



Cogeneration

> Case History

Museum of Science and Industry, USA

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**Power
Generation**

Where:

Museum of Science and Industry, Chicago, IL, USA

What:

Cogeneration installation featuring a Cummins Power Generation 1.75 MW lean-burn gas generator set, heat-recovery boiler and desiccant dehumidifier providing electricity, heating/cooling and domestic hot water

Purpose:

Demonstrate how a cogeneration or combined heat and power (CHP) system can save energy and money

Primary choice factors:

Cummins Power Generation lean-burn engine technology that delivers high fuel efficiency, low emissions and high specific heat output

Museum of Science and Industry in Chicago goes “green” with cogeneration system

CHICAGO, ILLINOIS, USA — A new 1.75 MW cogeneration system at the Museum of Science and Industry in Chicago is designed to provide up to 80 percent of the museum’s heat, hot water and electricity.

Cogeneration involves the production of two forms of power, usually electricity and heat, from a single source of fuel; in this case, natural gas. The chief benefits are high efficiency — upwards of 90 percent — and significant savings on overall energy expenditures. By generating electricity on-site and using the waste heat from the engine that drives the generator, the museum produces electricity for lighting, steam for space heating and cooling, and domestic hot water.

Department of Energy initiative

The project began to take shape when the Gas Technology Institute (GTI) of Des Plaines, IL, was awarded a grant from the U.S. Department of Energy to test and demonstrate a hybrid Building Cooling, Heating and Power (BCHP) system that would use a natural gas-powered generator set and a desiccant system. Following an economic analysis by GTI, the museum agreed to be the host site for the demonstration.



The Cummins Power Generation lean-burn generator set produces up to 1.75 MW of electricity and 4,000 pounds of steam per hour in a CHP application.



The lean-burn engine's radiator and critical exhaust silencer are roof mounted.

The cogeneration system consists of a Cummins Power Generation Inc. 1.75 MW lean-burn natural gas engine generator and associated controls, a Cain ESG1 heat-recovery boiler producing 4,000 pounds of steam per hour at 40 psi, and a Munters AM30N-S desiccant wheel dehumidifier that supplements the building's heating and air conditioning system.

System scheduled to operate daily

"The system operates from 8:45 a.m. to 6:00 p.m., over Commonwealth Edison's peak times," said Bill Vanderbilt, facilities manager, Museum of Science and Industry. "Before we turn the air conditioning on, the system is carrying about 90 percent of the building's total electrical load." Vanderbilt also said they use the waste heat from the engine to heat domestic hot water. When the air conditioning is on during the summer months, the main use of the waste heat output is to run a desiccant dehumidifier. The conversion boiler puts out so much steam that it is routed into the existing boiler header to heat much of the building in the spring and fall.

The heat-recovery boiler uses the waste heat from the engine exhaust to flash water into steam at 40 psi. The heat output from the heat-recovery boiler is also used to heat the domestic hot water supply. The 10,000 CFM Munters desiccant dehumidifier treats about 15 percent of the makeup air coming into an air handler serving a portion of the building. The dehumidifier removes

moisture from intake air in the summer months so that low-humidity air is passing over the air conditioning cooling coils. This reduces the load on the air conditioning compressor because dry air cools down more quickly.

In the winter months, the rotary air-to-air heat exchanger can be used to preheat a similar portion of incoming air, thus saving on heating costs.

Economic performance

Annual savings for the cogeneration installation were initially projected by GTI to be about \$200,000 based on natural gas priced at 50 cents per therm. In addition, heat from the cogeneration plant for heating domestic hot water was a late revision to the design, and savings from water heating have added to the system's benefits.

"Before we turn the air conditioning on, the system is carrying about 90 percent of the building's total electrical load. It pleases me how well it works," said Vanderbilt.

For more information about cogeneration power systems or other energy solutions, contact your local Cummins Power Generation distributor or visit www.cumminspower.com/energysolutions.

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