



## FUEL CELLS ADVANCING POWER RELIABILITY FOR HOSPITALS – CLEANLY, AFFORDABLY, EFFICIENTLY



### The Importance of Energy Security

Whether it's powering a hospital emergency room, illuminating a university dormitory, or running a manufacturing line, we live in a world where a reliable supply of electricity is imperative for day-to-day facility operations. But what happens when the university lights do not turn on; the manufacturing line shuts down; or that hospital emergency room loses power due to a storm related outage? What then?

For most, experiencing a loss of electricity means resorting to backup generators or finding flashlights and waiting until the power comes back on. However, for others, an extended power outage presents severe problems – some of which can be a matter of life or death. So it is no surprise that hospitals and healthcare facilities hold energy security among their top priorities when it comes to facility operations. While back-up generators remain the first line of defense, fuel cells provide continuous power to ensure critical infrastructure remains up and running at all times.

Fuel cells are an ideal form of power generation for hospitals - contributing to power resiliency while enhancing sustainability and lowering energy costs. But how?

### Fuel Cell Power Generation

Fuel cells cleanly and efficiently convert chemical energy from hydrogen-rich fuels into electrical power and usable high quality heat in a process that avoids combustion entirely and is virtually absent of pollutants.

Similar to a battery, a fuel cell is comprised of many individual cells that are grouped together to form a fuel cell stack. Each individual cell contains an anode, a cathode and an electrolyte layer. When a hydrogen-rich fuel such as clean natural gas or renewable biogas enters the fuel cell stack, it reacts electrochemically with oxygen (i.e. ambient air) to produce electric current, heat and water. While a typical battery has a fixed supply of energy, fuel cells continuously generate electricity as long as fuel is supplied; providing a constant source of power.

Fuel cells act as the heart of SureSource power plants, designed and manufactured by FuelCell Energy, Inc. These fuel cell plants operate on clean natural gas or biogas to produce both power and heat on-site, enabling power to be generated at the point of use. Unlike some other on-site power generation sources, they produce power continuously and are not reliant on weather or time of day. Due to the clean emissions profile, quiet operation and modest space requirements of SureSource power plants, they are very easy-to-site in urban and heavily populated areas - or in this case, directly next to the healthcare facility receiving the power. For reference in terms of size, one 2.8 megawatt SureSource plant occupies roughly 4800 square feet, about equivalent to the size of a tennis court. In comparison, you would need approximately 100 acres of solar panels to generate the same annual output.

### Fuel Cells for Hospitals

Fuel cell plants have proven to be an appealing solution for hospitals to generate power in an efficient and affordable manner, while enhancing energy security and advancing sustainability goals.

### **Efficient & Affordable**

SureSource power plants are 47 percent electrically efficient and can achieve total thermal efficiency up to 90 percent in a combined heat and power (CHP) configuration. The high efficiency of fuel cell power plants contributes to favorable economics through lower fuel consumption as they generate more power from a given unit of fuel than similar size internal combustion-based power generation. Utilizing power purchase agreements (PPA) to finance fuel cell plant projects, health care facilities can avoid the upfront investment entirely, install the power plant on-site, and pay only for the electricity as it is produced while a project investor owns the plant. In addition to benefiting from this pay-as-you-go structure, customers such as hospitals can benefit from significant savings over the lifetime of the fuel cell installation with predictable energy costs below grid prices.

### **Enhancing Energy Security**

Working separately from the electric grid, or “islanding”, is a feature that makes fuel cell power plants operating as a micro-grid an extremely attractive option for hospitals. Fuel cell power plants can be interconnected to one facility or multiple buildings, to produce a constant supply of power independent from the electric grid; ensuring that critical infrastructure remains up and running during extended grid outages or disturbances. This energy independence provides peace of mind for hospitals and their patients who are reliant on a dependable power supply.

### **Achieving Sustainability Goals**

Fuel cell power generation is very clean, allowing hospitals and customers dedicated to sustainability to improve their environmental footprint. Due to its chemical power generation process, fuel cell power plants generate electricity while emitting virtually zero pollutants; avoiding nitrogen oxide (NOx) that causes smog, sulfur dioxide (SOx) that contributes to acid rain, and particulate matter that can aggravate asthma. The power is delivered with a low carbon footprint, reducing the greenhouse gas emissions for customers up to thousands of tons per year.

### **The Proven Solution**

Tucked in next to Hartford Hospital and a small parking lot, a 1.4 megawatt SureSource power plant sits quietly, producing around-the-clock power for the 867 bed facility (one of the largest hospitals in the New England region). The plant is owned by Hartford Steam Company and Hartford Hospital buys the electricity and heat produced by the fuel cell power plant under a multi-year power purchase agreement (PPA); avoiding the capital outlay to directly own the power plant.

Configured as a combined heat and power (CHP) system, the fuel cell plant provides ~60% of the hospital's baseload power needs in addition to generating usable heat that meets all of the facility's space heating requirements. The excess heat generated is supplied to the Hartford Steam Company district heating system.

Since installing the fuel cell plant, Hartford Hospital experienced significant annual cost savings and also decreased its environmental impact with major reductions in NOx, SOx and PM, as well as 3,000 tons per year in GHG emissions as compared to the Connecticut grid.

A similar installation is operating across the country in Orange, CA at the University of California, Irvine Medical Center - one of the nation's highest ranked hospitals and Orange County's only Level I adult and Level II pediatric trauma center. The 1.4 megawatt (MW) combined heat and power (CHP) fuel cell power plant provides both ultra-clean electricity and usable high quality heat to the medical center; producing ~30% of the facility's power needs, and supplying heat for a direct exhaust absorption chiller to produce 200 tons of cooling.

UCI Medical Center benefits from the fuel cell power generation process, enhancing its sustainability profile with clean power that avoids pollutants associated with combustion-based power generation. Compared to the electric grid, UCI Medical Center's fuel cell installation annually avoids more than 28 tons of NOx, 64 tons of SOx, 3,000 pounds of particulate matter, and 7,000 tons of CO2 (equivalent to removing more than 1,000 cars from the road).

The plant is exempt from air permitting under the California South Coast Air Quality Management District Rule 219, due to the low carbon and virtual absence of criteria pollutants, accelerating the project development process. In addition, because the fuel cell is not providing backup power, the permits needed from the California Office of Statewide Planning and Health Development (OSHPD) are minimal.

A unique financing structure with PNC Energy Capital allowed UCI Medical Center to avoid the upfront capital investment by purchasing the power and heat under a multi-year PPA; paying only for the power/heat as it is generated, just like Hartford Hospital.

The fuel cell power plant installations operating at both Hartford Hospital and the UCI Medical Center offer clean, affordable and continuous on-site power and heat where it is needed. Hospitals continue to realize the benefits of fuel cell power generation as a sound solution to eliminate power supply challenges, advance sustainability goals and generate annual savings.

