AMEREN MICROGRID

Owen Lock - Application Director
S&C ELECTRIC COMPANY

- 100+ years old, headquartered USA
- Global provider of electric power systems solutions
  - Fusing, switchgear, distribution automation, power quality
  - Power systems studies, laboratory & testing
  - EPC and asset management
- Asia Pacific HQ in Melbourne
# MICROGRID AND ENERGY STORAGE PIONEERS

<table>
<thead>
<tr>
<th>Project Name</th>
<th>Wind</th>
<th>Solar</th>
<th>Onsite Generation</th>
<th>Self-Healing</th>
<th>Energy Storage</th>
<th>Islanding</th>
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AMEREN MICROGRID

- 1MW microgrid
- Supplies distribution feeder
- 6 months of engineering and design
- 7 weeks of construction
- Commissioned October 2016
GROUND BREAKING

- Supply an entire “real-world” distribution feeder
- Seamless transitions – no reliability standards exemptions
- Transfers and prolonged operation with DER & BESS (no rotating generators in play)
EPC BY S&C

- Policy & regulation
- Design & engineering
- Business case development
- Construction
- Optimisation
GENERATION SOURCES

- 100kW wind
- 125kW PV
- 2x 500kW Gas Generators
- 250kW/500kWH Energy Storage
ENERGY STORAGE

- Microgrid backbone
- Voltage/frequency source
- Renewables optimisation
- Black start
- Smooth transitions
MICROGRID CONTROL HIERARCHY

PRIMARY
Performed by energy storage Power Conversion System (PCS) controller

Fast acting controls, often sub-cycle

- Provision of stable voltage source
- Frequency Control
- Volt/VAR Control
- Power Quality manager
- Seamless islanding transitions
- Smoothing/ramp-rate control
MICROGRID CONTROL HIERARCHY

SECONDARY
Performed by Microgrid controller

- Generation dispatch
- Load control
- Renewables monitoring and control
- Coordinates islanding transfers
- Integration with utility ADMS System
- Storm preparedness
MICROGRID CONTROL HIERARCHY

TERTIARY
Performed by financially focused controller

- Load forecasting
- Generation & Weather forecasting
- Revenue stream prioritisation
- Market participation
24-Hour PureWave® SMS-250 Storage Management System Island Test at Ameren microgrid.

Start of test 8/3/17 8:00AM CST, Completion of test 8/4/17 8:00AM CST

2. SMS State of Charge < 90%, system dispatches Solar & Wind. Solar & Wind power microgrid load and excess power charges SMS.
3. SMS fully charged to 97%, curtails Solar & Wind to zero output. SMS powers microgrid load.
4. Daytime cycle similar to interval #2. Higher wind output.
5. Daytime cycle similar to interval #3.
6. SMS SoC < 90%. Approaching Sunset, thus low solar output. Low wind output. Still enough Solar & Wind to power load and slowly charge SMS.
7. Dusk. Solar Inverter shuts off. System relies on wind power to deliver microgrid load and SMS to provide voltage reference.
8. System successful through nighttime with strong winds and SMS. Microgrid load powered the entire time.
9. 24-hour SMS Island Test complete. SMS never dropped below 80% SoC. Sunrise brings solar power back up.
QUESTIONS?

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