Microgrids and Distributed Energy Resources

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What is a Microgrid and how are they used?
What is a Microgrid?

An integrated energy system consisting of interconnected loads and distributed energy resources…

In Normal Operations

- **DER (Distributed Energy Resources)**
  - On-site renewables and power generation facilities utilized in parallel with grid

- **Utility Meter**
  - May be possible to sell excess power back to the grid through a net metering contract

- **Switch**
  - Client Site
  - Buildings
  - Data Centers
  - Residential

In Island Mode

- **DER (Distributed Energy Resources)**
  - Microgrid will generate energy from local sources in the case of a grid outage OR other external event which makes local energy more desirable

- **Switch**
  - Client Site
  - Buildings
  - Data Centers
  - Residential

In an outage or event, the microgrid controller closes connection to the grid as needed

…which as an integrated system can operate *in parallel with* the grid or in an intentional *islanded* mode.
What is a Microgrid?

An integrated **energy system** consisting of interconnected loads and **distributed energy resources** which as an **integrated system** can operate *in parallel with* the grid or in an intentional *islanded* mode.

**Have to have:**
- Distributed Generation (conventional or renewable)
- Critical loads
- Controls to Island and shed
  - preserving critical loads and system stability
- Electrical Distribution Protection and Control

**Usually have:**
- Inverter based generation sources
- Storage or load flexibility
- AMI and SCADA Software
- A communications network
- Sequence of Events Recording (SER)
Advanced Microgrid Solutions
& Distributed Energy Resource Management

Welcome

Learn More About Microgrids
➤ How microgrids are changing the energy landscape
➤ How a microgrid can benefit you
➤ Energy and economic trends driving adoption
➤ Our advanced solutions
➤ The Schneider Electric difference

Visit Our Learning Center
➤ Download white papers
➤ Watch videos

Microgrids Deliver the Ultimate in Energy Flexibility
➤ Learn how

http://microgrids.schneider-electric.us/
Microgrid Value Proposition

Customized DERs to deliver enhanced reliability; efficiency and optimization; and environmental benefits.

**Reliable Energy**
- Ability to proactively island from utility and reconnect
- Preserve critical loads 24/7/365
- Repurposing grid tied inverters for island mode operation
- Determine root cause of outages and restore power quickly

**Efficiency & Optimization**
- Minimize energy costs through fuel switching, load control and grid services
- Prioritize most critical loads
- Have energy flexibility with the grid
- Harness combined heat and power, maximize incentives

**Green Energy**
- Incorporate low cost solar, CHP and other Distributed Energy Resources
- Implement net-zero projects, reducing carbon footprint
- Store energy for stability and grid services
Microgrid architecture

Central Control & Planning

Optimization of generation, storage and consumption

Struxureware DSO & Microgrid Controllers

Distributed Energy Resources

- DG Control
- Storage Control
- Machine Control

Consumption

- Breaker control
- Distribution/Protection
- Var Compensation
- Load shed control
- Static Switch
- Tap Change
- Transformer control
- Integ SEG
- Sensors

Inverter

Converter

- Wind
- PV
- Battery
- Rotating Mach

Plug

HVAC

Lighting

Building Loads

Schneider Electric Technology

Schneider Partners
Connecting a Campus Microgrid

- Demand Side Optimization
  - Weather forecast
  - Dynamic energy pricing
  - Requests from energy provider

Components:
- PCC meter
- SCADA
- EESS
- HVAC
- CHP
- Lighting
- Solar
- EV Charging Stations

Connections:
- Smart Distributed Generation
- Smart Loads
Microgrid Controller & Event Management

- **StruxureWare Demand Side Operation**
  - Predictive DER management
  - Forecast when to produce, store or sell energy
  - Interface with energy markets
  - Accessible from anywhere

- **PowerLogic Microgrid Controller**
  - Reactive DER management
  - Ensures microgrid real time stability & reliability
  - Manage of connect/disconnect from the grid
  - Optimize energy production & use

- **Client Constraints**
- Weather forecast
- Energy market pricing
- Demand response requests

Cloud

Client site
Use Case: Remote monitoring of DER

- Monitoring in real time (5 minutes refreshment rate) of all the DER connected to the platform

- Example 1: monitoring your DER energy consumption/production from anywhere with an internet connection on your computer, tablet, or smart phone
Use Case: Tariff management – Load shifting

- Shifting the electrical consumption from on peak hour to off peak hour, while ensuring the comfort of the occupant
  - Example 1: charging an energy storage system during off peak period and discharging it during on peak period
  - Example 2: consuming electricity with a HVAC during off peak period (pre heating or pre cooling) and reducing its electrical consumption during peak period

Energy bill optimization
Use Case: Tariff management – optimum start/stop

- Optimizing DER Start/Stop based on electricity tariff and building occupancy
  - *Example 1:* starting and stopping an HVAC system at the right time during the day for ensuring the comfort of the building occupant and avoiding wasting energy
Use Case: Tariff management – Battery Integration

- Optimizing when to charge and discharge your energy storage device based on electricity tariff
  - *Example 1*: charge batteries during low tariff periods
  - *Example 2*: discharge batteries when tariffs are high
Use Case: Demand charge – peak shaving

- Shaving the consumption peak in order to reduce demand charge or to avoid paying penalties
  - *Example 1:* shedding an HVAC during a peak consumption period, while ensuring the comfort of the building occupant
  - *Example 2:* discharging an energy storage system or turning on a distributed generation asset during a peak consumption period
Use Case: Self-consumption

• Consume energy produced locally first, import energy second

• Example 1: charging an energy storage system with the extra amount of electricity produced by a PV system and consuming it later during the day
Use Case: Demand Response – Load curtailment

- Performing load curtailment following a Demand Response request
- Can be performed as demo “manually” or via OPEN ADR with a utility / commercial aggregator who can bid on the energy market
  - Example 1: answering and performing automatically Demand Response requests (for instance load curtailment with a HVAC or an energy storage system) sent by a commercial aggregator through OPEN ADR

Energy bill optimization and contributing to the grid reliability
Use Case: Solar Forecasting

- Built-in industry leading Telvent DTN weather forecasting enables integration of solar PV with the intelligence to avoid issues with intermittency before they occur.
Tariff management – Load shifting

Shifting the electrical consumption from on peak hour to off peak hour, while ensuring the comfort of the occupant

**Example 1:** charging an energy storage system during off peak period and discharging it during on peak period

**Example 2:** consuming electricity with a HVAC during off peak period (pre heating or pre cooling) and reducing its electrical consumption during peak period
Self consumption

Consuming locally the energy which is produced locally

*Example 1*: charging an energy storage system with the extra amount of electricity produced by a PV system and consuming it later during the day.
Load curtailment for Demand Response

“No Brainer” for participating with comfort in DR mechanisms
Possibility to save up to 10% on your energy bill
Oncor MicroGrid

4 MG Zones including 9 generation assets
(2) PV arrays
(1) Microturbine
(2) Batteries
(4) Generators

http://microgridknowledge.com/rumor-is-true-oncor-unveils-first-of-a-kind-microgrid/
Client - Load Management

Microgrid Controller

500kVA Xfmr
480V

50kW Load Bank

400kW Fuel Cell/Inverter System

CL&P 13.8kV

480V

208V

Switchable Facility Loads

2 x 3.3kW PV Arrays/Inverters
Client – Distribution Automation

- CL&P 13.8kV
- Microgrid Controller
- 500kVA Xfmr
- 480V
- 50kW Load Bank
- 400kW Fuel Cell/Inverter System
- 2 x 3.3kW PV Arrays/Inverters
- MV Circuit Breakers
- LV Circuit Breakers
- Switchable Facility Loads
- 208V
Client – Grounding w/ Zig-Zag Xfmr

Microgrid Controller

CL&P 13.8kV Zig-Zag Xfmr

400A Neutral Ground Resistor

500kVA Xfmr

480V

50kW Load Bank

400kW Fuel Cell/Inverter System

2 x 3.3kW PV Arrays/Inverters

Switchable Facility Loads

208V

480V
Thank You!

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