire Substation

**Source: Microgrids: a Primer**

**draft review for EPRI Member Review and Comment 9/6/2013**

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# Current Microgrid Type Projects in NY

- Customers need to properly maintain existing emergency standby generation that can already create a microgrid type system
- Many colleges and large hospitals take advantage of this on their own campus
  - St Lukes, St Joseph hospitals, SUNY-Potsdam
- If CHP is desired, significant EEPS energy efficiency monies are available to right-size tri-generation (electric, heating, air conditioning) proposals
  - Likely to still rely on off-site natural gas infrastructure
- Central controls are critical to optimize supplemental energy purchases and manage use while islanded from the grid
  - Hourly pricing options, demand response participation, etc.
  - Automated load management requirements

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# Policy Issues

- Why a microgrid?
  - Is it clear that the risks of a ‘Sandy’ type storm drive the benefits enough to outweigh the costs?
    - How often is project expected to disconnect from the grid?
    - Properly maintained emergency backup generators with undergrounded energy services infrastructure should be in the matrix of options for a pure resiliency need
  - If the benefits are clear, the proper integration of all facets for a combined resilient and environmentally friendly system is critical
- Currently utilities can not own generation in NY
  - Utilities could be the right partner for microgrids
  - Does the need for a microgrid option cause us to re-think this?

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# Regulatory Issues

- What is the value to the microgrid of retaining interconnection to the grid?
  - Allows continuation of service during maintenance/emergency outages of microgrid generation
  - Allows resale of excess generation to the market or the utility
  - If necessary, connection to grid facilitates restart/operation of motors and generation
  - Instantaneous, on-demand access to the grid is most valuable to a microgrid
- What value can the microgrid provide to the host utility?
  - Is the microgrid designed, operated and controlled in a manner that frees capacity on the grid?
  - Can the microgrid be designed to provide services, e.g. voltage support, to the host grid?
  - Can the microgrid be fully functional during peak events, allowing for control of access by the host utility?
  - Need to quantify benefits of projects in specific locations
- Review of energy delivery system needed to serve customers within a microgrid footprint
  - Should look to prevent duplication of existing energy delivery systems
  - On-going maintenance needed for safe operation for the general public
- Transparency of all costs and benefits is critical for proper decision making and cost allocation

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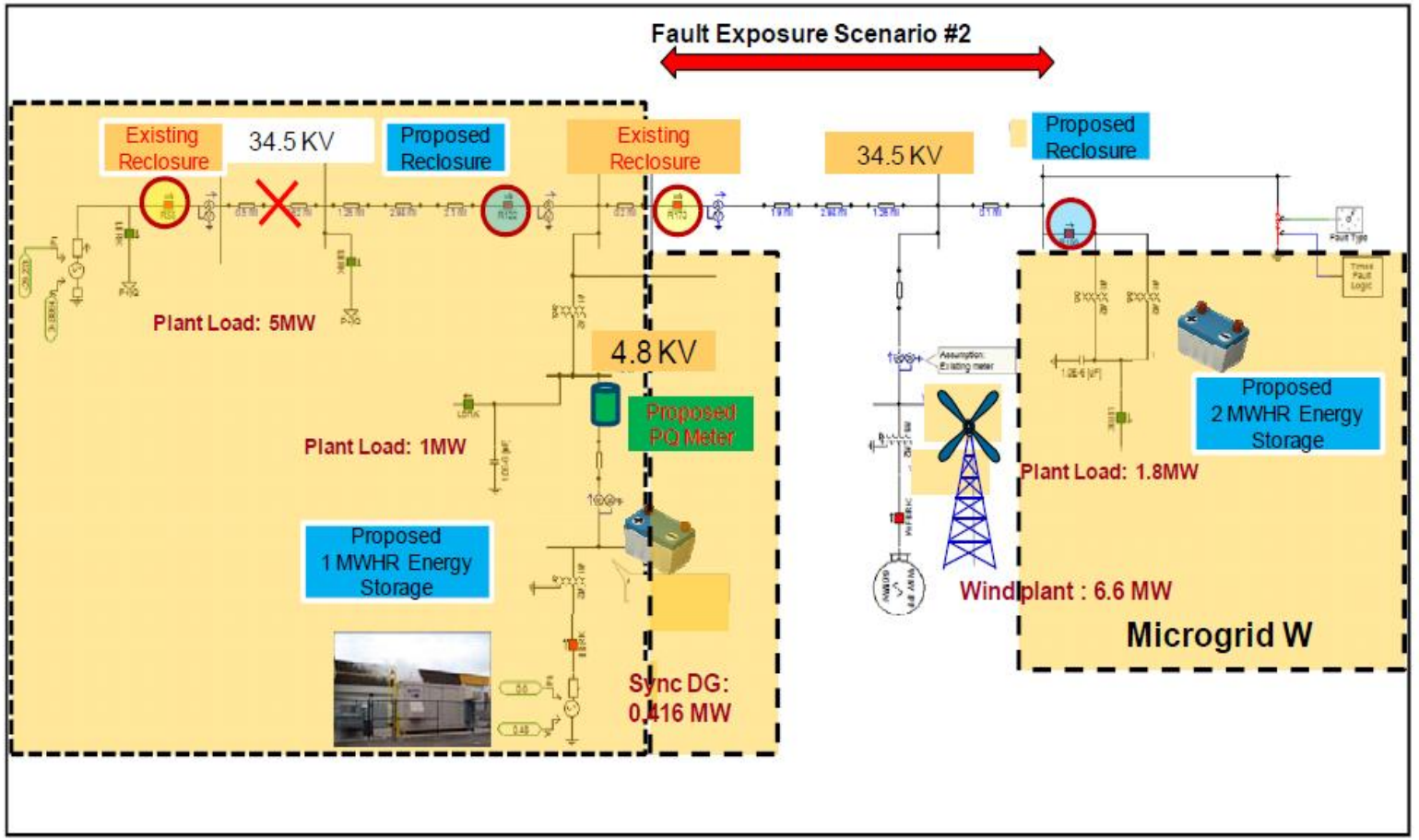
# NYSERDA EPRI Study




**National Grid Microgrid**
**Feasibility Study for Wethersfield – Orangeville Communities**