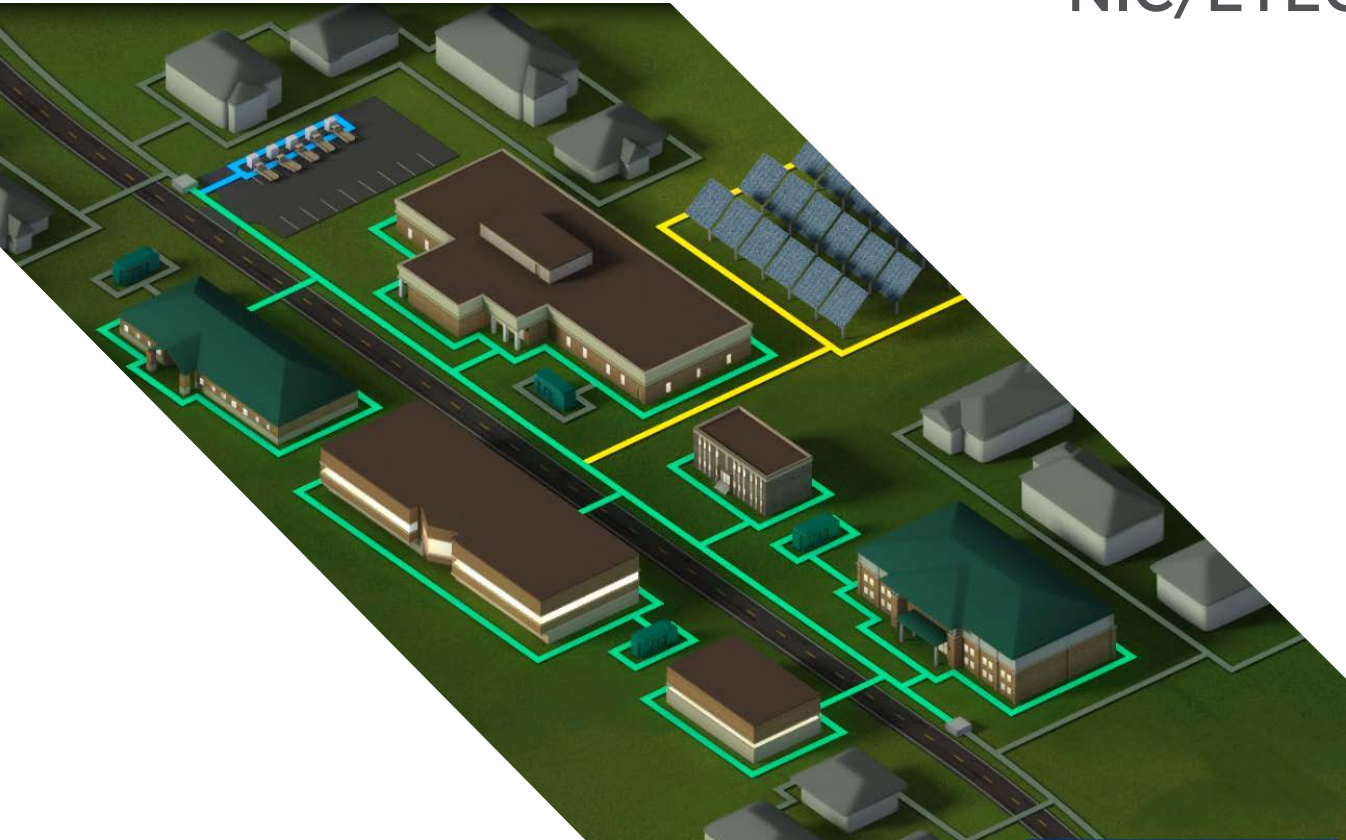


# NIC/ETEC Nuclear Supplier Workshop

# BUILDING A MICROGRID

September 7, 2017



# Microgrid Definition:

*“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 can] connect and disconnect from the grid to **enable** it **to operate in both grid-connected or island-mode.**”*

*- the U.S. Department of Energy*

# Microgrid Market Shifts



## Traditional Critical Infrastructure

- Central Power Plant Approach
- Only Operate in Absence of Utility
- Common at Data Centers and Hospitals



## Combined Heat & Power

- Central Energy Plant Approach
- Focused on Highly Efficient Utility Tied Operation
- Common on University Campuses



## Next Gen Critical Infrastructure

- Distributed Generation Approach
- Focused on Flexibility and Sustainability
- Renewable and Emerging Technologies

# Microgrid Construction Experience

- ▶ SPIDERS Program: Integrate distributed backup generators, renewables, batteries on DOD installations
- ▶ Campus Central Energy Plants (TECO and GRU): Prime movers for steam and continuous power generation that can operate grid-tied or islanded



# Microgrid Construction Experience

- ▶ Renewable-based Microgrids (Port of LA, Hawaii PEARL): Operate independent of the grid
- ▶ Utility-operated Peaking Plants (HECO/Schofield Barracks): secondary benefit as distributed generation upon loss of utility





# Microgrid Design and Construction Considerations

- ▶ Generation assets respond differently when grid-tied vs. islanded
- ▶ Upon power outage, some generation and loads trip instantaneously
  - Requires prime generation to ramp up/down in blocks
    - ▶ Are generators continuously operating as spinning reserve?
    - ▶ Do battery systems have enough capacity to respond?
    - ▶ Can SMRs react quickly enough?
  - Changes reactive power profile immediately
  - Can create secondary instability after outage

# Non-Technical Challenges

- ▶ Understanding ownership of assets and rights of access
  - Utility, customer, third-party PPA
- ▶ Understanding impacts to utility rate schedule
  - Demand charges based on power export?
- ▶ Increased complexity of distribution operations
  - Changes in safety protocols
  - Preparedness for infrequent events





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