



CF Industries

20 MW CHP Plant

Project Overview

In the early 1980's, increasing electricity costs led MS Chemical Corporation to consider installation of a CHP system to supply on-site power and steam generation. Initially, 20 different turbine/generator units were considered. After several months of detailed analyses, MS Chemical Corporation eventually selected the General Electric (GE) LM-2500 aero-derivative gas turbine generator set, since its power output very closely matched the plant's electric power demand. GE engineered and supplied the system which consisted of the turbine/generator, waste heat recovery boiler, switch gear, transformers, and microprocessor control system. The system was brought online for full operation on July 5, 1984. Besides providing power to the plant the CHP system also has the capability to supply power to the grid during plant downtimes.

CF Industries acquired MS Chemical Corporation's Yazoo City Plant in 2010 and continues to operate the CHP system. The plant produces up to 1.225 million tons of nitrogen products for agricultural and industrial use. Over the last few years, the complex has completed \$25 million per year in capital improvements to increase capacity, modernize infrastructure and improve energy efficiency.

Quick Facts

LOCATION: Yazoo City, Mississippi

MARKET SECTOR: Chemical Manufacturer

FUEL: Natural Gas

MAX CAPACITY: 20 MW

ENERGY OUTPUT: Electric power is generated at 13.8 kV but can be boosted to 115 kV if supplied to the grid

USE OF THERMAL ENERGY: Process Steam

IN OPERATION SINCE: July 5, 1984

EQUIPMENT:

- One (1) General Electric LM-2500 gas turbine (aircraft derivative engine) generator set
- One (1) Waste heat recovery boiler (WHRB) capable of providing 600 psig steam
- Additional natural gas burners are installed between the LM-2500 and the WHRB for supplemental firing if needed

ESTIMATED YEARLY SAVINGS: \$5,616,600

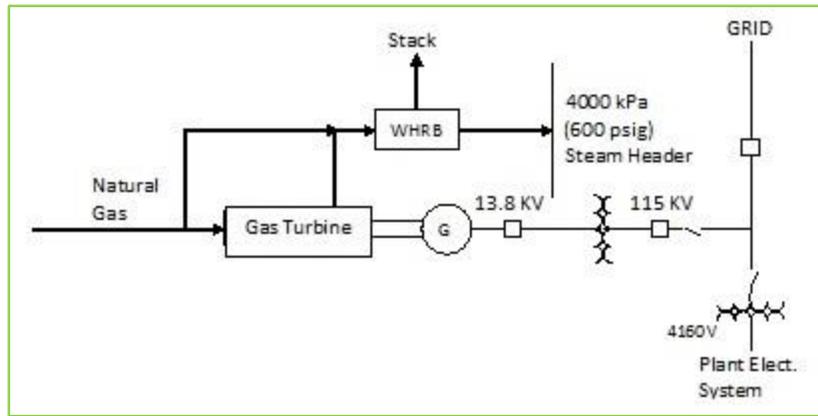
EFFICIENCY: 84%



CF Industries Yazoo City

CHP System Operation

Increasing electrical costs prompted the MS Chemical Corporation facility in Yazoo City, MS to consider the installation of a CHP system in the early 1980's. After an extensive and thorough evaluation, including consideration of twenty turbine/generator sets, MS Chemical decided to install a General Electric LM-2500 gas turbine/generator set, which is an aircraft derivative engine. This system did not offer the lowest installed cost per kW of generation capacity, but it did offer a high thermal efficiency (approximately 84%) as well as a close fit to the plant's electric power base load.



CF Industries Yazoo City Plant CHP Diagram

The system was designed by both MS Chemical and GE. GE supplied the turbine/generator, waste heat recovery boiler, inlet air filter, duct work, major electrical switch gear, transformers, and microprocessor control system. MS Chemical provided all associated engineering plans for installation and plant integration as well as electrical interconnections to tie-in to the local utility grid. Natural gas fuels the gas turbine and waste heat from the turbine is supplied to a waste heat recovery boiler, which in turn produces steam for the facility process. The hot gas duct between the turbine and the waste heat recovery boiler is equipped with natural gas burners for supplemental firing. The fuel flow to these burners can be controlled to maintain pressure on the plant steam header. The waste heat recovery boiler is also equipped with an economizer in order to maximize waste heat recovery. Installation of this system allowed the facility to discontinue the use of two natural gas fired auxiliary boilers which were previously employed to supply the 600 psig steam.

Electric power is generated at 13.8 kV, and can either be supplied to the plant equipment or boosted by transformers to 115 kV and supplied to the Mississippi Power electrical grid. During the system's first years of operation, the average electrical production cost for the CHP system has been approximately \$0.017/kWh compared to the average MS Power price of \$0.05/kWh. An operating summary for the first year of the system's operation can be found in the following table:

Operating Summary (Year 1)	
Fired hours	8611
Onstream factor	97.4%
Power generated, kWh	170.2 X 10 ⁶
Average output, MW	19.9
Steam production	118,000 lb/hr
Fuel to electric power	4,000 BTU/kWh

To read more about this project, see "[Cogeneration in a Nitrogen Fertilizer Complex](#)", Plant/Operations Progress (Vol. 5, No. 2), April, 1986.

For More Information

U.S. DOE SOUTHEAST COMBINED HEAT AND POWER TECHNICAL ASSISTANCE PARTNERSHIP

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