Microgrid Controls: Demystifying the Glue That Pulls It All Together
What is a Traditional Microgrid?

A group of interconnected loads and distributed energy resources that acts as a single controllable entity with respect to the grid.

- Able to disconnect from grid (island mode)
- Able to parallel with the grid (parallel mode)

Graphic Reference:
https://energycenter.org/self-generation-incentive-program/business/technologies/microgrid
What Does a Microgrid (MG) Control System Look Like?

• The brain is an industrial grade microprocessor-based controller, such as a PLC
• Has fast (millisecond range) response time for executing routines/functions
• Typically coupled with an industrial grade Supervisory Control & Data Acquisition (SCADA) software package
• May include manual control/sync panel(s) in the event of loss of the PLC
Why/When Do We Need a MG Control System?

• Black Start Sequencing
• Parallel / Island Mode Operation
• Power Import / Export Control
• Load Shed and Load Restoration
• Safety Interlocking

• SCADA Functions
• Monitoring, Trending, Alarming
• Demand / Frequency Response
• Time Synchronization
• Economic Dispatch
What is a Hybrid/mini-grid (mG)?

A group of interconnected loads and distributed energy resources that acts as a single controllable entity, BUT with no connection to the electrical grid.

- Fully standalone and self-sustaining

(no grid interface – ever)
Case Study: TWA Hotel

TWA Hotel’s mG Details:

- Three natural gas reciprocating engine generators 353kW each
- Energy consumers – Lobby/terminal building, hotel towers, convention center
- Engines part of Combined Heat and Power Plant
- Exhaust gas used to create hot water – increased overall efficiency
- Balance of Plant (BOP) controller - chilled water, hot water, condenser water, fuel gas, battery storage, etc..
- Energy Management System controls – staging of prime mover assets based on kW, load, battery charge. System integrates with DI.AN.E controls, Areos and Teco-chil to form a cohesive system.
Case Study: TWA Hotel

Challenges
- No grid connection
- Prime mover asset staging/selection priority
- Meeting the Varying hotel energy/thermal loads
- Hotel and convention center customers
- Load balancing of Reciprocating Engine Generators (REG)

Solutions
- Maintain high storage level in batteries to ride out plant or engine trips
- Based on equipment availability, current load conditions,
- Three engine driven and one electric chiller & multiple thermal modes SOO, REG
- Build resilient MG system based on industrial grade PLC technology
- Utilize the Energy Management System functionality within the BOP PLC to drive speed setpoints to REG
  - Changes based on charging or discharging battery modes

www.thermosystems.com
Each project has unique specified objectives (to island or not?, black start capability?, load shed/restore?, fuel source(s): NG, FO, LNG, to run on?, manual sync?, etc.), thus the MG Control System needs to be designed accordingly.

MG Controllers are not plug-n-play nor are they one size fits all.

The MG Control System is the brains of a MG and without them behavior is unpredictable! And can be dangerous especially if grid connected.
New or existing OEM equipment is INTEGRATED with plant controls to form a complete MG Control System.

The cost of the MG Control System is greatly dependent on the size and complexity of the overall MG system.

Success – meeting the goals of your user requirements – will require more than just selecting a controller. It will come from designing and deploying a well-thought-out integrated system of components.
Questions?