SOUTHEAST

U.S. DOE

CHP Technical Assistance Partnerships

PROJECT PROFILE

# Eastman's Tennessee Operations

## 200 MW CHP System

## Site Description

Eastman Chemical Company's Tennessee Operations is one of the largest chemical manufacturing sites in North America, covering approximately 900 acres. The Kingsport, TN, facility produces a variety of chemicals, fibers, and plastics and also serves as the worldwide headquarters for Eastman Chemical Company. The facility began operating its first CHP system in 1930 and has continued adding to the system, including its most recent expansion in 1993.

The CHP system is in continuous use and consists of seventeen boilers and nineteen steam turbines. All together, the CHP system has an electric generating capacity of 200 MW while also generating 3,600,000 lb/hr of steam at a range of pressures, in order to meet the thermal needs of the facility. The energy output by the CHP system accounts for over 90% of the site's thermal and electric demand.

## Quick Facts

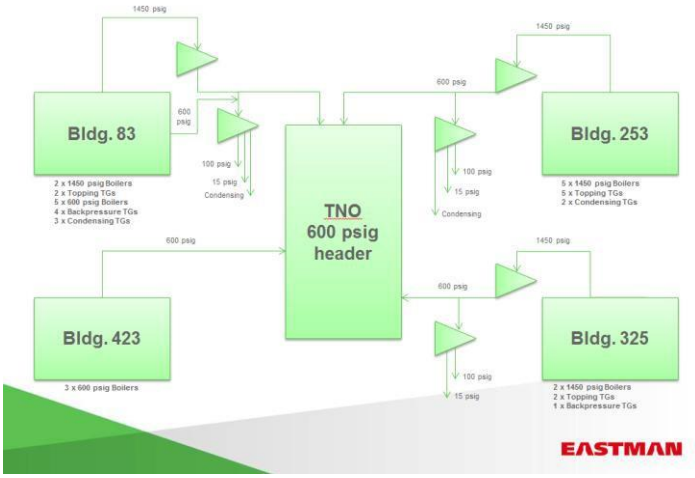
**LOCATION:** Kingsport, TN
**MARKET SECTOR:** Chemicals
**FACILITY SIZE:** 40,000,000 sq. ft.
**MAX GENERATING CAPACITY:** 200 MW
**AVERAGE ENERGY OUTPUT:** 155 MW
**EQUIPMENT:** 17 Boilers
19 Steam Turbines
**FUEL:** Coal, Natural Gas
**USE OF THERMAL ENERGY:** Process heating, space heating, cooling
**CHP TOTAL EFFICIENCY:** 70 %
**ENVIRONMENTAL BENEFITS:** 358,000 ton/yr avoided $CO_2$ emissions; 4,400 tons/yr avoided $SO_2$ emissions; 1,700tons/yr avoided NOx emissions
**ESTIMATED YEARLY SAVINGS:** $45 Million
**CHP IN OPERATION SINCE:** 1930

## Reasons for Installing CHP

Eastman's experience with CHP predates the construction of a reliable electric grid in the Kingsport area. When it first came online, the CHP system was the only reliable source of electricity for the facility. In modern times, the CHP system has served to provide the large electric and thermal loads required by the facility at prices more favorable than purchasing both independently. The system also allows for balancing of process steam demands at various pressures, all while proving to be more reliable than electricity from the grid.

**Eastman's Tennessee Operations Facility (Kingsport, Tennessee).** PHOTO COURTESY OF EASTMAN CHEMICAL COMPANY.

## Equipment and Configuration




**CHP Process Diagram.**
PHOTO COURTESY OF EASTMAN CHEMICAL COMPANY.

The current fleet of CHP equipment includes:

- 17 Boilers manufactured by Babcock and Wilcox, Alstom Power, and Riley Stoker.
- 19 Steam Turbines manufactured by General Electric and Siemens (ABB Stal).

Natural Gas and Coal are used to fuel the boilers, with coal being the predominate source. Three of the boilers are used as back-ups. The boilers generate a total of 3,600,000 lb/hr of steam, most of which is delivered to the turbines at a pressure of 1450 psi. After exiting the turbines, 3,000,000 lb/hr of steam is supplied to the facility at 600 psi, 100 psi, and 15 psi.

Of the nineteen steam turbines, five are condensing turbines, nine are backpressure (topping) turbines with a 1450 psi inlet and a 600 psi exhaust, and five are backpressure turbines with a 600 psi inlet and a 100 psi exhaust. The condensing turbines and one of the backpressure turbines have admission and/or extraction capabilities. The turbines have individual electric generating capacities ranging from 6 MW to 18 MW with isentropic efficiencies of approximately 70%. In total, the CHP system has a 200 MW maximum electric generating capacity, and supplies an average of 155 MW to the facility. All electricity generated is consumed on-site. The generated steam is used by the site for process heating, powering air compressors and refrigeration machines, and space heating inside the facility.

The system is wholly owned and operated by Eastman. While the original configuration of the CHP system was designed in-house, the newer additions were designed by Sargent & Lundy and by Bechtel Corporation, two engineering design firms. The CHP system is operated continuously and has maintained an availability of 99.9+% over the life of the system.

## Lessons To Share

Eastman contends that while CHP systems are not typically the lowest upfront capital cost approach to supply energy, when evaluated on life cycle cost basis, they are clear winners. If designed, operated and maintained well, Eastman believes CHP systems can provide a stable and advantaged energy position in the face of volatile fuel and electricity costs for decades.

## For More Information

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