



# Cokenergy

## 95 MW Waste Heat to Power CHP System

### Project Overview

Cokenergy, LLC installed a waste heat to power (WHP) combined heat and power (CHP) system in October of 1998 to recover heat from the coke-making process at one of the largest steel manufacturing facilities in the country, located in East Chicago, Indiana. SunCoke Energy owns and operates the coke-making facility, or coke battery, located on-site for steel manufacturing giant, ArcelorMittal USA, Inc.

The coke produced is the primary fuel used in the blast furnaces in the steel plant's smelting process. The WHP CHP system takes advantage of the large amount of waste heat created by the coke battery. The waste heat is recovered to create steam, which in turn supplies a portion of the steel plant's process heating needs and is used to drive a steam turbine to generate electricity. The WHP CHP system improves the efficiency of the historically dirty and energy inefficient coke-making process while reducing plant costs and lowering emissions.

### Reasons for WHP CHP

Coke, a necessary fuel in the steel manufacturing process, is a solid-state carbon fuel derived from coal. Coke production involves baking the coal in large ovens at several thousand degrees Fahrenheit, transforming the coal into coke and volatile by-products including CO<sub>2</sub>, SO<sub>2</sub>, and NO<sub>x</sub>. Through the use of a WHP CHP system, the high temperature exhaust of the coke battery is cleaned and transformed into useful heat and electricity for use in the steel manufacturing plant. Specific benefits of the WHP CHP system include:

- Fuel-free system - recovered heat is used directly to generate steam and electricity in boilers
- Offsets ~50% of the plant's process heating needs and ~25% of its power requirements
- Reduces plant CO<sub>2</sub> emissions by 515,000 tons annually
- Flue gas treated to remove SO<sub>2</sub> and particulate matter

### Quick Facts

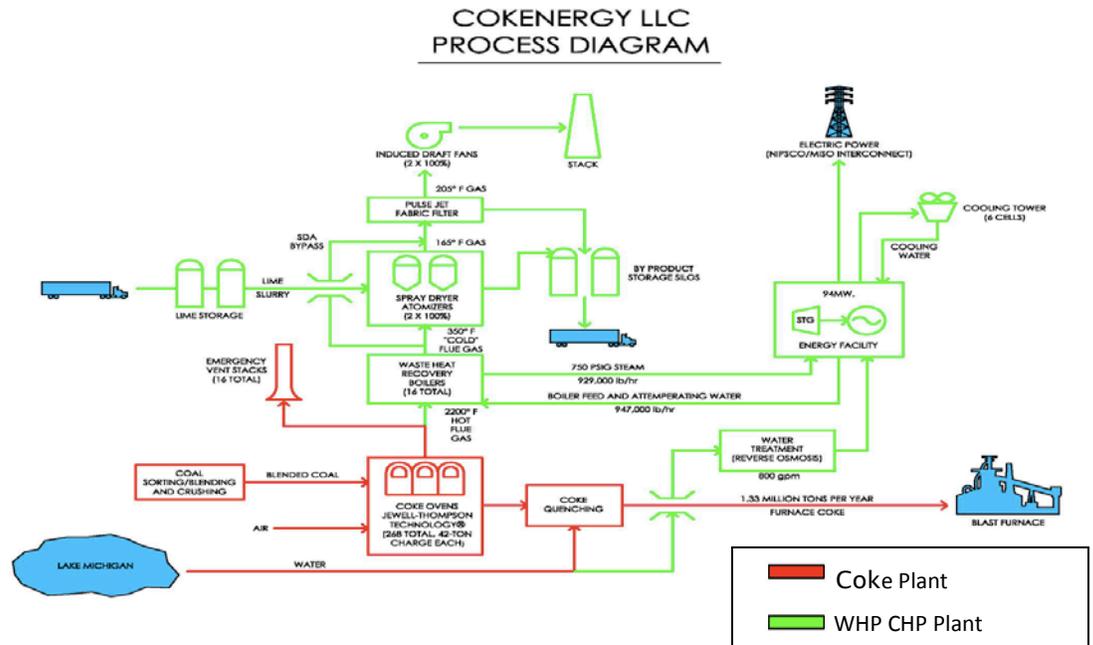
**LOCATION:** East Chicago, Indiana  
**MARKET SECTOR:** Coke and Steel Manufacturing  
**FACILITY SIZE:** Coke-Making Capacity of 1.2 Million Tons  
**ELECTRICAL GENERATING CAPACITY:** 95 MW  
**PRIME MOVER:** Steam Turbine  
**FUEL:** Waste Heat  
**USE OF THERMAL ENERGY:** 929,000 lb/hr of 750 psig Process Steam  
**TOTAL PROJECT COST:** \$165 Million  
**YEARLY ENERGY SAVINGS:** 503,000 MWh  
**ENVIRONMENTAL BENEFITS:** Reduces plant CO<sub>2</sub> emissions by 515,000 tons annually and offsets 800,000 tons of CO<sub>2</sub>, 15,000 tons of SO<sub>2</sub>, 3,000 tons of NO<sub>x</sub> per year as compared to grid generation.  
**PARTNERS:** Cokenergy, LLC, ArcelorMittal, and SunCoke Energy  
**BEGAN OPERATION:** 1998



SunCoke Energy Coke Battery

# WHP CHP System Design and Operation

The WHP CHP system consists of 3 major components: the 95 MW steam turbine/ generator, the flue gas desulfurization system, and the 16 heat recovery boilers. 2,200°F flue gas generated by the 268 coke ovens is sent through the waste heat recovery boilers, generating 929,000 lb/hr of steam at 750 psig. Exhaust from the boilers is treated and filtered in the flue gas desulfurization system before it is exhausted to the atmosphere. The steam is used in plant processes and in the 896,000 lb/hr rated steam turbine to generate electricity.



Cokenergy owns and operates the WHP CHP system, processing the hot flue gas from the SunCoke Energy coke battery and supplying steam and electricity to the ArcelorMittal plant. An agreement between SunCoke Energy and Cokenergy guarantees the supply of waste heat in exchange for processing of the flue gas to reduce its sulfur and particulate content. ArcelorMittal has a contractual relationship to purchase the excess generated steam and excess electricity from Cokenergy.

## Environmental Benefits



Cokenergy's Installed WHP CHP System at ArcelorMittal

At the time of construction, the combination of the heat-recovery coke plant and the Cokenergy facility was recognized by the US Environmental Protection Agency as Maximum Achievable Control Technology. The electricity produced from the waste heat displaces generation from regional utility companies and precludes the production of up to 3,000 tons of NO<sub>x</sub>, 15,000 tons of SO<sub>2</sub> and 800,000 tons of CO<sub>2</sub> tons per year when all waste heat is converted to electricity.

## For More Information

### U.S. DOE MIDWEST CHP TECHNICAL ASSISTANCE PARTNERSHIP

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*The Midwest CHP TAP is a U.S. DOE sponsored program managed by the Energy Resources Center located at the University of Illinois of Chicago.*