NORTHEAST

U.S. DOE

CHP Technical Assistance Partnerships

PROJECT PROFILE

Seaman Paper

283 kW Wood-fired CHP System

Site Description

The Seaman Paper Company of Massachusetts is a historic mill complex originally constructed in the late 1800s. The numerous connected buildings contain a gross floor space of 80,000 ft². The facility operates 24 hours a day, 7 days a week, with shutdowns only on major holidays. The facility uses two paper machines with a capacity of up to 100 tons per day to produce a variety of flat tissue papers. Most are used for decorative purposes, but some are waxed and used for food handling. At the time of the project the mill was using an average of 1.7 million gallons of #6 fuel oil and 25.5 MWh of electricity per year.

Quick Facts

LOCATION: Otter River, Massachusetts
FUEL: Wood (shredded shipping pallets)
POLLUTION CONTROL: BACT (Baghouse)
MAX CAPACITY: 283 kW
AVERAGE CAPACITY FACTOR: ~ 70%
ENERGY OUTPUT: 1.7 MWh per year
IN OPERATION SINCE: April 2009
EQUIPMENT: Turbosteam steam turbine generation set, Hurst biomass boiler
USE OF ELECTRICAL ENERGY: Displaces internal loads
ESTIMATED YEARLY SAVINGS: Over $1.5 million
JOINT PROJECT BY: Hurst Boiler and Turbosteam
ENVIRONMENTAL BENEFITS: 30% NOx reduction and 95% SO_2 reduction

Reasons for Installing CHP

The mill had previously used biomass (wood), but use of the previous biomass boiler had ceased approximately 23 years ago when it had required major upgrades. The continually rising price of #6 fuel oil combined with its price instability persuaded the mill owner to look at biomass again. It was determined that recommissioning the old boiler was not feasible and that new boilers would be required. Although the mill requires only 145 psi steam, it was determined that purchasing higher pressure boilers and installing a steam turbine would provide an extra financial incentive to the project.

Biomass Boiler and Steam Turbine Generator

Equipment and Configuration

Fuel Silo

Fuel Delivery System

Baghouses

The mill has installed two (2) Hurst 600 HP biomass boilers that can produce approximately 20,000 lbs per hour of 400 psi steam at 600°F. The boilers consume 41 tons a day of shredded shipping pallet fuel per day. The mill determined that shredded pallets, although slightly more expensive, would provide them with a more consistent fuel. The pallet fuel provides consistent 13.57 MMBtu per ton, moisture content of 20% to 22% and emissions of 26 lbs/MMBtu NOx, 0.06 lbs/MMBtu SOx. Particulate emissions are controlled by means of two (2) four cell baghouses.

Steam from the boilers is fed to a Turbosteam steam turbine generator set (STG). The STG consists of a single stage backpressure turbine, reducing gear and a 480 V synchronous generator. The turbine is rated to produce 301 kW shaft power when supplied 24,998 lbs per hour of 400 psi, 600°F steam that it reduces to the mills required 145 psi saturated steam. The reducing gear is 99% efficient and the generator 95% efficient thus providing a total of 283 kW of electrical power at the output leads. The controls of the turbine provide automatic synchronization of the systems output to the mills electrical bus.

The 480V output is tied into the mills main power bus by means of a 600A circuit breaker. The breaker and controls are designed to shut down the turbine in case of a utility power failure, thus preventing back feeding of power onto the grid.

Lessons to Share

All of the organizations involved in this project consider it successful and recommend this application to other facilities. Lessons to share include:

- There are many sources of revenue available from a project such as this. All potential revenue streams should be leveraged to provide maximum value to the project.
- Biomass takes up a great deal of space. Make sure there is adequate space for fuel delivery and storage.
- Biomass is not energy dense. It can require multiple trailer truck deliveries per day. The facility needs to be able to handle this. The effect of the increased truck traffic on the neighbors should also be considered.
- The plant's electrical output depends on the amount steam the plant is calling for. The system has averaged about a 70% capacity factor over the most recent year of operation. It is wise to do an economic analysis using a couple different capacity factors (70% and 90%, for instance).

For More Information

U.S. DOE Northeast CHP Technical Assistance Partnership
Dr. Beka Kosanovic
413-545-0684
kosanovic@umass.edu
More Case Studies:
http://www.northeastchptap.org/profiles/installations.php

HURST BOILER
PO Drawer 530
100 Boilermaker Lane
Coolidge, GA 31738
http://www.hurstboiler.com/

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