Microgrids: New Technology, Old Challenges

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POWER is pleased have the opportunity to work in microgrid, critical power, renewable energy and energy storage projects around the world. We see requests for microgrid services growing across the United States and are excited to have experts on our team who are leaders in the use of the advanced technologies required for their successful implementation. The opportunities and benefits that microgrids offer their project owners include:

- Increased penetration and impact of renewable energy sources;
- Experience with new DER and control technologies and business models; and
- Additional electric system resiliency and availability.

POWER has extensive experience in the delivery of engineering projects based on advanced technology, including elements of solar PV, energy storage, complex controls, and diverse disciplines.

Despite their attractiveness, microgrids can have technical performance challenges that are most cost-effectively addressed at the project start. The list of issues common to microgrid projects are most of the standard problems that come up in any complex electric power system project, along with a handful of technical challenges that are unique, as shown in the table below.

TABLE 1: COMMON MICROGRID PERFORMANCE CHALLENGES		
CHALLENGE	IMPACT	COMMENT
Voltage & Frequency Stability	Loss of ability to serve site electrical loads within IEEE requirements.	Voltage stability is produced by steady-state and dynamic balance of reactive power sources and sinks on the microgrid. Frequency stability is produced by balance of the system energy sources and loads. Correct microgrid design requires resources and the microgrid control system to correctly respond to changes in loads or sources. Thoroughly study each of the microgrid operating modes. Don't forget the impact that faults can if they remove individual large real and reactive power sources and sinks.
Fault Clearing/ Coordination	Delayed or mis-coordinated fault clearing; negative stability impacts.	Available fault currents and preferred or required breaker tripping sequences can be very different in the two microgrid operating modes: islanded and grid-connected. Protective device coordination must account for the variety of microgrid topologies and source availabilities. Reduced fault current in islanded mode may slow fault clearing without specific design choices intended to preserve operating speed. Fast fault clearance during islanded operation makes it more likely that the microgrid will ride through the fault.
Microgrid Arc Flash Hazards	Delayed or hazardous commissioning, operation, or maintenance work.	Microgrid installations produce the same arc flash hazards that other power generation and delivery installations do. Plan to analyze and label arc flash hazards as part of any new microgrid project.
Cyber Security	Potential loss of situational awareness, electrical control, or intellectual property.	Secure communication permits microgrid controls and SCADA systems to function effectively. Maintaining data and communication integrity protects valuable equipment and intellectual property.
Physical Security	Potential loss of apparatus or microgrid availability.	Site physical security is an important element of microgrid availability. If dependable microgrid operation is negatively impacted due to natural or human-caused events, the microgrid may not be able to serve its design purpose of serving critical loads when the bulk electric system grid is unavailable.
Air Quality Permits	Inability to operate traditional energy resources to their greatest effect.	Frequently, traditional backup power generation air quality permits have restrictive limits on the number of operating hours per year allowed. Confirm availability of these sources before including them in the base load generation mix.

As you plan your microgrid project, be sure to also consider these key performance challenges.