



East Kansas Agri-Energy, LLC

1.6 MW CHP System

Project Overview

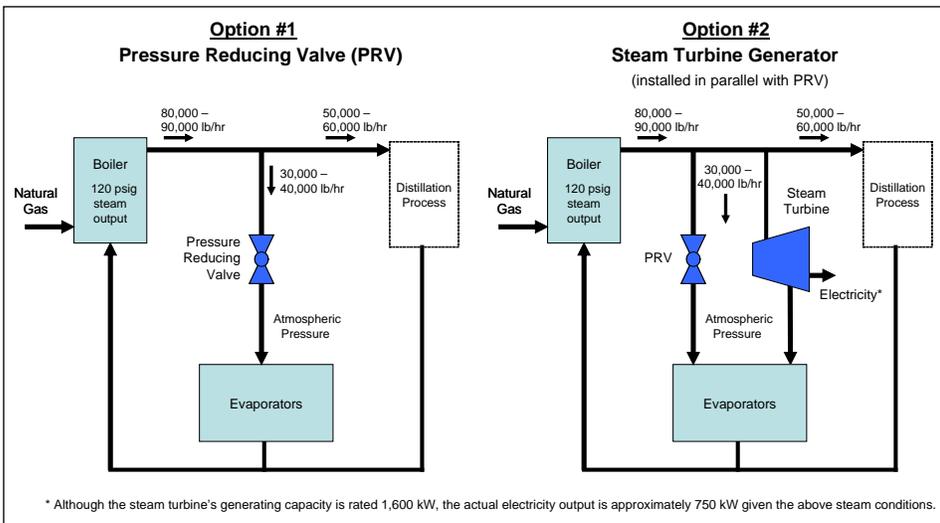
East Kansas Agri-Energy (EKAE), LLC, a 35 million gallon per year dry ethanol plant located in Garnett, Kansas, is the first ethanol plant in the U.S. to incorporate a combined heat and power steam turbine to generate electricity as part of its daily operation. The 1.6 MW Dresser-Rand KD2 steam turbine intakes 120 psig steam, produced by natural gas-fired boilers, and exhausts the steam at atmospheric pressure, producing one-third of the plant's required electricity. The 120 psig steam is utilized in the distillation process while the steam at atmospheric pressure is used in the evaporators. The steam turbine, integrated into the initial design of the EKAE facility and installed in June 2005, provides an average \$15,000 in monthly electric savings.

Background

EKAE is a farmer cooperative with more than 600 owner-members. The ethanol plant began operation in June 2005 following an industry record of only eight months of construction. The grain supply for the ethanol plant is supplied from a 150 mile radius including 10 counties in Kansas and four in Missouri.

Quick Facts

LOCATION: Garnett, Kansas
MARKET SECTOR: Ethanol Plant
ANNUAL PLANT CAPACITY:
 47 million gallons of ethanol
 90,000 tons Dry Distillers Grains
 150,000 tons Wet Distillers Grains
 150,000 tons CO₂
BOILER FUEL TYPE: Natural Gas
EQUIPMENT: Dresser-Rand KD2 Steam Turbine Generator Set
ELECTRIC GENERATING CAPACITY: 1.6 MW
INLET/OUTLET STEAM TURBINE PRESSURE:
 120 psig/ Atmospheric pressure
STEAM TURBINE NOMINAL FLOW RATE:
 40,000–50,000 lb/hr
ESTIMATED ANNUAL ELECTRIC SAVINGS:
 \$180,000 per year
BEGAN OPERATION: 2005



Source: U.S. DOE – Industrial Technologies Program, Steam Tip Sheet #20 – January 2006

Replacing PRVs with Backpressure Steam Turbines

Many industrial facilities produce steam at a pressure higher than that demanded by process requirements. Steam passes through pressure-reducing valves (PRVs, also known as letdown valves) at various locations in the steam distribution system to let down or reduce its pressure. A non-condensing or backpressure steam turbine performs the same pressure-reducing function as a PRV while converting steam energy into electricity.

In a backpressure steam turbine, shaft power is produced when a nozzle directs jets of high-pressure steam against the blades of the turbine's rotor. The rotor is attached to a shaft that is coupled to an electric generator. The steam turbine does not consume steam. It reduces the pressure of the steam which is subsequently exhausted into the process header.



East Kansas Agri-Energy (EKAE) Ethanol Plant – Garnett Kansas

Source: Insights – A Publication of the Dresser Rand Company, Volume 10 No. 2.

Integrating a Steam Turbine into the EKAE Ethanol Plant

Many ethanol plants present excellent CHP opportunities due to the continuous and coincidental thermal and electric loads of the ethanol producing process. The thermal and electric loads are such that they meet the size ranges of many commercially available CHP technologies. As a result, CHP systems have been installed and are operating in a number of ethanol plants across the U.S. providing operational, economic and environmental benefits. Combustion gas turbines have been the primary technology used in the ethanol industry, and although steam turbines have been in application for a number of years, it took some time before this concept was accepted into the design of ethanol plants.

According to Ken Ulrich, Sales Manager for ICM, Inc., a design engineering firm for ethanol facilities, “We had been recommending this to clients for several years.” The ethanol producers initially indicated little interest in entering into the electric industry, stating they wanted to maintain their focus on the core business of producing ethanol. Ulrich noted many of the responses citing, “I just want to make ethanol. Why should I buy a turbine and generator when I can put in a control valve?” This was the industry reaction until EKAE realized the opportunity identified by the engineering design team of ICM, Hughes Machinery and Dresser Rand by installing the first steam turbine in a U.S. ethanol plant. “They have to drop the steam pressure anyway, why not make electricity,” noted Kent Calvert, Sales Manager for Hughes Machinery Company. The steam turbine would provide a mechanism for electric savings and be environmentally conscious.

“I have to make the steam for the production process. This is a classic cogeneration application that’s been around forever. It’s nearly a perfect conversion of heat to work when you have an application where you use low-pressure exhaust steam.”

*- Ken Ulrich, Design Engineer
ICM, Inc.*

Source: Insights – A Publication of the Dresser Rand Corporation, Volume 10 No. 2 – 2007

For More Information

U.S. DOE MIDWEST CHP TECHNICAL ASSISTANCE PARTNERSHIP

1309 South Halsted Street (MC156), Chicago, Illinois 60607-7054

Phone: (312) 996-4490, Fax: (312) 996-5620

www.MidwestCHPTAP.org

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.