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MICROGRIDS FOR HEALTHCARE FACILITIES

'ISLAND MODE' ENSURES INDEPENDENT, LONG-TERM OPERABILITY

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With the future and stability of regional power grids more in doubt than ever, hospitals and other healthcare facilities face the critical task of establishing a long-term source for their "always on" power needs. Current requirements for temporary back-up power systems are far from sufficient, making it imperative for these critical facilities to address their resiliency to be able to provide uninterrupted care for the populations who depend on them.

A microgrid is an emerging solution. This freestanding power source provides not only for the resiliency of facilities, including hospitals, during long-term power loss, but also helps organizations meet sustainability goals, reduce their carbon footprint, and combat the rising costs of energy.

Operating in 'island mode'

NFPA 99 defines a microgrid as "a decentralized group of electricity sources and loads that normally operate in parallel with the Utility Source and can disconnect from the grid and function autonomously in 'Island Mode'"—i.e., isolated from the power grid indefinitely with little or no interruption of service. According to the U.S. Department of Energy, a microgrid operates to serve facilities within a clearly defined electrical boundary that acts as a single controllable entity. Such a microgrid can be made up of solar panels, wind turbines, combined heat and power plants, generators (diesel or natural gas), and battery storage, all of which produce power to serve the facility.

Microgrids should not be confused with traditional backup emergency power systems. Hospitals have had diesel backup generators for years to help them maintain the regulatory requirement of 96 hours of backup energy supply in the event of a power loss. Just because a hospital has a diesel generator, however, does not mean that it has a microgrid.

To qualify as a microgrid, an electrical power system must meet the following requirements:

- The microgrid must consist of a collection of components that work together to generate, transform, and store electrical power.
- The microgrid must have identifiable boundaries, separate and distinct from the external utility.
- The microgrid must have a controller that can "intelligently" manage the interconnected assets of the microgrid—able to adjust and react to load requirements and energy sources. "Smart" microgrids that integrate artificial intelligence (AI) technology can balance considerations like reliability of sources, cost, emissions, weather conditions, and more.

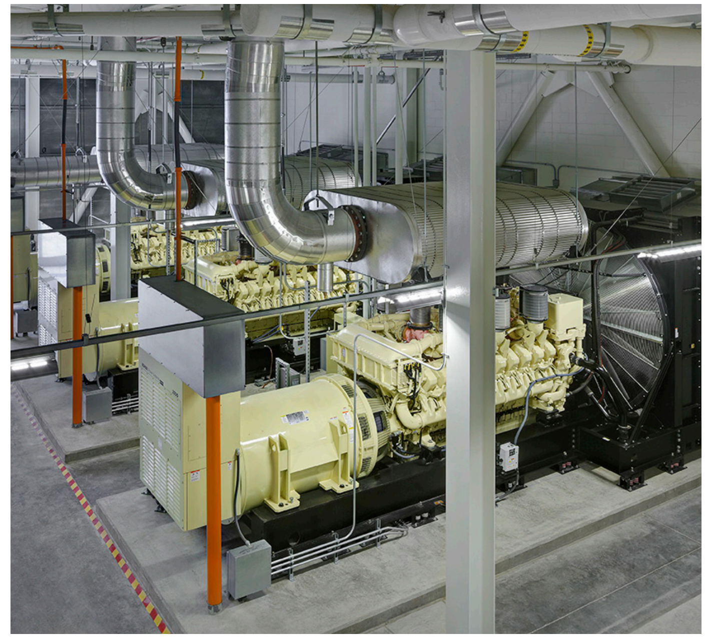
This balance of features enables a microgrid to truly enter island mode.

Why consider a microgrid?

The adoption of microgrid technology and the ability to operate in island mode, separate from the grid, provides many obvious advantages, including:

Cost savings. A microgrid with AI control components can give hospitals and healthcare facilities the opportunity to control their electricity expense through peak shaving and load shifting.

- Peak shaving means reducing power consumption briefly during peak hours, either by decreasing production (in the case of a factory) or, in the case of a healthcare facility with a microgrid, by triggering



Having a diesel backup generator does not mean a hospital has a microgrid. It is still required by code, however.

  a short spate of on-site power generation. Both actions reduce the amount of energy purchased during the utility's highest rate of the day.

- Load shifting is the practice of timing the highest volume of electricity consumption to periods when it will be at a lower cost.

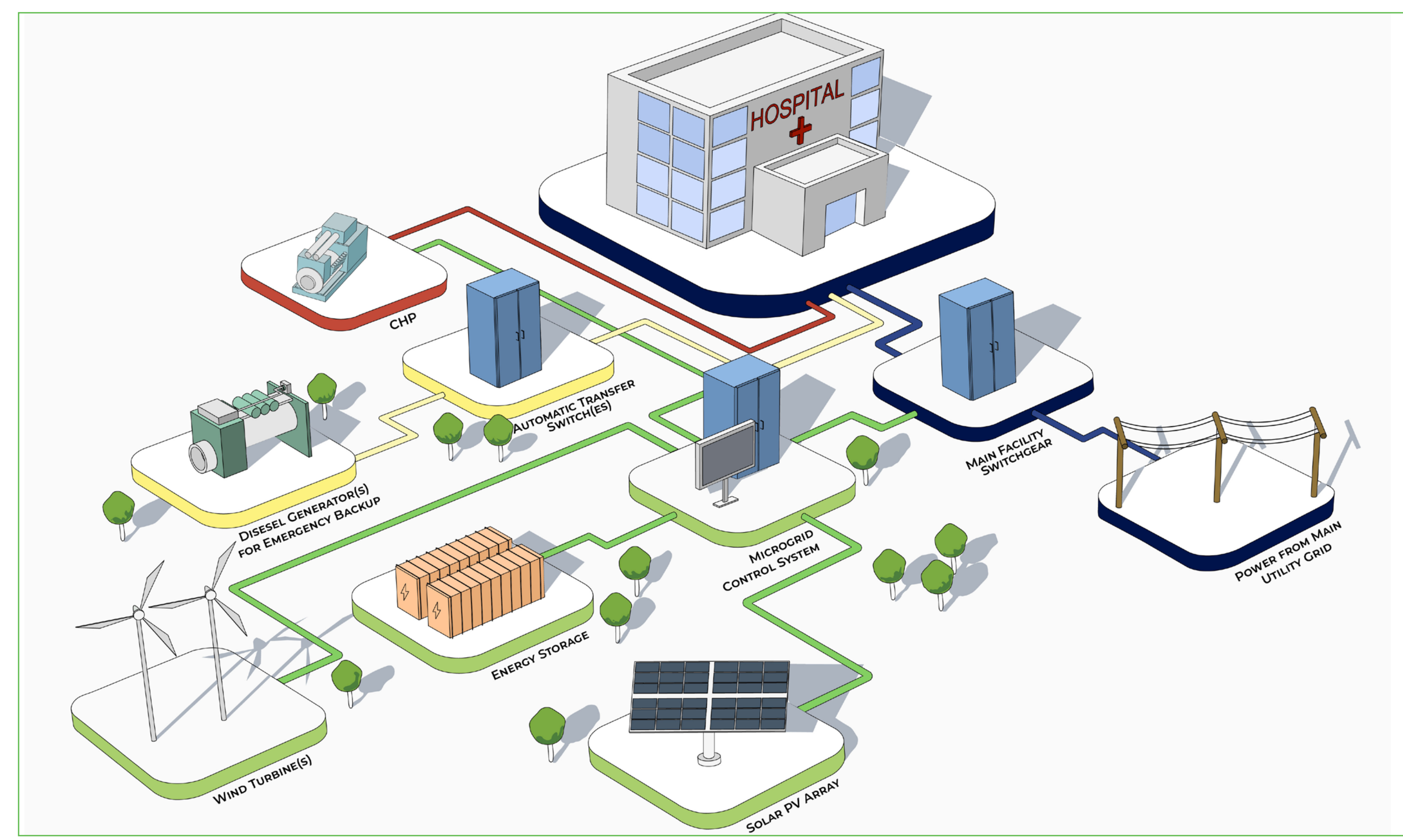
Both methods have the effect of reducing overall energy costs, even when the microgrid is not forced to operate in island mode.

Implementing a microgrid will, of course, entail up-front costs that will vary based on the systems chosen, but the return on investment due to increased energy savings can be calculated during design and pay long-term dividends. More importantly, however, the technology will ensure the uninterrupted care of patients.

Regulatory considerations. Hospitals and healthcare facilities are usually considered "essential" facilities, meaning they have a regulatory burden to safeguard against shutdown during interruptions of the power grid. It's easy to see why: failure of power at a healthcare facility could put patients' lives in jeopardy. Various regulations currently require at least 96 hours of backup operational power capacity, and those regulations could become more stringent. A microgrid goes beyond current regulatory burdens to future-proof the backup system of a healthcare facility.

In a regulatory environment where microgrids might one day be the rule rather than the exception, healthcare facility managers who stay ahead of the curve will enjoy significant advantages.

Resiliency. Adopting microgrid technology is more than just future proofing against regulatory considerations, but against actual, plausible disaster scenarios that could result in a long-term loss of power availability. In California, for example, rolling blackouts, rising costs, and wildfires have made the resiliency of the grid extremely suspect. There, as well as in any location facing a significant power disaster, 96 hours of generator fuel may not be enough. Moreover, the regulatory requirement presupposes that, should the interruption persist longer than 96 hours, replenishment fuel will be accessible—an assumption that might not hold true. In such circumstances, the ability to go into "island mode" could save lives.



A hospital microgrid is a decentralized group of energy sources and loads that can operate independently from the power grid.

Decarbonization. With 8.5 percent of all U.S. carbon emissions originating from healthcare facilities, the industry is evaluating paths toward decarbonization. Hospitals and medical organizations nationwide are stepping up with pledges of net-zero carbon emissions by target dates as soon as 2050.

If your healthcare organization has its sights set on net-zero, adopting a microgrid is a great opportunity to decarbonize, replacing generators that burn diesel and other fossil fuel-burning power supplies with green power generation. Photovoltaic solar cells, wind, batteries, combined heat and power, biomass generators, even hydropower generators for facilities located near running water—all these technologies can be analyzed to provide an optimal solution for first and ongoing cost.

Photovoltaic panels are one of the many components that can be part of a healthcare facility's microgrid.

Challenges, concerns, limitations

Microgrids are still evolving as a technology. Hospitals and healthcare facilities considering deploying one need to be aware of their limitations and take necessary precautions in their design and implementation. These considerations include:

Site-specific design. The appropriate combination of available microgrid technology and the scale of the system will vary from site to site and from organization to organization. A careful and comprehensive review and understanding of the existing power system and goals of the facility will be key to successfully implementing any type of microgrid system.

Distribution system configuration. Most hospital and healthcare facility electrical systems have single or multiple utility services, depending on the size of the facility, which connect to the regional power grid. The utility services provide the power to the healthcare facility through main switchgear, transformers, automatic transfer switches, distribution panels, and other similar electrical equipment. Implementation and integration of a microgrid will require a thorough review of the existing distribution system configuration and will likely require modification of that system to provide a means to interconnect the microgrid and associated controls.

Location. Equipment associated with microgrids such as generators, solar panels, wind turbines, generators, and batteries, all require space—a challenge for many campuses, especially those in urban and densely populated suburban locations. Careful planning of the location of microgrid components is essential for cost-effective integration with the facility power distribution system, harmonious integration with the campus and surroundings, and to ensure the equipment placement does not jeopardize future facility expansion.

The placement of microgrid components can be challenging for healthcare campuses in urban areas where space is limited.

Balancing generation and load. When operating in island mode, the microgrid must carefully maintain balance between power generation and load. Sudden changes could destabilize the system. To provide true resiliency, the microgrid must include an intelligent control system capable of maintaining the balance.

Stand-by power. Having a microgrid installed at your facility does not take the place of a Code Required Essential Power System as defined in NFPA. Until the code changes, you still will need a standby power source as well as the three branches of the essential power system to meet your emergency power needs. You may be able to slightly change the configuration of the essential power system, but it cannot be eliminated at this time.

Transition and controls. In many cases, the microgrid is always online and in parallel with the utility. If the utility source is available, the microgrid should monitor that source to ensure proper phase angle coordination that will allow a smooth transition when changing between utility and island mode and back. The power sources within the microgrid, however, must be carefully analyzed and controls put in place to regulate power output as the microgrid kicks in.

Starting the discussion

Implementing a microgrid in a hospital or healthcare facility has its challenges, but the advantages of doing so—increased resiliency, regulatory compliance, cost savings, and decarbonization—are substantial. Many organizations are already on a track to increase sustainability, and a microgrid can contribute to that mission, along with streamlining and future-proofing facility operations.

The first steps include gaining as much information as possible on the points briefly outlined in this paper. Several energy and healthcare industry organizations also have resources available; a few are listed at the end. Next, begin discussions on the topic with your facility's key stakeholders as well as representatives from your utility provider. Should a microgrid be determined to be a potentially feasible solution, you can then engage an engineering consultant to guide you through the planning, design, construction, and commissioning phases. Be sure, too, that your facility managers receive the education and training necessary to operate and maintain the technology.

With a microgrid in place, your facility will reap the benefits of increased energy savings, a reduced carbon footprint, and, most importantly, the resilience to remain operational and provide life-saving healthcare during any long-term loss of power from the grid or fuel to run generators.

Resources:

- "Microgrids: Taking Emergency Power Beyond Code and Beyond Carbon," an episode on the IMEG podcast, The Future. Built Smarter.
- "Microgrid Strategies for Hospitals and Healthcare Organizations," American Hospital Association on-demand webinar
- "Modernization Strategies for Essential Electrical Systems in Health Care Facilities," ASHE Monograph
- "Demonstration project proves value of health care microgrids," Health Facilities Management article
- "Microgrids for Healthcare Facilities," whitepaper by the Hospital Building Safety Board, California Department of Health Care Access and Information
- Microgrid Portfolio of Activities, U.S. Department of Energy Office of Electricity

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