DEFINING THE FUTURE OF ENERGY WITH MICROGRIDS

A solution to add more resiliency and profitability while decarbonizing US energy infrastructure

WHY DO MICROGRIDS MATTER?

Reliable and Flexible
Microgrids are designed to provide uninterrupted, 24/7 power and to balance load demands for an organization with changing power needs.

Resilient
Enhances resiliency with seamless islanding and providing power even if there is a utility outage

Reduced Carbon Footprint
Comprehensive integration of renewable energy to meet climate protection targets that reduce CO_2 emissions

Cost Optimizations
Utilizing the best mix of energy resources to ensure cost optimized solution especially by curtailing power from utility grid during peak hours and participating in energy market

More Secure
Since Microgrids are dependent on local assets to meet energy requirements, it is easier to keep them safe

MICROGRIDS APPLICATIONS

Microgrids provide different goals for different customers some of which are:

MICROGRID CONTROLLER

Microgrid controller is the heart of a Microgrid. It allows a quick and easy integration, combining various conventional and renewable generation and energy storage devices. Thus, intelligently controlled energy mix allows a robust, safe and economical operation of the microgrid.

It provides flexible communication, seamless continuity, maximum security, and no limitation during the migration.

Green Mode → **Minimum Emissions**
- Max renewable share
- Avoid rotating assets
- Optional BESS usage

Economic Mode → **Minimum Costs**
- Energy Tariff (Grid)
- Costs of different assets
- Max. renewable share

Reliable Mode → **Minimum Reliability**
- Max. SOC of BESS
- Rotating Assets
- CO2 reduction limited

MICROGRID KEY ELEMENTS

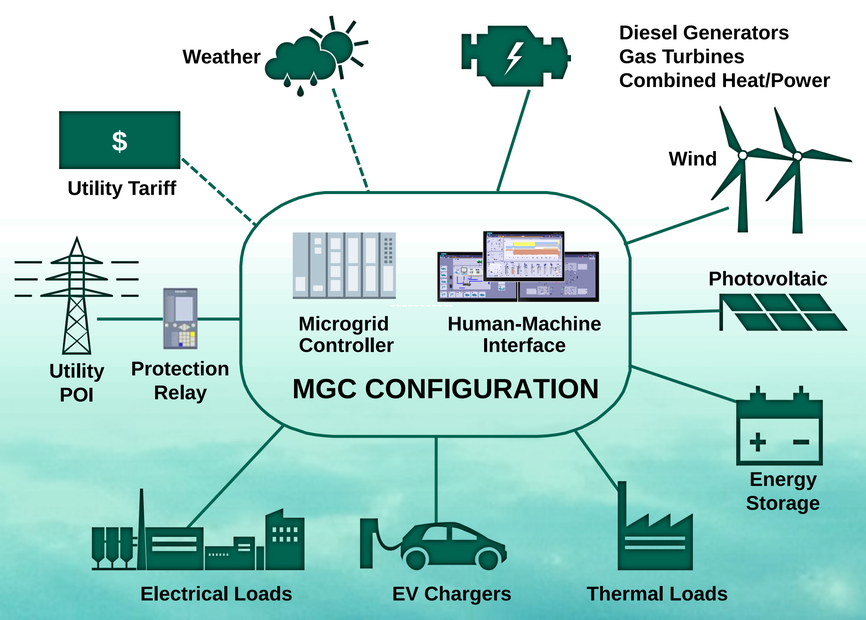
Utility Point of Interconnection POI
POI serves as primary source of power. Microgrids can be "islanded" or disconnected from the traditional grid during a natural disaster or cyber threat.

Energy Storage
Batteries store excess energy and save it for later use thus keeping power always in hand.

Controllable Generation
Nonrenewable, fossil-fuel energy sources may include biogas, fuel cells, or gas turbine engines. They provide stable and necessary levels of voltage and frequency to the system.

Non-Controllable Generation
These intermittent fuel sources fluctuate based on factors such as the weather. Examples include solar or wind power generated by photovoltaic and wind turbine products.

Loads
Both electrical and thermal loads can be controlled via Microgrid Controller depending on customer requirements



MICROGRID KEY FUNCTIONS

- Asset Monitoring
- Blackout Detection, Black Start, and Automated-Grid Modes
- Automatic Start/Shedding of Generators
- Generation Offsetting and Balancing
- Peak Shaving
- Integration with EV Infrastructure
- Load Shedding and Restoration
- Reserve Management
- State-of-Charge Management
- Load/Generation Forecasting
- Integration of Thermal Assets
- Energy and Ancillary Services Markets

Microgrid Lab in Princeton, NJ, USA

Resilient, Cost-effective and Carbon Neutral Microgrid Campus

1 Feasibility Studies
Before any products were ordered, numerous configuration options were simulated to best optimize the size of solar cells and storage batteries, based on current and future demands Siemens PSS (Portfolio Power System)

2 Energy Savings
Improve resilience, drive energy savings
- Siemens SICAM Microgrid Manager
- Select from Green, Eco & Reliable Mode
- Peak-shaving

3 On-Site Storage
The energy storage system has a capacity of approximately 1MWh. With the normal building load ranging between 400 and 500 kilowatts (kW), the building energy needs can rely solely on the battery for a period between two to three hours.

4 Dual Purpose PV Panels
Dual purpose photovoltaic (PV panels) - Solar panels generate the main source of energy for the facility and also act as a roof that shields parked automobiles from outdoor weather elements
• Solar panels currently supply 60% of the facility's energy

5 Building Efficiency
Building management systems are rarely, if ever integrated into microgrids. Here, the Princeton living lab sets a new precedent. Digital twin simulation is used to optimize the energy consumption of the building.

6 EV Integration
This microgrid also integrates multiple electric vehicle (EV) charging stations located in the adjacent parking lots and made vailable to building employees free of charge.

7 Monetize Excess Energy
Generate funding opportunities by selling excess energy back to the grid. Optimize grid control and building energy management

Living Microgrid Lab

The Siemens Princeton Island Grid project, created a "living lab", designed to address the challenges of resiliency, carbon neutrality and cost-effectiveness.

Through storms and outages, power remained stable and secure.

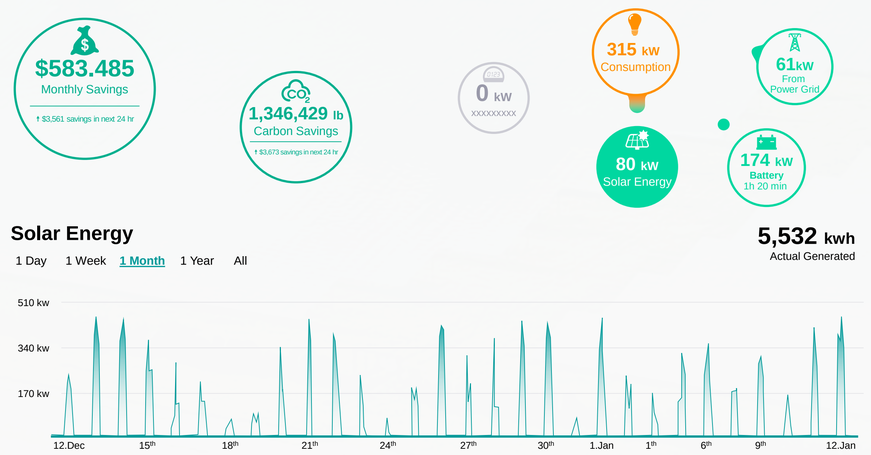
VALUE PROPOSITIONS

Economic & Energy efficiency
- Capex vs Opex
- Distributed generator control
- Load/storage control

Reliability, resilience
- Black start
- Network synchronization
- Online Control via HMI/Grid Monitoring and Control
- Enhanced SCADA functionality

Sustainability
- Generation/load forecast
- Dynamic grid constraint consideration using state estimator function

PRINCETON ENERGY ANALYTICS DASHBOARD



The Princeton Island Grid Dashboard uses simple visual language to visualize the energy flow between renewable energy sources, the power grid energy storage and energy consumers of a campus microgrid.

SIEMENS

Customer Tours Available! (Virtual or in person)