

Microgrids: Aligning Economics and Resiliency

National Town Meeting on Demand Response + Smart Grid

May 2014

Steve Pullins

Co-Founder/Chief Strategy Officer, Green Energy Corp

spullins@greenenergycorp.com

green energy corp

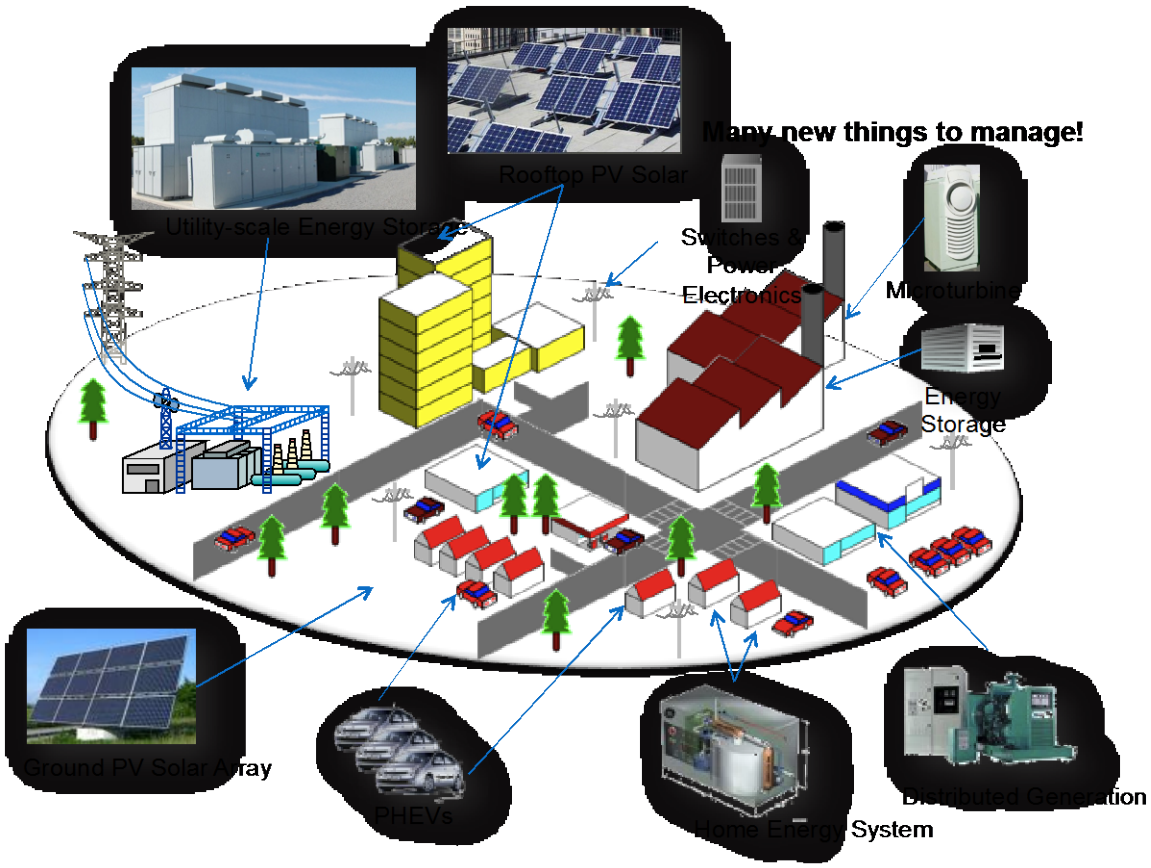
What is a Microgrid?

"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. 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

A microgrid improves reliability, economics, and emissions.

- Multiple resources
- Existing space
- Active controls
- Effective use of energy storage
- Above average use of renewables
- Serves host energy needs and grid ancillary services



Essential Questions about Microgrids

- Do microgrids have a role in the energy future for consumers? For utilities?
- Do microgrids help with resiliency and reliability?
- Can microgrids play safely with the main grid?
- Can microgrids help accommodate deep penetration of variable renewables?
- Do microgrids pencil out?

green energy corp

Key Lessons from Designing 24, Building 4, and Owning 3

- Economically viable: 2 to 40 MW campus with typical retail rates
- Significantly improves on-site reliability; a MUST
- All solutions (to date) reduce emissions footprint (0.12T/MWh)
- All solutions (to date) include energy storage, PV, and 2 to 5 other resource types
- All solutions (to date) include active management, and integration to building controls and price-driven load management
- Most selected Scenario: MaxSavings
  - 80% to 86% self-generation, rest from grid
  - Always grid connected
  - Sales to grid: zero to minimal

green energy corp

Microgrid Resiliency and Economics – Aligned?

- Continuity of operations:
  - Resiliency ↑ Economics ↑
  - Many NY, NJ, CT microgrids built before Sandy / resiliency became hot topic – resiliency as a by-product
- Hedge single resources:
  - For a consumer, the grid is a single resource
  - Resiliency ↑ Economics ↑
- Reduced distance – source to sink:
  - Resiliency ↑ Economics ↑
- **Can we drive electric system designs that increase resiliency and economics for the consumer?**

green energy corp

The Brevoort (Manhattan, NY) (1 of 30)

- Residential high rise with natural gas-powered CHP system
  - Four 100 kW CHP units powered all 290 apartments through Sandy
- Normal occupancy is 720 people. During Sandy, the Brevoort was able to house and provide power to 1,500 people through storm.



- “Powered by our CHP system, we were the only building on lower Fifth Avenue able to provide energy and full service to our residents.” - Diane Nardone, President of the Brevoort coop board
- The Brevoort was able to maintain power for central boilers, domestic water pumps, all elevators and all apartments

green energy corp

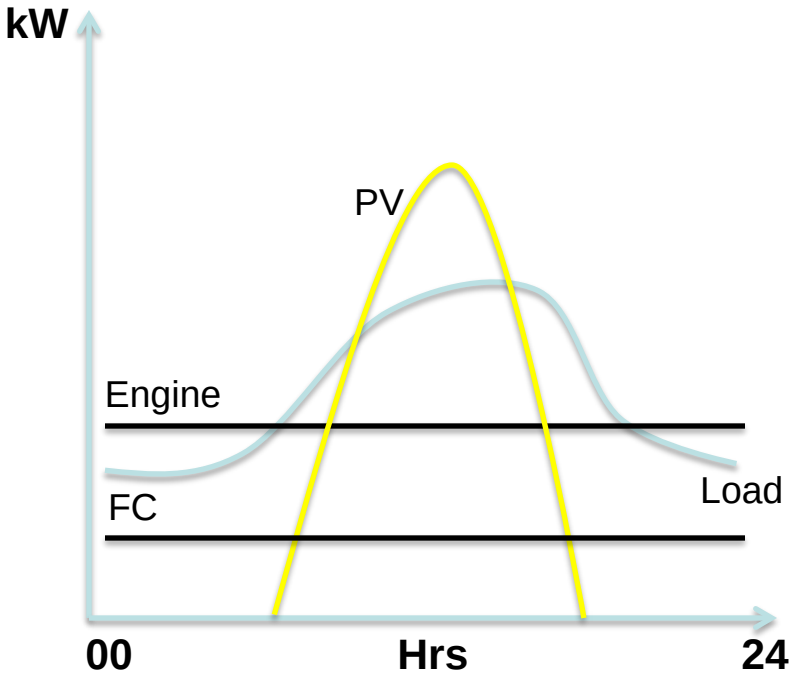
Connecticut Lessons for All of Us

- Pre-Sandy storm challenges
- Superstorm Sandy
- CT Department of Energy and Environmental Program (DEEP) Microgrid Program
  - Resiliency is best served locally
- Now we see MA, NY, NJ, & MD microgrid programs
- Need to understand the role of economics in setting policy and design drivers
  - DEEP Microgrid Program change: Round 1 to Round 2
  - Private funding takes place when the economics work

green energy corp

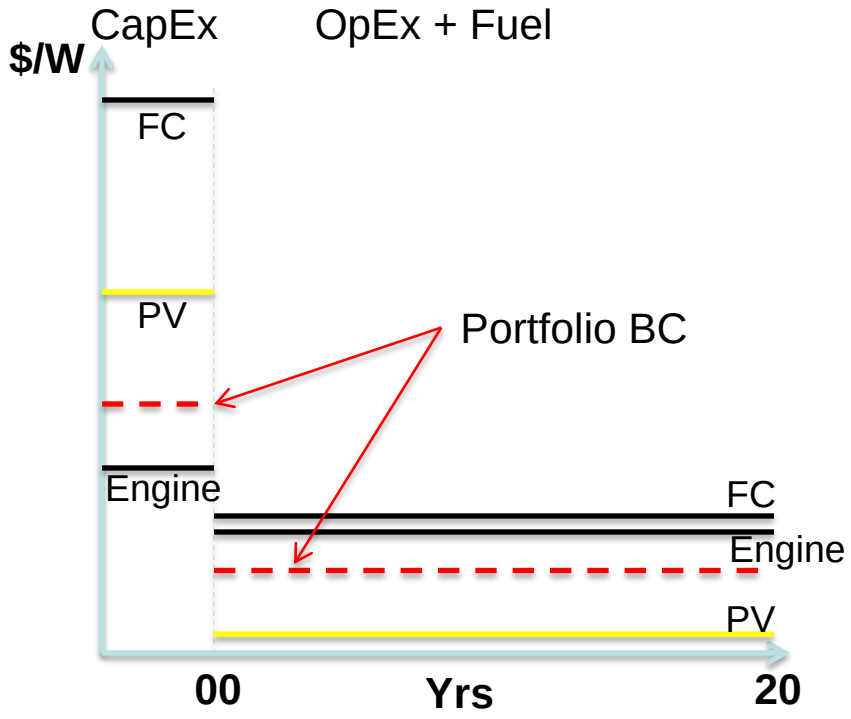
Power of the Portfolio

Technical View



- Multi-resource fit
- Hedging – reliability, economic
- Enables higher utilization and more renewables, thus lower emissions / MWh

Economic View



- Portfolio Business Case is better than individual ones
- Hedging ability results

green energy corp

CT Microgrid Example – Resiliency / $$

- High School, City Ice Arena, Grocery, Retail, Restaurants
- Temporary (tactical)
  - $3M
  - Single 1 MW natural gas engine, pre-existing 400 kW FC
  - Expected operations: 200 hrs/yr
  - No discernable reduction in CO_2
- Strategic (permanent)
  - $7.7M
  - 3 x 248 kW natural gas engines, 188 kW PV, 120 kW energy storage, pre-existing 400 kW FC
  - Expected operations: 8760 hrs/yr
  - 286 T/yr CO_2 reduction
- Compare 20-yr capital use: $0.75/kWh vs $0.04/kWh
- Compare reliability and resiliency: strategic slightly better

green energy corp

Conclusions

- Resiliency seems to be aligned with economics – could be a better set of design drivers
- The resource portfolio approach in microgrids seems to improve economics, reliability, and resiliency
- The growing number of microgrids are refining and improving the business case (costs and benefits)
- Microgrids are a great provider of ancillary services for grid support, but not necessarily a good supplemental energy resource

green energy corp

Green Energy Corp

Thank you!

Questions?

spullins@greenenergycorp.com

