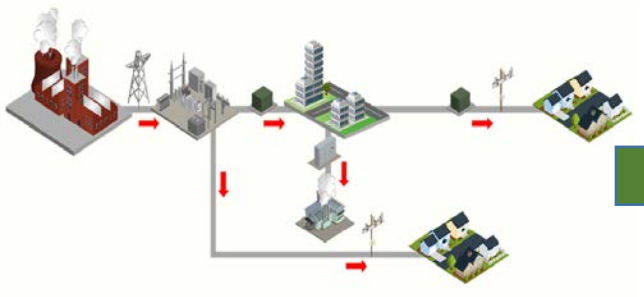
Tamer Rousan

Distributed Energy Resource (DER) Integration - Microgrid

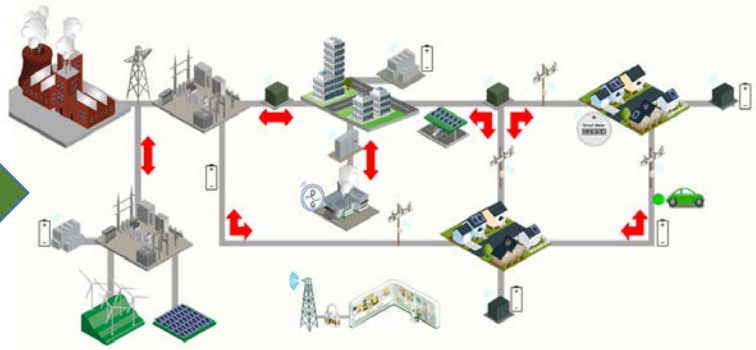
“Ameren’s Microgrid – Champaign Illinois” – T&D World Magazine, Aug. 2017

Distributed Energy Resource Integration Project - Motivation



The grid with central generation and one way power flow

Where the grid is heading



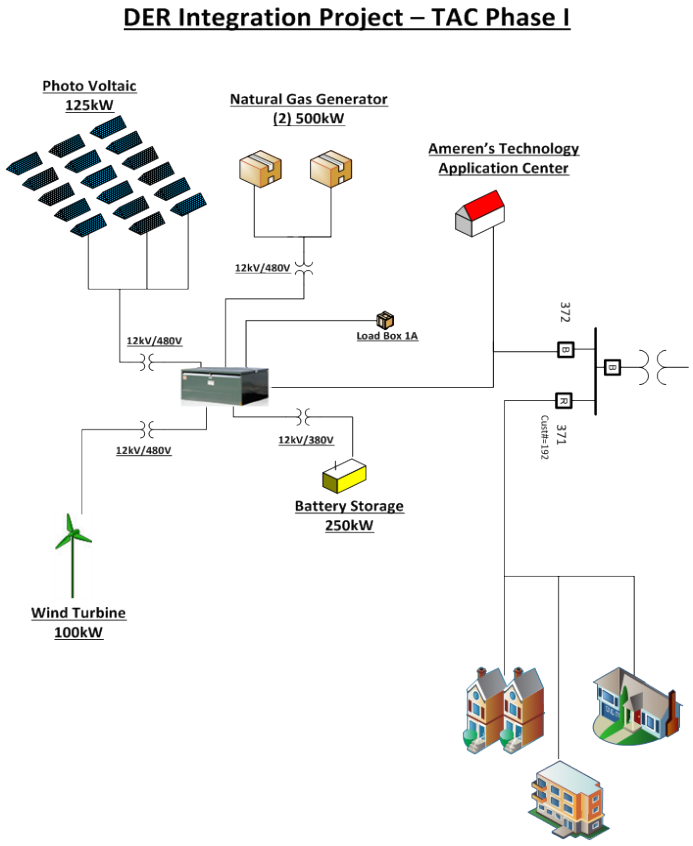
Grid of the future, with DERs and multi way power flow

- **Customer choice**
- **Customer behind the meter microgrid**
- **Community solar and community wind projects**
- **Growth in DER adoption and its deeper penetration**
- **Learning opportunities and building up internal expertise**

Distributed Energy Resource Integration Project - Objectives

- **Investigate the design, control and operations of Microgrid**
- **Investigate resiliency and reliability improvements that microgrids provide our customers**
- **Investigate the operations of DER's and energy storage on Ameren's systems and their interactions with customers**
- **Investigate the complex interoperability, economic dispatch, islanding, ancillary services, frequency and voltage control aspects of microgrids**
- **Investigate the demand response and energy choice concepts that microgrids offer our customers**

Distributed Energy Resource Integration Project – Design and Use-Cases

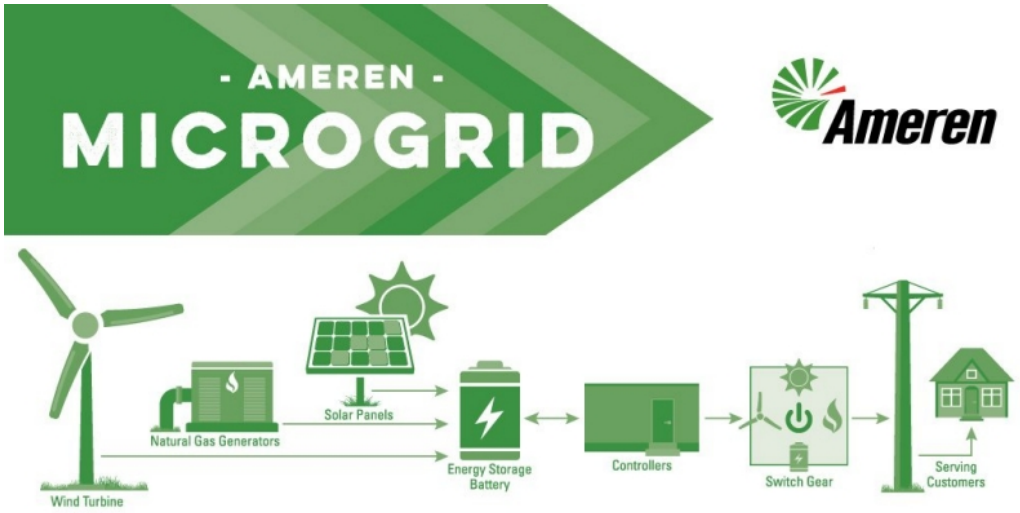


Proposed DER	
Device	Size
PV (1 acre)	125kW
Wind	100kW
Natural Gas	1000kW
Battery Storage	250kW

Use Case Priority	Use Case
1	DER Monitoring, Control and Integration
2	DER Optimal Power Flow
3	Integration with existing ADMS System
4	Frequency Control
5	Volt/Var Control
6	Power Quality
7	Grid Connected Transition
8	Islanded Transition
9	Islanded Mode of Operations
10	Grid Connected Mode of Operations
11	Demand Response
12	EV Integration
13	Peak Load Shaving
14	Optimal Economic Dispatch
15	Storm Preparedness
16	Operational Standards and Procedures

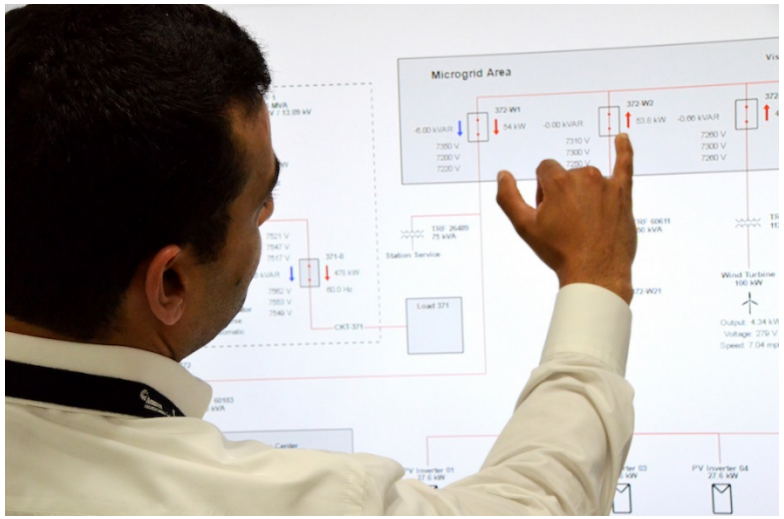
Distributed Energy Resource Integration Project – Timeline

- **6 months of engineering design**
- **7 weeks of construction**
- **Placed in service 12/22/2016**



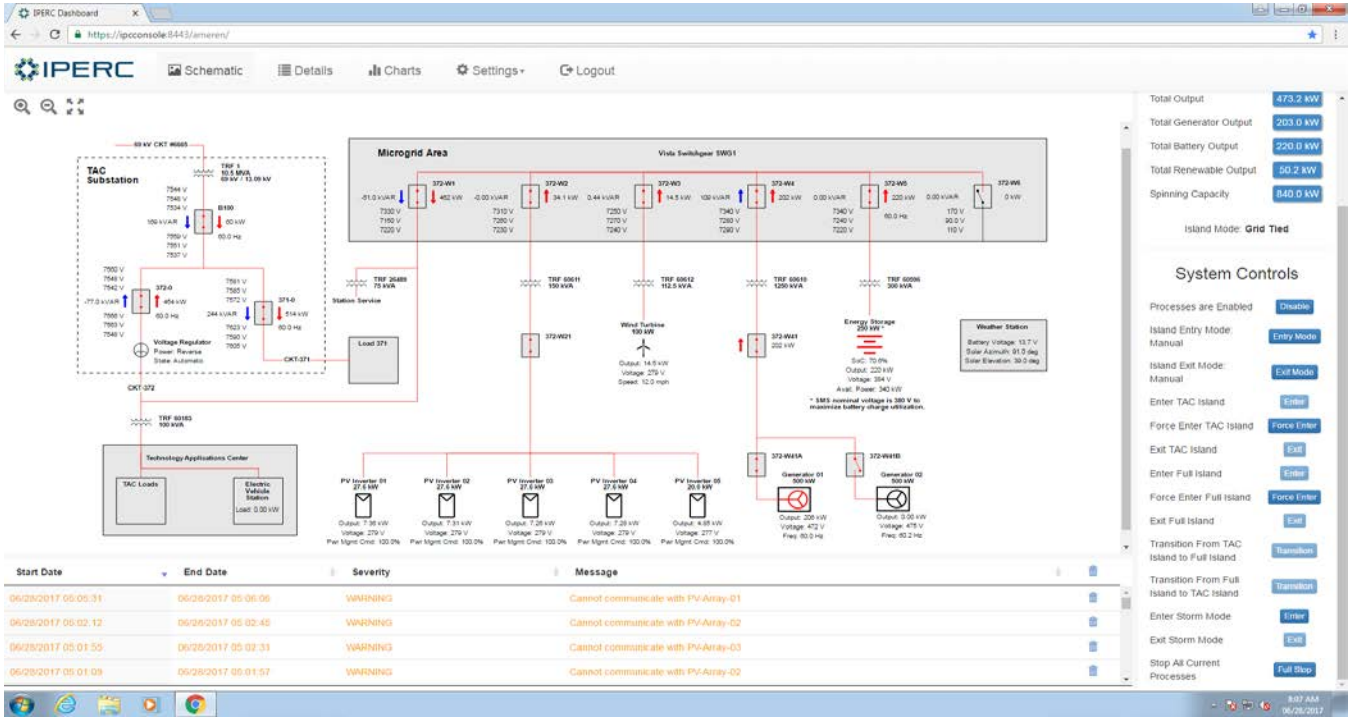
Distributed Energy Resource Integration Project – Control Layers

- **Primary**
- **Secondary**
- **Tertiary**



Distributed Energy Resource Integration Project – Modes of Operations

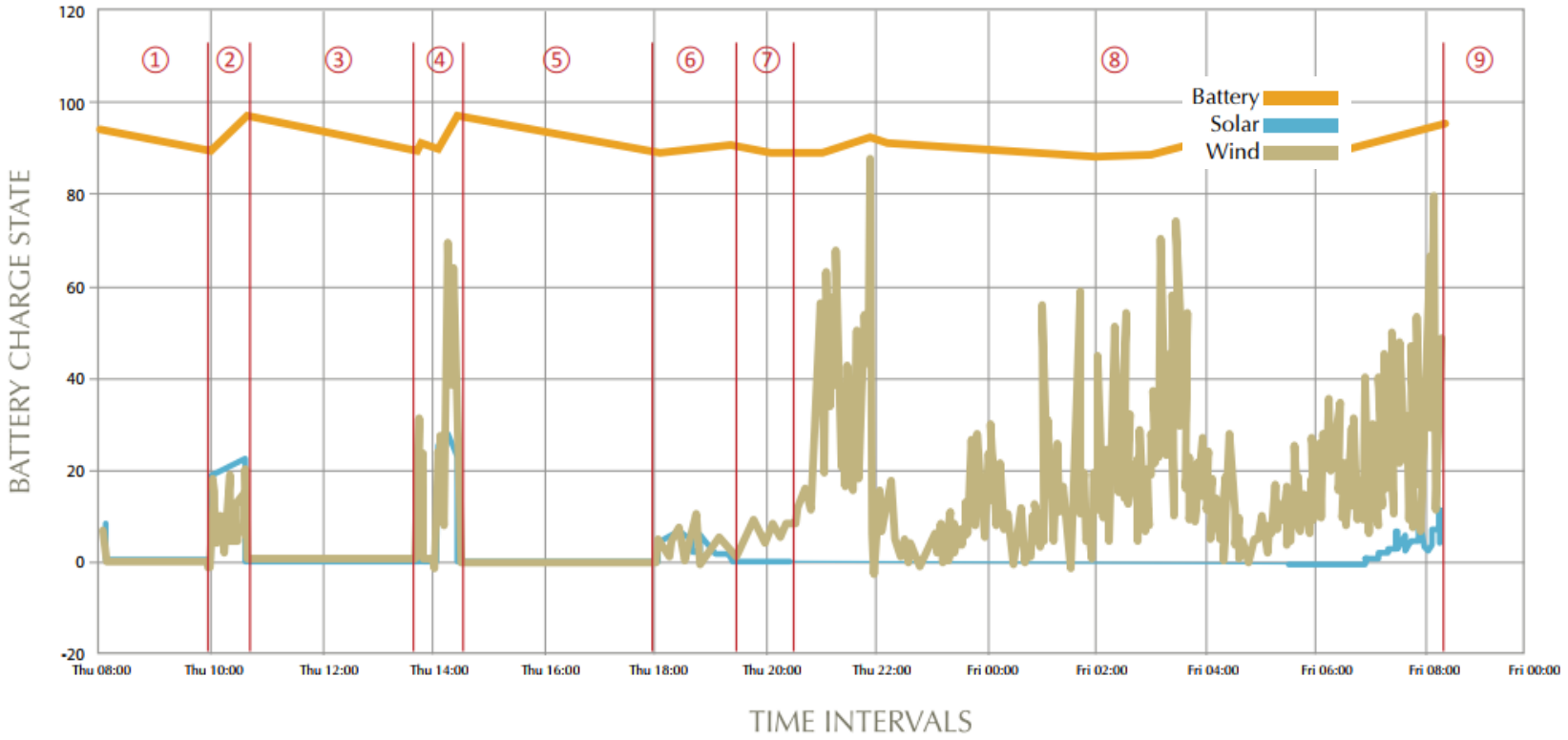
- **Grid-Connected**
- **Storm Mode**
- **Islanded**



Distributed Energy Resource Integration Project – Challenges

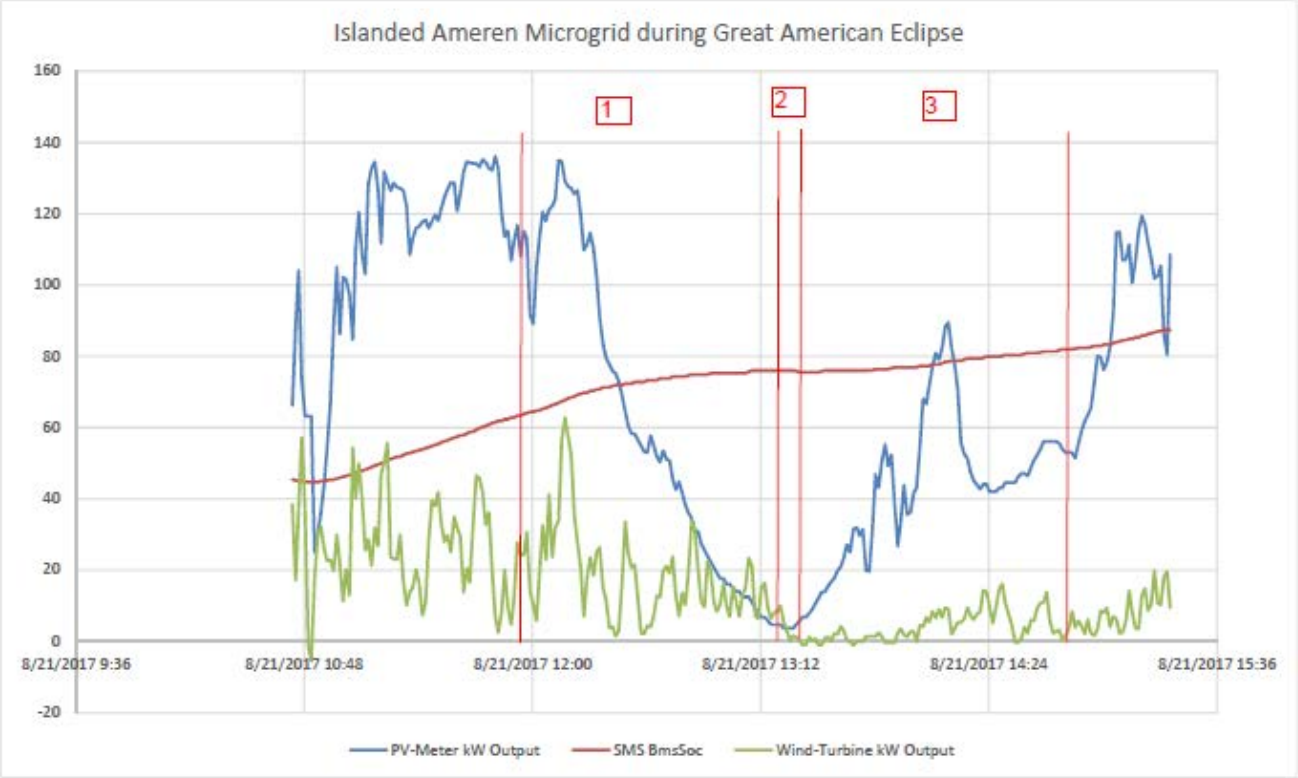
- **Regulatory – Owning Generation Assets**
- **Operations – Seamless Transitions**
- **Operations – Phase Unbalance**
- **Operations – Fault Magnitude (Islanded vs. Grid Connected)**

Distributed Energy Resource Integration Project – Successful 24-Hour TAC Load Island Test



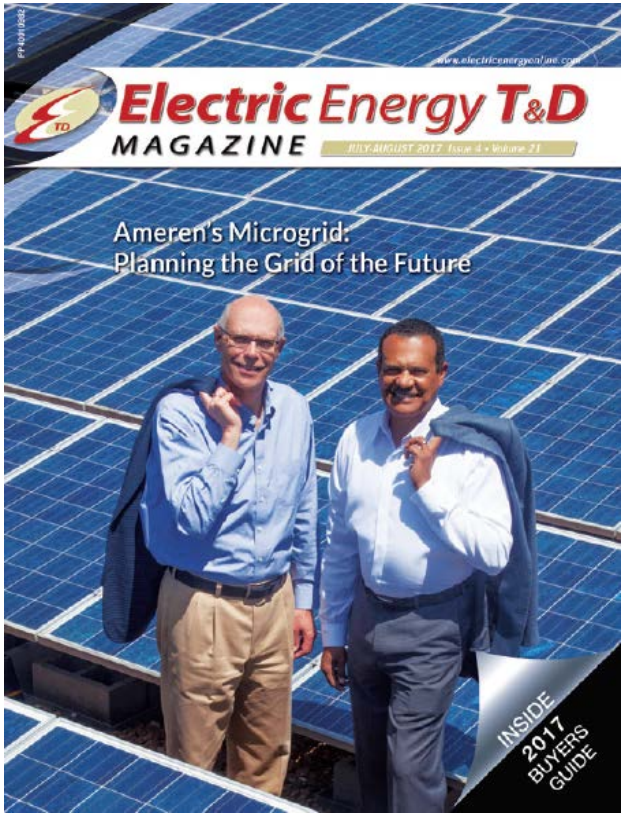
"S&C Electric" – https://www.sandc.com/en/news/sc-news/sc--ameren-conduct-successful-24-hour-islanding-test-on-microgrid/

Distributed Energy Resource Integration Project – Islanded during the Great American Eclipse



Distributed Energy Resource Integration Project – Microgrid Definition

- **First Microgrid to serve the entire distribution Feeder**
- **Seamless Transition from grid-connected mode to islanded mode**
- **Most diverse DER mix**
- **First military grade, ATO certified microgrid controller on Utility scale installation**



Questions?

Ameren Illinois' Tamer Rousan points out the area for energy-storage batteries as he gives media members a tour of the company's 'microgrid,' featuring advanced, distributed energy resources including a 160-foot wind turbine, 2.75 acres of solar panels, natural-gas generators and an electric vehicle charging station, on Wednesday on the University of Illinois campus in Champaign. (**Purchase a Print** | **More**)