Cogeneration and Emergency Generation in Health Care Facilities

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ABSTRACT

Hospitals and other health care facilities with full-time patients and residents have the opportunity to benefit from the installation of cogeneration systems.

Unlike other residences, which often have weekday energy peaks as people return from work, health care facilities tend to have a relatively level demand for electricity. Operation of a cogeneration system in such an environment is likely to be both efficient and practical. Also, governmental subsidies can offset a portion of the initial costs and decrease the project's payback period.

Cogeneration systems cannot generally be used for emergency generation in light of the typical start up time requirements. However, they can be used in conjunction with emergency generators provide enhanced reliability.

Cogeneration can also help smooth out the unintended "voltage sags" and instantaneous grid outages that can occur unexpectedly. These undesirable conditions can trip medical diagnostic equipment and cost the hospital or health care facility delays and loss of revenue. If interconnected to the electrical grid, cogeneration systems have the capability to sell excess energy or capacity.

Cogeneration can usually be readily installed on-site because typical units have a modest footprint. The systems do not produce much noise and may be placed in an insulated enclosure if desired. The operation and maintenance of a cogeneration system can be partially or wholly contracted out, if warranted.

Cogeneration, with the ability to save money, provide thermal energy and electricity and enhance emergency capabilities should be an attractive option for many health care facilities.

COGENERATION IN HEALTH CARE FACILITIES

The cost of electricity and fuel, the need to replace a boiler, the desirability of enhanced reliability and environmental concerns are all drivers underlying the increasing number of health care facility operators implementing energy conservation measures and installing on-site cogeneration systems.

Cogeneration combines thermal generation (space heating/cooling, dehumidification, water heating) with electrical generation. A conventional electrical generator may be as little as 30% efficient. This means that for every unit of fuel processed; only a third is converted into electricity. Much of the remaining energy escapes into the environment as heat loss. Cogeneration captures most of this thermal energy and recycles it for the heating and cooling needs of the facility. This substantially increases the efficiency of generation resulting in lower fuel needs, lower emissions, and reduced energy bills. In addition, cogeneration systems have high reliability ratings and can be used, in coordination with backup generation, to provide a reliable source of electricity supply outside of the electrical grid.

Cogeneration can be provided by several different types of machines depending on the intended use of the system, as well as, the structure and location of the facility. These include but are not limited to:

- The reciprocating internal combustion engine is a common technology for electrical generation and can utilize many different fuels;

- Combustion turbines are typically used for larger systems and can be fueled by high pressure natural gas or liquid fuel. These generators tend to have lower emissions which can be attributed to using a "cleaner" fossil fuel such as natural gas;

- Microturbines can be employed for smaller applications and can be fueled by low pressure "street" gas. These systems are a good choice for a system that will not be running continuously and will need to be turned off and on.

There are several occasions when health care facilities typically decide to install cogeneration systems. Among these are: a boiler needs to be replaced; the facility desires to air-condition one or more common areas; or the facility perceives an opportunity to save money on energy; or for all of these reasons.

For health care facilities, cogeneration systems are especially efficient and practical. The reason for this is hospitals, nursing and adult care facilities tend to have favorable load curves, meaning that they typically have reasonably level electric load curves on a 24 hour per day, 7 day a week basis. In apartment buildings, by contrast, energy consumption tends to peak in the evening, when people return home from work.

Cogeneration systems in health care facilities may be eligible for subsidies or tax breaks. In New York, the New York State Energy Research and Development Authority (NYSERDA) provides monetary incentives for on-site generation. In addition, the New York Energy Smart Loan Fund Program offers an interest rate reduction off a participating lender's normal loan interest rate for a term up to 10 years on loans for certain energy-efficiency improvements and/or renewable technologies.

A major portion of the cost of installing the systems may also be reimbursed through the Medicaid program.

A facility should consult with an experienced engineer to address such questions as: (1) is the installation of such a system feasible; (2) what kind of system is appropriate; (3) what would the costs be; (4) what cost savings might be anticipated; and (5) will the proposed system be cost-effective? To make these determinations, the engineer will inspect and gather information regarding a facility. Some of the questions appear to be fundamental but the answers may not be readily obvious, such as whether there is an appropriate location for a cogeneration system and what the electric and heating requirements of the facility are. In my experience, it will be important to have a knowledgeable consulting engineer's report, which should be expanded to encompass any energy conservation measures and energy control devices that are being installed at the same time.

If such a report supports the installation of a cogeneration system, then the consulting engineer determines the optimal type and sizing of the system. The engineering tasks will also include preparing plans and specifications, assisting with equipment procurement, participating in

the process of arranging for an interconnection with the utility electric system in compliance with utility and state requirements, analyzing and seeing to code compliance, arranging for the provision of gas and supporting the installation of the system. In the event that the health care facility does not have available onsite capabilities, it will have to contract for repair and maintenance and, very likely, remote operational services. The health care facility will also need legal assistance with contracts and regulatory compliance.

The health care facility must meet applicable regulatory and utility standards to comply with utility tariffs and, depending upon the size of the unit, may have to enter into an interconnection agreement with the utility.

Another consideration is that the state hospital codes often require that health care facilities have a backup or emergency generator. Such a backup generator can sometimes be used to produce income for the facility by playing a role in state and independent system operator programs. Experienced consultants and legal counsel can facilitate participation where feasible. Facilities may also need a supplemental boiler or hot water heater to produce heat and hot water because the cogeneration system may not provide all of the facility's heating needs.

The installation of a cogeneration system may provide a supplemental emergency source of power to provide electric and thermal energy reliability if the system has the ability to run independently of the utility electric system using synchronous generators possessing the ability to start without being "excited" by the grid. This capability is called "black start" capability. If neither the cogeneration system nor the back-up generator operates during a utility electric power outage, and a patient or resident is harmed as a result, the facility might be liable. Manufacturers of equipment and utilities may have limited or no liability for any damages that result from such a power outage. A cogeneration system with "black start" capability could help to provide an additional level of safety.

In addition to the approvals noted above, like other significant construction projects in health care facilities, the installation of a cogeneration system in a center may well require approval from the State Department of Health. Because cogeneration is viewed as "positive," regulatory agencies are generally supportive and attempts to gain approval to install the system are not likely to be delayed.

In New York State, for instance, energy conservation projects that cost less than $3 million are exempted from full review by the state hospital code 10 NYCRR §710.1(c)(1)(vi)—a process that can otherwise take as long as one year. Instead, the State only undertakes a limited prior review, which often can be accomplished in a matter of weeks. Legal assistance is typically required for this step.

In addition to complying with specific statutory and regulatory requirements, health care facilities must have a plan in place that will ensure residents' safety while keeping disruptions to a minimum.

A facility undertaking such a project will need to secure and monitor the area to make sure residents don't enter into the construction site. The facility also needs to consider hearing and sight impaired patients when devising a safety plan.

If residents have to be moved to accommodate the construction, the health care facility needs to have a plan for that as well. Construction equipment will not be permitted to block emergency exits or corridors.

Cogenerating units typically do not meet peak load because it is unlikely that a facility will have thermal needs that justify units sized to meet peak electric demand. Thermal demand can be assessed by the consulting engineer and will vary depending on occupancy and factors such as whether the facility has an on-site laundry.

The nature and condition of the boilers can also be critical. If the cogeneration system will provide sufficient thermal energy for the facility and avoid the need for replacing an old boiler, the cost factors can be favorable to the facility.

Health care facilities often install cogeneration systems in basement boiler rooms, but they can also be placed on rooftops, setbacks or even in generator sheds located adjacent to or near the main building.

A factor that many facilities consider is the noise of cogeneration units. These systems are not typically loud but they do make noise, and are often placed inside insulated cabinets. Cooling equipment located outside utilizes fans and can also produce sound but this can be reduced by the use of slow turning fans. Some building owners have dealt with cogeneration noise by constructing rooms out of cinderblock within boiler rooms, specifically to house the cogeneration system.

The decision to purchase, lease, or own units should be care-

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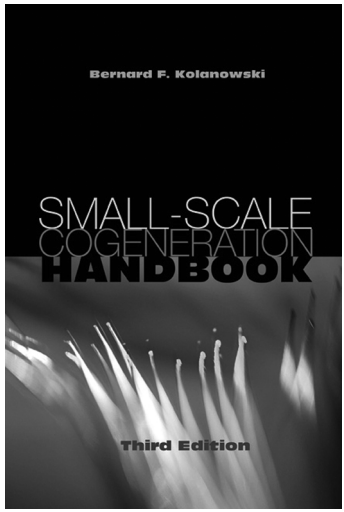

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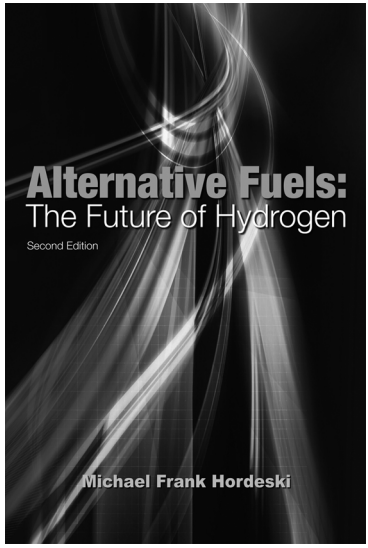

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fully considered and depends on a number of factors. In light of the capital cost incentives and other financial benefits, health care centers typically purchase the cogeneration system equipment. Facilities in New York State can typically obtain incentives such as lower interest rates on loans for the equipment. A number of other states also have incentives. As we have discussed, reimbursement for the capital expense is available to nursing facilities under the New York State Medicaid program. At times, health care facilities are also able to use the cogeneration system or the additional backup generator to produce income by selling power or "curtailment" in the wholesale market. In that regard, the wholesale market may be willing to pay health care facilities for the power or decreased demand enabled by the use of the cogeneration system or backup generator during peak demand in the market.

Because cogeneration systems are generally powered by natural gas, a typical question is what happens if the cost of the gas commodity goes up proportionally higher than the cost of electricity sold by the utility? The answer to that question depends upon the generation "mix" in the surrounding region, you may expect rough parity in these cost relationships over time because the cost of all fossil fuels tends to trend together if the generation mix in this region of power plants that produce power for the utilities includes a significant proportion of gas powered power plants.

The cost savings provided by cogeneration systems can be significant—particularly when the cost of the equipment is subsidized. Because the characteristics of facilities and other elements of these transactions and state vary widely, it is difficult to predict a payback or return on investment except to suggest that any cogeneration system in a health care facility will have a reasonable payback period.

ABOUT THE AUTHOR

Peter V.K. Funk, Jr. is a partner with Duane Morris law firm located in New York City. Mr. Funk practices in the area of energy with a focus on energy generation projects, including on-site cogeneration, energy conservation and energy management installations, demand-side management projects such as advanced metering, renewable resources, waste to energy and "green" generation, and energy-related financing matters. He has advised many clients in these areas and has

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