



# Non-wires Distribution Solutions

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**Midwest Rural Energy Council**

*Embassy Suites Minneapolis Airport, Bloomington, MN*

*February 9, 2023*

# History



- Greater emphasis on renewable energy solutions
- Political climate and environmental advocacy on the rise
- Cooperative member interest in renewables
- Is there a better way to plan distribution system improvements?
- Let's think outside the box

# Traditional Distribution Planning

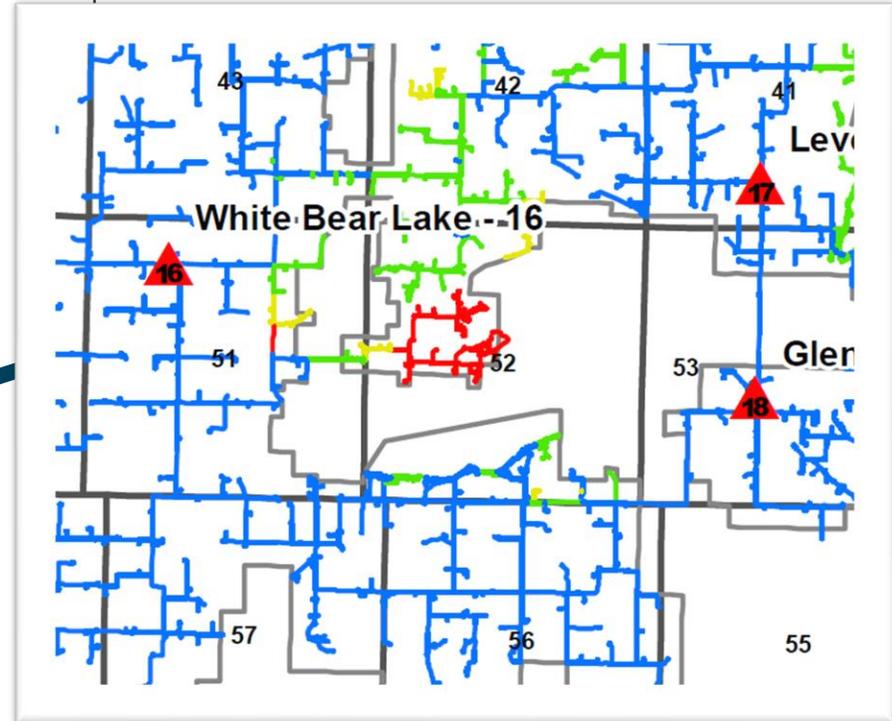
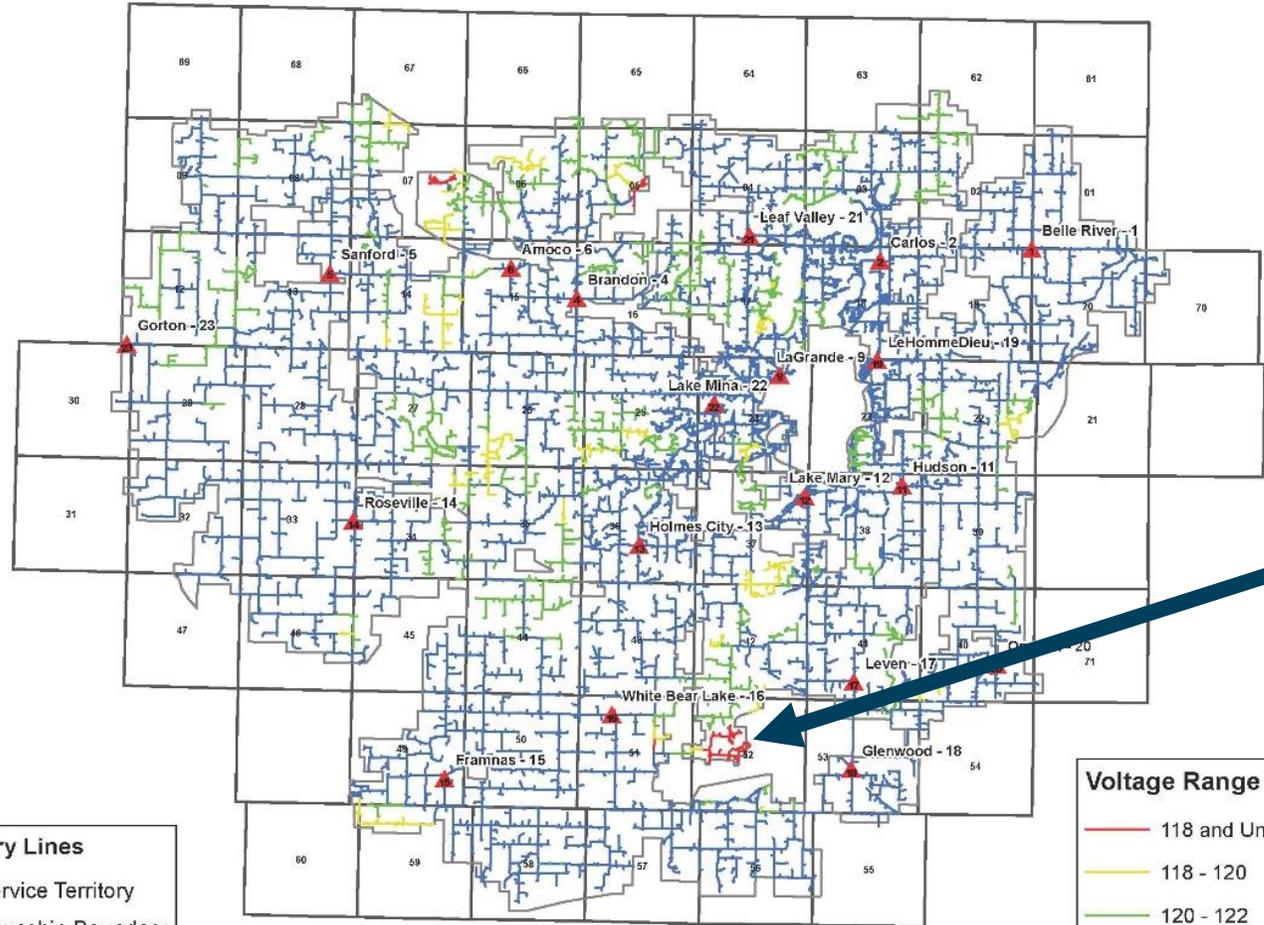


- Engineering study identifies system deficiencies
  - Low voltage
  - Thermal conductor overloads

# Traditional Distribution Planning



- Evaluate Solutions
  - Reconductor existing lines
  - Convert existing single phase lines to three phase
  - Upgrade existing substations
  - Build new lines in new corridors
  - Build new transmission line and new substation



**Boundary Lines**  
 — Service Territory  
 □ Township Boundary

**Voltage Range**  
 — 118 and Under  
 — 118 - 120  
 — 120 - 122  
 — 122 - 126



# The Emerging Solutions



- Demand side management
- Emergency standby generation
- Renewables – solar and wind
- Microgrids
- Batteries
- Portable standby generation using “green” fuels

# What Might Work on a Rural Distribution System?



- Demand side management – yes, but requires customer participation
- Emergency standby generators – yes, fossil fuel is a drawback
- Renewables – no, is not dispatchable
- Microgrids – maybe in the future, requires customer participation
- Batteries – no, cost prohibitive right now, good future option
- Green ammonia – currently in research and development, best option

# Developing Issues



- Grain drying
  - Occurs over a six week period in the fall
  - Highly dependent on the growing year (moisture content)
  - May overlap the beginning of winter heating season
  - Constant expansion of spot loads due to farm aggregation

# Developing Issues

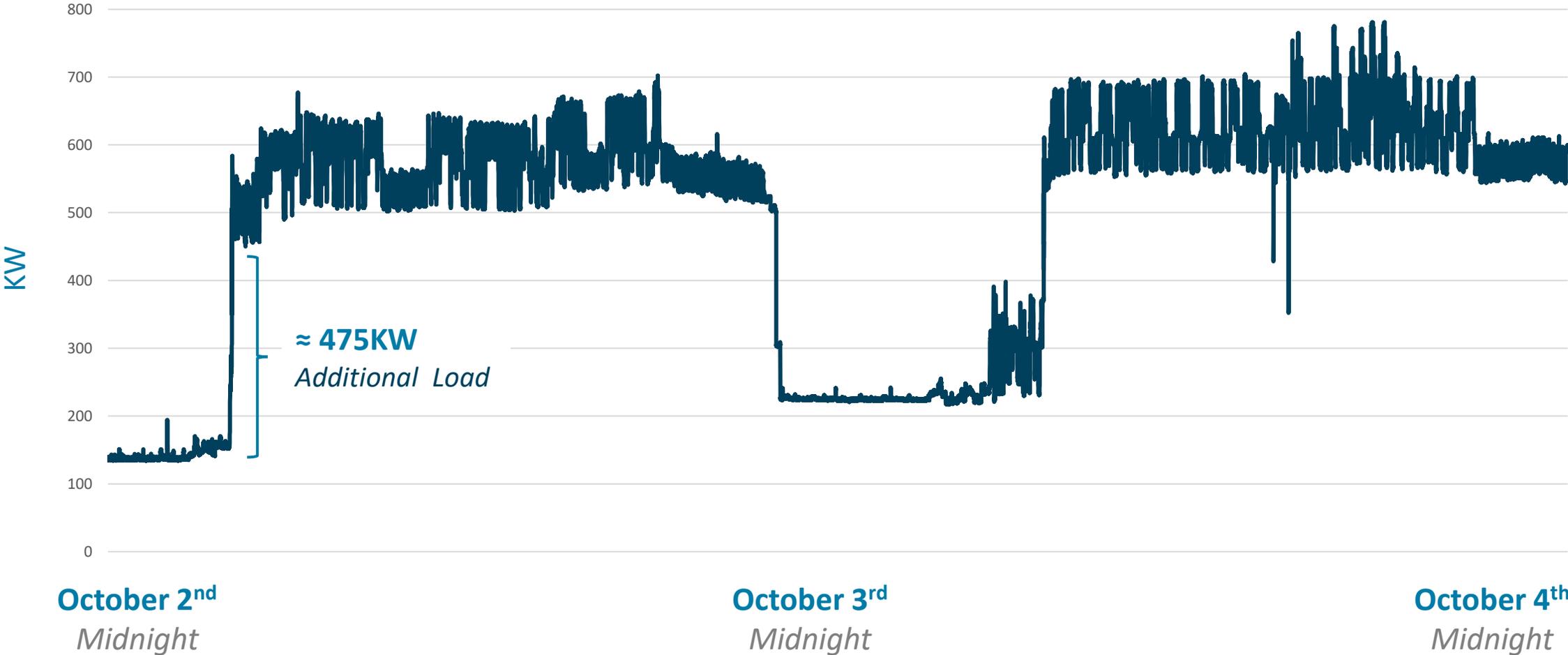


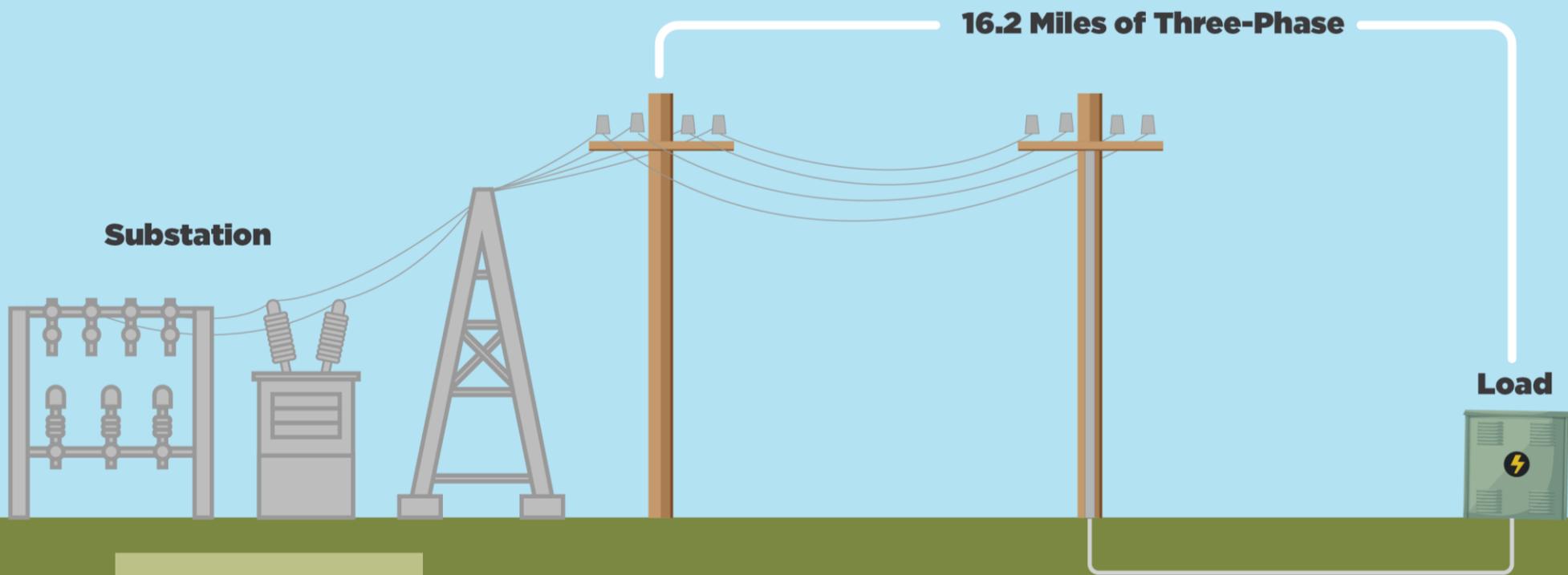
- Recreational homes
  - High density along lakeshore
  - Older single phase lines, lack of right of way, difficult to rebuild
  - Highly variable load profile depending on day of week, weather, holidays
  - Arrive on Friday, turn on AC, prepare meal
  - The looming issue of electric vehicles

# Real-world Example



# Agricultural Drying





**Substation**

**16.2 Miles of Three-Phase**

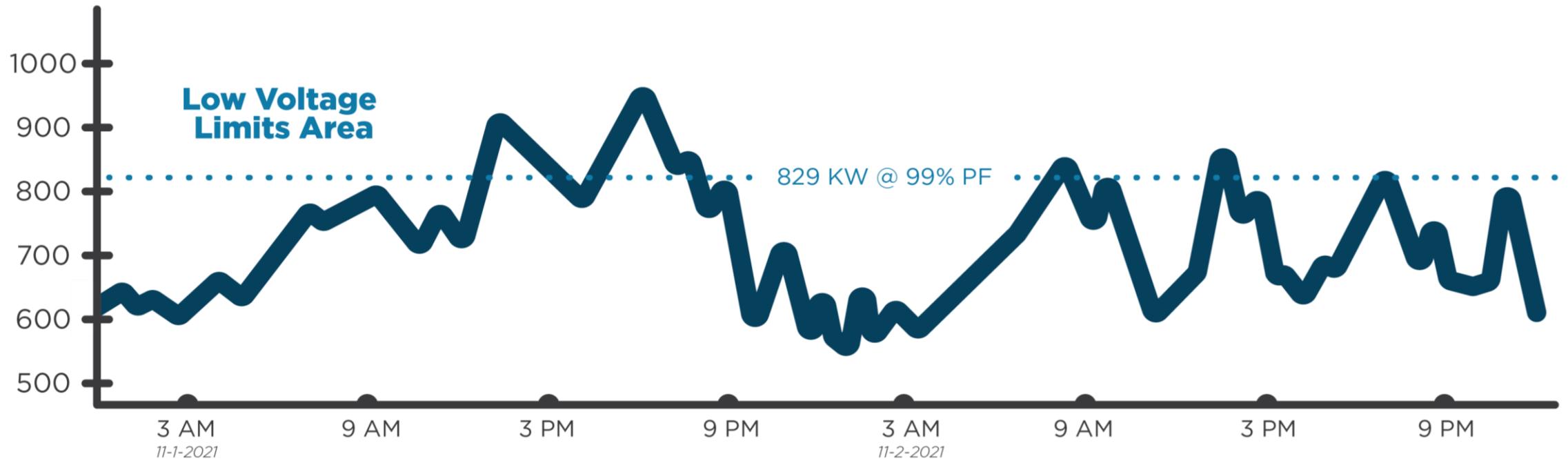
**At Max Peak:**  
A = 7,018 volts  
B = 7,018 volts  
C = 7,018 volts

**Load**

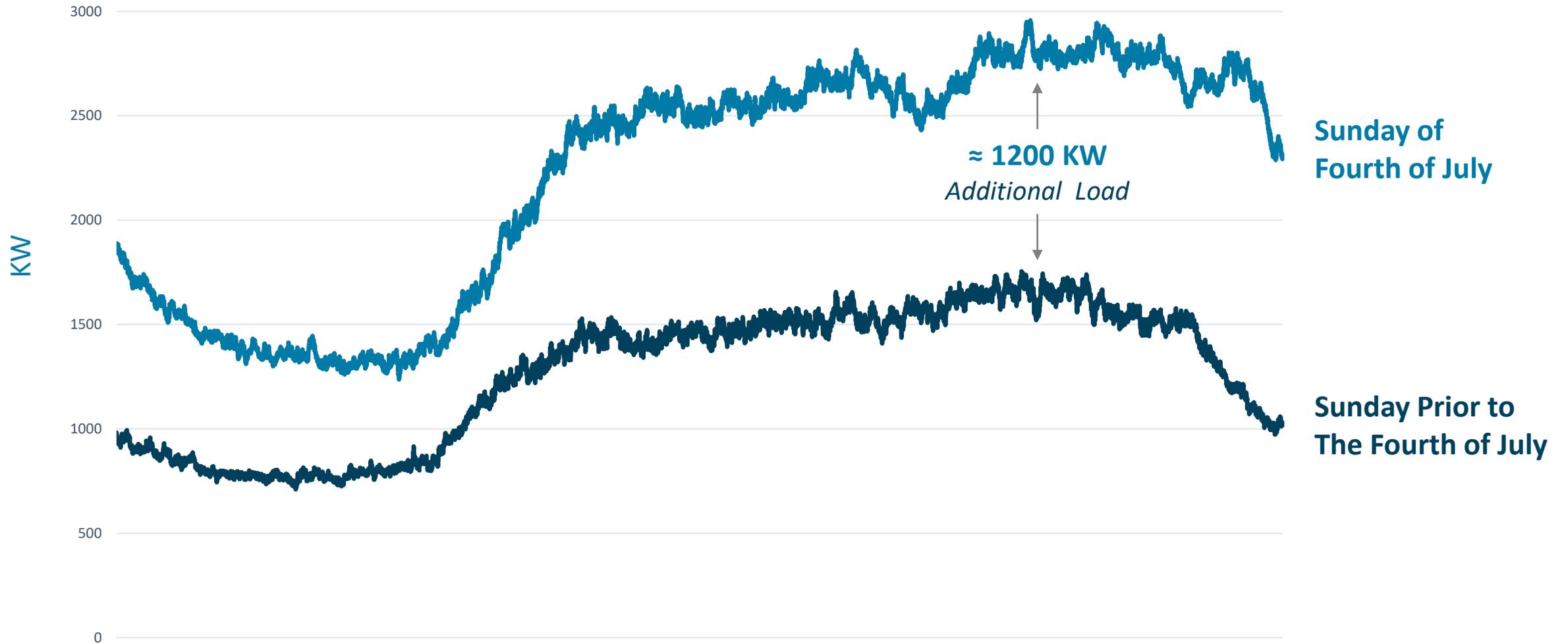
**Source Volts**  
A = 7,560 volts  
B = 7,560 volts  
C = 7,560 volts

Anything above 829 kW @ 99% PF  
gets below the voltage limit of 7,080 volts

# Feeder Loading



# Seasonal Account Impacts



# Anhydrous Ammonia



# Green Ammonia



- Ammonia traditionally used as crop fertilizer
- U of MN West Central Research and Outreach Center studies
  - Use wind and solar generated electricity to create ammonia from water
  - Ammonia as fertilizer
  - Ammonia as fuel supply for engines

# Agriculture and Energy



- Ag industry has high demand for ammonia in spring
- Rural energy needs are greatest in winter, summer, fall
- Ag industry has developed procedures to handle ammonia safely
- Lots of time to produce inventory
- Delivery and storage infrastructure already in place

# Where's the work to be done?



- Need to scale up production facility output
- Develop engine technology
- Demonstration project – interconnect genset with REA's distribution

# Conclusion



- Non-wires solution is a stop-gap to defer capital expenditure
- Most technologies are not ready yet – expensive
- Portable standby generation is leading option today in rural areas
- Ammonia appears to be promising fuel source
- Ammonia safety in residential areas must be demonstrated
- U of MN, Great River Energy, Runestone Electric Association research