

U.S. DOE



CHP  
TECHNICAL ASSISTANCE  
PARTNERSHIPS

# POET Biorefining & City of Macon, Missouri

## 10 MW CHP Application

### Project Overview

The City of Macon, Missouri, in partnership with POET Biorefining (formerly Northeast Missouri Grain, LLC) maintains a 10 Megawatt Combined Heat and Power (CHP) system. The CHP system provides nearly 60% of the steam requirements of the POET facility (which produces 50 million gallons of ethanol annually along with liquefied CO<sub>2</sub>, and dried distillers grains for animal feed) and provides full electrical backup power to the ethanol plant should the local utility grid experience a power outage.

The CHP system utilizes one 10 MW Solar Mars® 100 Gas Turbine Generator with Deltak heat recovery steam generator (HRSG) that captures the exhaust heat from the turbines to produce approximately 51,000 lbs/hr steam that can satisfy up to 60% of the thermal requirement of the ethanol production process. The ethanol plant also has two natural gas boilers (110,000 lbs/hr capacity) that supplement the thermal energy provided from the CHP system.

In normal operation, the power from the CHP system is fed directly into the power grid that serves the local area including the ethanol plant. However, with an electric substation installed at the plant as part of the CHP system, the ethanol plant has the capability to disconnect from the local grid should the grid experience an outage and have the CHP system supply the entire load required by the plant. According to Steve Murphy, the General Manager of ethanol plant, they have experienced numerous grid outages since CHP operations began in 2003 and have successfully maintained operation of the plant during these outages by switching the load totally to the CHP system.

### Quick Facts

**LOCATION:** Macon, Missouri

**ETHANOL CAPACITY:** 50 million gallons per year

**PROCESS STEAM REQUIRED:** 85,000 lb/hr at 125 PSI

**PRIME MOVER:**

Solar Mars™ Natural Gas Turbine

**GENERATING CAPACITY:** 10 MW

**HEAT RECOVERY EQUIPMENT:**

Deltak Heat Recovery Steam Generator

**CHP MAXIMUM THERMAL OUTPUT:** 51,000 lb/hr at 125 PSI  
**IMPLEMENTATION COST SPLITS:**

City of Macon – All CHP equipment

POET – Building, water/steam system controls

**ANNUAL PLANT EXPENDITURE SPLITS:**

City of Macon – 50% of fuel cost

– 100% of O&M cost

POET – 50% of fuel cost

– 100% of water treatment cost

**ETHANOL PLANT ENERGY SAVINGS:** 15–25% reduction in natural gas steam producing costs

**AVOIDED OUTAGES:** Ethanol plant maintained operation during numerous grid outages since 2003

**BEGAN OPERATION:** 2003



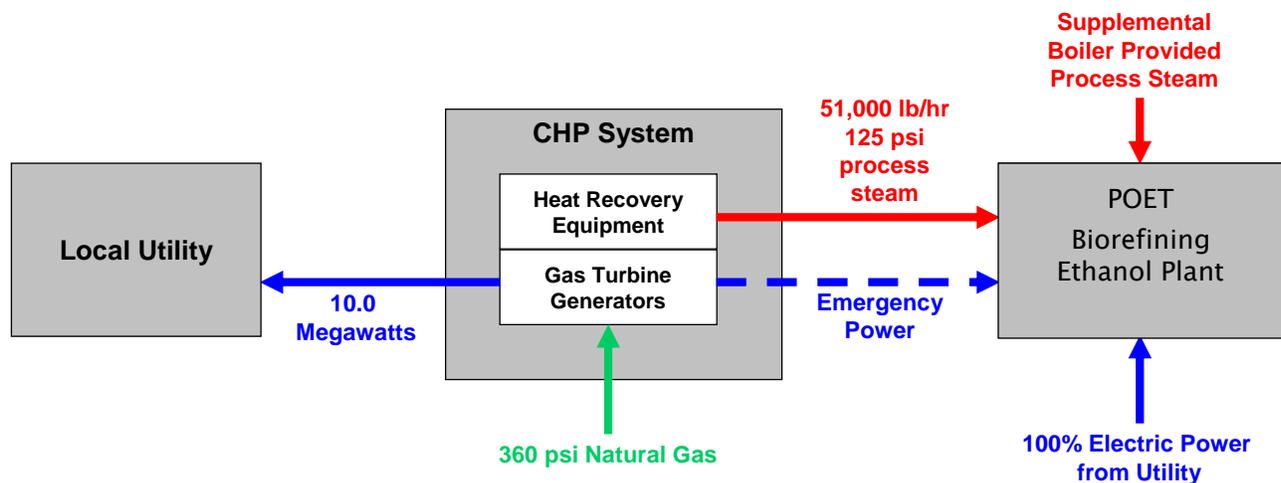
Ariel View of POET Biorefining Site

## The Solution and Unique CHP Partnership

In 2002, Macon Municipal Utilities approached the POET Biorefining plant with the idea to investigate CHP as a joint partnership between the utility and POET. The design engineers of Shafer, Kline & Warren, Inc. (SKW) were brought on to turn the CHP idea into a reality.

After reviewing several CHP options, the City of Macon and POET Biorefining decided on a 10 Megawatt CHP system that would be built on-site at the ethanol plant, but **purchased, operated and maintained by the City of Macon**. The only costs POET Biorefining would incur would be the building expansion to house the CHP system, water and remote controls.

The ethanol plant and municipal utility entered into a unique agreement with each entity paying 50% of the cost of the turbine natural gas consumption. The ethanol plant would benefit by recovering the entire waste heat load (maximum 51,000 lb/hr) from the turbine when in operation. In addition, the ethanol plant would reduce annual natural gas costs by 20% and increase the electric and thermal reliability at the plant. In turn, the City of Macon would decrease the fuel costs for the generated capacity by 50% and receive credits for providing the added electric capacity to the local power pool.



CHP System Flow Diagram

## CHP Benefits to the Ethanol Plant

- Up to 60% of the ethanol plant process steam load is supplied by the CHP system.
- Maintenance of the CHP system is contracted out to Solar Turbines, Inc. No additional staffing is required by the City of Macon or POET Biorefining to operate the CHP equipment.
- If the utility grid cannot supply electric power to the ethanol plant, the CHP system disconnects from the grid and supplies all the electric power required by the ethanol plant.
- For over 10 years of CHP operation, POET has avoided many utility power outages with the backup power capability of the CHP system.
- The CHP system reduces the amount of atmospheric pollutants associated with conventional power/steam generation.

## For More Information

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

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