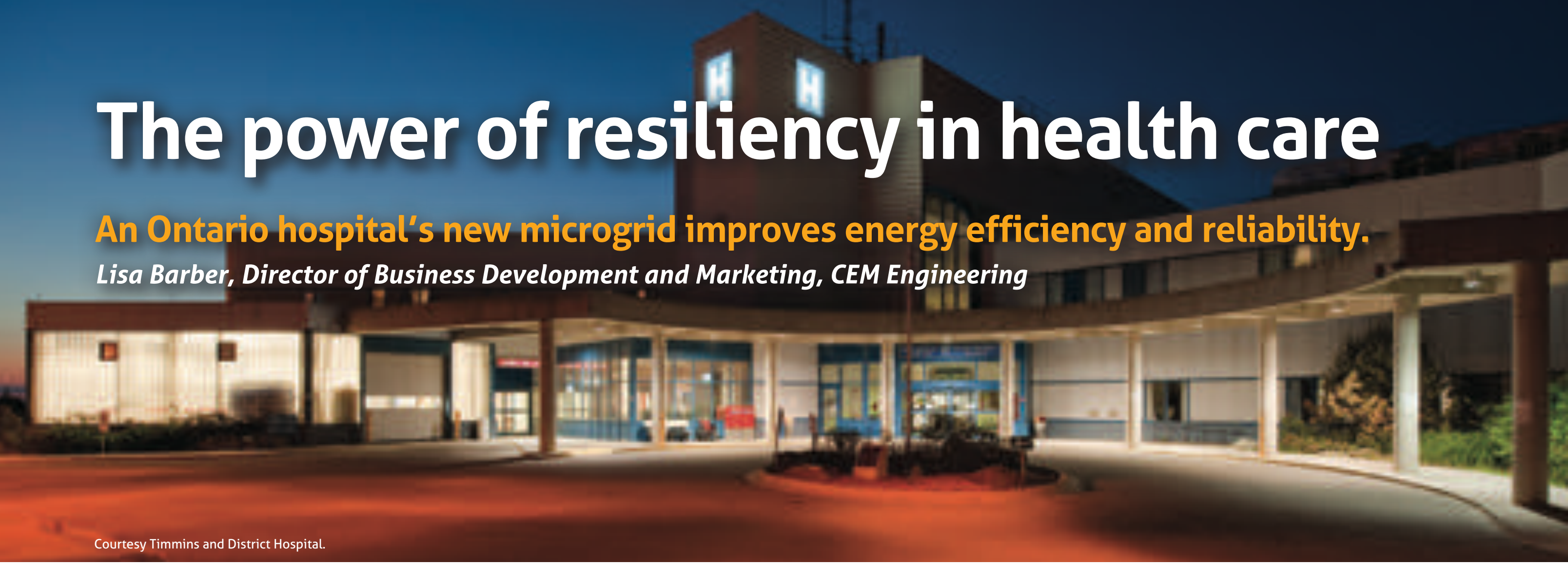
The power of resiliency in health care

An Ontario hospital's new microgrid improves energy efficiency and reliability.

Lisa Barber, Director of Business Development and Marketing, CEM Engineering



Courtesy Timmins and District Hospital.

Timmins and District Hospital, Timmins, Ont.

Extreme weather events throughout North America have revealed the vulnerability of health care facilities and the extent of devastation to the community when those facilities are ill-prepared. With global warming on a steady rise, extreme weather conditions are often felt worldwide through the loss of lives that stems from droughts, floods, heat waves and disease. That is especially the case when health care facilities cannot help their local communities. In the current pandemic, the novel coronavirus has taught everyone just how crucial health care systems are in times of crisis. It has also shown us how fast they can be crippled if not cared for by those who oversee them, particularly as it relates to life-saving equipment such as ventilators that rely on electricity. Now more than ever, health care officials need to address these vulnerabilities preemptively to improve the resiliency of their facilities while also meeting their sustainability goals.

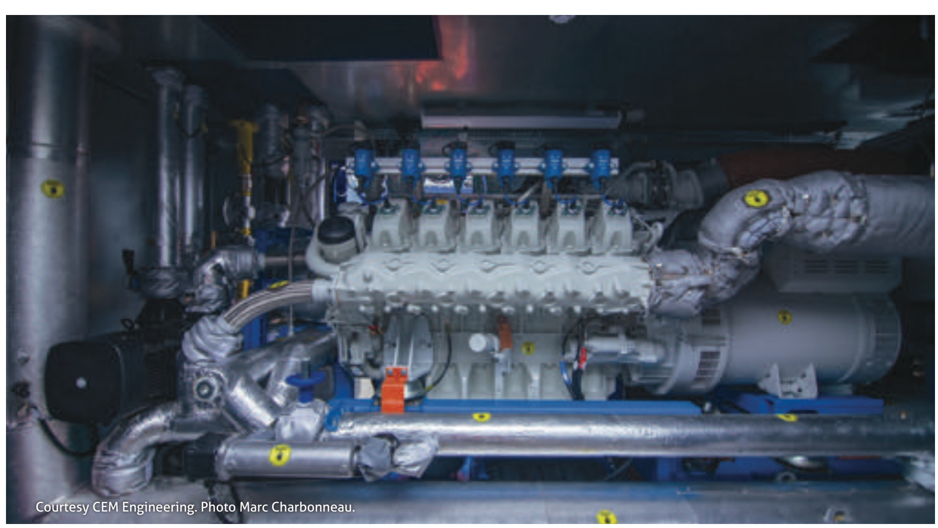
While some health care institutions are still grappling with what an effective disaster plan might look like, Timmins and District Hospital (TADH) in Timmins, Ont., recently underwent an innovative hybrid combined heat and power project to address its own resiliency issues. The objective was to create a microgrid to increase the power quality of the facility, actively manage the energy spend of the entire hospital complex and ensure it always has a reliable source of power. In doing so, the hospital has also significantly reduced the amount of wasted energy, which in turn saves money that it can put directly back into patient care.

In addition to improvements in health via prevention, diagnosis, treatment or cure of a disease, illness or injury, the increased power resiliency offered by this project serves as another important development for the greater health care community. Hospitals have a lot at stake in general and especially during a global pandemic. The success of the TADH CHP project was vital – not only because it was commissioned during COVID-19 but also for every patient counting on the hospital for better, faster and more reliable health care.

HYBRID CONFIGURATION

This unique hybrid project consists of two Tedom 287 kW CHP units and two Generac SG500 500 kW global adjustment mitigation packages. The project was executed under a turnkey engineering, procurement and construction approach by CEM Projects, which is owned and operated by parent company CEM Engineering. Back in 2016, CEM Projects had approached TADH with the idea to install CHP to help the hospital achieve its goal of reducing energy costs and becoming more energy-efficient. A provincewide incentive at that time would help reduce the overall capital required for the project. The CHP units would supply the hospital with 574 kW of power, reducing its reliance on the grid, as well as contribute up to 2.9 MMBtu/hr of hot water heating – around 15 percent to 20 percent of the facility's gas-fired hot water system capacity.

Using a specific staged project development approach that CEM has



Courtesy CEM Engineering. Photo Marc Charbonneau.

One of the two Tedom 287 kW CHP units serving the hospital.

created over the years, the firm was able to help the hospital understand and get comfortable with the overall project development cycle. This ensured that the hospital was spending enough time on the design phases to achieve a successful outcome.

GLOBAL ADJUSTMENT MITIGATION

To begin with, the proposed system included the two CHP units. As project design progressed, it was expanded to include the two additional 500 kW engines to allow the hospital to effectively mitigate its Ontario global adjustment (GA) charges through peak shaving. The GA fees were established by the provincial government in 2005 to cover the cost of providing sufficient generating capacity and conservation programs.

The decision to add the 500 kW engines to the design was prompted by the government of Ontario's announcement in April 2017 that customers with an average peak demand above 500 kW could opt in to the province's expanded Industrial Conservation Initiative. The initiative allows participating consumers to pay reduced GA charges based on their individual power consumption during the top five peak Ontario demand hours over a 12-month period.

For many commercial and industrial customers in Ontario, the GA surcharge ends up being a very substantial part of their monthly utility bill, as was the case for TADH. All Class A electricity customers pay the additional fee on top of their normal bill. The GA is set monthly to reflect the differences between the wholesale market price for electricity, known as the hourly Ontario energy price (HOEP), and regulated rates for generating stations, as well as payment for building or refurbishing infrastructure. Generally, when the HOEP is lower, GA is higher to cover additional energy production costs.

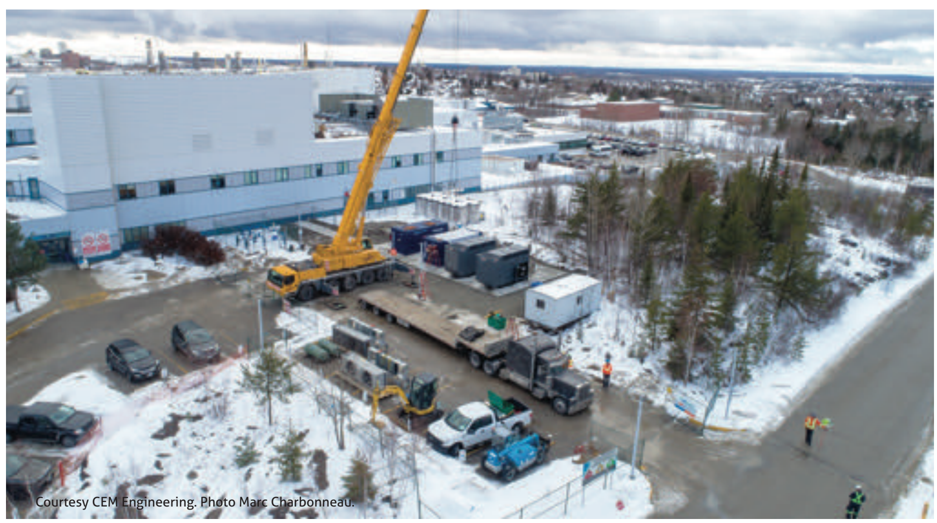
The 500 kW units used for the peak-shaving aspect of the project not only allow the hospital to reduce its GA charges but also act as backup/standby generators in the case of a major grid outage. The ability of the peaking generators and CHP systems to run in parallel with one another allows the units to operate as a single power solution to let the hospital island its facility from the grid in the event of a major power outage that could be caused by a wind or ice storm or more serious natural disaster. Although the generators have the ability to work in parallel, they also have the ability to operate independently for maintenance purposes.

THE ABILITY OF THE PEAKING GENERATORS AND CHP SYSTEMS TO RUN IN PARALLEL WITH ONE ANOTHER ALLOWS THE HOSPITAL TO ISLAND FROM THE GRID.

"DE-RISKING" WITH RICH-BURN ENGINES

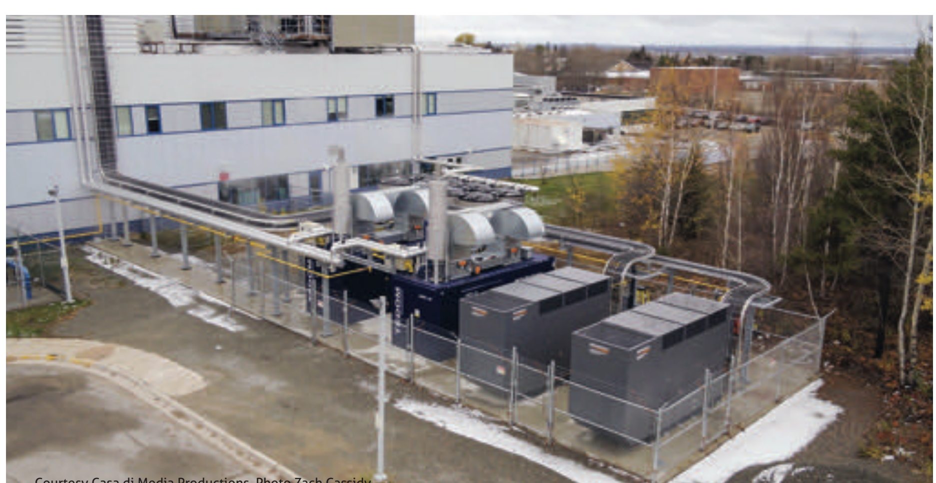
Due to the possibility of extreme winter conditions that can sometimes be experienced in the Timmins area, and the nature of the client and project application, CEM and TADH collectively chose to "de-risk" the project by implementing rich-burn engines. The alternate options would have been lean-burn and diesel engines that are often used for CHP and peak shaving. Rich-burn engines operate near the stoichiometric point of combustion with an air-to-fuel ratio that is balanced, resulting in an exhaust oxygen content of about 0.5 percent. Rich-burn engines in Ontario are emissions-compliant if they are equipped with three-way catalysts for applications that run over 50 hours per year. They are also of similar technology to the emissions controls found on a car that require very little maintenance.

Conversely, lean-burn engines, which can also be used for peak-shaving projects and are more commonly found in CHP applications, have an exhaust



Courtesy CEM Engineering. Photo Marc Charbonneau.

The Timmins and District Hospital CHP system, midconstruction.



Courtesy Casa di Media Productions. Photo Zach Cassidy.

The completed CHP installation at Timmins and District Hospital.

oxygen content typically greater than 8 percent, which requires use of the much more sophisticated selective catalytic reduction emissions control systems. While lean-burn engines typically consume less fuel than their rich-burn counterparts, lean-burn engines operate at higher in-cylinder temperatures and pressures, resulting in higher nitrogen oxide emissions that require SCR emissions controls. The SCR emissions control technology systems inject a liquid-reductant agent through a special catalyst into the exhaust stream of the lean-burn engine. The reductant source is usually automotive-grade urea that unfortunately can freeze in extreme cold conditions, increasing the risk for engine shutdown due to a lack of air emissions compliance.

After a successful project execution and with a fully operational plant today, the TADH CHP system is proof that microgrid projects like this can improve the quality and capacity of a patient's health care experience and the preparedness of the health care service provider in times when it is needed most. If history teaches anything about how to deal with the future, and if there was ever a time when communities need to be prepared, that time is now.

__Lisa Barber__ is director of business development and marketing at CEM Engineering, a thermal power consulting firm and leading designer of custom-engineered systems in Canada. Headquartered in St. Catharines, Ont., the company consists of over 70 mechanical engineers, electrical engineers, designers and support staff across three offices (St. Catharines, Oakville and Calgary). Barber brings to her role experience that includes sales management, public policy, business strategy, marketing and project management in diverse markets that span power generation, cogeneration, biogas, renewable natural gas and environmental controls. She uses her skills and experience to help industrial clients increase earnings through efficient energy use and energy cost reduction initiatives. Lisa@cemeng.ca