CHP installations

Near-real time ultrasonic metering enables building managers to cut waste and maximize efficiency.

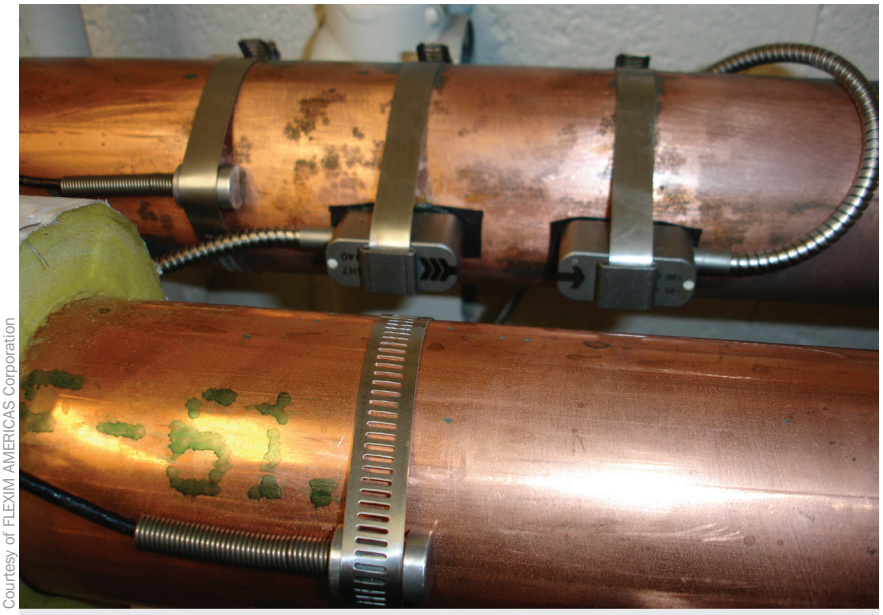
By Jack Sine

Owners of older buildings with inefficient heating and cooling systems are increasingly interested in energy savings from combined heat and power (CHP). While a typical natural gas plant operates at 35 percent efficiency, a CHP, also called cogeneration (cogen), system runs at more than 90 percent efficiency.

CHP works by using modular turbines connected in parallel to generate electrical power on site, capturing the heat created and using it to warm the facility in winter and drive an absorption chiller in warm months. As a result, those who use CHP no longer depend on the power grid.

DSM Engineering Associates in Hauppauge, New York, specializes in CHP retrofits for large buildings including apartment buildings, office space, manufacturing plants and education facilities.During their more than 20 years in business, they have successfully completed projects in buildings in the New York City area including three campuses of the State University of New York, the New York State Energy Research & Development Authority (NYSERDA) and Consolidated Edison Company.

Company representatives say NYSERDA has made their job easier by not only being a customer but also funding CHP conversions that meet their qualifications.



Courtesy of FLEXIM AMERICAS Corporation

Ultrasonic flow meters are capable of accurately measuring low flows during off hours in a CHP environment.

"It makes a CHP conversion eminently affordable, so when you combine the energy savings with NYSERDA funding, our clients have a very short return on investment," said Jim Armstrong, vice president at DSM.

Brad Selmon, president of East Coast firm M. A. Selmon, confirmed that similar programs exist across the country. He recently helped a Massachusetts sporting goods manufacturer convert to CHP with a modular cogen system with ultrasonic flow metering, and they received federal and state incentives worth hundreds of thousands of dollars. "It worked so well [that] they are installing CHP units at another site and getting similar incentives," Selmon says. "The metering was key to qualifying because they have to be able to verify to the state of Massachusetts how much they are reducing their carbon footprint."

Monitoring electric & thermal

DSM had noted that they didn't see many building owners in New York state properly monitoring their energy use, especially with the recent weak economy. The best methods for doing so, installing building management systems (BMS) or energy management systems (EMS), are expensive, so the company had been working to identify a more affordable option based on interval and real time data.

"The value of having that kind of information in front of you is very well instilled into my mindset," says Armstrong, who previously worked for Con Edison Control Center and had access to that data to make decisions about power purchase, generation and dispatches there.

Now as a consultant, Armstrong says, his work centers on developing, designing and installing supervision of packaged cogen systems in a variety of types of buildings. Along the way, he noticed that most older buildings do not monitor their electrical and thermal energy use.

"If you can get a picture of how much energy the building is using, what the consumption patterns are, what the real loads are, you can make adjustments to get the optimum efficiency out of your

system," Armstrong says.

In the past, those monitoring buildings have looked at monthly utility data to determine use and demand. This was used to optimize new boiler or chiller system design as well as cogen design for how many units should be installed and what their capacities should be. Still, this data set was not sufficient for the company to precisely design the optimal system.

An ultrasonic solution

As a solution, DSM used electric profiling systems to get a better picture of the building's energy use to determine its consumption throughout a day or longer periods of time. Armstrong says the system, which ideally collects data for up to a year, worked effectively and made the data accessible remotely through an Internet connection. The system itself is an electrical box that takes four sets of circuit transformers so the company can monitor four circuits and voltage input. The data can also be downloaded to a laptop if the setup is temporary.

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Finding the right flow meter

The company faced a bigger struggle with the thermal profiling to determine cogen heating and cooling on any given day in as close to real time as possible, preferably with remote access like the the electrical system. They tried insertion meters but found they required too much maintenance and didn't prove to be accurate on slow flows on off-peak times. When they tried ultrasonic meters, they ran into the same issues with slow flow rates and inaccuracies along with discovering the paste that held the transducers to the pipe hardened and needed to be replaced. Finally, they found a product with slow flow measurement from FLEXIM AMERICAS Corp.

Metering slow flow

The producers of the slow flow measurement meter first developed the technology in response to a request for a device needed to monitor ground water contamination to maintain EPA standards. Before that, a FLEXIM engineer says, no one at the company had thought about measuring such slow flows as they had developed other instruments to measure gasses, liquids and slurries over a wide range of temperatures. Working with the company that requested it, engineers adapted an existing meter to improve accuracy to 1 to 2 percent. In fact, they found their development worked so well that they incorporated the technology into other meters, providing plenty of options to DSM.

How ultrasonic flow meters work

Because the flow meter used was ultrasonic, it contains no moving parts and does not require frequent calibration and maintenance. Instead, a transit-time difference method is used to record measurements, utilizing the fact that the transmission speed of an ultrasonic signal depends on the flow velocity of the carrier medium. An ultrasonic signal moves slower against the flow direction of the medium and faster when it is in the flow direction.

To create the measurement, two ultrasonic pulses are sent through the medium, one in the flow direction and the second against it, and the meter's transducers work alternately as a transmitter and a receiver. As a result, the transit time of the signal sent in the flow direction is shorter than the one sent against the flow. The meter measures the transit time difference and calculates the average flow velocity. Since the ultrasound signals propagate in solids, the meter can be mounted directly onto the exterior of the pipe non-invasively. To resolve the transducer paste issue, engineers developed solid mounting pads that don't need replacing and conform to the shape of the pipe.

Permanent monitoring & sizing

Now the flow meter producer is using portable meters for short-term monitoring to size a system that meets the needs for cogen vendors that are preparing economic models to apply for funding from NYSERDA. NYSERDA has requested an hourly model for a year based on a standard weather profile and how the machines are expected to perform based on the load. Here they use interval loading information to build an hourly thermal model for the building and determine electrical use for the year. From there they layer on the cogen system to determine output.

Today they are encouraging clients to install permanent electrical and thermal metering to optimize the efficiency of their cogen systems and to determine opportunities for efficiency in operations. Overall, they are meeting their goal for a low-cost system to provide the information without the expense of retrofitting a BMS or EMS. The monitoring system also saves money on installation thanks to NYSERDA.

Staying off the grid

A final advantage of incorporating CHP technology either as the prime means of electrical power, heat and cooling or as a backup is that a business is no longer dependent on the power grid — and no longer affected by power blackouts and brown outs. FC

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