

## Energy demand on the rise

Demand for power continues to rise globally, posing challenges to the availability and reliability of utility grids.

Access to affordable and reliable electricity remains a key challenge for much of the population in Sub-Saharan Africa, where the World Bank estimates 7 out of every 10 people does not have access to electricity. Even in areas with grid power, high electricity tariffs and frequent power outages continue to impede economic productivity. In response to these challenges, many businesses and communities turn to diesel or natural gas generators to provide reliable power, but volatile fuel prices and harmful emissions still make this a suboptimal solution.

Microgrids provide a more cost-effective, reliable, and environmentally friendly solution to these electricity challenges.

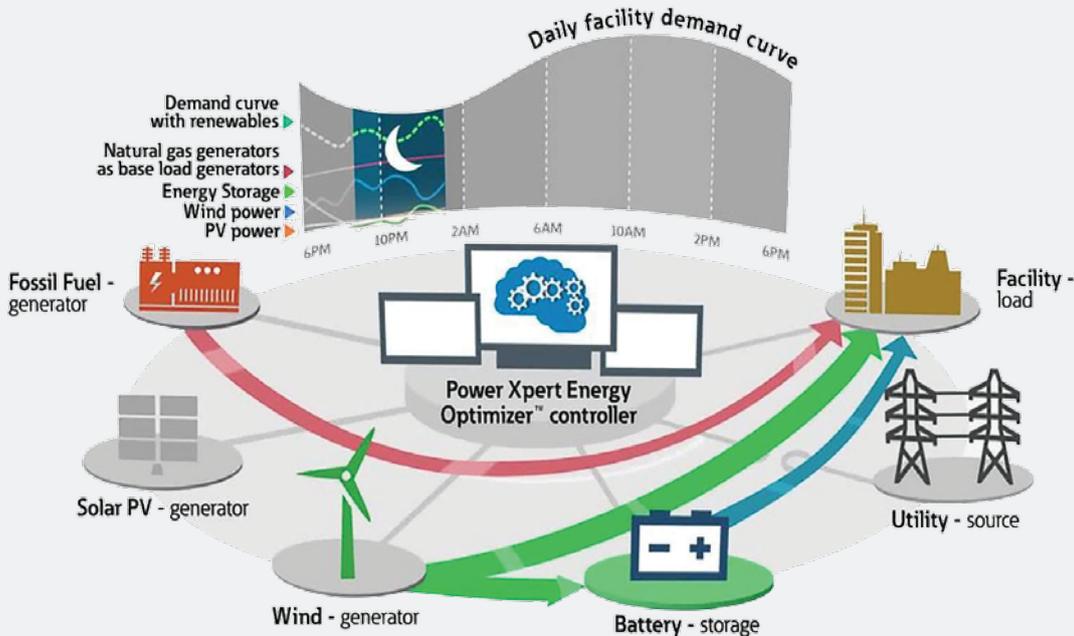


*Powering Business Worldwide*

Eaton is a proud BBBEE Level  
1 Contributor in South Africa

# What is a Microgrid?

Microgrids are localized stand-alone power generating, distribution, and energy storage systems that can be operated independently or connected to the primary grid. They provide a reliable, efficient solution to unexpected power losses, effectively balancing variations in energy demand, optimizing energy usage for more reliable power, and reducing operating costs and carbon emissions.



Using advanced software controls to optimize system operation, microgrids dynamically shift energy loads as needed to various local power sources, (i.e. solar PV, wind, battery storage, generators, or the utility grid) to maximize efficiency and reduce costs.

## Types of Microgrids

### Grid Tied

Microgrids connected to the utility grid can generate and distribute power from locally produced power sources as well as from the utility grid.

#### Applications:

- Commercial and Industrial Businesses
- Data Centers
- Hospitals and University Campuses

### Off Grid

Microgrids not connected to the utility grid rely solely on local generation power sources to meet all local energy demand.

#### Applications:

- Rural Communities, Schools, Clinics
- Ecolodges and Resorts
- Remote Military Bases

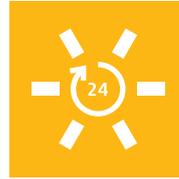
# Benefits of a Microgrid



## Decrease costs

- Avoid peak demand and time of use tariffs
- Reduce reliance on expensive fuels like diesel
- Eliminate costs from unexpected power loss or load shaving

Utilities are increasingly using time of use tariffs and maximum demand charges to manage demands on the grid. Through a combination of distributed energy resources, such as solar PV, and a battery storage system, a microgrid will optimize your energy stream for the greatest financial advantage, avoiding costs through peak shaving and offsetting higher energy charges.



## Increase reliability

- Seamlessly island to ensure continuity of power supply
- Enable grid stability and efficiency
- Easily adapt to changing generation/ load assets

The effects of power losses on a business can be astronomical. To keep business running around the clock, a microgrid can seamlessly shift loads to distributed energy and storage resources, ensuring operations continue as usual. Microgrids can ensure you never suffer losses in production due to unstable electricity and outages.



## Reduce CO2

- Increase renewable energy power generation
- Maximize renewable energy sources to meet regulatory requirements
- Mitigate harmful carbon emissions

Microgrids incorporate renewable energy sources with effective energy storage technology to compensate for the intermittent nature of renewables and help achieve clean energy goals. Integrated solar microgrid solutions ensure affordable, safe, and reliable energy supply while decreasing harmful CO2 emissions.



## Increase autonomy

- Manage power and generations assets to meet your needs
- Dynamically shift energy loads as needed
- Individually control generation sources and loads

Microgrids allow flexible and dynamic control with standardized communications that enables easy system configuration, commissioning, and future adaptability to changing system assets. Individual level asset controls allow you to achieve your specific functionality requirements.

# Why Eaton?

Eaton has unmatched expertise in designing and building off-grid and grid-connected microgrids. Our microgrid solutions ensure power supply resilience, power quality, sustainability and cost-effectiveness in a broad range of applications. Our portfolio encompasses the full range of enabling technologies including renewable power generation, automation, grid stabilization, grid connection, energy storage and intelligent control technology, as well as consulting and services.

Eaton's modular approach, enabled by the Eaton Power Xpert Energy Optimizer™ Controller, greatly simplifies the overall control system configuration, integration, testing, training, on-going support and future adaptability of the Microgrid Energy System to changing assets as microgrid systems evolve with new generation resources, economics and changing load configurations and priorities.

Eaton has a 90 year heritage in Africa and is committed to developing the continent through our innovative, customer-driven solutions that work to enable your business.



Eaton is bringing the best of global technology to build a more energy efficient Africa.

## Available functionality

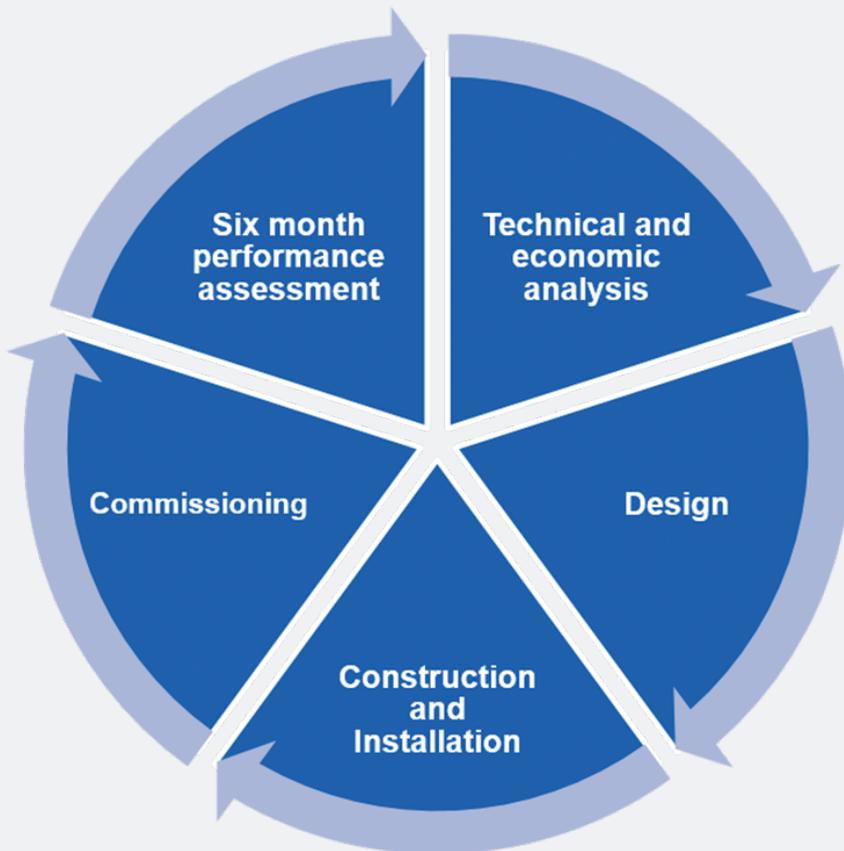
- Individual generation source and load control
- Ramp rate control for integrated energy storage and PV
- Smart energy storage integration and management
- Full system communications including high-speed peer-to-peer messaging
- Local system HMI with system displays for control and system status, alarming, trending, and history
- Unintentional and intentional seamless islanding
- Automatic energy management control
- System power quality management
- 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 integrations (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

# Eaton provides total system design and support.

Eaton offers turnkey solutions for microgrid systems, including generation equipment. Eaton's power system expertise and engineering service capabilities cover the vital aspects of a microgrid or energy storage system application, including 1) Microgrid feasibility study, 2) Total system design, 3) Control system, 4) Project Implementation, 5) Full start up and commissioning, and 6) Ongoing maintenance.



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.

**When power reliability or cost of electricity is a concern,  
Eaton is your one stop shop for power management solutions.**

# Success story

The Eaton microgrid installation in Wadeville, South Africa has significantly reduced operating costs and improved the reliability of power at the manufacturing plant.

## Background

The Wadeville facility, which has a peak load of approximately 400kW, employs over 300 employees, and serves as a manufacturing hub for sub-Saharan Africa. Due to ageing infrastructure and scheduled grid maintenance, the Wadeville facility had been experiencing an increase in electrical faults and load shedding. Cost of electricity was also increasing, both through time of use tariffs and energy charges impacted by seasonality, reaching as high as R5.39 (\$0.40) per kilowatt hour during periods of peak demand.

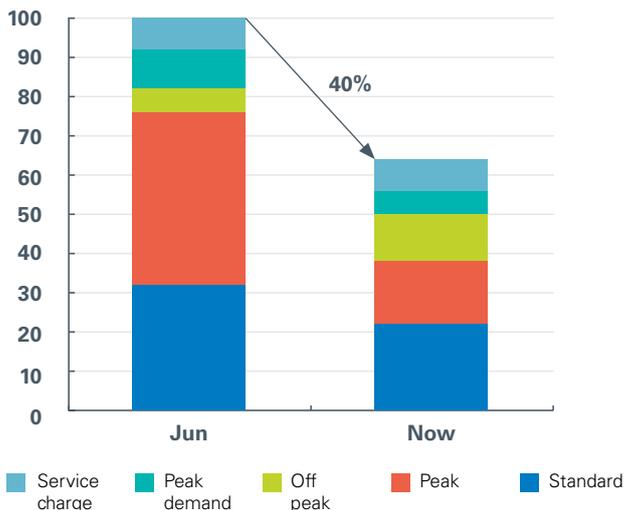
## The solution

Eaton implemented a dynamic microgrid solution, leveraging a 275 kW / 200kWh lithium ion energy storage system, 200 kWp solar PV installation, and 400 kVA diesel generation, able to function in grid-tied or islanded mode.

### Key microgrid functionality includes:

- Peakshaving
- Increased integration of solar PV
- Islanding, and black-start capability

### Microgrid installation reduced energy costs by 40%



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Wadeville, South Africa Installation

## Results

After the installation of the microgrid, the Wadeville plant experienced overall energy cost savings of 40% on average, including a 65% reduction in peak charges. The levelized cost of energy (LCOE) was also reduced by nearly 10%, from R1.59 to R1.44. The microgrid system also allows continuous operation of manufacturing, regardless of the utility supply, eliminating losses in productivity due to power quality.

The Wadeville microgrid application demonstrates how simple, cost-effective, modular systems can address unique energy challenges across sub-Saharan Africa.



Click for more information on the Wadeville Microgrid, or visit [eaton.com/microgrid](http://eaton.com/microgrid)