Can CHP Work at Co-ops?

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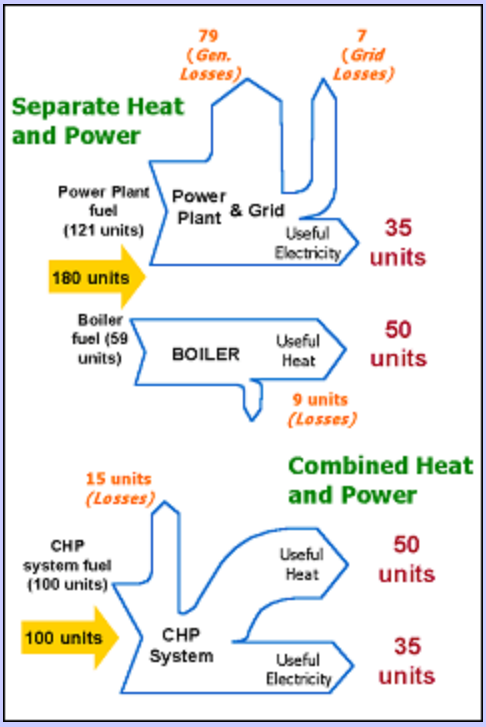
As energy prices continue to rise, many co-ops are looking at ways to reduce costs for customers. Can the installation of a combined heat and power (CHP) system offer one solution? What kind of load is required to make the system work? Tech Surveillance talked with several industry experts and a co-op that is utilizing a CHP system for one of its key accounts to see if CHP and co-ops can indeed be a good fit.

A CHP System Can Be Twice as Efficient as Central Power Generation

CHP is the creation of both electricity and steam from a single source located nearby or on-site. The benefit of a CHP system is increased efficiency through the recovery of waste heat created in the electricity generation process. The waste heat can be used to fulfill a site's thermal energy needs, such as hot water, direct heating, steam, or process heating. The combination of the use of otherwise wasted energy, in addition to the avoided energy losses through transmission from a central power plant, allows CHP systems to be twice as efficient as a central power plant.

Figure 1: Comparison of Conventional and CHP Heat and Electric Generating for Typical Electric and Thermal Efficiencies.



Source: U.S. Combined Heat and Power Association

Figure 1 demonstrates the efficiency of a CHP system. To produce 35 units of electricity and 50 units of heat, conventional generation methods would require 180 units of energy, and would lose 95 units. A CHP system can create the same amount of electricity and heat with only 100 units of fuel.

The concept of CHP is not new. In the past, co-ops have reported difficulty finding customers with the right kind of load to support a CHP application. Has anything changed?

"The first thing to look for when installing a CHP system is a steady thermal load," says Sean Casten, president of Turbosteam Corp., Turners Falls, Mass., and an executive committee member of the U.S. Combined Heat and Power Association. (For more information on thermal recovery, see *CHP and DG: A Match Made for a Rising Fuels Market?*)

Casten says many rural manufacturing facilities have steady thermal loads. "We've found particularly attractive opportunities for CHP in sawmills and many close-to-the-farm food processing facilities such as canneries and breweries," he says.

Examples include co-ops served by Bonneville Power Administration (BPA), Portland, Ore., which recently has been alerted to potential price increases and limited ability to increase future supply. Vermont Electric Cooperative, Johnson, Vt., is using a CHP system to save a furniture plant from moving to a lower-cost electricity state.

Successful CHP systems also can be installed in many other applications, such as universities, hospitals, hotels, apartment buildings, prisons, thermally intensive manufacturing, and chemical plants.

Will Rising Fuel Costs Drive CHP Applications?

"Increased fuel prices have undoubtedly made the awareness of CHP and its potential more attractive," says Dick McClelland, president of Energy Signature Associates Inc., Pittsburgh, Pa. Whether the price of electricity will rise concurrently with that of other fuels remains to be seen. This "spark spread," McClelland explains, will be the future driver.

Cost And Percent Difference by Energy Source, 2002 Through 2025		
Energy Source	**Cost Increase: 2002-2025** (2003 dollars per million Btu)	**Percent Increase/Decrease: 2002-2025**
Distillate Oil	1.40	22.1
Liquefied Petroleum Gas	2.89	34.0
Residual Oil	0.68	17.3
Motor Gasoline	0.99	8.8
Natural Gas	1.58	40.6
Metallurgical Coal/td>	-0.29	-15.4
Steam Coal	0.00	0.0
Electricity	1.02	6.9
Source: EIA Annual Energy Outlook 2005, Table A6		

According to projections made by the U.S. Department of Energy's Energy Information Administration, natural gas costs are projected to increase about 40% by 2025, followed closely by liquid petroleum gas with a 34% increase (see Figure 2 for complete list).

Although these fuels may experience the highest price increases, projected electricity costs still top the cost chart with a projected $15.75 per million Btu in 2025 (Figure 3).

"As fuel prices continue to increase, so will opportunities for CHP," says John Holt, manager of generation and fuels at NRECA. "CHP offers the opportunity to be more efficient and recover what is now lost heat. It will make the whole industry more efficient, which is something that the nation as a whole needs; cooperation between the utility and the customer is imperative."

DOE and CHP advocates like Casten argue that more investments should be made to improve the efficiency of the grid. "Our national electric system has tolerated zero efficiency growth over the past 50 years. We currently have only 33% efficiency and use only 8% of our waste heat," says Casten.

Vermont Co-op Sees CHP as Best Option

After being approached by the state office of economic development to reduce energy costs for a local Ethan Allen furniture plant by 20%, Vermont Electric stepped up to the challenge.

Vermont imports 65% of its electricity and, after transmission charges, has some of the highest industrial electric rates in the country at 8 cents per kWh. Competing with the global market and much cheaper energy rates in other areas of the country, Ethan Allen could no longer afford to keep its Beecher Halls, Vt., plant open if it couldn't save on its energy bill. For example, Ethan Allen's Dublin, Va., location pays only 4.9 cents per kWh. Because the Beecher Halls plant employs nearly 1,000 people, Vermont did not want to lose such an important economic asset.

The co-op had already visited the plant and "picked the low-hanging fruit" in terms of energy improvements, according to Dave Hallquist, IT and business development manager at Vermont Electric. "We looked at [using] a natural gas line that runs near the plant, but we felt the price of gas was far too volatile and expensive right now," Hallquist says. So Vermont Electric decided to install a 500-kW steam turbine at the facility which will be able to take advantage of all the factories steam generation created with waste wood from the facility. With this smaller, more mobile option, even if the plant was forced to close, the equipment could be moved to another location.

Exploring other options, Vermont Electric noticed a steady 1.5-MW thermal load. Coupled with a steady flow of wood waste, CHP became the obvious solution. "Initially, we wanted to install a 1.5-MW cogeneration unit, but there was still too much risk [involved in] investing in a facility that still might be forced to shut down," Hallquist says. So Vermont Electric decided to install a 500-kW turbine at the facility. With this smaller, more mobile option, even if the plant were forced to close, the equipment could be moved to another location.

Does Vermont Electric see the installation of CHP systems as a plausible solution to rising energy costs for other customers? "We have several other locations that have comparable thermal loads," Hallquist says. "Cogeneration is key for us from an energy standpoint."

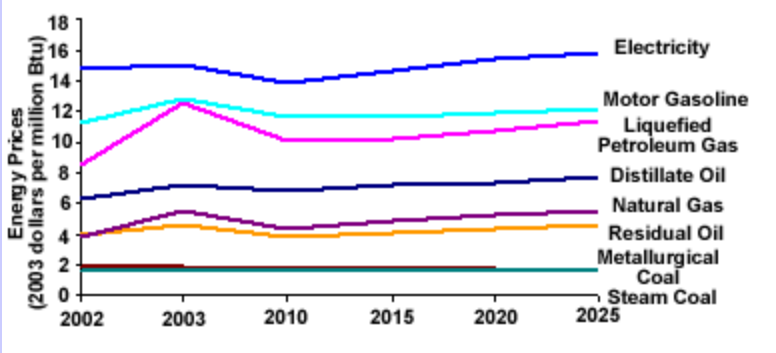
Is CHP Right for High Altitude Applications?

In May 2001, Fall River Rural Electric Cooperative installed a 4.5kW CHP propane fueled fuel cell system at the Yellowstone National Park west entrance admissions building. Used to provide both power and hot water and heating to the building, the project was installed as a demonstration application. Unfortunately the application only operated for six months and was removed in the spring of 2002. The system required a lot of

maintenance efforts—primarily the fuel processor which had a difficult time operating in the high altitude, explains Dave Peterson, staff engineer at co-op.

The cooperative was looking to sell the fuel cell as an option to customers that lived in locations where expensive line extensions installed would need to be installed. If the fuel processor was able to function under the altitude requirements, it would be a viable option for select customers.

Figure 2. Future energy cost projections, 2002 through 2025.



Source: EIA Annual Energy Outlook 2005, Table A6

"This has been a learning experience," says Peterson. "We would be interested in installing another CHP application in the future, but we want to wait until we are sure that the product will not require as much maintenance."

Economics Hinge on Precise Conditions

Once a co-op determines that CHP may be right for a customer, the utility must put together a tight business case and an efficient implementation. Thermal work is a specialized expertise. Casten urges co-ops to contract this work out. He also recommends finding one contractor to handle most of the installation to avoid a communication breakdowns that could result in a less than optimal final system.

Beyond technological challenges, economic questions also need to be answered. "Installing CHP will be a challenge for co-ops," NRECA's Holt says. "It will be based on getting the right conditions economically, such as who is going to put in the heat recovery system, and who will finance it?" Holt explains.

The drive to standardize DG interconnections is one bright spot for CHP. The Federal Energy Regulatory Commission (FERC) issued uniform interconnection procedures for generators up to 20 MW. The rule, which includes an expedited process for smaller generators, should lower interconnection costs. The new IEEE Standard 1547.1 on testing establishes tests to ensure that DG equipment will perform properly on an electric system, which also is predicted to speed up interconnections.