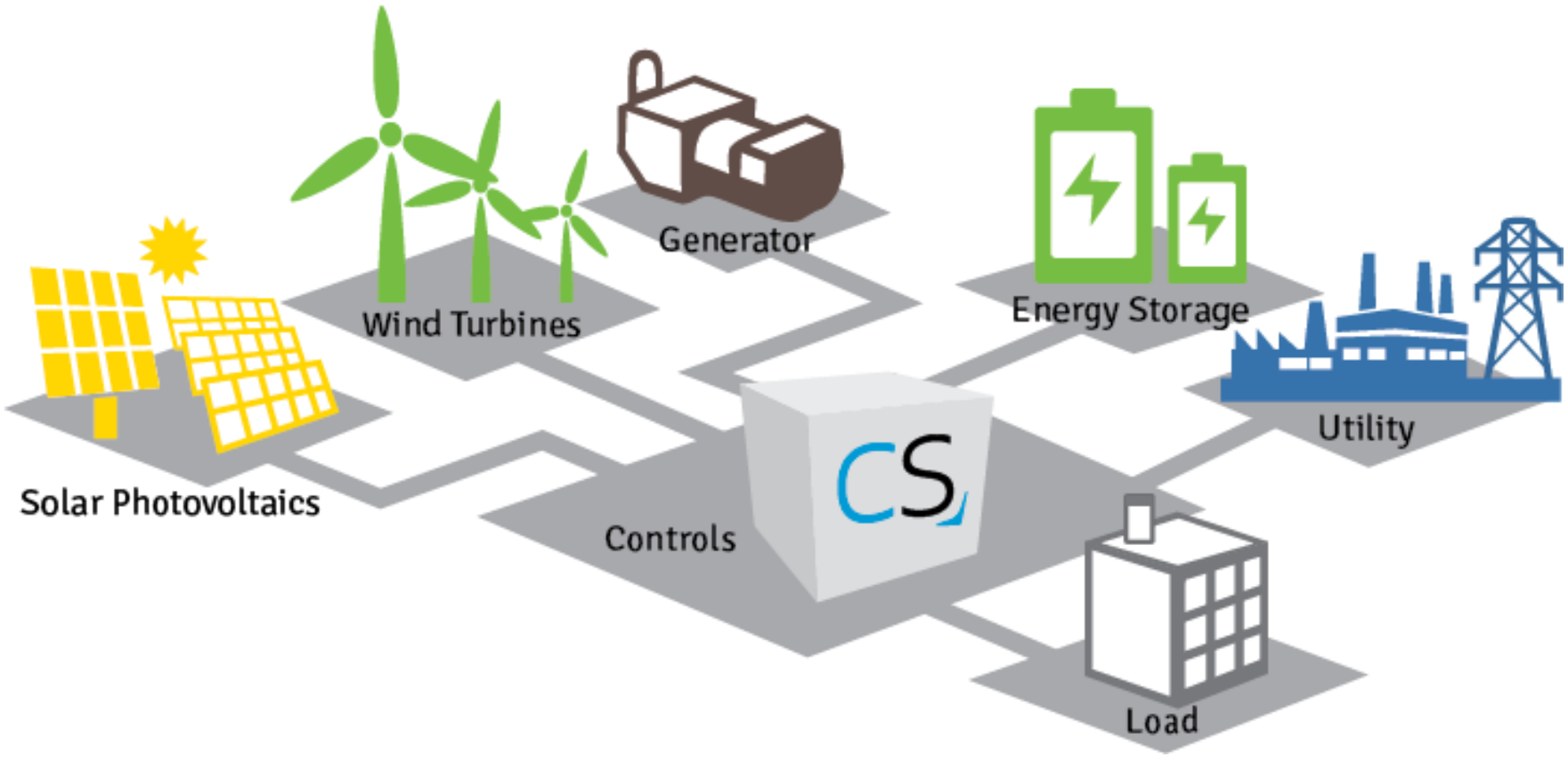
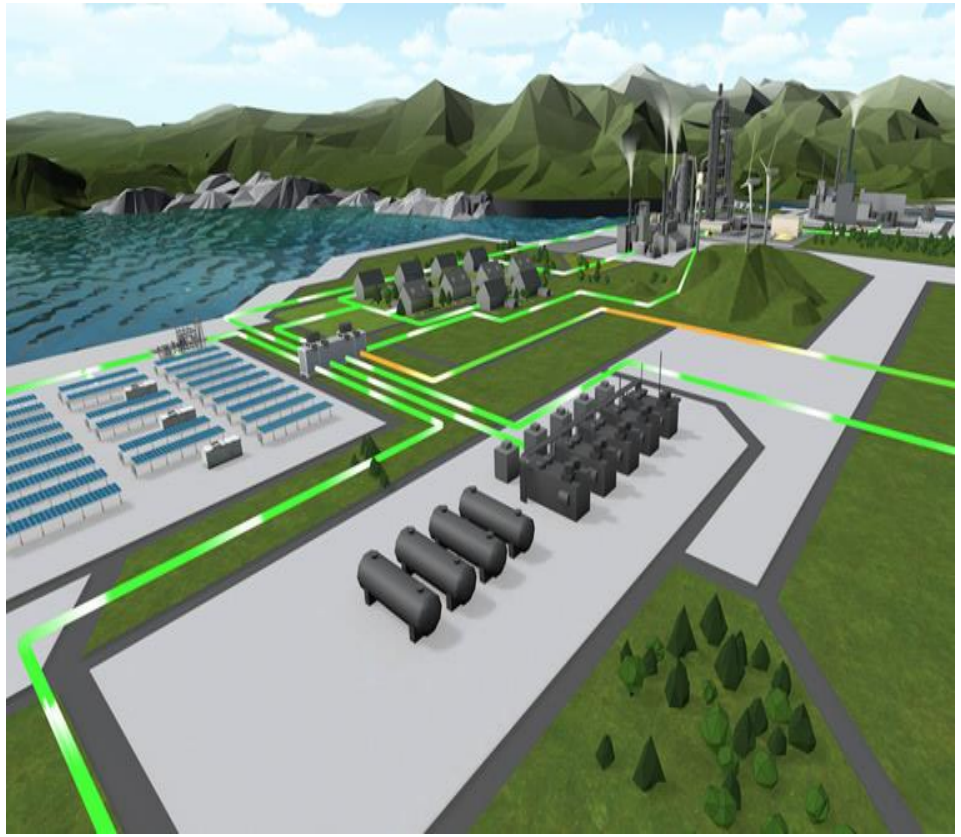


The Role of Microgrids in Helping to Advance the Nation's Energy System

MARTIN ENERGY GROUP

What is a Microgrid?



A microgrid is a discrete energy system consisting of distributed energy sources (including demand management, storage, and generation) and loads capable of operating in parallel with, or independently from, the main power grid. The primary purpose is to ensure local, reliable, and affordable energy security for urban and rural communities, while also providing solutions for commercial, industrial, and federal government consumers. Benefits that extend to utilities and the community at large include lowering greenhouse gas (GHG) emissions and lowering stress on the transmission and distribution system and reducing energy costs.

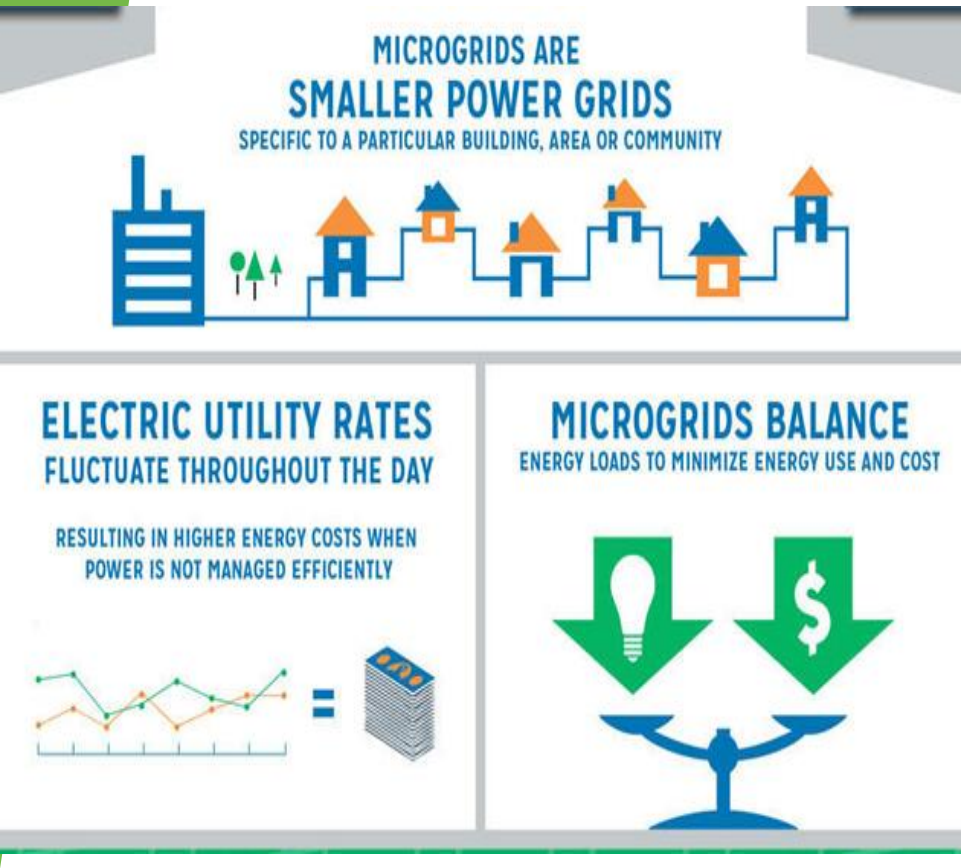
What is a Microgrid?

Microgrids are modern, small-scale versions of the centralized electricity system. They achieve specific local goals, such as reliability, carbon emission reduction, diversification of energy sources, and cost reduction, established by the community being served.

Microgrids focus on resilient power supplies at a wide range of types of businesses, communities and other environments as well as to allow the increased penetration of renewables. This has spurred the creation of new technologies and control mechanisms that allow microgrids to operate in a grid-connected model and also independently for extended periods of time.

These activities are leading to the development of a new concept referred to as the **"dynamic microgrid"** – a top-down breakup of the distribution grid into an interconnected set of microgrids. Such an architecture would radically change utilities' business models and how they address storm response as well as deliver their many other mandates.

What is a Microgrid?



The dynamic microgrid's key characteristics are as follows:

- **Accommodate different sources of energy**: From centralized fossil-based sources to distributed and renewable ones, it is able to handle fuels directly such as natural gas for heating or processes or to generate electricity via reciprocating engines, fuel cells or microturbines.

- **Be self-sufficient, at least for short periods and possibly on a continual basis**: The control mechanism within the dynamic microgrid can handle balancing the supply-demand equation within itself or continuously as a part of a larger grid.

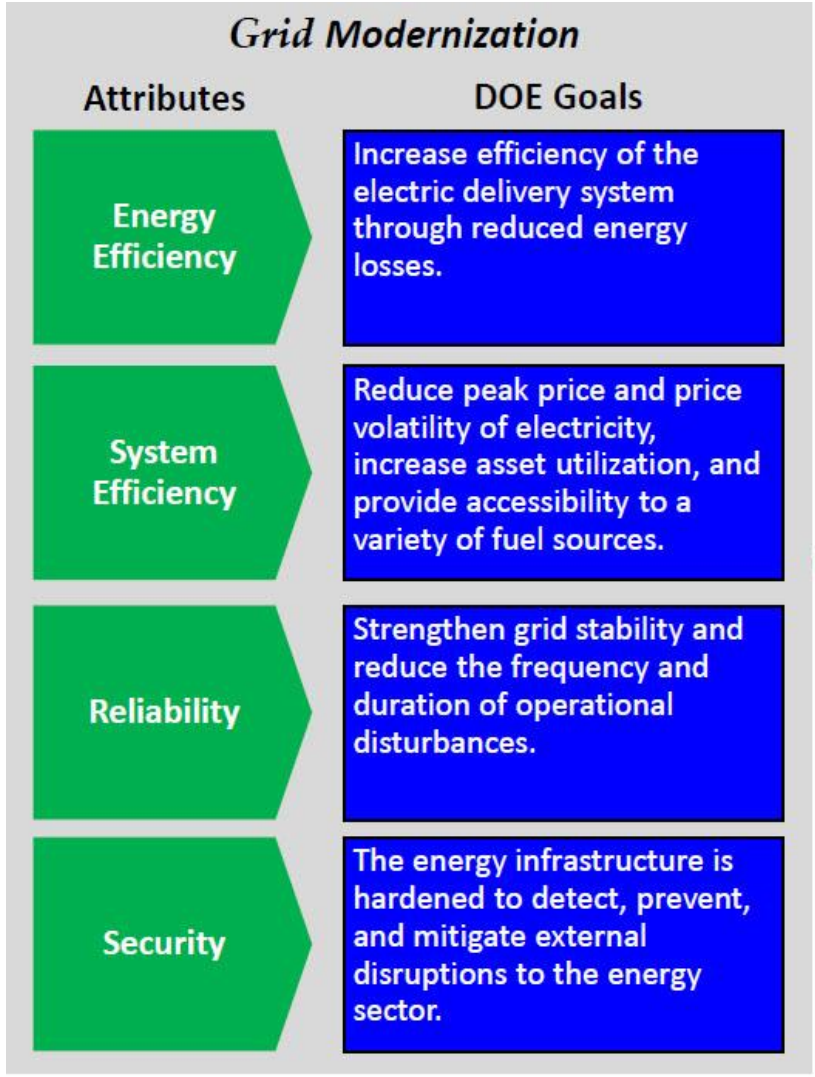
What is a Microgrid?

The dynamic microgrid's key characteristics:

<u>Use advanced self-healing capabilities</u>: The self-healing capabilities include features such as the ability to: 1) decouple itself from the main grid automatically under certain conditions; 2) reconfigure and reroute power through different feeders upon the occurrence of a faulted condition; and 3) drop one or more loads depending upon their criticality at a given time.

<u>Automatically optimize supply and demand resources</u>: This functionality requires that the optimizer must consider conditions such as demand response in all its variations, integrating renewables, energy storage, electric transportation as well as other local energy resources to be used or managed. Also, depending upon the location, the dispatch solution needs to consider wholesale and retail electric markets.

What is a Microgrid?



MICROGRID ENHANCED DISTRIBUTION

- Ease of CHP application
- Supports increase of renewables firms intermittent resources
- Arbitrage of energy price differentials
- Enhance G&T by use of plug-and-play DER for peak shaving
- Enhance reliability with international islanding
- High local reliability
- Energy during outages

Changing the Utility Resource Mix?

Significant risk from prolonged electrical outages
extreme weather events increasing in frequency since 1995.

Innovation and vision needed to build an electrical grid that can:

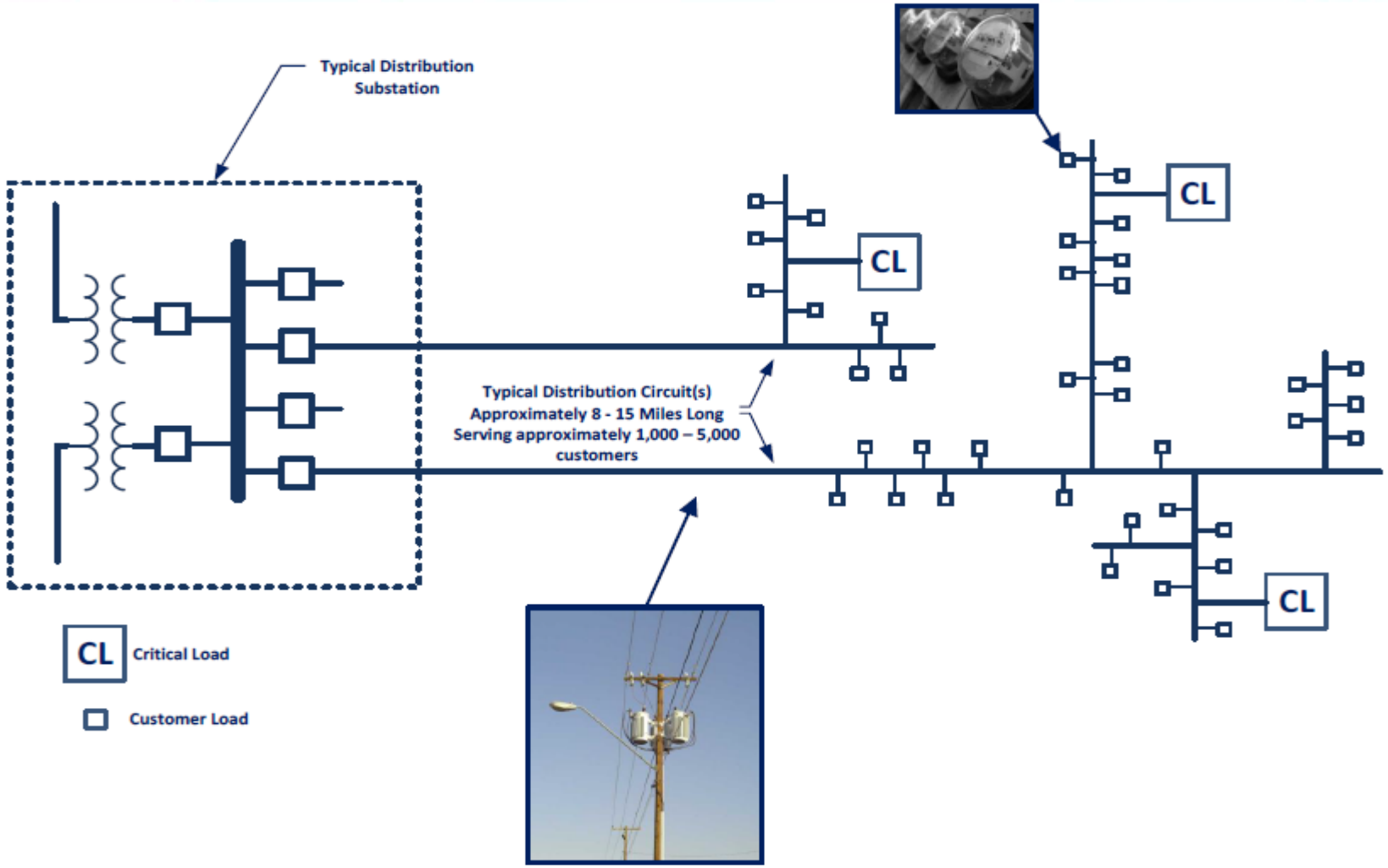
- incorporate renewables,
- reduce energy costs,
- adapt to large-scale disruptive events,
- remain operational in the face of adversity,
- minimize catastrophic consequences that affect quality of life, economic activity, national security and critical infrastructure operations.

Changing the Utility Resource Mix?

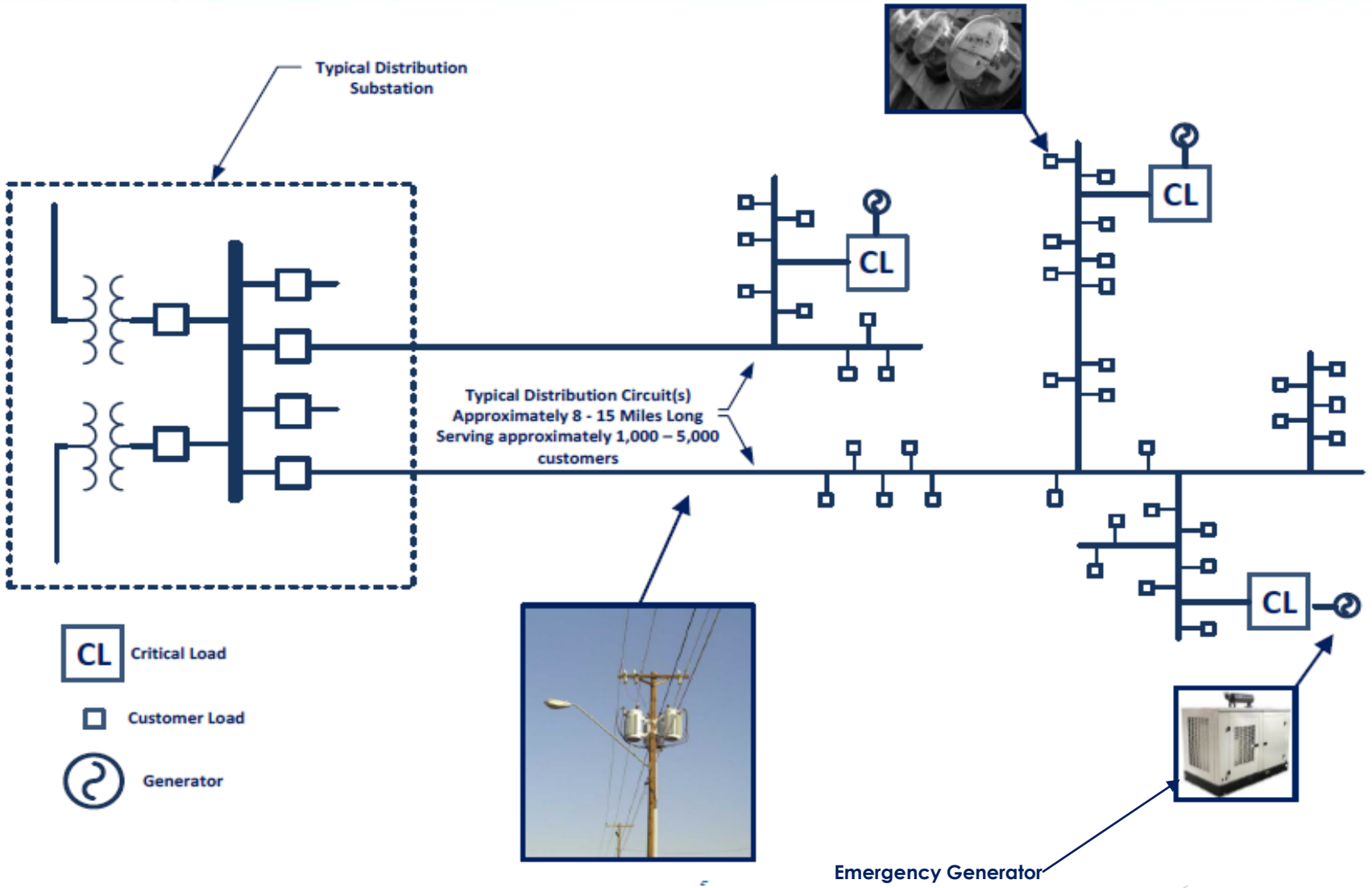
The idea of a localized power grid or **microgrid** fits into this overall strategy in several key ways.

- More power produced on a local level
- Less a community needs to import from outside power plants
- Temperatures soar, more people crank up the air conditioning
- Huge drain on the grid.
- If there's not enough to go around
  then not everyone gets power

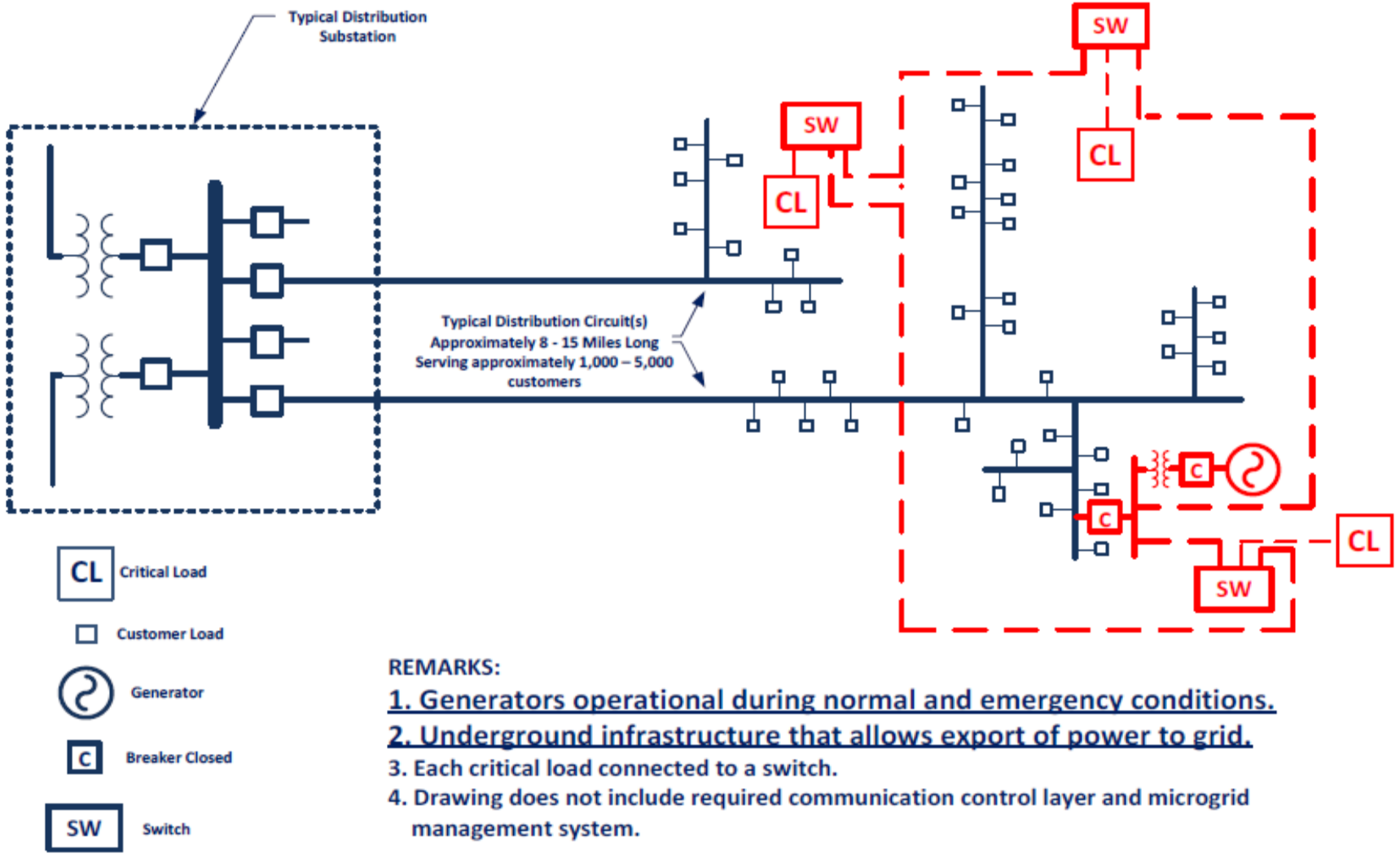
Typical Distribution Infrastructure



Typical Emergency Generation



Typical Microgrid Infrastructure



REMARKS:

1. Generators operational during normal and emergency conditions.
2. Underground infrastructure that allows export of power to grid.
3. Each critical load connected to a switch.
4. Drawing does not include required communication control layer and microgrid management system.

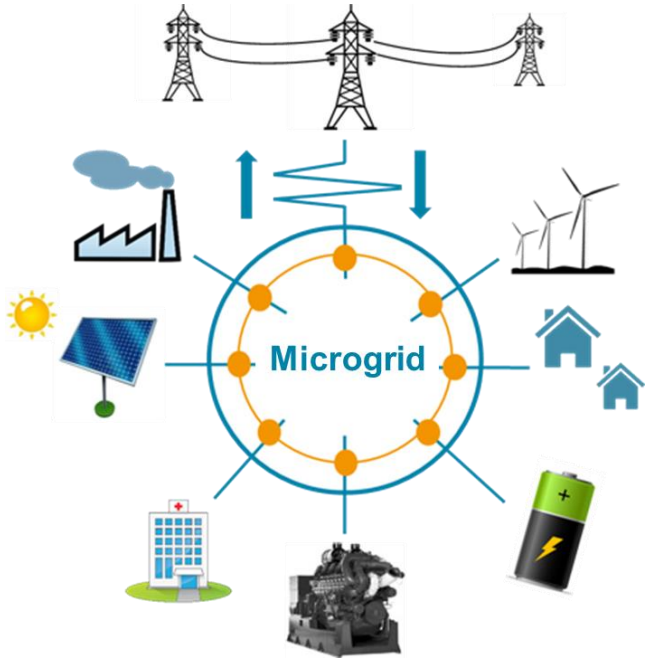
Microgrid – Major Components

Fast and secure communication to monitor real-time network status

Optimize operations and control of DERs & loads

- Connect to buildings via EMS/BAS
- Continuous monitor and trend microgrid components health
- Smart metering to obtain load and DERs profile
- Electricity pricing and demand response capabilities
- Continuous communication to utilities and energy markets

Control & Operation
at your fingertips

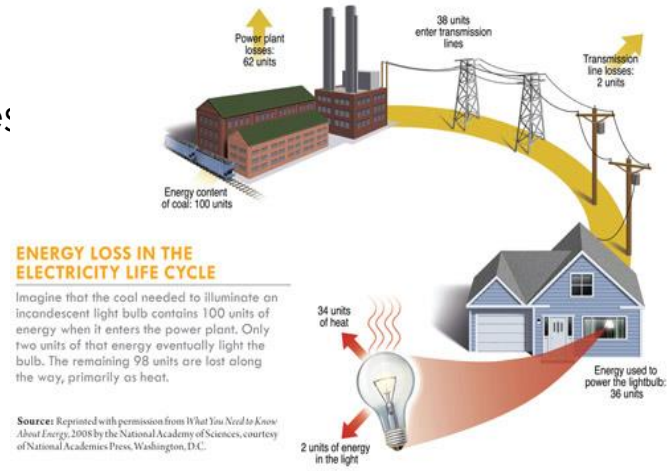


Microgrid – Major Cost Components

Energy Resources (30-40%)	**Switchgear Protection & Transformers** (20%)	**SG Communications & Controls** (10-20%)	**Site Engineering & Construction** (30%)	**Operations & Markets**
Energy storage; **controllable** loads; DG; renewable generation; CHP	**Switchgear utility interconnection** (incl. low-cost switches, interconnection **study**, protection schemes, and protection studies)	**Standards & protocols**; **Control & protection technologies**; Real-time signals (**openADR**); **Local** SCADA access; Power electronics (**Smart Inverters**, DC bus)	A&E (**System design and analysis**); **System integration, testing, & validation**	O&M; Market (**utility**) acceptance

Microgrid –Value Proposition

- **Efficiency**
  - Reduce fuel consumption
  - Supply close to demand minimize distribution losses
  - Combined electricity and heat generation



- **Reliability**
  - Optimally manage on-site energy resources 24/7
  - Power quality and reliability at the local level

- **Energy Security**
  - Ensure energy supply for critical loads utilizing on-site generation
  - Grid independence capability

- **Economic Savings**
  - Peak Shaving/Load shifting and supply management with demand response
  - Enables hedging against energy cost fluctuation
  - Reduction of cost of electricity with on-site generation and effective energy management

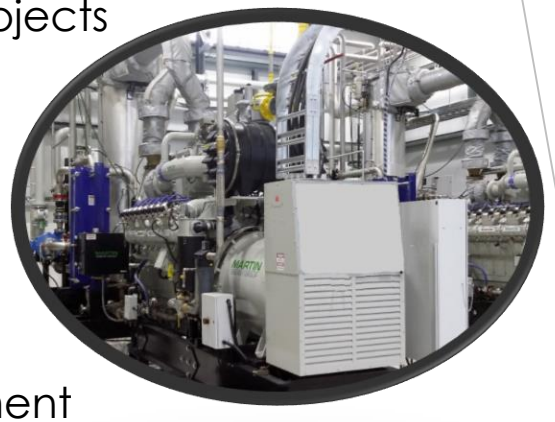
- **Sustainability**
  - Reduction of carbon footprint by integrating cleaner fuel resources

Microgrid Project Lifecycle

The Martin Energy Group Advantage

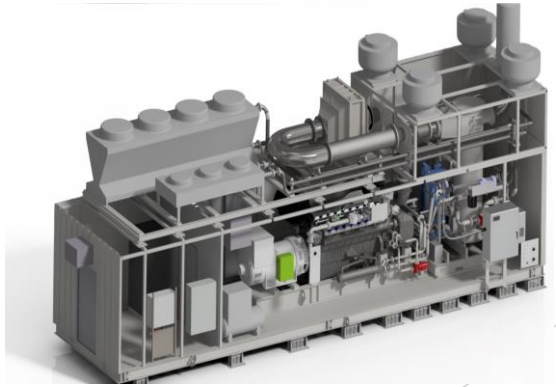
MEG Offers :

- ❑ "Significant" Experience of delivering high quality projects USA and beyond
- ❑ Long Term Utility Bill Reduction
- ❑ All Monitoring & Maintenance (Included)
- ❑ Transparent Cost Projections
- ❑ Above Average ROI with Quick Payback
- ❑ Turnkey Solution - "One Stop Shop" or simple equipment manufacturer. Capital or Finance packages.



MEG Smart Power provides :

- ❑ Energy Efficient - Improved LEED Score
- ❑ 15%-60% Carbon Footprint reduction
- ❑ Save Money



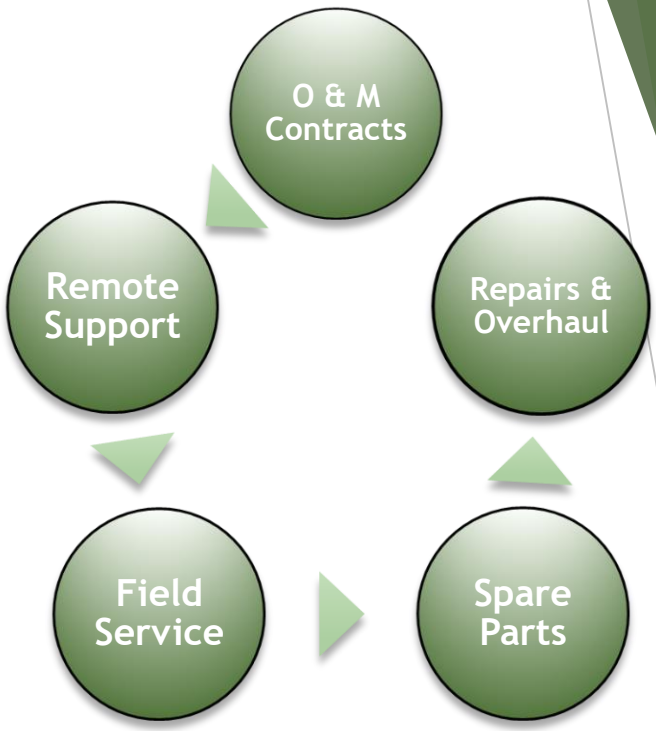
MEG Reliable Projects :

- ❑ Fully Independent and Redundant Power
- ❑ Power located On-Site
- ❑ Stable, Available, Low Cost Gas Fuel Supply
- ❑ Not Dependent on Unreliable Power Grid
- ❑ Isolated from Severe Weather Disruptions

The Martin Energy Group Advantage

MEG Solutions include :

- ❑ 400 + CHP Unit Installations
- ❑ Significant Microgrid Experience
- ❑ 36 States / Provinces
- ❑ 6 Countries
- ❑ 200+ MW of CHP Power Installed
- ❑ Multiple DG Solutions integrated into single platform



MEG Case Study

FISHER RANCH PRODUCE . BLYTHE, CA

- 3.5 MW Natural Gas Generators
- 637 KW Solar Photo Voltaic array
- 4 MW Utility Scale Battery Storage
- Online Power Conversion System (PCS)
- 160 Tons Ammonia Absorption Chiller
- Smart Controls with remote operation and self healing
- Island Power System – No Grid Connection

Smart Controls

Solar

Battery

Generation

MARTIN ENERGY GROUP

For further information
Please contact :
Michael Massolini
E: mmassolini@martinenergygroup.com
W: www.martinenergygroup.com

Energy Reliability, Flexibility & Accessibility