

PEER

AMEREN MICROGRID

CASE STUDY

JULY 2018



Ameren is the 1st microgrid to achieve PEER Gold certification globally.

“With the technologies we’re testing at our Champaign microgrid, we’re on the ground floor of a movement that will one day reshape how energy is produced and delivered to our customers. We’re proud that our efforts, and those of our project partners, have been recognized with the prestigious PEER certification.” - Richard J. Mark, Chairman and President, Ameren Illinois

Located near the University of Illinois, the Ameren microgrid is one of the most technologically advanced microgrids in the world. With live customer loads and having a seamless transition, Ameren’s microgrid becomes the first in North America to have such advanced microgrid functionalities. It has the capacity to generate up to **1,475 kW** to power **192 residential and commercial customers** within the project boundary. The microgrid consists of natural gas generators, battery energy storage, and solar and wind generation technologies. With a very high commitment to supply reliable and quality power and to evaluate their electricity infrastructure with global standards - **Ameren microgrid pursued PEER certification and achieved Gold** after undergoing a rigorous certification and review process.

Key Highlights of Ameren Microgrid

- Mitigated approx.. 530 tons of CO₂ emissions
- More than 50% of the project’s electric cables are undergrounded
- Only microgrid control system to hold an authorization to operate accreditation from the department of Defense

RELIABLE & RESILIENT MICROGRID INFRASTRUCTURE

Microgrids are the emerging energy eco-system that provides practical answers through a local, interconnected energy system within clearly defined electrical boundaries, incorporating loads, decentralized energy resources, battery storage systems and control capabilities.

Ameren microgrid is a pacesetter in providing reliable, affordable and quality power to its customers by implementing Distributed Energy Resources of **363MWh on-site renewable energy generation**, constituting one **wind turbine of 100kW** generation capacity, **solar power generation of 125kW** and **two natural gas generators** with a generation capacity of **500kW each**. **100% of microgrid’s project loads**

are provided with an alternate power supply, with seamless transfer controls and an outage management system is in place for all loads.

Ameren microgrid supports two modes of operation that includes reactive mode and proactive mode. In **reactive mode**, there is an automated fault clearing system to attempt to remove the fault and generation resources are automatically started during this event. If the fault is not cleared, the facility's switchgear automatically switches the circuit from the line with the fault to the other line. And in **proactive mode** they can manually transition their customers from grid-connected to islanded. The process of this switchover is entirely automated once the grid operators have made the decision to enter island mode. **Separate backup sources are in place for technology application centre control building which controls the microgrid.** With these implementations, customers have experienced very less outages, achieving **SAIDI (System Average Interruption Duration Index) of 2.0 minutes and SAIFI (System Average Interruption Frequency Index) of 0.07 numbers.**

89 % of the Ameren's customers have **advanced meters** with a bi-directional communication system. Collaborating with S&C Company, Ameren microgrid continuously monitors the power quality to determine the potential impacts of the microgrid on customer power quality, analyzing voltage sags & interruptions, harmonics, flicker etc. at various points in their microgrid using a software model of the existing electrical system provided by Ameren. The **Li-ion Polymer based energy storage system (200kW, 500kWh)** is used to adjust the VAR (volt-ampere reactive) and watts, that mitigates the power quality issues. This is done automatically when they execute a seamless transition from the grid to island mode and similarly the same system also helps in managing the energy feed from the solar and wind when transitioning back to a grid-connected mode.



Figure 1. Aerial View of Ameren Microgrid, Illinois

Focusing on the resilience, Ameren's microgrid was built well above any flood plains and have installed water channeling to drain the microgrid site down toward the grassy area underneath the solar array thus preventing heavy rains from concentrating at the site of electrical microgrid equipment. And approximately **57% of the sites electrical lines are undergrounded**, eliminating their susceptibility to wind, ice,

falling trees, and lightning damage. These measures helped Ameren microgrid to score exceptionally high under the reliability and resiliency category. Also, after the landmark Energy Infrastructure Modernization Act, or Smart Grid Bill, was passed in 2011 in Illinois, Ameren Illinois' grid modernization initiatives have resulted in an overall **17% increase in reliability and saved customers an estimated \$45 million each year.**

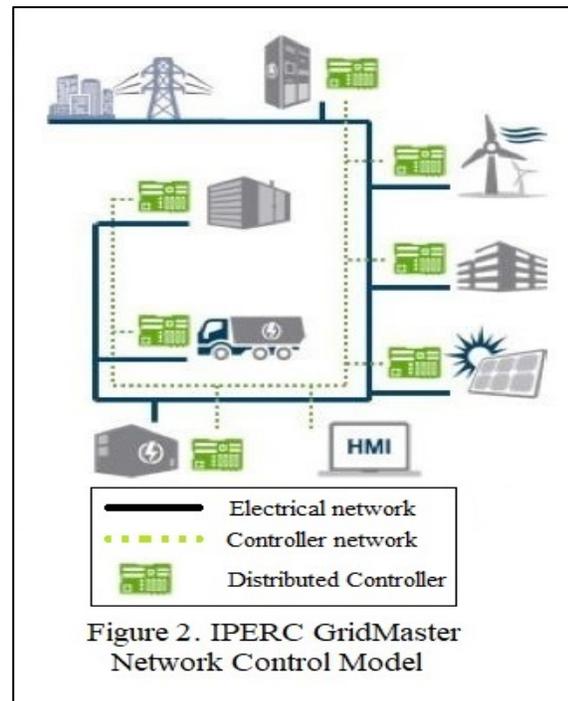
EXEMPLARY PERFORMANCE THROUGH DEMAND SIDE MANAGEMENT

PEER emphasizes implementing comprehensive energy efficiency programs under the Demand Side Management (DSM) credit to achieve permanent reductions in energy demand and consumption through load management and conservation. The project has implemented a **master control system** to support the multifaceted nature of distribution automation and the higher-level applications of DSM.

Ameren microgrid is the first utility to install a military-grade cybersecure microgrid controller, which is manufactured by S&C Electric subsidiary **IPERC** (Intelligent Power & Energy research Company), called **the GridMaster**. This integrated hardware and software system has a distributed control architecture, which enhances the resiliency of the installation by eliminating single points of failure. The GridMaster is built from the ground up to adhere to **IPERC's defense in depth cybersecurity protocol**. It is the **only microgrid control system to hold an authorization to operate accreditation from the department of Defense**. GridMaster can detect

cyber threats to the projects control system and act to mitigate those threats. Ameren microgrid's primary protection scheme allows them to automatically detect faults on the system, isolate and clear those faults. Each asset on the microgrid has its own electrical protection equipment.

Even during complete loss of power, the system continues to operate. The distributed, circular communication system between IPERC GridMasters allows for **communication in either direction, providing resilience during**



communications outage. If the primary GridMaster is damaged or compromised, another GridMaster will take over coordination of the system. The IPERC GridMaster also provides data that allows them to detect and analyze issues within the system such as poor power quality, low voltage, and or impending equipment failures and can notify operators regarding these concerns. The **communication infrastructure network** is connected to **all major assets** of the project. The IPERC GridMaster system has the following capabilities:

- Monitors and records project load data, equipment fault data & switch & fault status.
- Displays relevant information to project operators and notifies operators when faults occur.

PEER CERTIFICATION:

PEER, or Performance Excellence in Electricity Renewal, is the first certification dedicated to measuring and improving power system performance. Applicable to any power system or electricity infrastructure, PEER-certified systems gain a competitive advantage by differentiating their performance, documenting the value produced and demonstrating meaningful outcomes. The PEER Rating System includes four credit categories:

- ▶ Reliability and Resiliency (RR)
- ▶ Energy Efficiency and Environment (EE)
- ▶ Operations, Management and Safety (OP)
- ▶ Grid Services (GS)

PEER Certification for Utility Projects	
Certified 05 July 2018	
Total Points Achieved	62
Reliability and Resiliency	23
Energy Efficiency & Environment	09
Operations, Management & Safety	11
Grid Services	18
Innovations & Regional Priority	01
Total Possible Points	110

Out of a possible 110 points, Ameren Microgrid **earned 62 points**, achieving **PEER Gold certification** under version 2 of the rating system as a utility project type. Ameren Microgrid met all the prerequisites including reliability performance monitoring, environmental performance disclosure, system energy efficiency coefficient disclosure, triple-bottom line analysis, and customer survey. All these show Ameren Microgrid’s commitment to

supply reliable and quality power to their customers using a flawless system focusing on grid modernization. As a microgrid utility, it demonstrates that - **“Decentralization can help tack the energy challenges of the 21st century by creating an optimized way to access reliable, green and resilient grid system.”**

About PEER

Performance Excellence in Electricity Renewal (PEER) is a rating system and certification for defining, assessing and verifying the overall sustainable performance of electricity delivery system design & operations. PEER is designed to deliver sustainable, resilient and reliable energy around the globe. Learn more: peer.gbci.org