Microgrids: Presentation to DOE Electricity Advisory Committee June 30, 2015

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Advancing Microgrids in New York

- Anbaric is a clean energy infrastructure development company… we're actively developing HVDC projects in the Northeast and microgrid projects in NY
- In NY, Anbaric and Exelon have a collaboration that will establish microgrids ranging from 10 to 200 megawatts at selected locations.
- The Alliance initially plans to develop at least five large microgrids at sites in Long Island, New York City, and Upstate New York.
- The microgrids will use state-of-the-art demand efficiency and management technology to equip customers with reliable and efficient sources of distributed generation.
- Customers include large commercial real estate developments, hospitals, universities, industrial businesses or municipalities.

"Adjusting to the new reality of extreme weather means making our communities as resilient as possible and that is especially important when it comes to our local electrical grids."

Governor Cuomo

ANBARIC MICROGRID Exelon

Questions

1. What policy barriers hamper the Microgrid market and what should be done to address them?
   - Varies from state to state.
   - We see New York and California as hotbeds for development because regulations are evolving
   - In other states, we're monitoring

2. What certainties are needed to attract investment; where will the investment come from?
   - Business doesn't need and should not be given "certainties."
   - Instead, utilities and third party entities (like Anbaric) are already investing in microgrid development
   - There are trillions of dollars of capital seeking placement in the US power infrastructure market

3. Because micro-grids can be both complementary and competitive to traditional utilities -- how do we maximize the benefits of micro-grid development without pushing the development so far that utilities may feel the need to react defensively?
   - Utilities remain essential: they are (in NY argot) Distribution Service Platforms and regulators need to ensure they're adequately funded.
   - That said, secure in their role, utilities should be expected to be open to microgrid proposals from third parties… regulators need to ensure utility practices (like ISO practices) don't hinder innovation

Questions

4. What are the economic costs and benefits of microgrid developments -- from the perspective of the customers within the microgrid area and from the perspective of customers outside the microgrid area?

- Varies case by case: the costs and benefits should not be measured in terms of economics alone… there's resilience, ability of microgrid customer to have its own values (e.g. decarbonizing), volatility and uncertainty of energy pricing in existing power markets, etc etc
- Generally, customers outside microgrids should not subsidize customers inside microgrids (and vice versa).

4a. How can a microgrid best be integrated into the existing distribution system in a way that provides benefits to the system as a whole?

- Varies case by case.

4b. Who should bear the costs of microgrid development?

- In most cases, microgrid customers.

Anbaric's New York Microgrids Under Development

#	Project Name	Location	Project Size	Category	Customer(s)
1	Rockaways	Queens, NY	>$100 million	Public	Residents of the Rockaways
2	Empire State Plaza	Albany, NY	$30-50 million	Public	OGS/NYPA
3	Mega-Factory	Upstate New York	>$100 million	Industrial	Big company
4	SI University Hospital	Staten Island, NY	$50-80 million	Hospital	North Shore LIJ
5	"NYC Commercial"	Manhattan, NY	$30-40 million	Commercial	Real Estate Customer
6	Freeport Electric	Freeport, NY	$50-100 million	Municipal	Village of Freeport

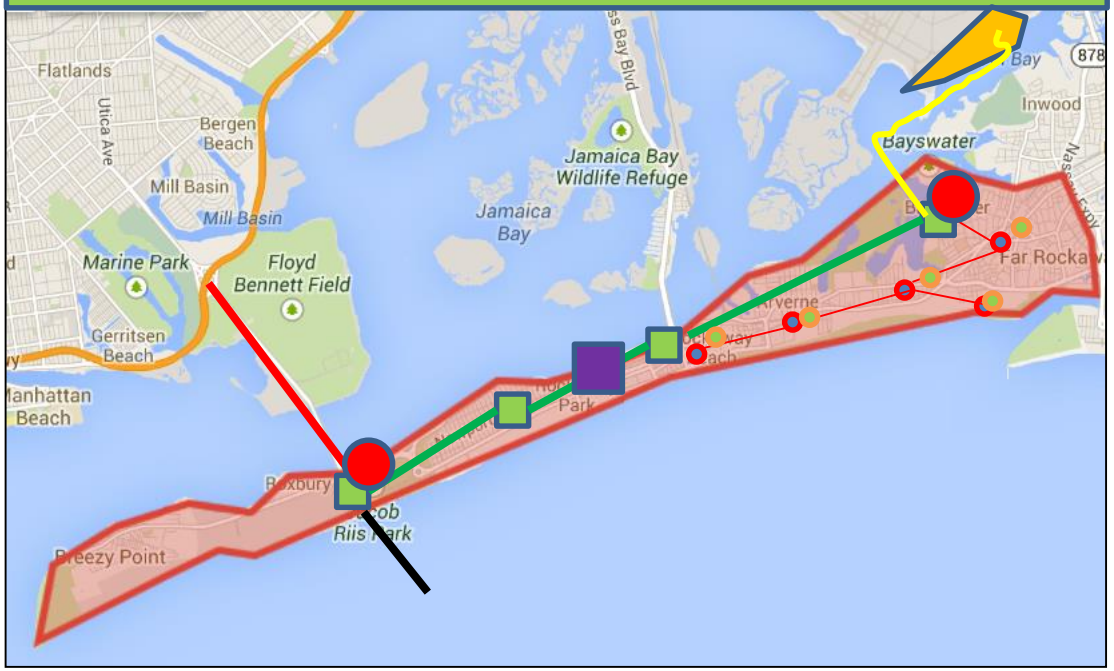
Typology of Projects: The Rockaways Microgrid

4 new flood-protected **substations**

New gas link to Transco Rockaway lateral

New redundant LIPA-Coned **connection**

Rockaway Peninsula District Microgrid



20 MW of Solar PV at JFK Airport

AC cable from PV through bay to main substation

30 MW CHP networked at 5 NYCHA developments (6 MW each)

4 MW biogas renewable CHP at Rockaway WWTP

Buried flood-protected distribution **backbone with automated switching**

Autonomous cell controllers and **battery storage** for islanding & economic dispatch

Advanced **building controls** at 5 NYCHA locations

Typology of Projects: 500MW of New Firm Power in an Restructured Market

As America re-industrializes, imagine a very large factory:

- Technical optimization: the right power portfolio
- Grid optimization: relations with the Grid that “work”
- Political optimization: managing federal, state and local regulators
- Capital optimization: using the capital of power companies, not the factory owner
- Energy price risk minimization: an array of power price hedging options
- Power quality optimization: to be determined with factory’s internal engineers

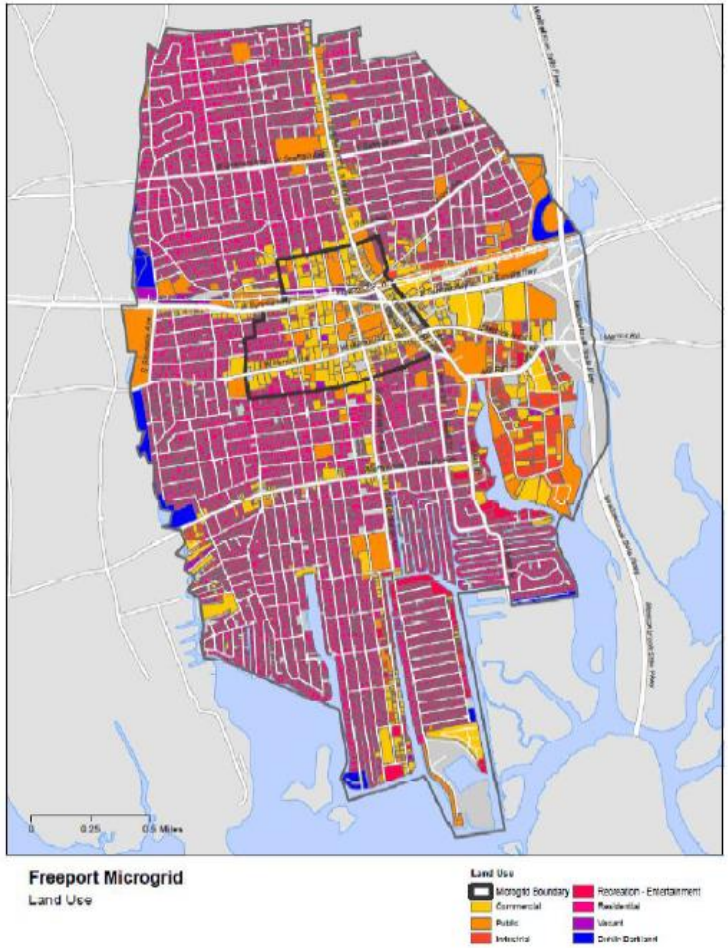
Typology of Projects: Municipal Utilities

Leading municipal microgrids

- microgrids an make a town's Distributed Energy Resources more valuable for grid operations
- municipal utilities invest in the complex operator capabilities and bring out a maximum value to the grid

Typical goals

- Create centers of resilience
- Establish/implement town's carbon aspirations
- Reduce energy price volatility



Typology of Projects: Hospital Complexes

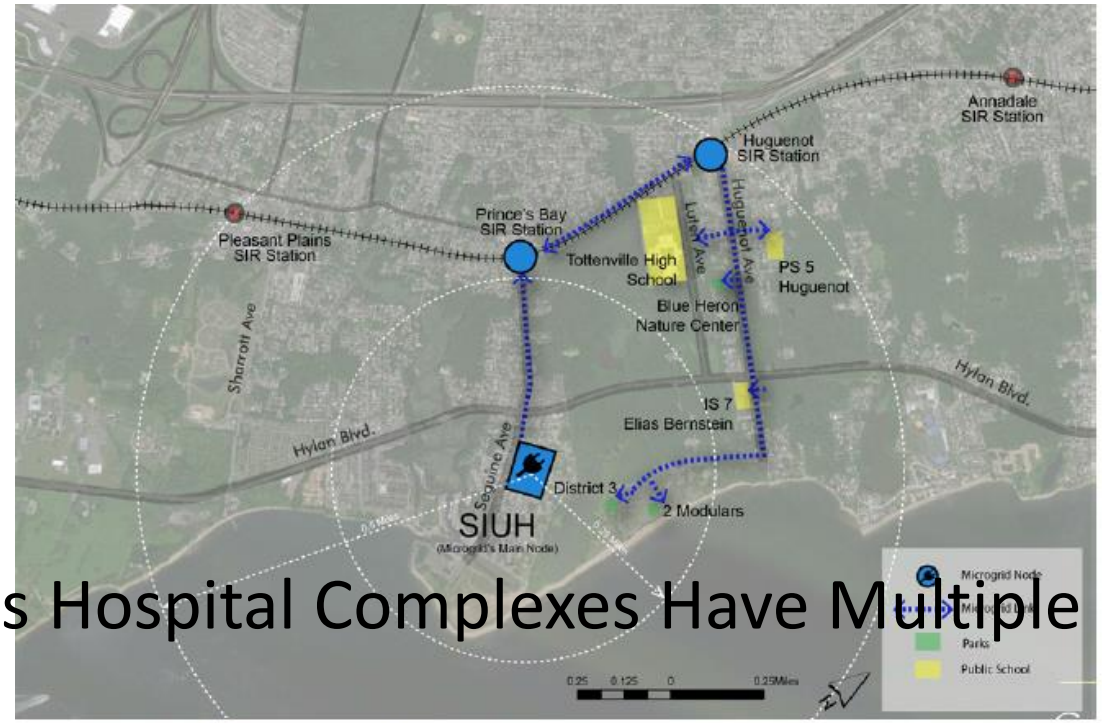


Figure 31: South Shore Microgrid Network Pilot Project

- Microgrids Hospital Complexes Have Multiple Benefits
  - Reduce cost and volatility of energy
  - Expand the area of more resilient energy from just the hospital complex to surrounding neighborhood

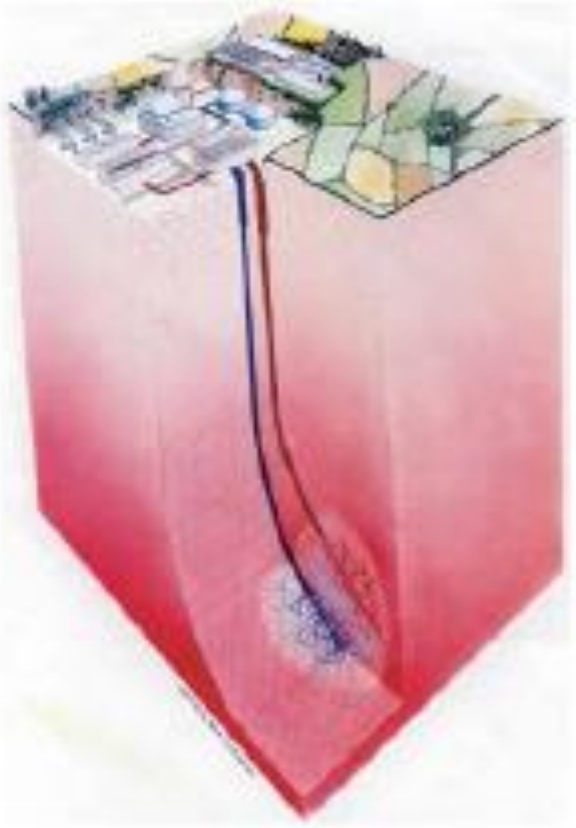
Typology of Projects: Universities

Leading academic microgrids

- UCSD
- Princeton
- Cornell

Typical goals

- Increase resilience
- Decarbonize
- Display engineering excellence (e.g. Cornell)
- Reduce energy price volatility



A Paradigm That Scales

Third party microgrids will standardize solutions, introduce the discipline of project finance, and increase scale – creating an assembly line to provide microgrids to large, diverse groups of customers.

Resiliency Case:
Vulnerable Communities

- A microgrid enables vulnerable areas to **remain resilient** in the face of extreme weather, mitigating the reoccurrence of Sandy-like devastation.
- As a means of **securing resiliency** in places like the Rockaways, utilities like PSEG Long Island can utilize distributed generation technologies to **address costly transmission and distributed upgrades**.

Business Case:
Critical Infrastructure

- Microgrids allow critical infrastructure like hospitals and other emergency services to **maintain operations** during severe weather events.
- Microgrids will enable end users to interact with the macro-grid to **achieve significant cost savings.**

A Vehicle for DER Growth

Microgrids will be a vehicle for the growth and integration of Distributed Energy Resources (DER) in the state. A packaged approach helps improve economics and will make DERs feasible where they aren‘t as stand-alone projects.

Environmental Case:
Growth of DER

- Anbaric’s “hierarchy” of Distributed Energy Resources puts priority on those with greatest environmental benefit, such as **demand-side efficiency** and **thermal storage**
- Microgrid controls can help integrate **renewables** and **storage** in a more beneficial way and improve their contribution to the local and regional energy mix
- A focus on efficiency ensures the right-sizing of **distributed generation** and the optimization of thermal vs. electrical load curves will increase **cogeneration** efficiencies

Thank You