



Local power sources are becoming a must, not a luxury

An upward trend of extended outages due to aged equipment, loss of experienced utility workers and an alarming increase in severe weather-related events is interrupting electric service and impacting significant portions of the population. Microgrids—stand-alone, power generating, distribution and storage systems that can isolate itself from the primary utility grid, provide load control and optimize energy usage—can provide a reliable and efficient solution to unexpected power loss.



[View Eaton's microgrid capabilities video.](#)



According to Eaton's Blackout Tracker Annual Report, electric outages cost our economy \$150 billion annually and impact approximately 14.2 million people.

Eaton's microgrid/energy storage experience

Over the last decade, Eaton has successfully applied its power systems expertise to the design and implementation of microgrids and complex energy storage systems for military facilities, campuses and utilities. We understand microgrids' and energy storage's inherent electrical behavior and challenges. Our power system experts have developed and harnessed unique optimization strategies that maximize system performance, functionality and reliability.

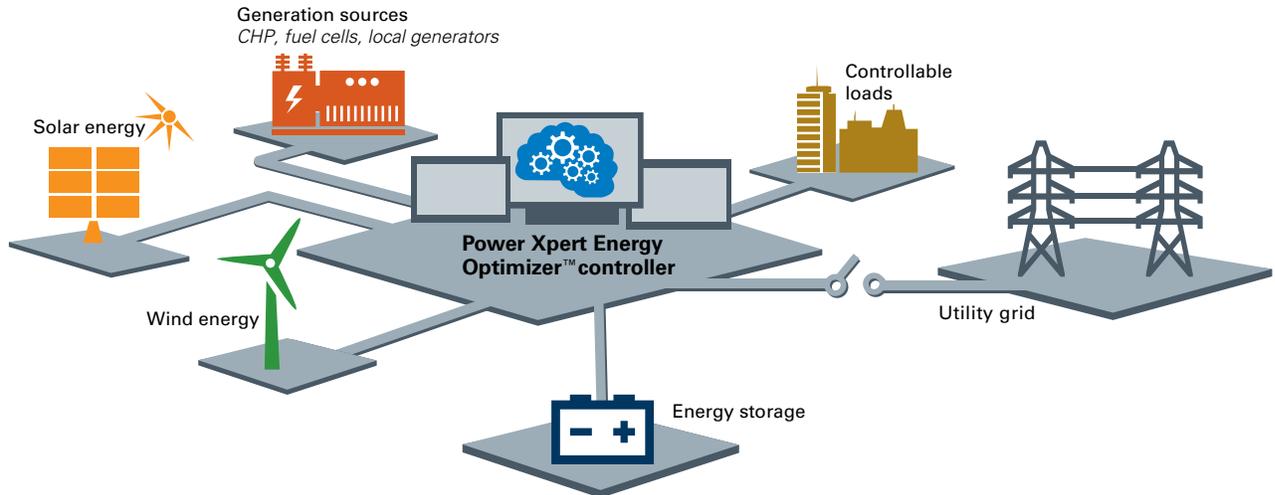
Eaton's solution

Our experience supplying control systems for microgrid and energy storage applications molded the design basis for the Eaton Microgrid Energy System (MES) with the Power Xpert Energy Optimizer™ controller: a microgrid/energy storage control system that, by design, simplifies control system configuration, testing, project cycle time and future adaptability to changing microgrid assets. At Eaton, we believe that advanced control systems should be configured rather than custom programmed—the Power Xpert Energy Optimizer controller accomplishes these goals for both microgrid and stand-alone energy storage applications.



Powering Business Worldwide

Eaton Microgrid Energy System



Generation, distribution and control



Eaton's modular approach greatly simplifies the overall control system configuration, integration, testing, training, on-going support and future adaptability of the Eaton MES to changing assets as microgrid systems evolve with new generation resources, economics and changing load configurations and priorities.

Proven, reliable systems

The hardware basis of the Eaton MES is the utility-proven SMP family of controller, server and I/O modules coupled with our Yukon™ Visual T&D HMI products. These products are designed and implemented for substation automation applications with installations throughout the world, and are environmentally hardened with a long operational history in harsh outdoor utility applications. By careful design, they include the latest utility cybersecurity features and safeguards embedded into each system device as well as system wide.

For ease of configuration and maintenance, the Eaton MES is based on open standards throughout, including IEC 61850 communications. Designed for substation applications, IEC 61850 has the advantage of providing fast communications for successful control strategy execution requiring low latency times such as equipment protection applications or voltage and frequency regulation control.

Power Xpert Energy Optimizer controller

The Power Xpert Energy Optimizer controller is the MES' system control module. It maintains overall system stability, shaves peak demand, shifts loads, manages black starts, achieves lowest total cost, maximizes renewable energy contribution or provides utility demand response functionality.

Modular approach/scalable system

The Power Xpert Energy Optimizer controller implements a modular approach. Each type of generation source and load modules are configured for each application using unique templates. Each module includes the unit/load control module, alarms, reports and needed HMI screens for integration and implementation of that generation source or load.

The Power Xpert Energy Optimizer controller's modular approach allows the Eaton MES to be efficiently scaled to any application size, or adapted to changing generation/ load assets, simply by choosing and configuring the appropriate templates. Preconfigured and customer templates are available so our customers can achieve their specific functionality requirements.

Predictive control

Predictive control strategies utilize weather or price forecasts to proactively engage assets and load controls to achieve maximum system performance.

Pre-tested to ensure functionality

Prior to delivery, each microgrid system is subjected to a closed loop simulation test to ensure system functionality and control integrity before it arrives at the customer site.



Available functionality

- Individual generation source and load control
- Ramp rate control for integrated energy storage and PV applications
- Smart energy storage integration and management
- Full system communications including high-speed peer-to-peer messaging
- Local system HMI with system displays for control and system status, alarming, trending and history
- Unintentional and intentional seamless islanding
- Automatic energy management control
- System power quality management
- Synchronized grid reconnection
- Grid-fault detection, isolation and safety interlocks
- Black start, including sequencing and power quality stabilization
- Frequency and voltage control, including ancillary services
- Fast internal demand response control
- Enterprise integration (SCADA, OMS, etc.)

Control options

- Low cost operation
- Priority load control
- Renewable maximization
- Energy arbitrage
- Peak shaving
- Load shifting
- Conservative voltage regulation
- Predictive control profiles given weather and price forecasts
- Utility demand response functionality
- Embedded battery management system

Total system design and support

Eaton's power system expertise and engineering service capabilities cover the vital aspects of a microgrid or energy storage system application including:

- Microgrid feasibility study
- Total system design
- Control system
- Project implementation
- Full system commissioning and startup
- Ongoing maintenance

Eaton offers turnkey solutions for microgrid systems, including generation equipment. The benefit of turnkey supply is having a single point of contact for the entire microgrid project given our advanced project management capabilities. Our electrical engineering services and systems capabilities span the total life-cycle from engineered design, testing and commissioning, through life extension and modernization needs.

Eaton's broad utility product capabilities, power systems design expertise, supply of renewable energy installations, energy storage systems, microgrid systems, utility automation components and solutions, and advanced optimization algorithms make us uniquely qualified with a unique set of skills.

Eaton's engineering service team

Eaton's engineering service team delivers solutions to enhance your electrical distribution system's power performance, reduce operating costs, and maximize reliability, safety and integrity. Independent of the age, manufacturer or complexity of your electrical distribution system, our design, build and support services integrate and optimize power systems to ensure that it is aligned with your business goals.

Eaton's service team is one of the largest and most experienced teams of power system engineers in the industry, with industry-standard software and advanced modeling and analysis capabilities at their fingertips. Their comprehensive portfolio of design services includes safety studies and energy management, power quality and reliability audits.

Eaton understands your business requirements and sets strategies for your power system. With Eaton's help, you'll witness a range of business benefits, from reduced costs to a more effective use of capital. Our engineering and consulting services help you manage your power system as a strategic resource that can give you a competitive advantage.



Success stories

U.S. MILITARY BASE

The microgrid installation at a U.S. military base was designed to assure electrical energy surety independent of the utility grid availability. To accomplish this, multiple generation sources, including natural gas generators, solar and wind, and energy storage, were integrated on a common grid structure with the base's loads that can be seamlessly islanded from the main grid.

The resulting microgrid system seamlessly islands and reconnects safely to the primary grid, coordinates each generation/storage node that is connected and available to the microgrid, optimizes generation deployment and dynamically manages loads to achieve energy surety at this facility.

UTILITY

A western utility needed to develop a customized 5 MW energy storage system to complement a planned microgrid system that integrates distributed and renewable generation that is reliably supplied to 500 business and residential customers using a dynamic, intelligent, power management system. Eaton was selected to design and supply the energy storage facility and successfully integrate it into their microgrid system.

Eaton provided Power Xpert® PV inverters that were adapted for battery storage application, low voltage switchboards, step-up transformers, medium voltage switchgear, metering, protection and UPS control. Eaton's contribution also supported the control to coordinate and regulate operation of multiple inverters and battery banks and interface with the utility control system.

The resulting system intelligently provides seamless support for power delivery in the event of an upstream outage, provides short-term peak shaving for demand management, coordinates the operation of the inverters and balances demand among the battery blocks and responds to real and reactive power commands.

For more information,
visit Eaton.com/microgrid
and Eaton.com/service

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