

The Perfect Fit

Cogen gives top performance at chemical plant

"Titanium dioxide is the whitest substance on earth," says Maggie Strayer, Energy Manager at Millennium Inorganic Chemicals, "and last year our facility here in Ashtabula produced 197,000 metric tons of it." Titanium dioxide is a basic chemical that is an ingredient in paints, plastics and other products. Producing titanium dioxide requires a lot of steam, 24 hours a day, seven days a week. This constant steam load, coupled with a high electricity load, made Millennium a perfect candidate for cogeneration.

reliability, and low environmental impact. Also, we wanted to be able to concentrate on our core business and turn over our energy management to the energy management experts." Cogeneration, the production of both power and useful thermal energy from a single energy source, provided the cost savings, reliability, and environmental benefits Millennium was seeking. Cinergy Solutions, Inc., based in Cincinnati, and Dominion East Ohio, provided the energy expertise.

Cinergy owns the cogen equipment at Millennium and is responsible for the design, construction, and operation of the installation. "At Cinergy Solutions," explains Kevin Hooker, Cinergy Station Manager at Millennium's Ashtabula plant, "energy is our core business. We specialize in developing energy solutions tailored to each individual customer. At Millennium, we wanted to provide economical and reliable steam and electricity in an environmentally responsible

manner. With this cogen project, Millennium has cut their raw material production cost for steam and electricity by about 20 percent. Because they can produce both the electricity and steam they need using only one fuel source, their level of efficiency is also much higher."

We were looking for cost savings, reliability, and low environmental impact.

"Cogeneration offered Millennium a way to reduce costs, increase reliability, and decrease emissions by displacing coal-fired equipment," notes Dominion East Ohio Account Executive Steve Kroszkewicz. "We put together a special contract for them and helped facilitate the project. We're always interested in helping our customers reduce costs through energy-conserving projects such as cogeneration."

Generating power and steam

The Cinergy cogeneration plant is a combined heat and power (CHP) facility and consists of a total of five natural gas turbines

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Cost savings, reliability, and low emissions

"Millennium began looking at cogeneration for this facility back in late 1998," notes Strayer. "We were looking for cost savings,

Emissions are substantially reduced with the new cogen equipment.

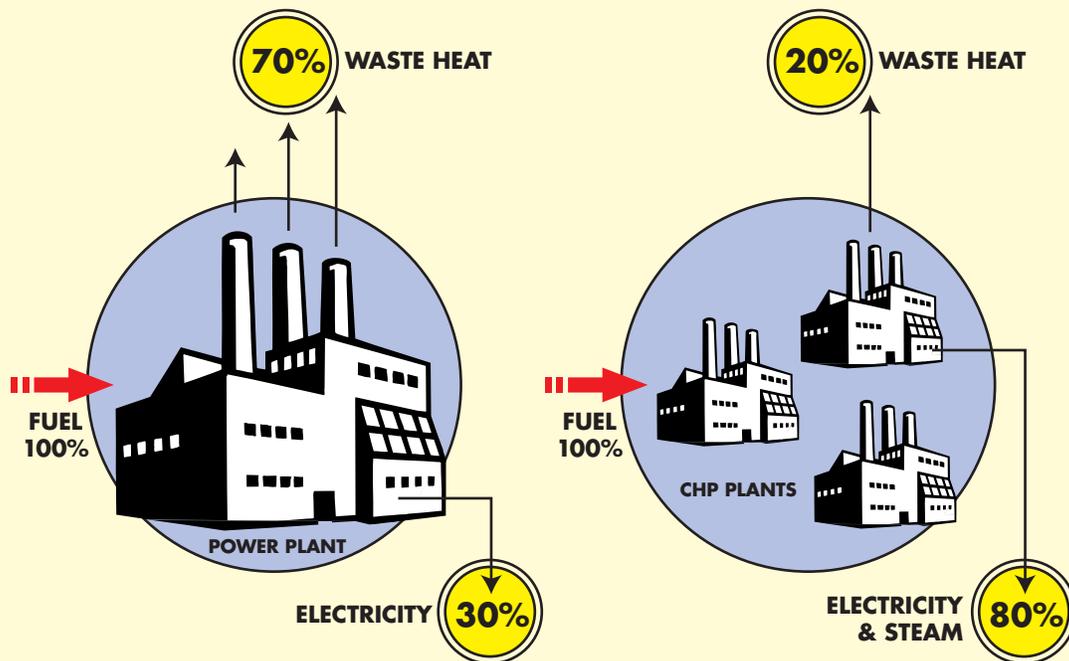


What is Cogeneration?

Cogeneration is the production of both power and useful thermal energy from one energy source. That single energy source, known as the prime mover, is most commonly a natural gas turbine, a steam turbine, or an internal combustion reciprocating engine. Because a prime mover converts only a portion of input energy to power and rejects the remainder, the rejected energy can be captured and converted to thermal energy. Cogeneration systems used in industrial applications generally range from 100 kilowatts to 50 megawatts, although larger installations can go as high as 1000 megawatts.

Onsite cogeneration systems are a reliable, economical, and environmentally sound option for large facilities with consistent and high demands for both thermal and electrical energy. Overall energy efficiency of gas turbines, when full use is made of recovered heat from the exhaust, can exceed 90 percent. Because natural gas is the cleanest-burning of the fossil fuels, any displacement of coal and oil units by natural gas systems will reduce environmental impact. Advanced control technologies are also readily available to reduce emissions.

CONVENTIONAL GENERATION VS. COGENERATION



(Rolls-Royce KB-7S) with a combined rating of 24.75 megawatts. Four of the turbines are equipped with supplementary-fired heat recovery steam generators. The fifth is a backup and is equipped with an unfired heat recovery unit. Two back-pressure steam turbines with a combined rating of 1.5 megawatts complete the installation.

Natural gas turbines use air as a working fuel. Air is taken in at atmospheric pressure, compressed, and delivered to a combustion chamber where it is mixed with natural gas as fuel. The fuel is burned, further raising the temperature and increasing the mix of air and combustion gases. The high temperature, pressurized mixture is delivered to a turbine

where the gases perform mechanical work by rotating the turbine shaft.

The turbine exhaust, which can reach temperatures as high as 1000°F, is then available as a source of heat. At Millennium, the exhaust is delivered to the heat recovery

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steam generators and used to produce steam for process. When higher pressure steam is required, the two back-pressure turbines are called into service, increasing efficiency.

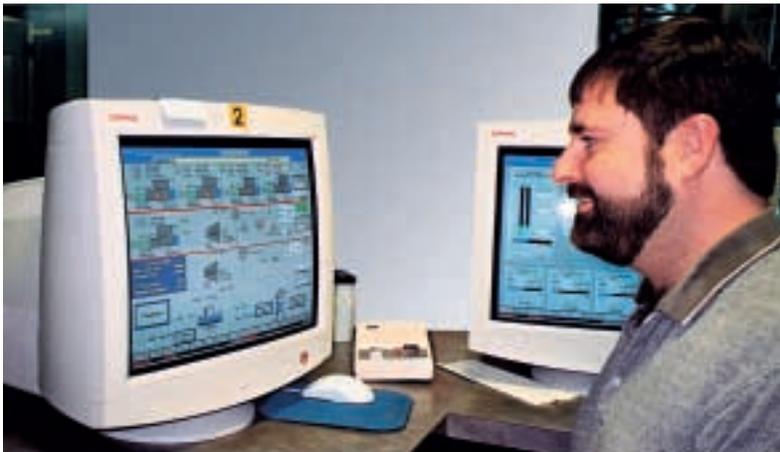
Efficient, effective, environmentally sound

The cogeneration installation currently provides Millennium with 260,000 PPH steam and 18.5 megawatts electricity,

Cogeneration is a great fit for installations such as Millennium's Ashtabula plant

meeting all onsite needs for both steam and electricity reliably and efficiently. "At the present, we are not producing more electricity than we can use at our plant," says Strayer, "although the facility was designed to produce more than we need. We are actually using only four of the five turbines. At some future point, we may generate more than we need and sell the excess."

The cogen facility operates at an overall thermal efficiency of approximately 76 percent and, according to Kevin Hooker, provides all onsite electricity and steam reliably and cost-effectively.



Millennium's constant steam and electricity loads made it a perfect candidate for cogeneration.

Before switching to cogeneration, Millennium used coal and natural gas boilers to produce the steam they required. Because the new system uses only clean-burning natural gas, emissions levels at the plant have been reduced by 520 tons NOx per year, 2,200 tons SO2 per year, and 256,000 tons CO2 per year. Further, the new turbines are equipped with an advanced dry low NOx emission system that lowers emissions without using either water or steam injection.

Millennium's cogen installation operates at an overall thermal efficiency of approximately 76 percent. "Combined heat and power

systems, such as the cogeneration system at Millennium, can reach efficiencies that can more than double conventional power generation," notes Doug Rider, former Environmental and Chemicals Marketing Manager at Dominion East Ohio. "Cogeneration is a great fit for installations such as Millennium's Ashtabula plant which runs 24 hours a day, seven days a week, and has large and consistent energy and steam loads."

"Our cogeneration system has done everything we wanted it to," concludes Millennium's Strayer. "We wanted reliability, cost savings, and emissions reductions—and we got them all."