Different types of microgrids

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Microgrids are not fundamentally different from wide-area grids. They support smaller loads, serve fewer consumers, and are deployed over smaller areas. But microgrids and wide-area grids have the same job within the power generation eco-system, distributing electricity, and the same constraints, perfectly matching generation and load at all times.

Microgrids existed before anybody used the word microgrid. For example, smaller islands have electric grids which usually qualify as microgrids. Likewise, in the early days of electricity, the individual systems of private utilities were microgrids. Over time, almost all of those individual systems were linked, resulting in continent-wide interconnections.

Microgrids, however, are making a comeback. They are seen as a practical, cost-effective way to integrate local renewable energy resources, and to provide redundancy and resilience. There are two categories of microgrids, off-grid and grid-connected and each encompass many different setups.

Islands that are too far from the mainland are typically served by their own microgrid. In the past, island microgrids were usually built around diesel or heavy fuel oil generators. While easy to transport and easy to store, these fuels could prove to be expensive. However, in the absence of a suitable alternative, many islands continue to rely heavily on such generators.

Today, modern microgrid features allow island utilities to integrate larger quantities of intermittent renewable resources such as solar and wind. Stationary energy storage, in particular, is extremely helpful in managing transitions between intermittent resources and traditional generators.

Island utilities find that investing in a modern microgrid grants multiple benefits. Generating more electricity from renewable resources allows islands to reduce both their fuel costs and the local environmental impact associated with the use of those fossil fuels. Using their generators in a more optimized way allows island utilities to reduce maintenance costs, increase efficiency, and, in many cases, reduce the number of generators needed on the island. The reliability of the electrical system is also improved, leading to better service quality and less frequent outages.

Off-grid microgrids also exist in remote areas. Many settlements in Siberia and in Northern Canada, for example, are not connected to any outside electrical system. Remote industrial operations also possess a self-sufficient electrical system. Mines, in particular, require large and robust electrical installations.

These remote electrical systems are required to ship diesel, fuel oil or other liquid fuels over long distances. Unsurprisingly, this can quickly become very expensive. Imagine trucking fuel across hundreds of miles of frozen terrain or on a dirt road. As a result, the owners of these remote industrial operations are eager to

deploy as much renewable power as possible, along with sophisticated microgrids to effectively integrate and distribute that power. Some mines also seek to synthesize their own fuel on site using renewable electricity.

In fact, many microgrid users are located in urban or industrial areas that are fully served by an electric utility. Why do businesses and institutions go through the trouble of investing in a microgrid when they can simply receive electricity from the utility? There are two main reasons.

Homeowners invest in a home generator for the same reason. The difference between a home with a generator and, for example, a military base with a microgrid is complexity and scale. A home has one, maybe two electrical panels. All it takes to integrate a home generator to a residential electricity system is a transfer switch.

A military base includes dozens of buildings, several generators and a variety of critical electrical equipment such as radars and air traffic control systems, often spread over hundreds of acres. Integrating these components requires a sophisticated electrical infrastructure--in other words, a microgrid.

Civilian facilities with complex electrical systems incorporate microgrids to ensure the reliability of their electrical service as well. Hospitals, airports, university campuses and large industrial plants all utilize microgrid components to effectively integrate backup power generation into their electrical system.