



# Evergreen Community Power Plant

## 33-MW CHP System

*Combined heat and power application utilizing wood-based fuel*

### Site Description

Since 1993, the United Corrstack paper mill has made corrugated cardboard products and has been an important part of its surrounding community. The Evergreen Community Power Plant (ECPP) was built in 2008 by Interstate Resources Inc. to serve the heating and electric loads of the paper mill. The paper mill and the ECPP are located on a 41 acre site near downtown Reading.

### Reasons for CHP

Interstate Resources Inc. was looking for ways to make their paper mill more cost competitive. A declining domestic demand for paper products has pushed other paper mills out of business. In addition, the price fluctuation in the natural gas market during the 2000's created uncertainty for many energy-intensive industries.

In an attempt to reduce operating costs, a combined heat and power plant using alternative fuels was built. Thankfully, the paper mill has excellent technical potential for a CHP plant because of its consistently high heating and electric loads.

### Quick Facts

**LOCATION:** Reading, PA

**MARKET SECTOR:** Pulp and paper products

**FACILITY SIZE:** 435 tons of cardboard per day

**FACILITY PEAK LOAD:** 8.5 megawatts (MW)

**CHP IN OPERATION SINCE:** 2008

**EQUIPMENT:** Boiler and steam turbine

**FUEL:** Wood-based biomass

**USE OF THERMAL ENERGY:** 70,000 lbs of steam per hour

**CHP TOTAL EFFICIENCY:** 77 %

**ENVIRONMENTAL BENEFITS:** 59,581 tons of carbon equivalent saved per year

**TOTAL PROJECT COST:** \$140,000,000

**ORIGINAL PAYBACK:** 12-15 years

**ACTUAL ANNUAL SAVINGS:** - \$10,158,160

**ACTUAL PAYBACK:** Uncertain



The boiler house (left), the exhaust stack (center), and the paper mill (background)



## Fuel Source

The fuel for the ECPP is mulch that is comprised of forest industry waste, shredded construction wood waste, and demolition debris. The fuel is mostly wood-based, but there are significant amounts of paper, plastic and other foreign debris. It has an energy content that varies from 5,500 to 7,000 Btu per lbm. The fuel arrives on site via tractor trailer delivery, and the ECPP typically consumes 300,000–350,000 tons of fuel per year.

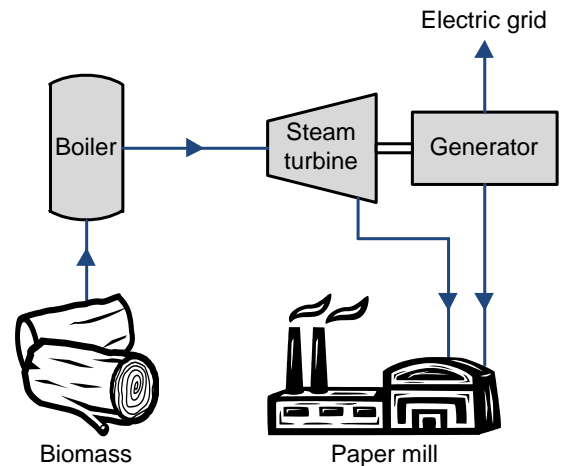
## CHP Equipment & Operations

Fundamentally, the ECPP is comprised of a boiler with a steam turbine and generator. The circulating fluidized bed boiler produces 330,000 lbs of steam at 1,200 psi with a thermal efficiency of 87%. The steam from the boiler is directed to an extraction, condensing steam turbine. The 3 turbine extractions allow precise control of the paper mill and plant parasitic loads. The turbine condenser maximizes the amount of electricity produced from the excess steam. The attached generator is rated for 33 MW, much larger than the attached plant and mill electric loads. In situations when it is economically favorable, the ECPP will generate excess electricity and opportunistically sell power back to the grid.

## Economics

There are several expense and revenue streams to consider when evaluating the ECPP. The values provided below are typical annual amounts. It is clear that the plant is simply not making profit as of yet.

Item	Expense	Revenue
Fuel transportation	\$2,400,000	-
Ash disposal	\$2,450,000	-
Chemical treatment	\$2,000,000	-
Staff and repairs	\$21,000,000	-
Energy to paper mill	-	\$11,000,000
Electricity sold to grid	-	\$6,681,840



## Lessons To Share

- Fuel sourcing: The wood-based fuel market in Pennsylvania is underdeveloped. Moving forward, the plant will look to other states (specifically New Jersey) that have more developed biomass markets for their fuel supply.
- Interaction with the electricity market: The ECPP has low fuel costs compared to conventional fuels. Securing strategic power purchase agreements can improve the profitability of the ECPP.
- Ash disposal: A significant cost for the ECPP is the removal of ash. Environmental regulation which gives priority for the use of biomass ash for beneficial reuse would lower the ash removal costs.
- Technical assistance programs: Programs which investigate the feasibility of potential CHP projects are cost effective solutions for improving energy efficiency.

## For More Information

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FOR A DETAILED CASE STUDY ON THE ECPP AND FOR MORE CHP PROJECT PROFILES, VISIT US AT:

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