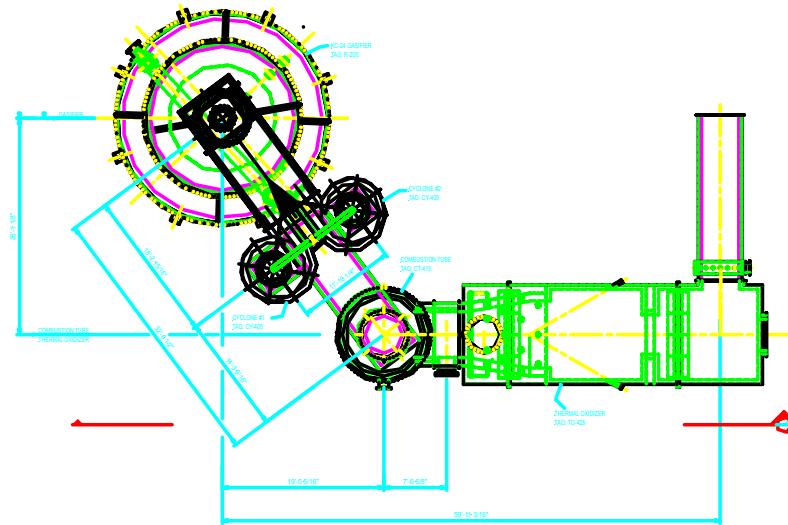


Case Study Wood Waste Gasification & Thermal Oxidation



Preliminary Plan View
Commissioning Scheduled for June 2006

Summary Description

Gasification of wood waste to fuel a thermal oxidizer. Design solid feed rate of two hundred eighty-eight tons per day. Thermal oxidizer exhaust used to produce fifty thousand pounds per hour of high pressure, super-heated steam and to provide thirty-five million Btu's per hour of thermal energy for drying duty. Super-heated steam sent to backpressure turbine to produce approximately one megawatt of electricity and exhaust process steam for use in host ethanol plant.

Project Location

Little Falls, Minnesota

Background Description

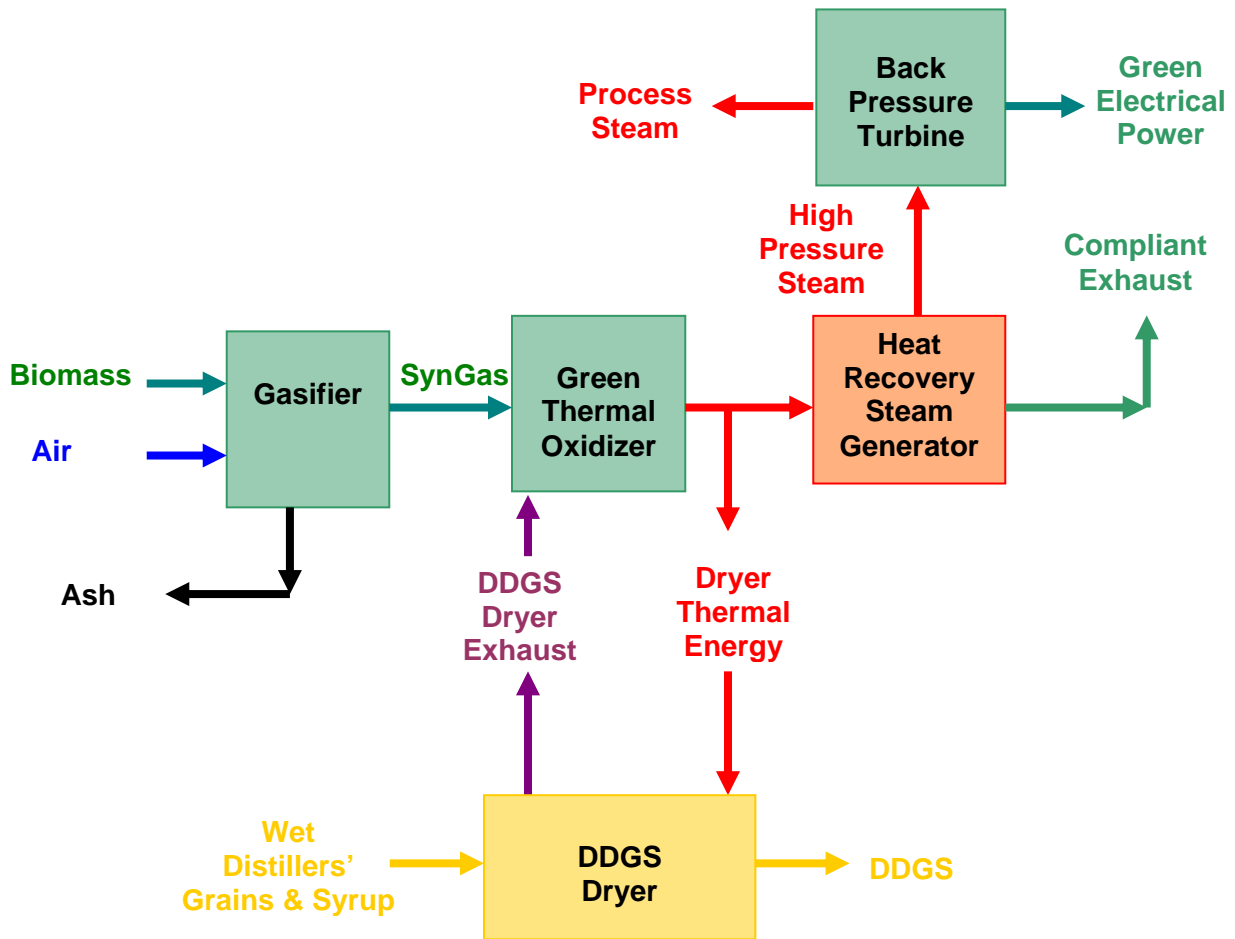
The spent distillers' grains and syrup, DDGS, from ethanol manufacturing are normally dried and sold as animal feed. The exhaust from the DDGS dryer contains volatile organic compounds and for compliance with air quality regulations, these organic compounds must be destructed.

In a conventional arrangement, these organic compounds could be destroyed by direct thermal oxidation, regenerative or recuperative thermal oxidation. However, each of these three possible technologies has drawbacks. The exhaust from the DDGS dryer is dust laden. This entrained organic dust will plate on heat recovery media in a regenerative thermal oxidizer or on heat recovery surfaces of recuperative thermal oxidizers, fouling both technologies. The application of a fossil fueled direct thermal oxidizer adds significantly to the energy cost of operations of the ethanol plant.

Primenergy's unique solution was to apply our knowledge of solids gasification and thermal oxidation.

The Little Falls Project

Gasification is the thermochemical conversion of an organic solid into a combustible gas. Applying gasification technology to supply the auxiliary fuel for thermal oxidation eliminates the need for fossil fuel and stabilizes energy costs. The block flow diagram following depicts this unique process arrangement.



The heart of the process is an atmospheric updraft gasifier. This gasifier will convert waste wood or other biomass materials into a hot, combustible synthesis gas, with calorific constituents consisting primarily of carbon monoxide and hydrogen. Hot synthesis gas leaving the gasifier is directed to a thermal oxidizer and mixed with the dried distillers' grains and syrup (DDGS) dryer exhaust. The synthesis gas is combusted within the thermal oxidizer and thermally converts the volatile organic compounds contained in the dryer exhaust into carbon dioxide and water. Exiting the thermal oxidizer, the hot combustion products are split and sent to both a heat recovery, steam generator and back to the DDGS dryer.

The steam generator recovers thermal energy to produce high-pressure, superheated steam (600 psig and 800 °F). The second stream of combustion products exiting the thermal oxidizer is supplied as the thermal energy requirement for the DDGS dryer.

High-pressure steam from the heat recovery, steam generator will be first sent to a backpressure steam turbine to generate approximately 1,000 kW of power that can be marketed as “green power” or consumed by the ethanol plant. The steam exiting the turbine will be at a lower pressure of 150 psig. The ethanol plant can use this lower pressure steam for its processes.

The combination of biomass gasification and thermal oxidation provides not only a unique solution for environmental compliance, but displaces the entire fossil fuel requirement for the ethanol plant. This process arrangement will ensure an extremely clean exhaust capable of meeting any emissions guideline, and eliminates fossil fuel from ethanol manufacturing.