



SHEPHERD
ADVISORS
and



MIDWEST
CHP
APPLICATION
CENTER
In Partnership with
the US DOE

combined heat & power in industry

Lorin Industries

3.2 MW CHP Application

Project Profile

Quick Facts

Location:
Muskegon, Michigan

Facility Size:
700,000 square feet

Facility Type:
Metal Finishing, Anodized Aluminum
Manufacturer

Maximum Electric Demand:
13 megawatts

Generating Equipment:
Four 1,100 HP Caterpillar Reciprocating
Engines

Generating Capacity:
3.2 megawatts (MW)

Primary Fuel:
Natural Gas

Heat Recovery:
Steam used to heat process tanks

Operation Schedule:
Primarily used as a peak shaver,
24/5 Monday to Friday.

Local Electric Utility:
Consumers Energy

Began Operation:
October 1990

Project Overview

Lorin Industries of Muskegon, Michigan operates a 3.2 MW Combined Heat and Power (CHP) System that provides electric peak shaving and steam to heat their process tanks. The prime movers of the CHP system are four 16 cylinder Natural Gas Caterpillar Engines. As of September, 2005, these are operated throughout the year to avoid the high demand charges associated with the on-peak period.

At the time of construction, the CHP system was sized to produce steam for the 6 production lines in operation, which would cover 100% of the lines' steam needs and about 50% of electrical load when operating at full capacity. The later addition of 2 more lines increased electrical and steam needs. In 1994, the system provided about 50 percent of the electrical and about 80 percent of the thermal energy needed by the company. Company officials estimated the savings to be about \$540,000 per year. The overall payback time was four years.

History of the Company and Plant

Founded in 1943, Lorin Industries began as a metal finishing company. Post-war demand motivated the company to shift production over to anodized aluminum in 1948, and Lorin has expanded to a multinational firm with \$60 million in annual sales. Lorin's CHP system was installed in 1990 for two primary reasons: to avoid losses caused by interruption in production from frequent power outages, and to decrease total electricity costs, primarily through reducing peak electricity demand.

When all 8 production lines are operational, they demand a total of 13 MW of power, along with steam to heat process tanks. Lorin's electric demand varies throughout the month, however, as not all production lines are run continuously. This, combined with the required utility base-load charges, reduces the number of hours demanded of each individual engine, which typically runs about 180 hrs/month. Lorin's system is composed of four 16 cylinder Caterpillar Engines (modified diesel engines which run on natural gas), producing a total of 3.2 MW of electricity, or between 20% - 50% of the plant's electrical power needs. The waste heat off of these is used to generate steam through three heat recovery boilers - two 50,000 lbs and one 15,000 lbs - which provide 50-90% of the firm's annual steam needs. Additional power needs are provided through connections to Consumer's Energy, and additional steam capacity is met through two conventional boilers which are run on demand.

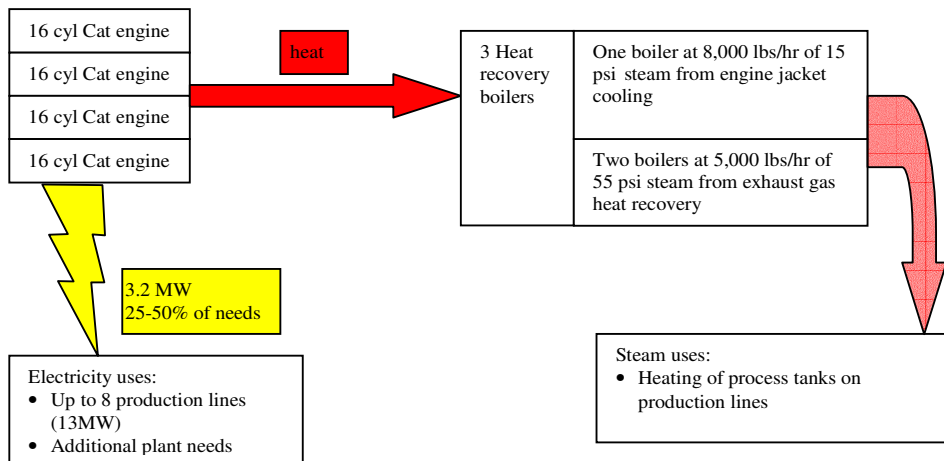
Additional Facts

- Four 16 cylinder Caterpillar Engines (modified diesel engines which run on natural gas) drive the generator sets to produce 3.2 MW of electricity. Waste heat off of these is used to generate steam through three boilers: two at 55 psi and one at 15 psi.
- When in operation, the CHP system supplies between 25-50% of the plant's operating electric demand, and 50-90% of its steam requirements.
- The Lorin engineering staff provides the daily maintenance for the CHP system, checking the oil, battery and standard operation of the system. Michigan Caterpillar handles the heavy maintenance and does regular check-ups which are calculated on run-time hours.

Challenges

The size of the CHP system Lorin could install was limited by its steam needs. In theory, an optimal solution to this problem would be to increase electrical output and lower the steam production. This was not pursued, however, since changing the ratio of steam to electricity produced will often decrease the overall efficiency of the system. Because of the constraints placed on the system by steam needs, energy security (one of the original objectives) was not attainable.

Though the electrical capacity installed was not great enough to sustain the plant at full capacity in the case of an outage, this does not mean that CHP systems must cover the facility's maximum electrical demand in order to function as an effective back-up generation system. When critical operating systems are wired to the cogeneration system at the implementation of the project, it can still ensure energy security.



25-50% of the electric demand met by the CHP system

50-90% of steam needs are covered

**“Over all I would say we are pleased with the system. It helps to cut our electric costs and we are mostly using it to peak shave our load.”
Jim Nalewick.**

Energy Center Equipment

The following equipment comprises Lorin Industries' CHP system:

- Four (4) 16 cylinder Caterpillar Engines (800 kW each)
- Three (3) Heat Recovery Steam Boilers (2 @ 5,000 lbs/hr and 55 psi; 1 @ 8,000 lbs/hr and 15 psi)
- Two (2) conventional boilers for additional steam production on demand

For further information, contact:

Shepherd Advisors
2488 Antietam Drive
Ann Arbor, MI 48104
Phone: (734) 665-5410
www.shepherdadvisors.com

Midwest CHP Application Center
851 S. Morgan Street
Chicago, IL 60607-7054
Phone: (312) 413-3835
Fax: (312) 996-5620
www.CHPCenterMW.org

