GENERATOR SYSTEMS WITHIN A MICROGRID SYSTEM

Buckeye Power Sales
Reliable Power Professionals Since 1947

Having already proven their value and concept in critical power situations, microgrids are now considered one of many solutions for providing continuity of electrical power supply with microgrid system applications undergoing a boom in the last few years. This Information Sheet looks at the benefits of microgrids and the role of a standby generator systems when integrated into a microgrid to provide a reliable alternative to the main utility grid for installations having numerous interconnected power sources to multiple loads.

1.0 WHAT IS A MICROGRID - DEFINITION:

A microgrid is a group of interconnected loads and Distributed Energy Resources (DER) operating in clearly defined boundaries as a single controllable entity within a utility grid network.

Microgrids are independent electrical distribution systems with a combination of power sources including; engine generator systems, power storage devices, and renewable energy, all supplying a group of multiple connected loads within a microgrid system. The loads within the microgrid can be automatically controlled and operated in a coordinated way, either while the microgrid is connected to the main utility network or operating disconnected with the microgrid unconnected to the main grid and operating in island mode. (See diagram one).

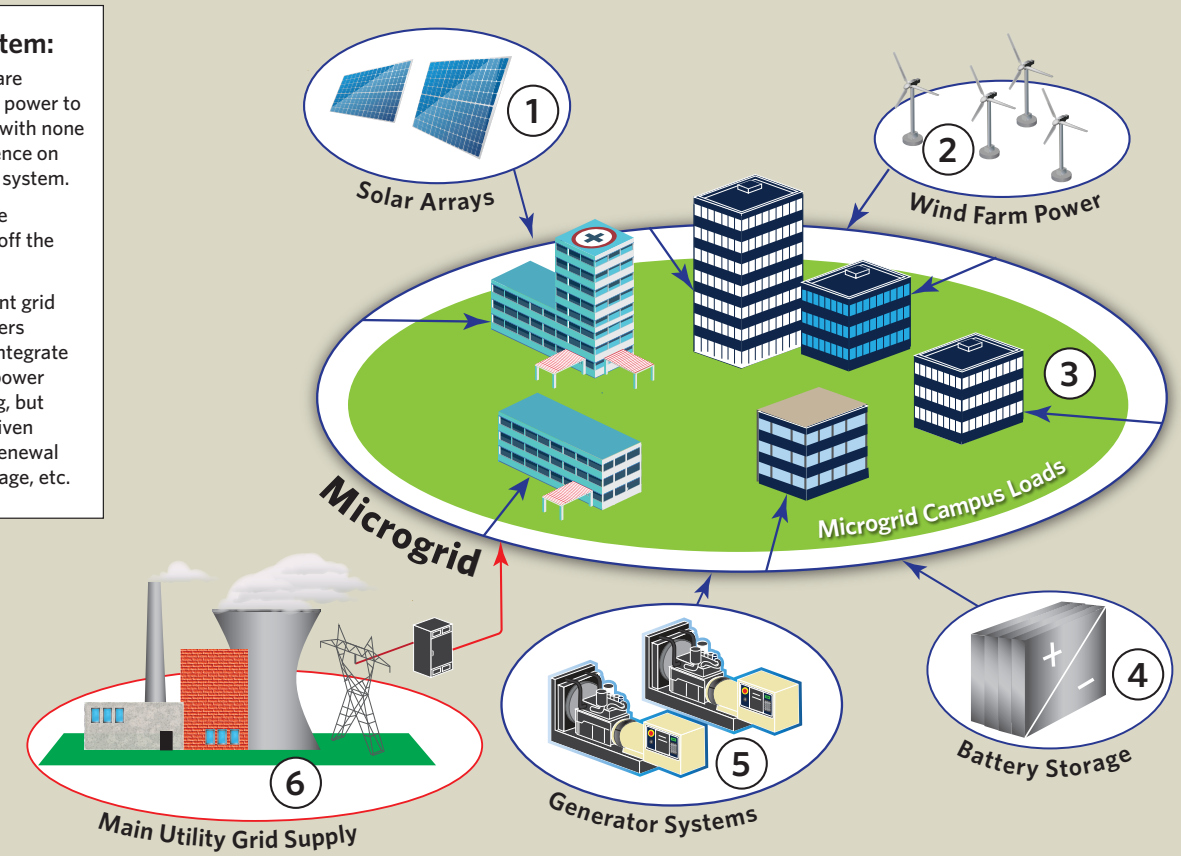
Unlike traditional utility systems, a microgrid is designed to operate as a true smart grid environment. Entities such as technology centers, military bases, extensive health facilities, universities, and research centers that have multiple connected loads of all types and are highly dependent on the reliability of the existing utility supply can benefit the most from microgrid systems.

Microgrid System:

Microgrid systems are designed to provide power to campus style loads with none to minimal dependence on the main utility grid system.

In "Island Mode" the Microgrid is totally off the main utility grid.

Being an independent grid provides the designers greater latitude to integrate various sources of power generation including, but limited to engine driven power generation, renewal energy, battery storage, etc.



Key to:
Microgrid System

1 - Solar Array: Solar voltaic can be sized to manage a certain level of constant load to reduce costs and and reduce emissions.

2 - Wind Farm: Renewal energy to compliment solar.

3 - Microgrid Loads: Often referred to as Campus Loads as they have numerous buildings/facilities connected to the Micro grid.

4 - Battery Storage: Emerging battery technology is enabling battery standby systems in addition to backup to renewal power and UPS systems.

5 - Generator Systems: In addition to being a standby power source that can peak shave, and contribute Combined Heat and Power (CHP) to the campus.

6 - Main Utility: In a true microgrid not required.

2.0 WHY MICROGRID SYSTEMS ARE EVOLVING:

The principal drivers for adopting an independent microgrid systems are:

2.1 Main Utility Grid Reliability: While over the years there has been numerous discussions of modernizing the US utility supply, but little progress has been made with much of the system still above ground and dating back over 100-years. In fact, as our society and infrastructure has become more dependent on reliable electrical supply and less tolerant of power outages, the utility supply has become more unreliable.

2.2 Zero Power Interruption Tolerance: The digital information age has made commerce and individuals reliant on uninterrupted access to data storage and intercommunication. Installations with a network of interdependent loads such as military bases, research centers, data storage, health facilities, universities, and communication centers are left exposed to economic, life critical, and security consequences when the traditional utility supply is their principal power supply.

2.1 Advances in Deliverable Power: Traditionally a standby generator system using a reciprocating engine, or turbine through an automatic transfer switch (ATS) has been the emergency power solution when the utility fails. However, standby sets are sometimes over-powered, and with critical loads, rely upon uninterrupted power systems (UPS) while the standby generator runs up to speed.

Advances in power management control systems, development of renewable energy, and power storage, all lead to a better utilization of standby generator systems within a microgrid system.

3.0 BETTER UTILIZATION OF GENERATOR SYSTEMS WITHIN A MICROGRID:

A traditional standby generator system supplies power when the primary power (usually the main utility supply) goes off line. The facility manager of the connected load has little influence on how the utility power is generated, controlled, or priced. When the utility supply fails the standby generator supplies the power, is sized accordingly, and the rest of the time sits idle.

In a microgrid system the generator system can play a more continuous role operating in sync with other sources of power supply, for example:

3.1 Working with Renewable Energy Sources:- Developments in renewable energy such as wind and solar have made them economic alternatives to the utility supply. However, mother nature does not guarantee an uninterrupted source of wind and solar. A suitable sized generator set can supplement power demand as its cycles up and down, and when renewable energy power falls off.

When designing a microgrid system the system engineers will look to optimizing the sizing of the generator set and greater utilization.

3.2 Energy Storage:- Advances in battery technology have significantly changes the concept of stored energy. Lithium batteries are now being used as stored energy not just for a few seconds in an UPS system, but for considerable longer periods to supplement renewable energy power supplies such as photovoltaic and wind turbines. The system engineer will design a generator set that can power the battery storage to both make up for loss of renewable energy, and as a bridge when loads within the microgrid put spikes on overall energy requirements. This will result in a generator system being sized to its optimum power.

3.3 Load Control:- Advances in digital load monitoring, switching, and control provides system engineers within a microgrid system the tools to “smartly” manage connected load and alternative power supplies within the grid. Instead of just being a standby generator system the traditional generator set is integrated into the overall primary power components. This is a similar application to “Peak Shaving” when the generator set supplemented base-line utility power used to power intermittent large loads.

4.0 TYPES OF MICROGRID SYSTEMS:

The principal advantage of a microgrid system is to provide more reliable power, better management of power resources, and more control of costs than reliance on the utility provides. Microgrid designs can be completely isolated from, or work in conjunction with the utility grid. The system designers will consider all the options which can include variations of the following:

4.1 Custom Microgrids (or true microgrids):- These systems are complete power systems independent of any utility supply. Many microgrids installed today are this type. They usually employ current technology and are independent of any utility supply regulations. They are designed for greater energy reliability than the utility can provide, reduce energy costs, adopt renewable energy resources, and also have less impact on the environment.

4.2 Utility or Community Microgrids:- While this version operates as a true microgrid system, it is connected to the main utility grid and will be subject to the same regulations a utility has to comply with.

4.3 Virtual Microgrids:- Cover DER at multiple sites, but coordinated so that they can be presented as a single controlled entity.

5.4 Remote Power Systems:- The nature of their remoteness takes them downstream and too isolated to connect to the main utility grid. Isolated power systems are commonly described as microgrids, but without utilizing the smart technology of a true microgrid.

5.0 GENERATOR COMBINED HEAT AND POWER (CHP):

Several installations such as a university campus, military base, or large health facility, utilize central HVAC systems for the circulation of heat and chilled air to all the buildings within the campus. A generator system’s cooling and exhaust heat rejection can be recovered through heat exchanges and circulated throughout the campus. This improves thermo efficiency and reduces operational costs of facilities within the microgrid.

6.0 SUMMARY OF ENGINE DRIVEN GENERATOR SYSTEM WITHIN A MICROGRID:

Traditionally an engine driven generator system is used as standby power to the main utility grid through an Automatic Transfer Switch (ATS). Within a microgrid system the generator through logic monitoring systems can be used as standby to alternative sources, but also supplemental power to renewable energy sources as the campus load cycles up and down. In addition to providing standby the generator system within a microgrid becomes a more robust source of power.

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