

A composite image featuring a young child with curly hair blowing a dandelion seed head. The background is a soft-focus green field with a large, bright sun in the upper left. Overlaid on the scene are semi-transparent images of a wind turbine and solar panels, symbolizing renewable energy.

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Boaz Reliability Microgrid

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Battery Pilots

Wisconsin

- Sauk City (16 kW/45.6 kWh)
- Portage (5 MW/10 MWh)
- Boaz (400kW/3200 kWh battery) anticipated in service 5/2023)



Iowa

- Wellman (672 kW/2652)
- Marshalltown (250 kW/584 kWh)
- Decorah (2.5 MW/2.9 MWh)
- Cedar Rapids (5 MW/10 MWh)



Boaz Reliability Microgrid



What is a microgrid?

- The DOE defines the microgrid as “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.”

What is a microgrid?

- Think of a laptop computer without a battery.
- It has different types of loads like the screen driver, cooling fan, hard drive, and optical drive.
- It will only run when plugged in. The laptop without a battery is Boaz today. Pull the plug and the laptop will immediately stop.
- With a battery, when the laptop is unplugged, the laptop continues to operate just like our equipment will power Boaz.
- The battery will only power the laptop for so long. It must be plugged back in before battery power is exhausted. “Island time”
- Power will keep the laptop running and recharge the battery for the next time it is unplugged.

Selection Process

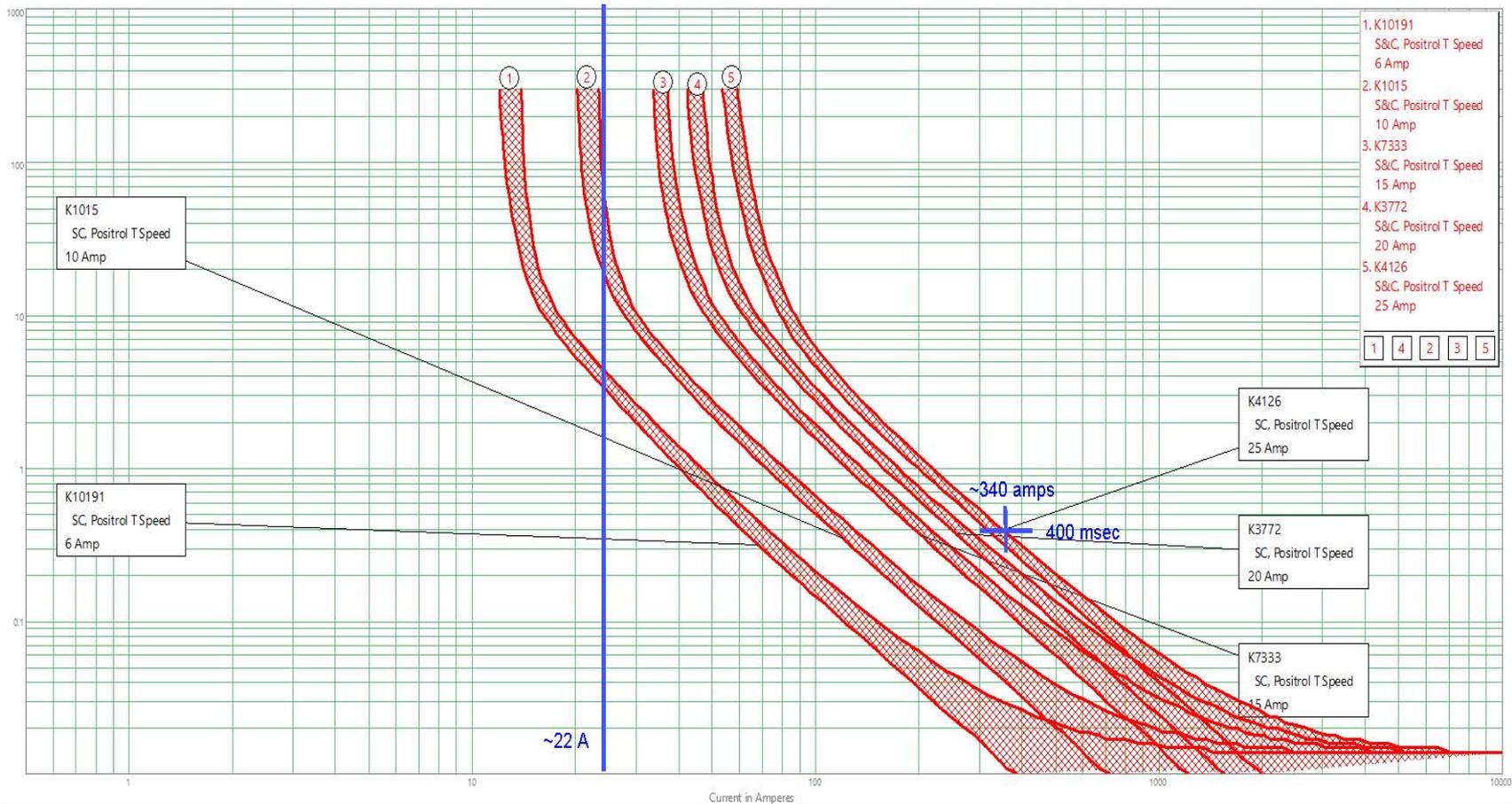
- Started with a list of 17 potential locations
- Developed a list of criteria
- Collected data for each location
- Ranked locations based on criteria
- Determined equipment size based on backup time
- Checked for available land for microgrid location

Village of Boaz came out on top

Technical Requirements

New equipment for Alliant Energy

1. 400kW/3200kWh capacity (8 hour battery)
2. Seamless transition to “island” mode and back to grid connected
3. Maintain system protection scheme even when islanded





Boaz Reliability Microgrid

- Scheduled completion – 05/2023
- 3 – 1.2 MVA inverters for 3.6 MVA
 - 3rd inverter for fault contribution only
- 2 – 1.6 MWh LFP battery modules for 3.2 MWh
 - Over 8 hours of backup at peak load
- Breakers and SEL relays used to “island”
- Designed to seamlessly transition off and on grid
- Microgrid is 15 miles from substation with two reclosers in the line

Use case is to improve reliability

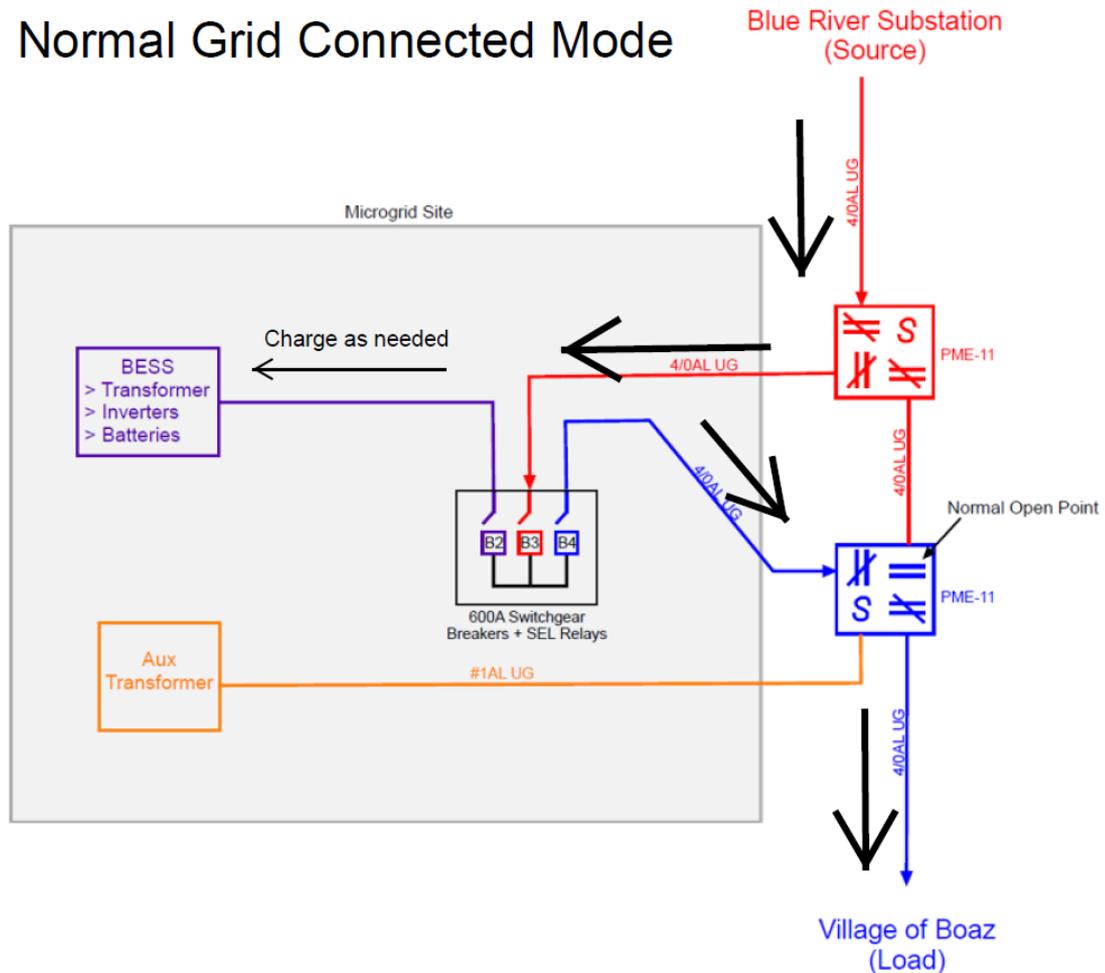
Other Microgrid Equipment Issues

- Delta transformer winding is required because of inverters over 500 kVA size
 - Not Standard in Wisconsin so this became a Pilot within a Pilot
 - System Protection required an SEL 487V relay to detect open phase conditions.
- Inverter AC voltage needed to be under 600 volts for work rules
 - Using 550 volts which is not a standard voltage
 - Unique transformer requires a backup
 - The transformers for the Portage and Deer Run batteries use the same voltage and windings but are larger. Microgrid was designed to allow room for the larger transformer, reducing backup inventory
- Internal Communication Standard Changes
 - Began as full EPC to include communication equipment
 - Standard changed to include “Trusted” box that contains firewalls and managed switch
 - Required change order

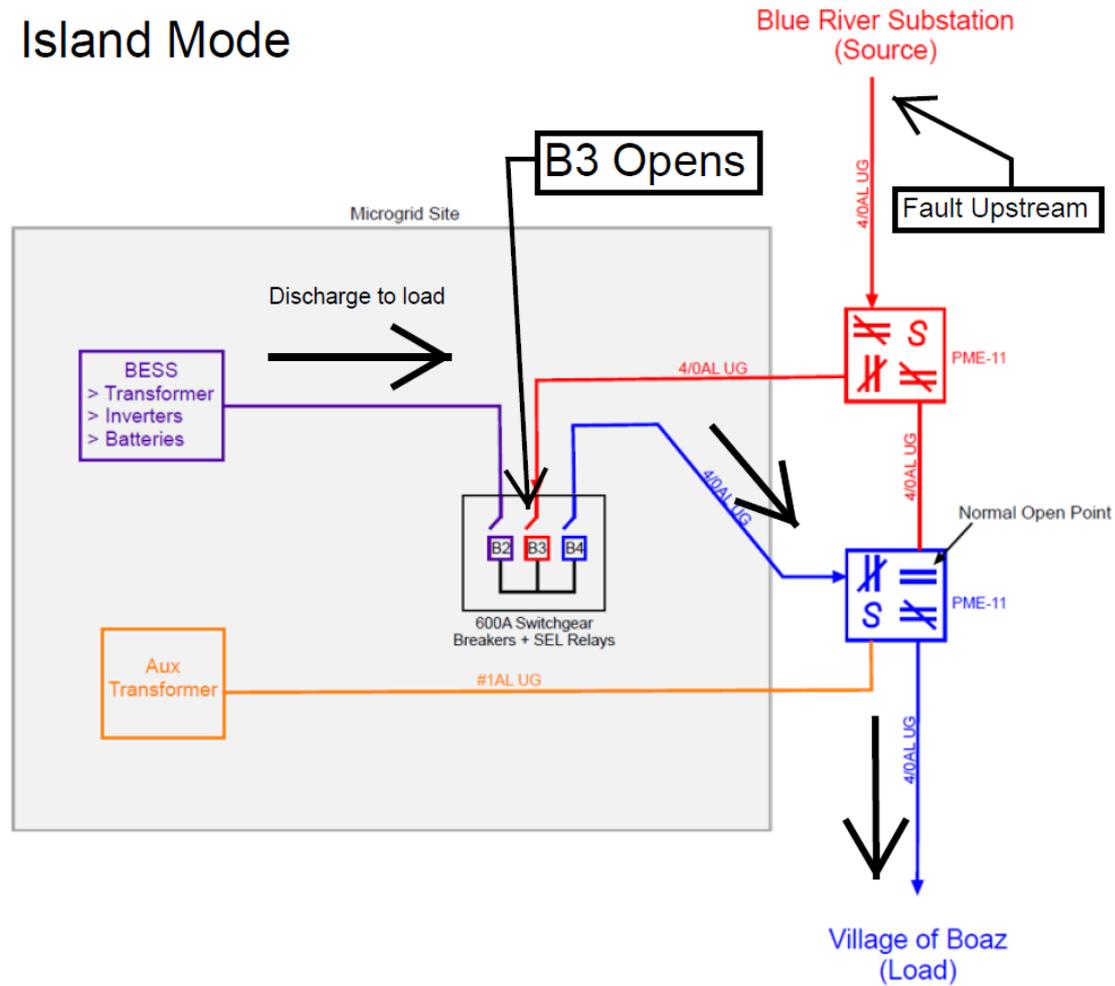
Boaz Reliability Microgrid



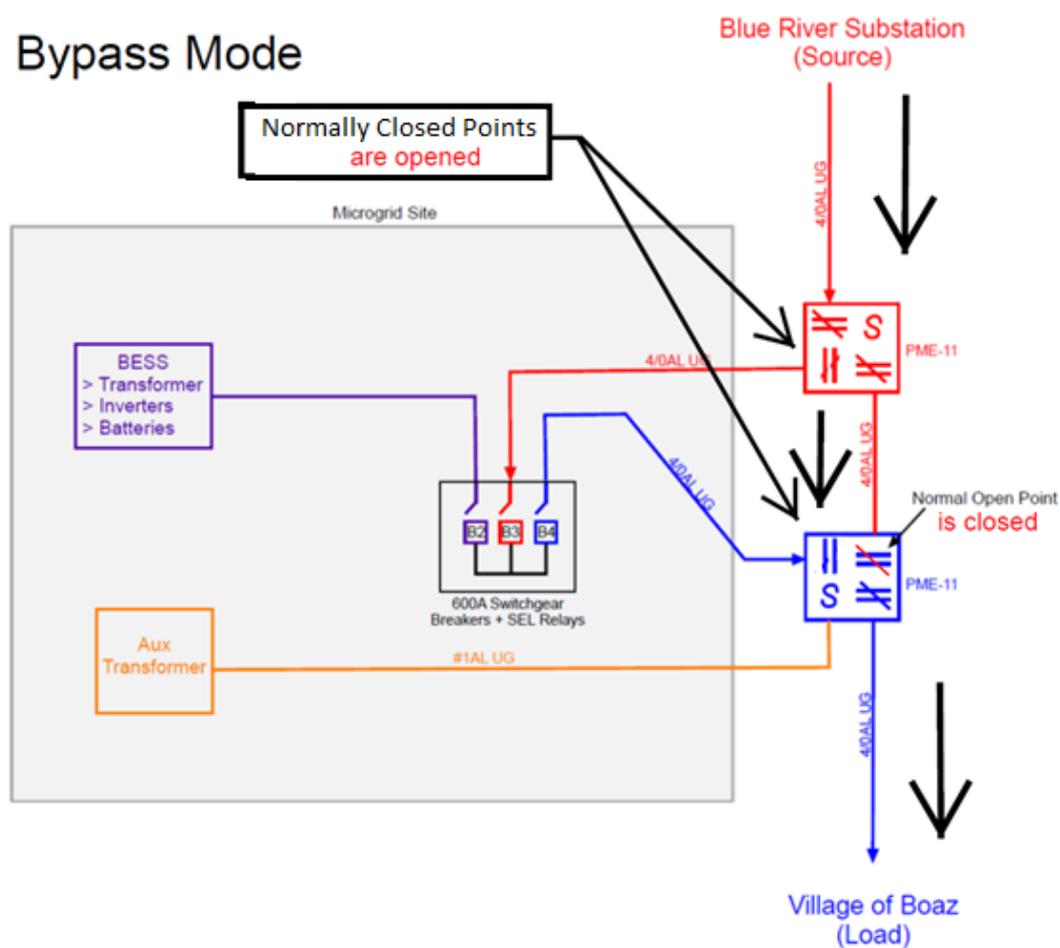
Normal Grid Connected Mode



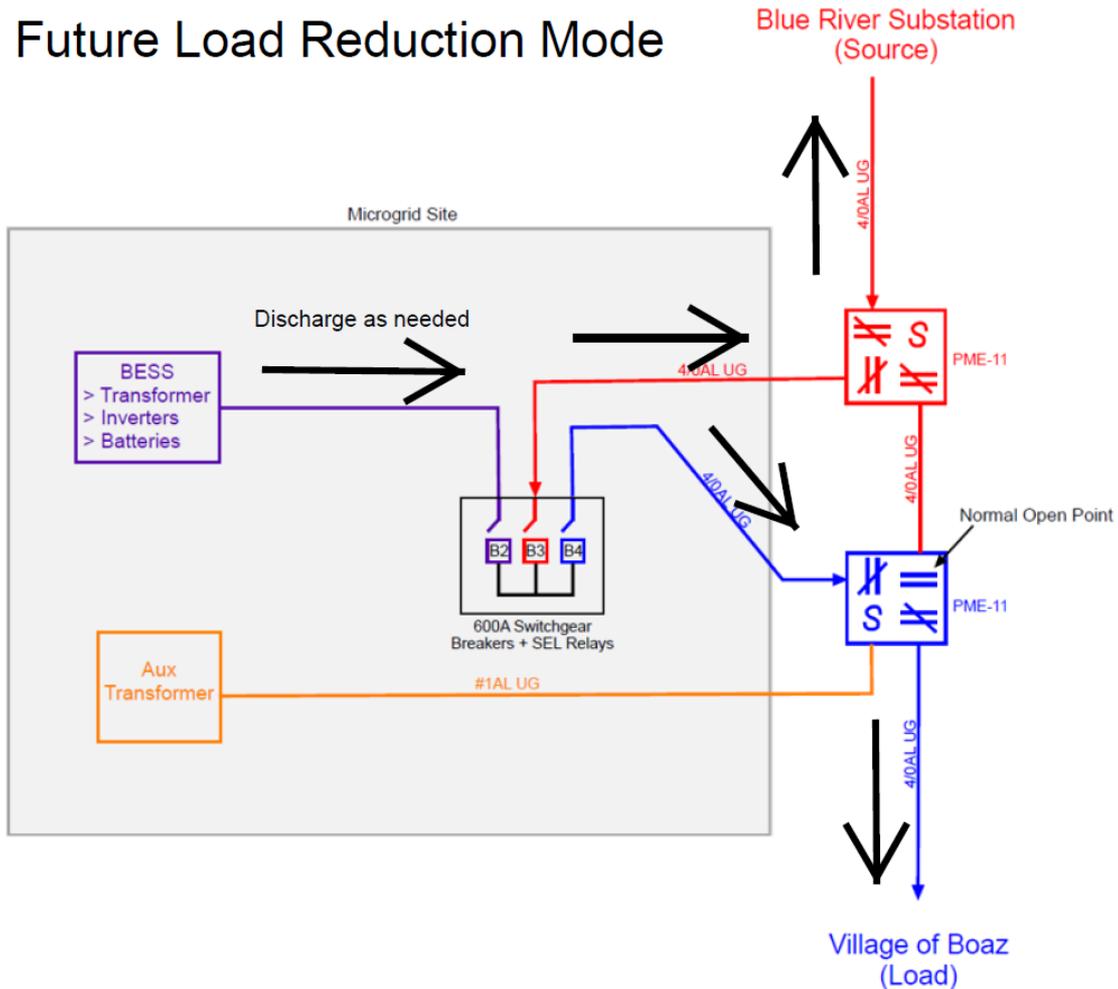
Island Mode



Bypass Mode



Future Load Reduction Mode



Boaz as a Test Bed Environment

- Autonomous reliability microgrid operation
- Directed to “island” or discharge to offset load
- Use with other batteries as a virtual power plant (VPP)
- Install PV to increase time in “island” mode
- Incorporate AMI data and demand response to increase time in “island” mode.

Questions?

