An Evaluation of the Economic and Resilience Benefits of a Microgrid in Northampton, Massachusetts

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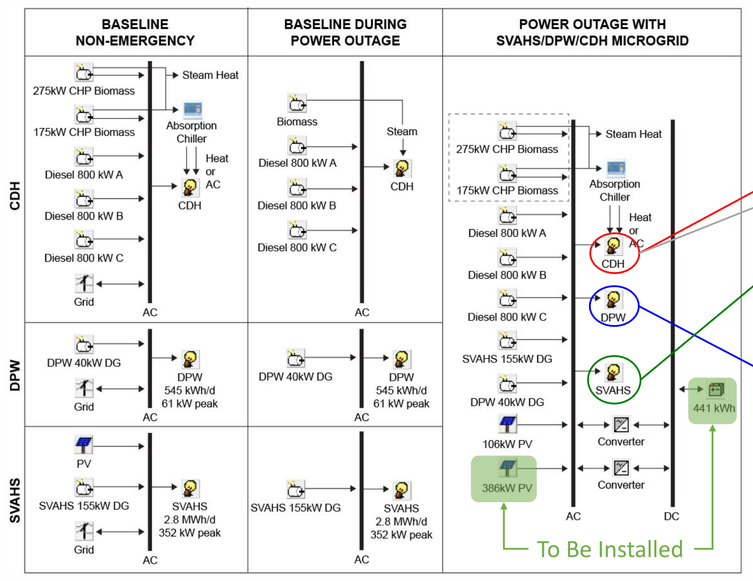
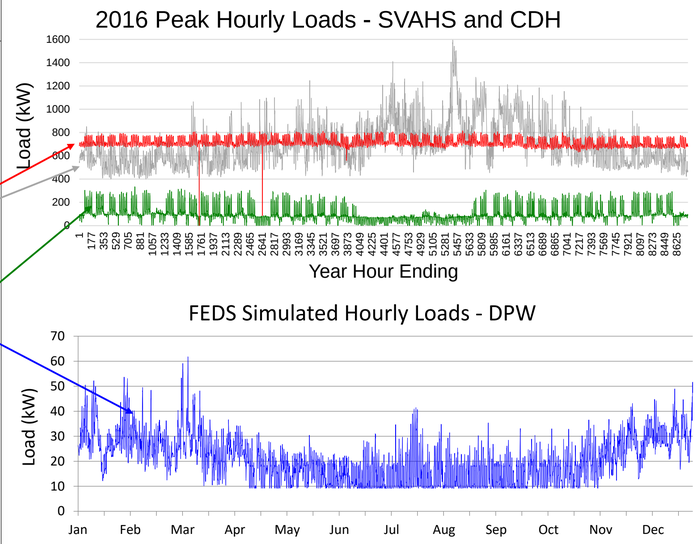
PROJECT OVERVIEW

Evaluate the economic and resilience benefits of a proposed microgrid (MG) in Northampton, MA

Distributed energy resources at three facilities:

- Cooley Dickinson Hospital (CDH)
  - Three 800 kW diesel generators (DGs)
  - Two CHP biomass (incapable of operating during outages)
  - 441 kW/441 kWh battery (to be installed)
  - 386 kW PV (to be installed)
- Northampton Department of Public Works (DPW)
  - 40 kW DG
- Smith Vocational & Agricultural High School (SVAHS)
  - 155 kW DG
  - 106 kW PV





ECONOMIC ANALYSIS

Benefits obtained with optimal battery operating schedule

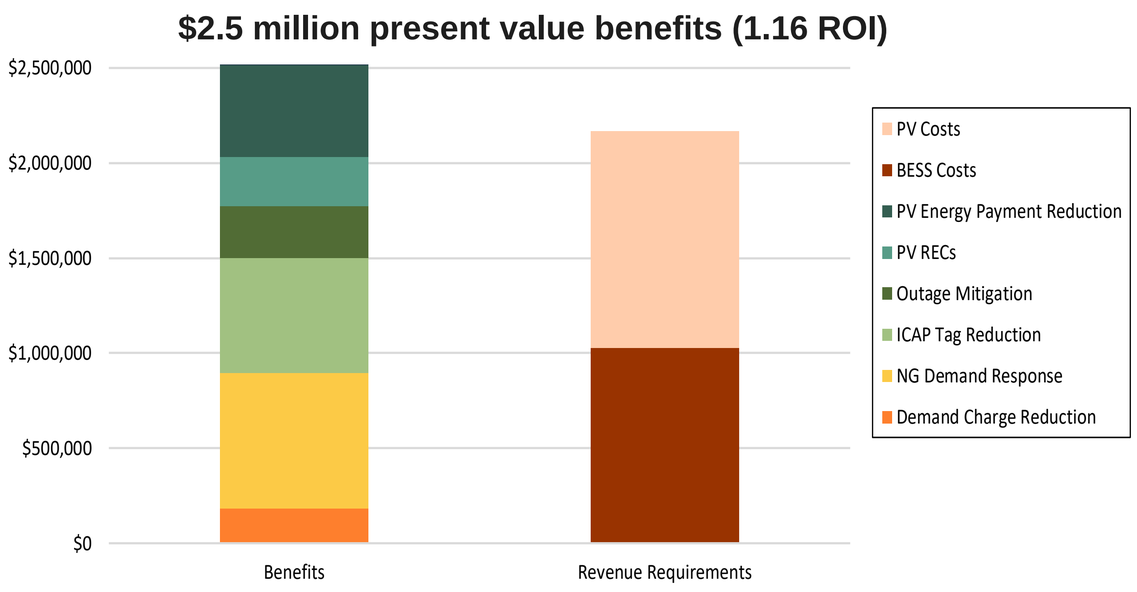
- Objective: maximize benefit
- Constraints: operational constraints & grid service requirement

Value streams:

- National Grid demand charge reduction
- National Grid demand response program participation
- ISO-NE installed capacity tag reduction
- Energy purchase reduction through PV array production
- Energy arbitrage exploiting time of use pricing
- PV renewable energy credits (RECs)

Costs:

- Battery energy storage system (BESS) & Solar PV
- Initial investment & Major maintenance and replacement



RESILIENCY ANALYSIS

Investigate survival rate in 10000 simulated random outages

System Connectedness

- No microgrid
- Limited microgrid
- Full microgrid

Seasons:

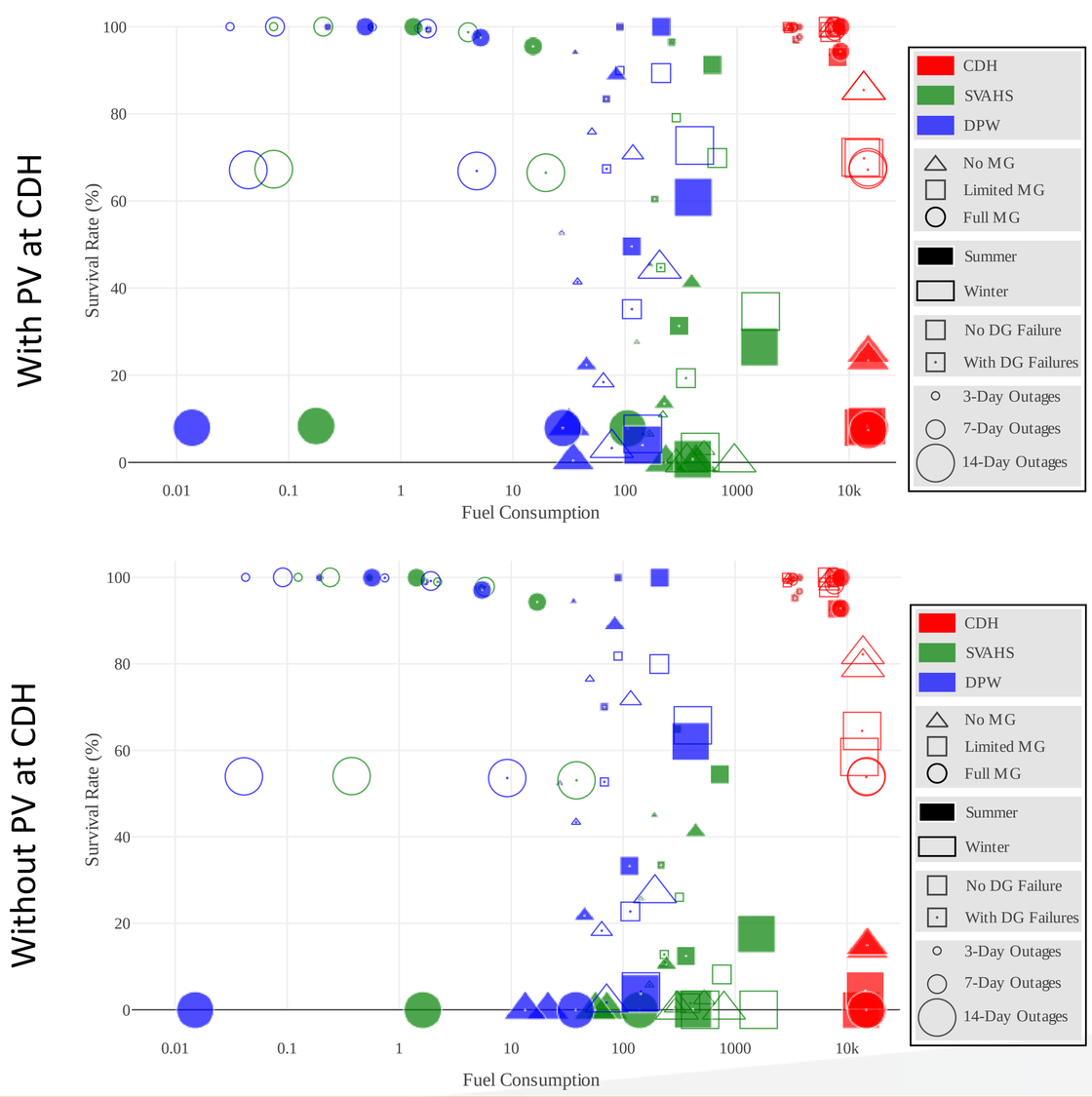
- Summer: June – October
- Winter: November – May

Diesel generator failure probabilities

- Fail to start: a DG fails to start up on demand
- Fail to load: a DG fails to pick up load after started
- Fail to run: a DG fails in the second hour of serving load or later

Key findings:

- All sites are more likely to survive when a microgrid is formed
- Survival rates are low in 14-day outages due to fuel shortage
- Additional PV at CDH significantly improves survivability
  - Especially in outages with longer durations, because it helps conserve fuel



CONCLUSIONS

This project evaluated the economic and resilience benefits of a microgrid proposed in Northampton, MA that would link the Northampton DPW, CDH, and SVAHS. An innovative evaluation framework was proposed to capture economic benefits from multiple grid services in grid-connecting mode and resilience benefits in islanding mode. It was found that

- With a cost of $2.2 million, the BESS and the 386-kW solar array are estimated to generate $2.5 million in present value benefits over a 20-year life, resulting in a return on investment (ROI) of 1.16.
- With the PV array installed at CDH, forming a microgrid helps increase survivability of all facilities against an outage.

Acknowledgements

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