



By: *Gordon Feller*

Microgrids Are Quickly Becoming an Important New Option



Interest in distributed generation solutions and microgrids continues to accelerate – and will become more visible as many more microgrids are successfully deployed over the next 12 months.

A report published by Wood MacKenzie identified 546 microgrids that were installed in 2019. Of that installed capacity, 86% included fossil fuel generation.

With the emergence of wind, solar and battery storage systems as viable and economical energy solutions, why is there still a significant demand for fossil fuelled generators in microgrid projects?

Simply put, there is a need for system resiliency that often outweighs sustainability objectives. A fossil-fuelled generator incorporated into a microgrid solution ensures that power will be there when needed over 99% of the time.

What is the viewpoint of operators of facilities in industries such as healthcare, retail, manufacturing and quick service restaurants?

Rob Brockel, Generac's Senior Director, indicated that in discussions with them "they note the importance of critical systems remaining online to service patients and customers, or to prevent a substantial financial impact from loss of inventory or disruption in a manufacturing process. While facility operators are looking at different solutions to provide resiliency or critical backup they tend to keep sustainability in mind".

Brockel noted that, "as they evaluate options for fossil-fired generation, they will quickly learn that environmental objectives can still be met using natural gas fuelled generation to provide onsite power using reciprocating internal combustion engines. The emissions impact of a natural gas fuelled solution can be up to 99% lower than their diesel counterpart when looking at NOx emissions".

Natural gas can more easily meet air quality requirements

According to one study conducted by the Joint Institute for Strategic Energy Analysis (and published by the US government's National Renewable Energy Lab), "Because natural gas engines often have significantly less sulfur and NOx emissions than comparable diesel engines, natural gas can more easily meet air quality requirements. This results in a simpler permitting process for natural gas compared to diesel".

In remote areas "off grid" where natural gas supply is not available, the microgrid can leverage the ability of many generators to operate on propane, LNG, CNG and other gaseous fuels.

The renewable energy resources within the microgrid also aid the utilities' sustainability goals by reducing carbon footprint

Brockel says that, from the customer's perspective, "the usage of propane makes sense in areas where there is no supply of natural gas and/or reliable supply of electricity. Hence, propane currently occupies a sweet spot for immediate reduction in carbon emissions using low-cost infrastructure for its transportation and storage in a liquid state. In other words, environmental goals can be achieved by utilising propane without any additional costs to the customer".

The renewable energy resources within the microgrid also aid the utilities' sustainability goals by reducing carbon footprint -- as many of these microgrids target at least 70% renewables penetration.

The utility can still manage and control all these distributed energy resources (DER) through virtual power plant and distributed energy resource management control software like that offered by Generac Grid Services with its Concerto platform.

The operating costs could be

greatly reduced

All of the utility's assets can be controlled under a common platform for simplicity and efficiency in system control.

From the standpoint of the customer behind-the-meter, Brockel thinks "a microgrid can potentially reduce energy costs. For very remote customers that were relying solely on propane generation to provide all power needs, by incorporating renewables to form a microgrid, the operating costs of the system will be greatly reduced".

Planned maintenance and refueling schedules can be extended, as the generator will be running fewer hours per year due to the system using the renewable generation when available to cover the loads.

For businesses, remote microgrids can be either grid-tied or off-grid systems, and Brockel thinks "they can be used in either configuration to meet the needs of each business individually. For a grid-tied microgrid, the system can be used to reduce energy cost through energy management like peak shaving or participating in demand response programs, as well as provide resiliency during longer utility outages to minimise impact on business operations".

When used in either configuration, a microgrid will improve the carbon footprint of the organisation and help work towards sustainability goals

For island-based microgrids, resiliency is likely the main driver for the microgrid, but it also could be less expensive to self-generate power onsite instead of paying the interconnection fees with the utility.

When used in either configuration, a microgrid will improve the carbon footprint of the organisation and help work towards sustainability goals.

With the global push toward decarbonization, more organizations have sustainability goals to reduce their carbon footprint. Using microgrids with high renewable penetration and generators for resiliency of the system makes a logical stepping stone to achieve these goals.

Public transportation

A small number of public transportation agencies have been busy developing microgrids to power their EVs and battery-electric bus fleets.

The numbers are growing, with two major systems – Massachusetts Bay Transportation Authority (MBTA) and Montgomery County Department of Transportation (MCDOT) -- among the latest in a steady stream of new entrants.

One leading figure working on this challenge is Alinga Energy Consulting's director, Ruby Heard. She is the principal author of *Microgrids and their Application for Airports and Public Transit*, a report commissioned and published by the US Transportation Research Board.

According to Heard, there are four key advantages of such projects:

- Increased power system resiliency and reliability – the ability to isolate the power system in the event of a utility power outage or disturbance and continue to supply load from on-site power systems.
- Energy cost savings – reduced energy costs through increased self-consumption of renewable energy by utilising on-site storage assets.
- Increased renewable energy penetration – increased self-consumption of renewable energy by utilising on-site storage assets.
- Flexible and modular energy systems – microgrids can be designed and built out in stages and they can be flexible for future

expansion while utility connections can be costly and slow to upgrade.

Benefits to the electricity network can be leveraged by transit agencies. Heard points out that “utilities can benefit from customer microgrids if they can delay or eliminate the need for costly upgrades to utility infrastructure, for example due to capacity shortages or constraints in the network.” Transit agencies could then make a case to share a portion of the development costs with their utility.

She notes potential revenue streams in providing grid services, such as frequency regulation and voltage support, although these opportunities aren’t available to all customers.

A complex endeavor

Developing microgrid is a complex endeavor. Most companies and organisations would lack some aspect of the development equation whether that be funding, design capability or operational expertise.

Grid-connected microgrids face technical, financial, regulatory and organisational challenges.

A fully remote microgrid has disadvantages: There are no benefits from grid supply. Thus, the project owner needs to invest in assets to support the entire facility.



A fully remote microgrid has disadvantages: There are no benefits from grid supply. Thus, the project owner needs to invest in assets to support the entire facility

Supplying 100% of demand can result in very large, costly generation and storage assets, particularly when trying to incorporate intermittent renewable energy systems.

Heard and other experts point out that advanced microgrids constantly monitor the grid supply, responding quickly to fluctuations and disturbances which ordinarily result in poor power quality or power loss.

Not only will this keep the lights on, but it can also protect systems and equipment from being damaged by surges.

Traditionally back-up power would be provided by generators but a sophisticated microgrid offers faster response, clean energy from renewable sources and fully utilised/monetised assets.

Microgrid assets are working all the time to reduce energy costs. Heard highlights the fact that “they provide a return on investment.”

“Diesel generators are more of an insurance policy that require regular maintenance, but only provide benefits in the event of an outage. They also tend to be smaller, localized units which support limited loads. A microgrid built on renewable energy assets can sustain a facility indefinitely while diesel generators require a constant supply of fuel, which during a disaster event, may not be available”.