MICROGRID KNOWLEDGE SPECIAL REPORT

Microgrids for Hospitals and Healthcare

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What is a microgrid?

A microgrid is a self-sufficient energy system that serves a discrete geographic footprint, such as a hospital complex, campus or community. During a power outage, the microgrid islands from the utility grid, and the microgrid's on-site resources provide power to its host buildings. An advanced microgrid also optimizes multiple energy resources and load to achieve the hosts' goals for price, sustainability or efficiency.

Microgrids in Hospitals

Executive Summary

Given their lifesaving and life sustaining work, hospitals cannot tolerate power outages. They require reliable energy. They also use more energy than commercial and industrial facilities of comparable size. These two factors complicate efforts at hospitals to minimize energy costs and achieve sustainability goals.

In the past, most hospitals have turned to diesel generators to provide backup power, but now they are increasingly adopting a better, cleaner option: microgrids.

Hospitals install microgrids to ensure they'll have electricity when a storm or other disaster disrupts the flow of utility-supplied electricity.

Microgrids also offer various around-the-clock benefits. Those that incorporate fuel cells as their generation source, for instance, can help lower a hospital's emissions and reduce its energy costs. Most fuel cells run on natural gas, which is at historically low prices and has a cleaner emissions profile than diesel fuel.

COVID-19 has placed unprecedented strain on our hospitals, making power outages to these facilities unthinkable. Microgrid Knowledge and Bloom Energy see this as a crucial time to get the word out to the healthcare community about how microgrids can benefit their mission. So, we have prepared this special report, "The Fuel Cell Microgrid for Hospitals and Healthcare," which is downloadable free of charge. We invite you to circulate this link widely, especially to colleagues in the healthcare arena.

Chapter 1: A Turning Point for Microgrids

Microgrids are one of the fastest growing sectors within the electric power industry, and they are poised for even wider adoption in the wake of recent events.

The North American market for microgrids is expected to grow to $10 billion over the next seven years, and the global market from about $3 billion to $30 billion over the same time frame, according to Guidehouse Insights (previously Navigant Research). The driver behind much of that growth is concern about the reliability of electrical service.

There is no better place to observe how reliability concerns are playing out than in California. In 2019, there were 25,281 blackouts, a 23% increase from the 20,598 blackouts in 2018, while the number of utility customers affected jumped to 28.4 million in 2019, up nearly 50% from 19 million in 2018. Overall, in a roughly two-year period ending December 31, 2019, there were more than 50,000 significant blackouts in California, affecting about 51 million electric customers.

California is also facing a rising level of forced outages. In the wake of deadly wildfires, the state's investor-owned utilities received regulatory approval to de-energize transmission lines that could otherwise spark wildfires. These public safety power shutoffs (PSPS) cause homes and businesses to lose their power. Between October 2017 and October 2019, there were 2,374 PSPS events in the state, sometimes for days at a time or even, in one instance, for about one week.

Pacific Gas & Electric (PG&E), the state's largest utility, has warned that the power shut-offs may be necessary for a decade. With unreliable power becoming a new normal for millions of Californians, interest has heightened in microgrids. PG&E, which serves a large portion of Northern California, had planned to install microgrids in 2020 that total more than 300 MW, but those plans were recently put on hold.

It is not only utilities that are building microgrids in California. Many private developers are installing projects for businesses, communities, institutions and government entities. One such entity is Blue Lake Rancheria, a tribal community in Northern California's Humboldt County, which installed a microgrid in 2017 to reduce costs, improve power reliability and achieve its carbon reduction goals. But the microgrid proved to offer even greater benefits when it provided lifesaving electrical service, which saved at least four lives, in the fall of 2019.

> Municipalities and businesses in regions across the country hard hit by disasters, ranging from wildfires and hurricanes to tornadoes and flooding, are realizing the benefits and relief that microgrids can provide.

Protecting health and safety have become key reasons for building microgrids. The city of Fremont, California, installed microgrids at three of its fire stations. Originally built because the city wanted cleaner energy, the microgrids now ensure that the city's emergency services will be able to function even if PG&E initiates a PSPS event.

California is an epicenter of microgrid development, but the technology is also taking off in other states. Municipalities and businesses in regions across the country hard hit by disasters, ranging from wildfires and hurricanes to tornadoes and flooding, are realizing the benefits and relief that microgrids can provide.

Metropolitan Ministries, a nonprofit dedicated to providing services to the poor and homeless in Tampa, Florida, has to contend with life threatening hurricanes such as Irma in 2017. Concerned that it might not be able to serve its community the next time disaster strikes, the organization installed a microgrid that is able to provide it with emergency backup power.

Other essential, non-emergency services are also tapping into the benefits of microgrids. When high winds and tornadoes left about 140,000 people in the Dallas, Texas, area without electrical power last fall, four grocery stores in the region were able to continue to serve their customers when their backup microgrids switched on.

In January, Stop & Shop, a Northeast grocery chain, announced plans to install microgrids that use Bloom Energy fuel cells in 40 of its stores in Massachusetts and New York. The microgrids will run around the clock to ensure that the stores can serve customers even if the electric grid is experiencing an outage.

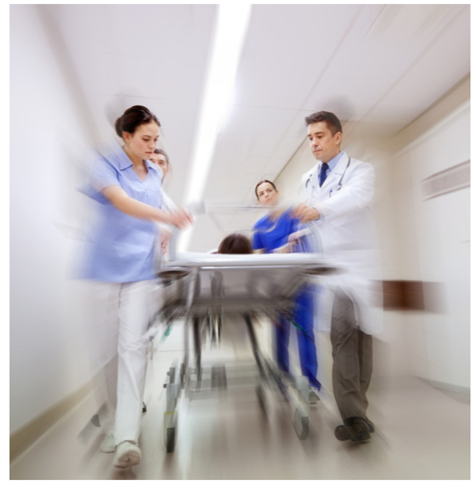
Microgrids in healthcare

Unlike many other businesses, hospitals and healthcare centers often operate around the clock. It is not surprising, then, that hospitals are also turning to microgrids.

From California to Massachusetts, hospitals across the country are installing microgrids to help them achieve key goals. In California, Kaiser Permanente has installed a microgrid that it says will result in energy cost savings while enhancing reliability, resiliency and lower carbon emissions.

In New England, Partners HealthCare is installing 4.1 MW of Bloom Energy fuel cells across its footprint of medical, healthcare, administrative and data center facilities, including its corporate headquarters in Somerville, Massachusetts, its North Shore Medical Center and a data center in Marlborough, Massachusetts.

For Partners HealthCare, enhancing sustainability is a top priority and installing fuel cells has enabled it to move closer to its sustainability goals.



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Installing a microgrid can enable businesses to achieve one or more strategic goals, such as reliability, affordability and sustainability. Microgrids can ensure reliable operation by providing backup power. But, unlike other forms of backup power, such as diesel generators, microgrids can perform more than one function, giving them the ability to generate revenue and cut costs. And, depending on the type, a microgrid can improve the sustainability of an organization by lowering greenhouse gases and other emissions.

With recent code changes, other generation sources can also be incorporated in the normal source capacity of a hospital's essential electrical system. Thus, when a utility outage occurs, these other sources can carry the hospital load in a microgrid capacity. In this scenario, the backup continues to be the 'last line of defense'. This extra layer of redundancy obtained thru the microgrid also allows the hospital to continue to perform elective surgeries during a power outage, thus improving patient health and comfort.

To better understand how a microgrid can achieve these goals requires a closer look at just what a microgrid is and what it can do.

Chapter 2: Types of Microgrids

A microgrid is a simple concept. It is a small version of the electric power grid. From here, however, just like the electric grid itself, the definition becomes more complicated.

The actual components within a microgrid and their configuration can vary widely, but, generally speaking, a microgrid contains generation and possibly storage assets (such as an integrated battery system), along with a software-based energy management system and controller. The microgrid performs within a discrete geographic footprint, serving one or more buildings. While it can operate independently, it typically acts in concert with the central grid.

Rapid deployment microgrid being installed at the Sleep Training Arena. Courtesy of Bloom Energy

The microgrid controller enables a key microgrid capability: islanding. A sophisticated combination of hardware and software, the controller senses the condition of the surrounding grid and automatically disconnects from it during a power outage. The microgrid then activates its on-site generation or energy storage to provide a continuous and seamless flow of electricity to host buildings and operations.

Microgrids can achieve various goals, including reliability, sustainability, efficiency and affordability, depending on the programming of the controller, the complexity of the microgrid's design and the types of generation resources it employs.

A microgrid solely designed to provide backup power, for example, could be composed simply of a diesel generator and a controller. The controller would monitor the grid and instruct the microgrid to turn on when there is an outage.

Other microgrids are built and programmed to do even more work. They can be designed to monitor the weather, electricity prices and voltage fluctuations on the grid and adjust their operations accordingly to help achieve the host's goals. For example, the microgrid may sell what are known as ancillary services to the grid to help the grid balance supply and demand; this creates a source of revenue for the microgrid operator. Or, the microgrid may buy power from the grid when prices are low, store it in batteries, and then discharge it when grid prices rise as a means to manage the host's energy costs.

One of the key considerations when designing a microgrid to provide backup power is the fuel source. While diesel engines are considered the workhorse of backup power generators, they are also vulnerable to several problems that could jeopardize their ability to function in an emergency. Top among these vulnerabilities is fuel supply.

Diesel fuel can be stored on-site, but eventually stored fuel can run out and be difficult to replenish in an emergency. As the National Renewable Energy Laboratory noted, long power outages "often coincide with abnormal conditions such as extreme weather events, which can close roads and impede normal transportation."

So, the disaster—be it wildfire, hurricane or flooding—that causes a power outage can also block roads, preventing crucial deliveries of diesel fuel. This was the case in 2017 in Puerto Rico when hospitals that were relying on diesel backup engines ran out of fuel in the aftermath of Hurricane Maria. Those hospitals had to turn away patients until their fuel supplies could be replenished.

During Superstorm Sandy in 2015, 16% of emergency medical services organizations reported that diesel generators did not perform as expected, according to a report from the American College of Emergency Physicians. Six hospitals in New York completely shut down, forcing the evacuation of 6,400 patients. Some of those facilities remained closed for more than 100 days. And, in 2018, Hurricane Irma knocked out power to more than 200 Florida hospitals and nursing homes, leaving many running on backup generators with only enough fuel on-site to last a few days.

Diesel fuel can also degrade over time, and diesel engines can fail to start for a variety of reasons, such as a depleted or faulty start-up battery or contaminated fuel. And, even when they are not running, diesel generators consume energy in the form of heaters and charging systems.

One more consideration is that conventional diesel engines can be dirty, producing a wide array of pollutants which, in some jurisdictions, can limit the number of hours they can run.

Alternatives to diesel fuel include renewable energy resources and natural gas. Many CHP plants run on natural gas, which has become the go-to energy source over the past decade because abundant supplies in North America have pushed prices down to historic lows. An even cleaner option is a microgrid with a fuel cell that uses natural gas to produce power but without combustion and the resultant pollutants.

A generator running on natural gas is vulnerable to supply disruptions, too, but most natural gas is delivered by underground pipelines, making it one of the most reliable energy sources available. In addition, the nation's network of gas pipelines is so extensive that there is built-in redundancy. So, despite the fact that the U.S. natural gas system typically experiences a handful of disruptions every month that last a day or more, deliveries to end-users are rarely affected, according to a 2019 report by the Rhodium Group. And, according to industry data, 99.79% of natural gas deliveries under contract were fulfilled between 2006 and 2016.

Renewable energy can also be incorporated into microgrids, especially microgrids that aim to reduce emissions. Falling solar panel prices have led to a rapid increase in microgrids that use solar power either as a primary or secondary generation source. Incorporating solar power into a microgrid can be very beneficial to lower emissions, and many microgrids have been installed for that reason. A solar powered microgrid can also be a good tool to lower energy costs, but if a microgrid is going to be used for backup power, it is likely to fail if it relies on solar power alone. To avert this problem, energy storage is often paired with solar, but that can add significantly to total system costs. Even then, a solar-plus-battery microgrid is vulnerable to disruptions if the sun is obscured by storms or by smoke from wildfires. An optimal solution is to combine a reliable generation source with a high capacity factor, such as a fuel cell that can run at its full potential continuously, with low cost, but intermittent, low capacity factor renewable resources, such as solar power. Such a combination in a microgrid would provide a sustainable and economic energy source that can reliably meet any fluctuations in load.

Photo credit: Will Heegaard/footprintproject.org

In terms of achieving the goals for installing a microgrid — reliability (backup power), affordability (low cost energy source) and sustainability (a low emissions profile — fuel cells have the ability to check all the boxes: low cost and reliable fuel source, minimal emissions and high reliability as reflected in high capacity factors.

This is because fuel cells can run on hydrogen, which is most commonly produced from natural gas or biogas (methane). Hydrogen can also be produced from water using a process powered by a renewable energy source, such as solar or wind power. The resulting hydrogen fuel often qualifies as a renewable resource. The hydrogen used to power a fuel cell microgrid can also serve to store energy. When demand is low, the hydrogen can be stored. When demand is high, the hydrogen can either be injected into the gas pipeline infrastructure or used to produce electric power from the fuel cell.

Chapter 3: Microgrids in Hospitals

It is hard to imagine an institution more critical to public health and safety than a hospital. Unfortunately, hospitals are also vulnerable to the wide range of threats—floods, hurricanes, wildfires—that can cause electric power outages. The loss of power at a hospital, however, can be particularly catastrophic.
In addition to the ordinary functions performed by electrical service such as lights, communications, and heating and cooling, hospitals also need electricity for critical functions, including life support systems such as ventilators and dialysis machines, emergency room equipment, and diagnostic equipment and monitoring systems for everything from heart monitors to oxygen delivery systems. The loss of power to these critical systems could be life threatening. Hospitals also often function as a focal center for the surrounding community during emergencies by providing shelter from the elements.

Hospitals not only have a more urgent need for electrical power than many other institutions, but they also use more power. Large hospitals account for less than 1% of all commercial buildings and 2% of commercial floor space, but they consume 4.3% of the total delivered energy used, according to the U.S. Energy Information Administration. And, despite energy efficiency inroads over the last two decades through the U.S. economy, hospital energy use is not declining. Nor is the overall carbon footprint of the industry.

Hospitals have high rates of energy consumption because they are open 24 hours a day, every day of the year, serving thousands of patients, employees and visitors who all require light, heat and cooling resources. In addition, hospitals also house many energy intensive activities such as laundry, food services and refrigeration as well as medical and lab equipment, sterilization machines, computers and servers, which also need energy to run. In general, hospitals use up to 2.5 times as much energy as commercial buildings of similar size.

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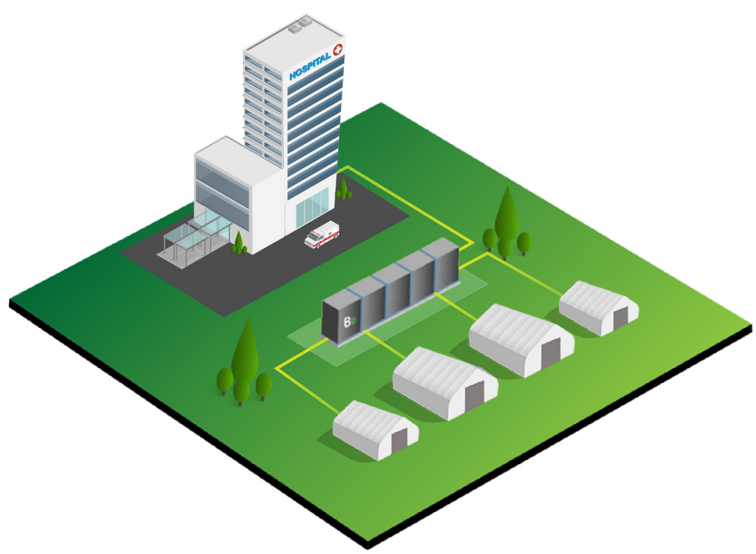
Criticality and high use mean that hospitals have to take extra care to make sure they have reliable energy supplies. Regulators require hospitals to have some form of backup power, and they have more stringent and complex requirements for backup power than most commercial institutions. In short, hospitals must identify all loads whose failure can lead to patient injury or death, i.e., essential electrical systems, and back them up with a reliable source.

At the most basic level, hospitals must be able to provide essential electrical service to equipment whose loss would result in major injury or deat—in addition to the direct supply of power to that equipment.

Diesel generators are a common source of backup power but, as discussed earlier, they have several potential weaknesses, including limits on how much fuel can be stored on-site, potential fuel delivery issues, and the possibility that they will not perform when needed.

Some hospitals have already moved beyond diesel generator backup systems in favor of CHP plants that provide electricity and heat, making them more efficient and cost-effective to operate. CHP plants can also be configured as microgrids, which, in turn, can incorporate a variety of distributed energy resources (DERs), such as solar panels, wind turbines or fuel cells.

A microgrid can combine and control a variety of energy sources while monitoring and managing energy supply and demand. As a result, in an emergency, a microgrid can continue to supply the hospital with power when the surrounding grid goes down.



Bloom Energy is repidly deploying fuel cell based microgrids to power existing and temporary hospitals while they care for COVID-19 patients. Courtesy of Bloom Energy

But its value is not confined to power outages; a microgrid operates 24/7/365 so it can supply day-to-day power capacity. Unlike backup generators that have to be maintained in order to ensure that they will work in an emergency, microgrids are always on duty. When not needed for backup generation, a microgrid also can help a hospital achieve its cost and sustainability goals by:

- Participating in various energy management programs, such as demand response, peak shaving and load management.
- Leveraging on-site generators and energy storage resources when electricity prices are high on the grid.
- Earning revenue from selling what are known as ancillary services to the grid. For example, at times the grid needs a sudden injection of power to maintain its supply/demand balance, such as when large wind or solar farms suddenly stop generating power because of the weather. A microgrid can apply that injection and gets paid to do so.

The potential of using a microgrid as both a source of backup power and a source of revenue is an important consideration for hospitals. Even as the threats that could necessitate the use of backup generation proliferate, hospitals are increasingly finding themselves under financial pressures that could put large capital projects out of reach. Many hospitals, particularly smaller and rural hospitals, are struggling financially. Despite a greater than ever need for healthcare services, costs are rising and profits are under pressure. A microgrid can also help hospital financial executives plan for the future.

In addition, rising healthcare costs are prompting pushback from consumers and legislators, resulting in lower reimbursement levels to hospitals. Many hospitals are also facing competition from lower cost clinics and ambulatory care centers. At the same time, facilities find themselves grappling with capital costs for new buildings, equipment and technology improvements, as well as rising labor costs.

Luckily, there are business models that can put microgrids within reach for hospitals and can even help offset the expense.

Photo credit: NicoElNino/Shutterstock.com

Chapter 4: Microgrid Business Models

The growth of microgrids in recent years has brought with it advances in business models that make microgrids more financially feasible for a variety f organizations and institutions, including hospitals.

From an operational perspective, there are many types of microgrids. The two major categories are off-grid and on-grid. An on-grid microgrid is connected to the surrounding electric power grid but has the ability to island when needed. On-grid microgrids are often created for their resilience value or to improve reliability. They can be used in settings that are as small as a single facility, such as a home, commercial building or hospital, or they can be deployed in campuses designed for universities, healthcare centers, research parks and military bases.

> Just as the setting and function of a microgrid can vary, there are a variety of business models available to organizations that want to install a microgrid.

Off-grid microgrids, those not connected to a central grid, tend to be found in remote areas, such as Silvies Valley Ranch, an eco-friendly community in Burns, Oregon, or Cuttyhunk Island in Massachusetts. Just as the setting and function of a microgrid can vary, there are a variety of business models available to organizations that want to install a microgrid. Those business models have evolved as the microgrid market has expanded.

The most basic model is also the simplest: the customer-owned microgrid. A customer, such as a hospital, pays a developer to install a microgrid. Usually these agreements are structured as a turnkey contract that covers a developer's costs—construction, financing (interest payments) and equipment. In this model, the customer takes on the financial risk in terms of project completion and the performance of the microgrid once it is in place and operational. The parties can modify the agreement to defer, offset or share aspects of project risk, such as completion or performance guarantees.

Photo credit: MAD.vertise/Shutterstock.com

Organizations looking for more flexibility and less risk can now take advantage of an alternative model, the microgrid-as-a-service model. From a client's perspective, the main benefit of the microgrid-as-a-service model is that it eliminates the upfront cost of installing a microgrid. This can be a very attractive benefit for businesses, such as hospitals, that have a need for high reliability but are under pressure from rising costs and shrinking margins.

In addition, many businesses are reluctant to take on the risk of building a microgrid because they are wary of becoming involved in a business that is not central to their core mission.

The as-a-service model simplifies the installation of a microgrid by distancing the organization or client from the development and construction process, as well as from operation and maintenance costs. The organization's responsibility is distilled to making a series of payments over time. This avoids having to monitor operation and maintenance costs and it can be helpful for financial planning. The as-a-service model provides the certainty of regular, predictable payments, instead of fluctuating payments to a utility and the possibility of rate changes.

The model has several variants. Some contracts are structured as power purchase agreements, others as leases, or some as pay-as-you-go arrangements. The underlying concept is the same for all of the models. A developer takes on the financial risk of funding and building a microgrid for a client and, upon completion, operates the microgrid for the customer. The client pays the developer for the microgrid through a series of contractual payments. Payments are made for an agreed-upon amount for energy consumed over a set time frame. The payments can vary from a simple repeating fixed amount to energy prices that include both volumetric and capacity components. Payments can also be linked to an index, such as wholesale power market prices, or to the price of another commodity, such as the cost of natural gas, which is often used for microgrids that feature a fuel cell or some form of gas turbine.

Separate but related to the power purchase model is the lease model in which a developer installs a microgrid for a client, retains ownership of the facility and leases it to the microgrid host, who makes monthly lease payments and also often receives the right to acquire the microgrid at the end of the lease term.

Leasing structures are particularly popular when a microgrid is eligible for a tax credit. A microgrid with solar panels or battery storage could be eligible for a federal investment tax credit, for instance, but not-for-profits and some other entities cannot use those credits. A lease allows the developer to use the tax credits, which can help reduce overall costs of the project.

Another variation of the as-a-service model is the pay-as-you-go model, in which payments are only made as the client uses the energy produced by the microgrid. It has become a popular model in the developing world.

When experienced third parties operate microgrids—the approach used in as-a-service models—they can enhance the microgrid's revenue potential, which can lower costs for the microgrid host. Microgrid developers are adept, in a way that many microgrid hosts are not, in undertaking "value stacking," the practice of layering revenue streams from a facility, such as a microgrid.

If a hospital enters into a microgrid-as-a-service agreement, the microgrid can be available to the host for backup power. When the host does not need the output of the microgrid, the owner can run the microgrid remotely, turning it on when grid power prices spike in order to save the host money or selling power to the grid in the form of ancillary services, such as capacity or demand response, that can generate income. By monitoring market conditions, the microgrid owner is able to schedule the microgrid to run when conditions warrant. By using value stacking to increase microgrid revenues, the overall cost of a project can be reduced for the owner with savings passed on to the host, making microgrids an affordable solution for hospitals.

Chapter 5: Hospital Deployments and Microgrid Case Studies

Hospitals must be built to provide a unique combination of durability and human service. They have to be rugged enough to run 24/7/365 and withstand severe weather and sudden spikes in usage, and they have to be able to provide care in a detailed and compassionate manner that often relies on technology that is highly dependent on reliable electricity. One aspect of hospital infrastructure reflects both realities: the electric plant.

Hospital electrical infrastructure has evolved with the times. To ensure reliable power, hospitals made diesel generators their go-to solution for decades. They were readily available, and fuel could be stored on-site. In recent years, however, natural gas solutions have increasingly been seen as a viable and often superior alternative to diesel engines.

According to a March 2019 report by the Joint Institute for Strategic Energy Analysis, "natural gas generators are less likely than diesel generators to fail during a power outage." The report also found that "grid-connected generators run for backup as well as additional services have higher reliability due to more frequent operation, and lower net costs than generators used solely for backup."

While gas generators are well suited for the rugged needs of hospital reliability, they fall short on a hospital's mission to care. Gas generators and CHP plants may both be reliable, but they also emit pollutants that can be particularly dangerous to the at-risk population of a hospital. Gas generators are also noisy.

This is why some hospitals are turning to another alternative, fuel cells.

Concerned about diesel generators operating near the windows of at-risk patients, one leading healthcare provider has been exploring ways to reduce or eliminate diesel generators from their facilities. That organization began deploying fuel cells at their facilities in 2012 to reduce operational costs and improve local air quality, which became an even more urgent concern during the COVID-19 crisis. Their vision for the future is to enable fuel cell powered microgrids to reduce, or even eliminate, reliance on diesel generators.

Covid-19 clinic. Photo credit: Footprint Project

Fuel cells run on hydrogen, which can be sourced directly, but in commercial applications hydrogen for a fuel cell is derived more frequently from natural gas or biogas, which is a renewable fuel. Fuel cells also use little water during normal operations, which is an important consideration in many regions where drought has become more common.

Sustainability was also a driving force for Sutter Health, a not-for-profit health system in Northern California, that wanted a state-of-the-art medical center incorporating advanced technology and green building practices. In its effort to achieve LEED Gold status, Sutter used a Bloom Energy Server at its Santa Rose Regional Hospital. The fuel cell provides power for the hospital while decreasing carbon dioxide emissions by more than 600,000 pounds per year, reducing the hospital's carbon footprint by 19%.

Other technologies, such as solar panels, are sustainable, but they also have shortfalls. Medical technology company Medtronic installed a 320 kilowatt (kW) solar array at its Fountaingrove facility in Santa Rosa, California, in 2011 in an effort to reduce carbon emissions by 15% by 2020, but the company wanted further reductions in emissions and energy costs. So, Medtronic installed a 400 kW Bloom Energy Server that is capable of providing 96% of the electrical requirement for the Fountaingrove B building, while also generating an estimated $2.3 million in energy savings over 15 years.

Installation of the Bloom fuel cells increased the percentage of on-site electrical generation from about 13% to more than 85%. It also reduced CO2 emissions by 19% and will save three million gallons of water every year from being used by thermoelectric plants.

Several other hospitals have already turned to microgrids to improve reliability and lower costs. Since 2009, Utica College and Faxton-St. Luke's Healthcare in New York have operated a 3.4 MW microgrid to provide the bulk of their power needs as well as backup power in case of a grid outage. Hospitals in Boston, Florida, New Jersey and Texas have also installed microgrids, often incorporating CHP plants that can provide around-the-clock power, as well as heating and cooling.

As sustainability concerns continue to grow in the face of the rising threat of climate change, the combined goals of improving reliability and reducing emissions are likely to make fuel cell microgrids even more attractive.

A microgrid at the heart of the physical plant of every hospital may become the standard for the hospital of the future. And, in many cases, it's essential right now. Using an array of resource—fuel cells, solar panels, battery storage devices, and smart software and controls—microgrids offer a way for healthcare to lower energy costs, increase sustainability and ensure that life-sustaining electricity is always available.

The Bloom Energy Server is an advanced distributed energy generation platform that operates 24x7 with the highest efficiency of any power solution available in the world today. During power outages, our system continues to provide always-on power, enabling hospitals to work without disruption and meet sustainability goals. For more information about Bloom Energy microgrids, contact BloomEnergy.Information@bloomenergy.com