MIDWEST CHP APPLICATION CENTER
In Partnership with the US DOE

combined heat & power in museums

Museum of Science & Industry
Chicago, Illinois
1.75 MW CHP Application

Project Profile

CHP Quick Facts

Location:
Chicago, Illinois

Project Managing Firm & Design/Engineering Firm:
GTI, Des Plaines, IL
Ballard Engineering, Rockford, IL

Equipment:
(1) Cummins 1.75 MW engine generator set (natural gas fueled)
(1) Cain Industries Exhaust Steam Generator (4,000 lbs/hr @ 40 psi)
(1) Munters DryCool Desiccant Dehumidifier (w/ Enthalpy Wheel)

Equipment Cost:
$1,723,125

Annual Energy Cost Savings:
Approx. $200,000

Simple Payback:
Est: 8.6 Years

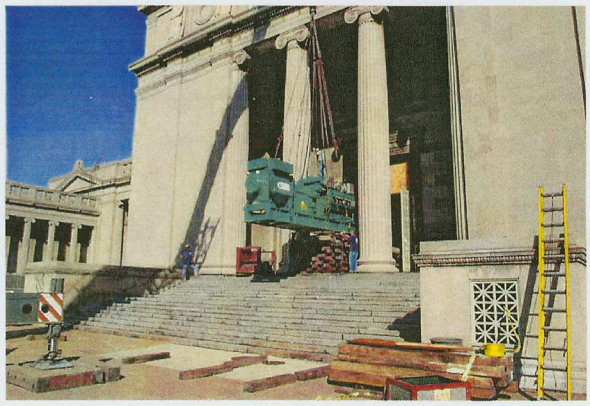
Fuel Use Efficiency:
60.5% (38.3% electric; 22.2% thermal)

System Online:
February 2003

Project Overview

In 2003, the Museum of Science & Industry, one of Chicago's premier museums, was selected as a US Department of Energy (DOE) test site to demonstrate the installation and operation of an advanced hybrid Combined Heat & Power (CHP) system. The heavily co-funded project included sponsorship by the Museum, the US DOE, the Gas Technology Institute (GTI), and both the City of Chicago, and the State of Illinois. GTI served as the US DOE project manager and Ballard Engineering (Rockford, IL) was selected as the design and installation engineering firm.

The system is located on the second floor of the museum in a partitioned area adjacent to an existing exhibit space. Plans include incorporating the CHP system as part of an exhibit on distributed generation.



CHP Concept

A single Cummins 1,750 kW natural gas fueled engine generator set powers the system. The engine's exhaust heat is recovered and recycled through a waste heat recovery boiler which is capable of producing up to 4,000 lbs/hr of steam at 40 psi. The steam is fed back into the building's common steam header. The advanced hybrid system also incorporates a Munters DryCool desiccant unit that treats approximately 15% of the intake air in the Southwest section of the museum. The desiccant unit dehumidifies the ventilation air during the summer months (reducing the cooling load in the building), and preheats the incoming air in the winter months (reducing the heating load in the building). A small portion of the recycled heat from the engine/generator set is utilized to regenerate the desiccant wheel.

The system has demonstrated an overall efficiency of 60.5%. At full load, the fuel consumed by the system equates to 15,580,000 btu/hr (8,903 btu/kWh) yielding 38.3% electrical efficiency. The energy captured by the waste heat recovery boiler (3,467,000 btu/hr) provides the additional 22.2% in thermal efficiency.

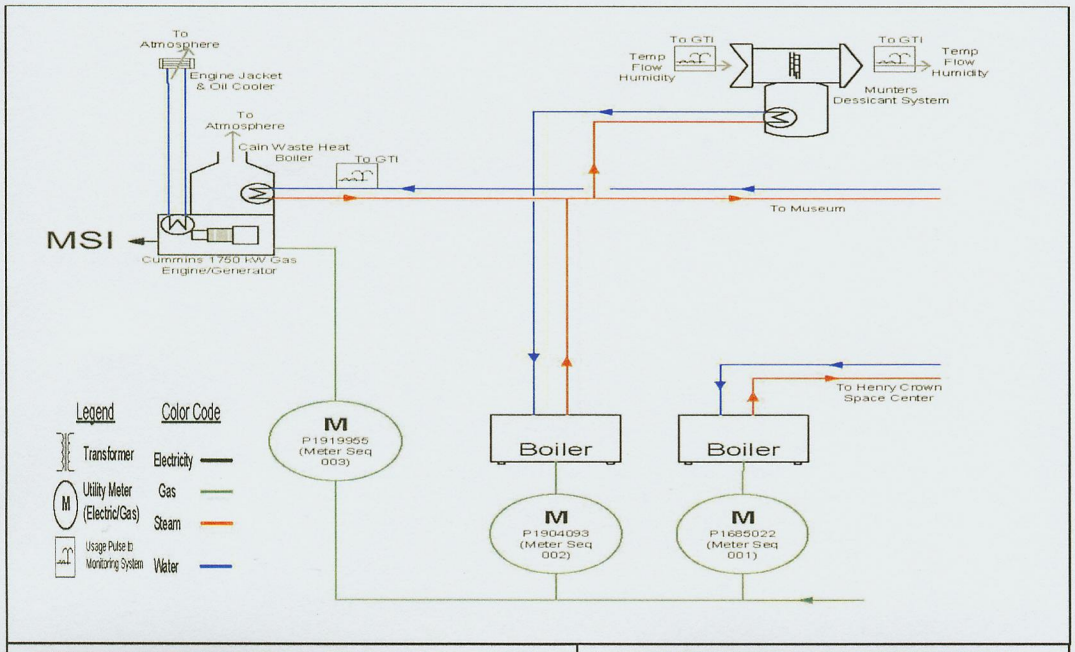
Grid Interconnect

The electrical power from the system, which is generated at 480 volts, is fed through a step-up transformer to interconnect with the 12,470 volt network distribution system that serves the museum. This is the first CHP system to be connected to one of Commonwealth Edison's (ComEd) network (vs. the more common radial) distribution systems in the Chicagoland area. A cooperative effort between ComEd & Ballard Engineering resulted in the required system modifications that allowed the interconnection to take place.

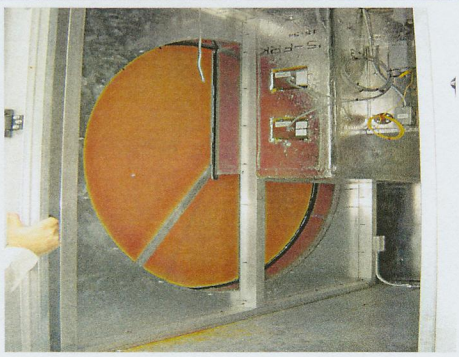
The Vision

The vision associated with this project was to install a system that could function both as an educational display for museum visitors and as an efficient and cost effective source of the museum's electrical and thermal energy requirements. This created the challenge of locating the CHP system in an area that would allow both functions to be realized. Such issues as accessibility for public viewing, ease of connecting into existing electrical service and steam lines, structural requirements, and noise were all design considerations.

Ultimately, the system was installed on the second floor of the west wing in a 100-year-old section of the building. The room that houses the engine, generator, waste heat recovery boiler, and controls was constructed in a manner that allows the future installation of viewing windows. This will allow the functioning CHP system to be the centerpiece of a future distributed energy exhibit. The museum attracts over 2 million visitors per year.



CHP System



Desiccant Dehumidifier Package

"The Museum of Science and Industry feels fortunate to have the CHP/co-generation plant installed and operating on a daily basis. In addition to the significant cost savings realized by reducing our electrical peak demand and recovering the heat to offset our steam demand, we have created a small exhibit around the alternative energy sources installed at the Museum, which includes an educational overview of the co-generation plant and energy recovery system."

Greg Prather
Director of Facilities and Exhibit Maintenance
Museum of Science and Industry

For further information contact

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