


Sustainability and Resiliency Drives Utility System Sharing

Sustainable Approach to Resiliency

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Topics of Discussion

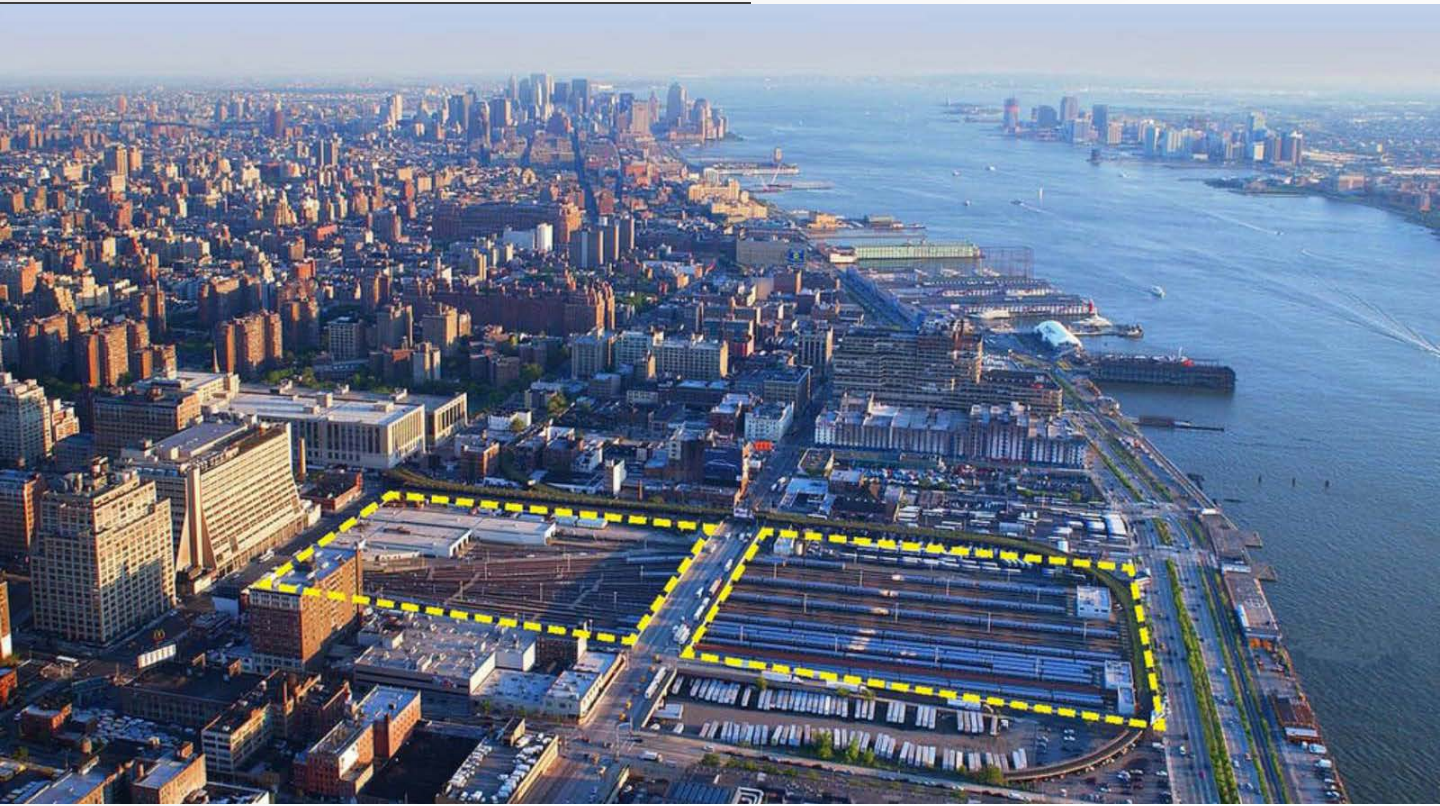
- Introductions
- Hudson Yards development project
- What is a microgrid & what are its benefits?
- Hudson Yards microgrid case study
- Q & A

Project Description

Hudson Yards, located on the west side of midtown Manhattan in New York City, is the largest privately funded development projects in the United States comprising a mixed use development. The development is designed with a Micro Grid which connects to ConEdison thru a high tension interconnection at 13.2kv level and onsite generation serves 70% of the electric load while also serving heating and cooling loads of the development.

Resiliency an important consideration post Super Storm Sandy in New York City and drove collaboration with ConEdison to create an interconnection which meet ConEdison standards but also allowed for sharing of ConEdison switches and wires during an outage. This overlapping Micro Grid design allowed for power flow to sections of the ConEdison distribution to back feed section of the development that could not be feed normally while parallel to ConEdisons 13.8kv system.

The system architecture and control solutions and system control are presented for this Micro Grid installation.



Micro Grid (MG)Benefits

- Parallel with Utility
  - Utilizing all the CHPs waste heat
  - Lower Utility Costs
- Resiliency Benefits
  - MG can island and provide entire campus with CHP capacity electric power
  - Provides heat and cooling
  - Supplies selected normal power

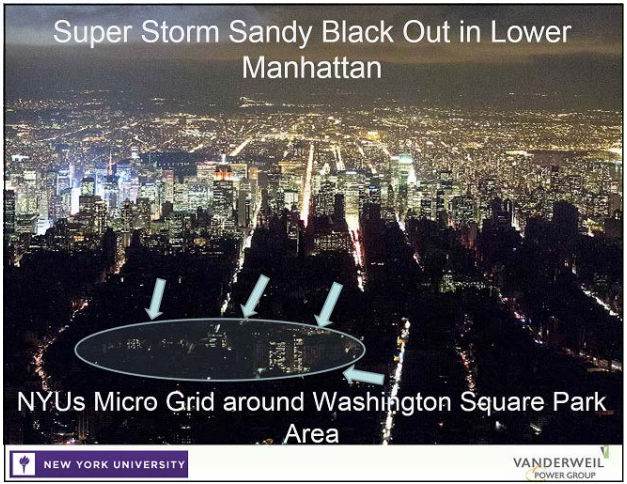
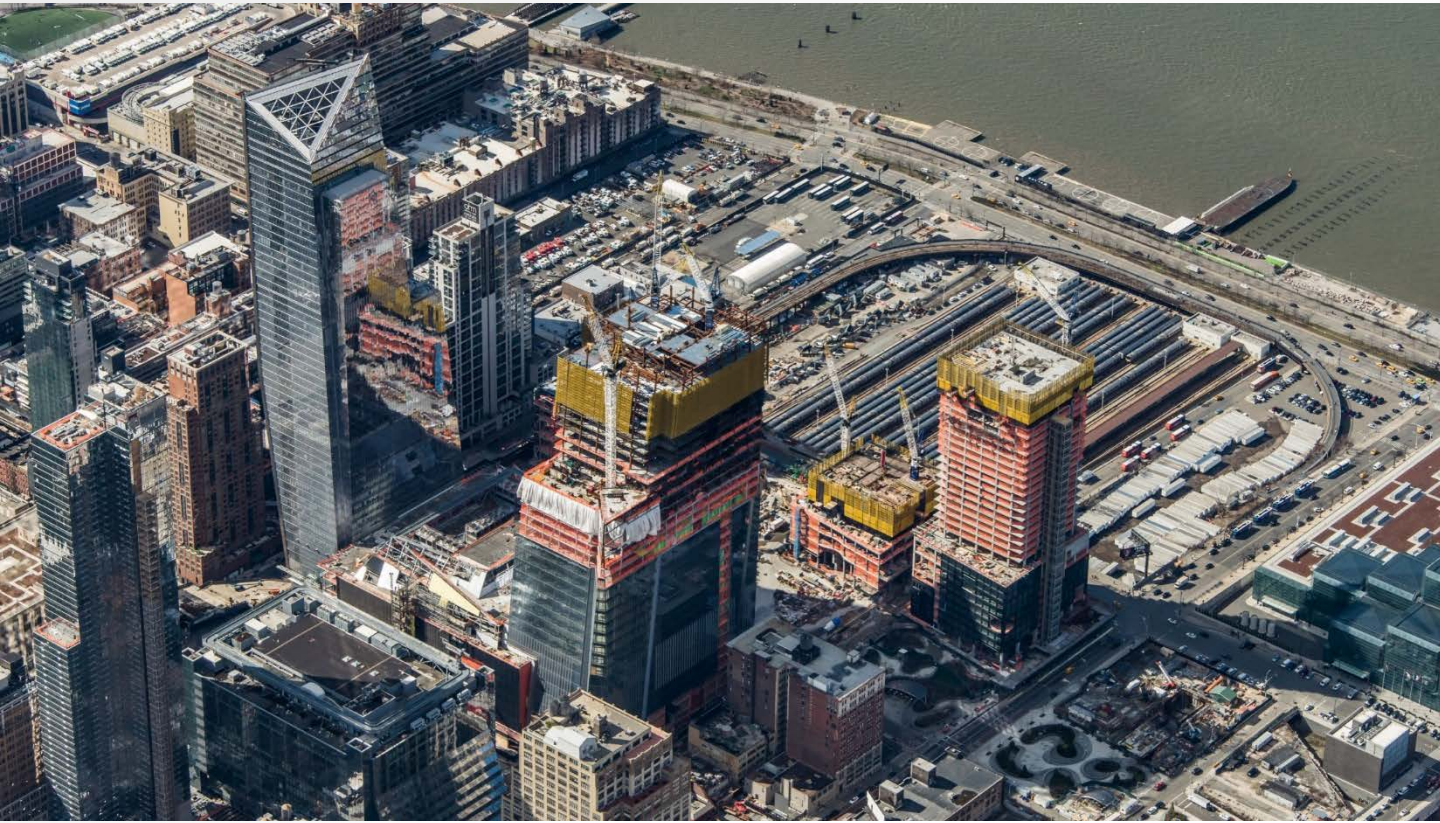
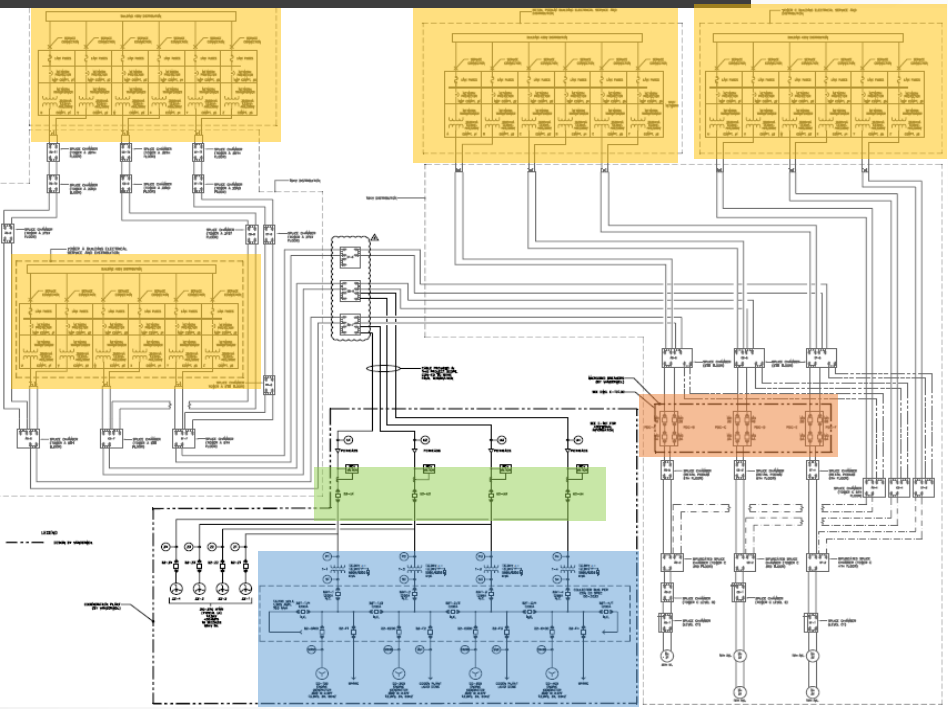


Image Reference:
http://www.edwardtdodge.com/wp-content/uploads/2014/12/2014_10_19_NYU-Blackout-Sandy.png



Case Study: Hudson Yards



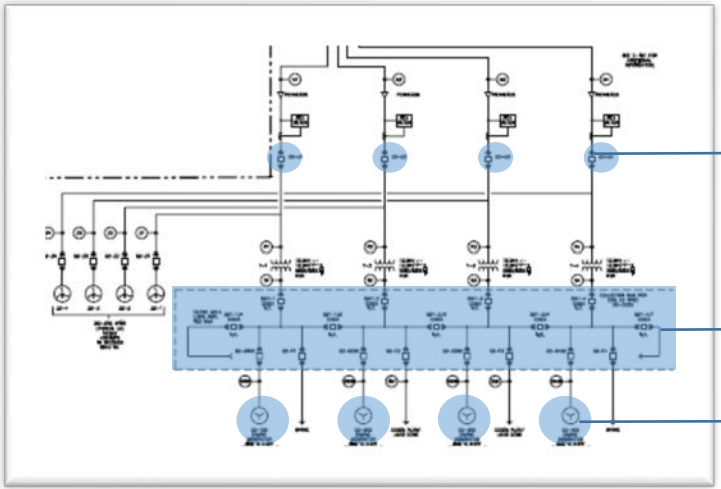
CHP Plant

Utility Breakers

Building Loads

Micro Grid Breakers

Hudson Yards Micro Grid CHP



Utility Breakers

Ring Bus

Generators

Microgrid Control System

- Remote control and monitoring of loads, breakers, and equipment
- Supervisory Control and Data Acquisition System
  - Visualization
  - Dashboards
  - Historian
  - Trending
  - Reporting
  - Alarming (remote & local)
- Utility company interface – Transfer/Trip, RTU
- Energy Metering
- Automatic Load Shedding
- Automatic Load Restoring

Microgrid Control System Cont.

- Demand Response
- Frequency Response
- Import/Export Control
- Time Synchronization
- Sequence of Events (SOE) Forensics
- Safety Interlocks
- Economic Dispatch

Microgrid Control System Architecture

- Smart Power Meters and Relays (Switchgear Manufacturer)
- Generator Local Controller (Vendors)
- Microgrid or Power Management System (PMS) Controller (Controls Contractor)
- Operator Interface (Controls Contractor)
- Data Collection and Historian Servers (Controls Contractor)
- Utility Company Control System or SCADA

Case Study: Hudson Yards

Challenges

- Complex ancillary systems serving CHP
- Varying heat load
- High profile tenants
- Multiple remote distribution bus
- ConEd requirements for remote monitoring and supervisory control
- Load balancing of REG

Solutions

- Deliver one fully integrated control system tightly integrating together all MG & CHP functions & sub-systems.
  - Benefits: operators single interface (look & feel), cost effective, single supplier
- Absorption chillers & multiple thermal modes SOO, REG
- Build resilient MG system based on Rockwell Automation technology
- Expanded RIO architecture for fast load shed of 480V breakers
- Implement dedicated RTU PLC with DNP3.0 protocol for interfacing with ConEd
- Utilize PLC based Power Management System to drive speed setpoints to REG

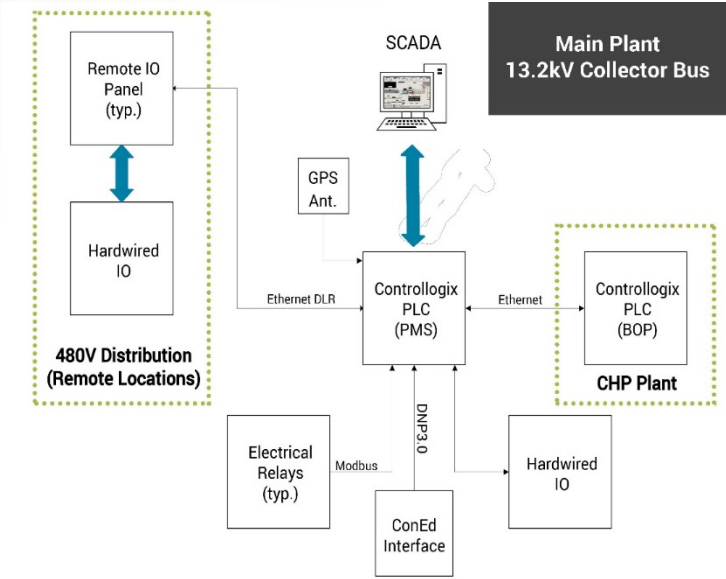
Case Study: Hudson Yards

Hudson Yard's Micro grid Details:

- Energy producers – CHP Plant, Four natural gas reciprocating engine generators ~ 3MW each coupled with four absorption chillers to maximize efficiency
- Energy consumers – Residential, office and commercial space at Hudson Yards
- Controls
  - Balance of Plant (BOP) controller (thermal) - chilled water, hot water, condenser water, fuel gas, etc..
  - Power Management System (PMS) controller (electric) – electrical breaker control, generator speed, etc..
- Microgrid breakers, collector bus, power distribution

Control System Overview

- Redundant ControlLogix PLC panel in cogeneration plant
- Three remote IO panels located at separate 480V distribution locations
- Fiber optic device level ring
- ~800 hardwired IO
- 26 Power Relays in electrical gear communicating Modbus
- FactoryTalk SCADA
- Panelview



Control System Functions

- Con Edison Monitoring and Control Interface Point – DNP3
- Load Shed/Restore at 480V breaker level
- Load lockout
- Breaker monitoring and control
- Modes of operation
  - Utility Parallel
  - Black start
  - Island
  - Stand Alone

Utility Parallel Mode

- Utility and Micro grid breakers are closed.
- Engines are synchronized to Utility across Inter-Tie breakers by CHP plant's Master Sync panel
- GE-489 Relays will be programmed to trip generators if Voltage or Frequency fall out of tolerance.
- The Balance of Plant will manage Engine Generator Loading based on number of Con Ed breakers in service.
- Con Ed can trip utility breakers through communications to the PMS processor using DNP3 protocol.

Black Start/Island Mode

- If Con Ed system is offline, Engines can be black started utilizing an emergency generator that powers the Cogen DESS.
- Once at least 2 engines have been synchronized to the Collector Bus, the Cogen DESS will be transferred back to normal power in a closed transition mode.
- The Cogen plant is now in Island Mode and is not providing power to the facility (IT and U breakers are open)
- If the utility is unavailable, Operations can transfer to Stand Alone mode through coordination with Con Ed.

Stand Alone (Micro grid) Mode

Transition to Stand Alone Mode:

- All micro grid breakers must be opened, which must be confirmed by Con Ed and Cogen operations.
- Direct transfer trip by Con Ed is disabled on the U and IT breakers.
- Close U and IT breakers, connecting Cogen to Building Loads
- Begin Priority Load Control to selectively close 480V breakers to utilize Engine Generator load capacity.

Priority Load shed

- The PMS controller will close 480V breakers to utilize Cogen capacity.
- Transducers on the G breakers monitor total KW consumed. The PMS PLC will use this information to determine whether to shed or restore load.
- Priority based, hundreds of breakers.

Conclusion

Benefits received from this solution:

- Flexibility in development
- Reduced energy use for heating and cooling
- Additional power during natural disasters and outages
- Reduced operating costs
- Single integrated control system
  - Utilize PLC based solution which offers scalability & flexibility
  - Lower life cycle cost for owner vs other technology providers
  - Tightly integrated CHP and MG

Q&A

Thank You

Q & A