



**MIDWEST  
CHP  
APPLICATION  
CENTER**

In Partnership with  
the US DOE

combined heat & power in schools

# Maine South High School

## 1.6 MW CHP Application

### Project Profile

#### Quick Facts

**Location:**  
Park Ridge, Illinois

**Number of Students:**  
2,597 students

**Size of Facility:**  
500,000 square feet

**Maximum / Average Facility Demand:**  
1,500 kW / 1,100 kW

**CHP Electric Generating Capacity:**  
1,600 kW

**CHP Thermal Generating Capacity:**  
4,000,000 btu/hr hot water heat recovery

**Prime Movers:**  
(2) 800 kW Caterpillar 3516 1,200 rpm  
Reciprocating Engine Generators

**Fuel Type:**  
Natural Gas

**CHP Operating Schedule:**  
Operated when utility power price signals  
rise above the cost of on-site generation

**Maintenance of CHP Equipment:**  
Staff performs all maintenance

**Year of Installation:**  
1992

**Installed Costs:**  
\$1,200,000

**Current Annual Savings:**  
\$120,000

#### Project Overview

In 1992, Maine Township High School District 207 began operating a CHP system on the campus of Maine South High School (MSHS) to provide energy savings and reliable backup power during utility power outages. The CHP system generates 1.6 MW of electricity and 260°F hot water to supply building heat, domestic hot water, and absorption cooling to the 500,000 square foot campus. At the heart of the CHP system are two 800 kW Caterpillar 3516 natural gas-fired reciprocating engine generators with heat recovery. The CHP system was originally installed for \$1.2 million with an estimated simple payback of 4 years. Today, positioned in a newly deregulated utility market, the CHP system is operated when the electric utility price signals rise above the cost of on-site generation, operating approximately 2,200 hours per year with \$120,000 in estimated annual energy savings.



Maine South High School CHP Facility

#### From Installation to Deregulation

In the year preceding the CHP installation, MSHS experienced 13 extended electric utility outages. These events turned out to be quite costly for District 207 as a single outage spanning over 30 minutes would cost the school district approximately \$170,000 per day in operating expenses. To avoid these outages and the related expenses, District 207 hired KJWW Engineering Consultants in 1992 to design and install a CHP system that would provide energy savings and backup power during extended utility outages.

Following the first 12 months of operation, the local electric utility, Commonwealth Edison (ComEd), offered District 207 an alternative electric rate in return to shut down their year-old CHP system. This rate, known as Rider 27, would deliver electricity at a price lower than the cost of on-site generation. With this offer, District 207 agreed to shut down the CHP system and purchase electricity under Rider 27.

MSHS was supplied electric service under Rider 27 for approximately 15 years, until January 2007 when ComEd entered into deregulation, and with deregulation, Rider 27 was eliminated. At the onset of ComEd's deregulation, District 207 was now faced with the dilemma on how to address the future electric needs of MSHS. Would the CHP system, lying dormant for 15 years, be a viable technical and economic option once again? What, if any, bundled electric rates would be available from ComEd in the newly deregulated utility market? What types of rates and options were available via other electric providers?

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Many electric rates and options were available to District 207 to meet MSHS's future electric needs:

- ▶ Lying dormant for 15 years with periodic startups, the CHP system had experienced minimal runtime, thereby increasing the equipment life of the CHP system. Minimal maintenance would be required to bring the system out of semi-retirement and begin continuous operation.
- ▶ If a self-generating customer was connected in parallel with the grid and required electric service from ComEd, this customer would now be subjected to the hourly market electric prices, leaving the customer vulnerable to market price volatility. This was due to new rate structures and terms outlined by ComEd for all customers beginning January 2007.
- ▶ Entering deregulation, ComEd unveiled a new set of increased electric rates for all existing customers. After a number of years of frozen electric rates, ComEd customers experienced on average a 26% increase in their electric utility bills beginning January 2007.<sup>1</sup> Faced with these rising energy costs and the newly deregulated market, existing ComEd customers, including District 207, were now free to shop other electric providers that offered bundled rates and rate structures to self-generating and non-self-generating customers.

The best option for MSHS and District 207 was one that would optimize the use of the existing CHP system as an asset, which also provided the school district some energy budget stability from the volatile real-time electric market. At this juncture, District 207 turned to Constellation New Energy (electric provider) and Ballard Engineering Co. (deregulated energy consultant and engineering firm) to bring the dormant CHP system back online through an electric rate structure and engineering software model favorable towards self-generating electric customers operating in a deregulated electric utility market place.

Through this partnership, District 207 took advantage of low off-peak hourly electric index prices and limited their on-peak energy operating expenditures by self-generating when the price of power would rise above the cost of self-generation. In addition to operating their CHP system in direct relation to the hourly index prices, a long term block contract was purchased to stabilize 50% of the electric load costs. On a daily basis, District 207 can sell the contracted block of electricity to the market at market price for added revenue when the school is self-generating and not using the purchased block of electricity. Ballard Engineering's Optimization Model software provided the information and flexibility to District 207 to manage their own energy costs while operating in an unstable and volatile electric and natural gas market place. The school district today saves approximately \$120,000 per year in energy related expenditures while operating their CHP system.

<sup>1</sup> [http://www.citizensutilityboard.org/newsReleases20070219\\_study.html](http://www.citizensutilityboard.org/newsReleases20070219_study.html)

## Weathering the Storm

During the week of August 20, 2007, more than one million electric purchasing customers lost electricity due to a series of violent rain storms that ravaged the Midwest region. One such storm hit the Chicagoland area Thursday afternoon on August 23<sup>rd</sup>, crippling the area and forcing nearly 630,000 ComEd customers to lose power. Ten minutes prior to the storm hitting the area, MSHS disengaged themselves from the grid and began operation of their CHP system. This action enabled MSHS to maintain building operation and ride through the heavy rain storms.

The CHP system is also equipped with black start capability. Should the grid and the CHP system go down; the CHP system can be restarted without the grid. The engines can be started with the use of a battery (similar to starting a car engine). Once up to speed, the system is connected through a generator breaker to a load that allows the CHP parasitic loads to be powered. The second step then engages the tie breaker that places the full load on the CHP system. To operate in this mode, the CHP system must be producing electric power with a synchronous generator or inverter based system.

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**Caterpillar 3516 Reciprocating Engine**

**13 annual  
electric utility  
outages prior to  
the CHP  
installation**

**CHP system  
provides energy  
savings and  
backup power**

**CHP system  
operates in a  
deregulated  
utility market**

**CHP system  
maintained  
building  
operation  
during August  
2007 storms**

