Bioenergy Insight

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Survival of the fittest

Will Brazil's current economic climate lead to an energy crisis or a huge potential for renewables?

Safety bubble

Domes and their systems provide superior fire protection for storing wood pellets

Regional focus: bioenergy in South America

East Texas Electric Coop. reports continued success seven months after commercial operations began at its state-of-the-art biomass facility

Going strong

East Texas Electric Cooperative (ETEC), a consortium of East Texas electric cooperatives, has invested in a 50MWe biomass power plant to continue providing safe, reliable and affordable power to its members.

Formed in 1987, ETEC is pursuing a diversified generation portfolio through investment in modern, efficient facilities. The new biomass powered facility allows the cooperative to continue to pursue innovations that will allow for the integration of renewable energy sources while preserving affordability and reliability.

Gemma Plant Operations, a subsidiary of Gemma Power Systems, is the operating partner for the new biomass facility. The plant entered commercial service on 31 October 2014. After seven months of operation Gemma has either met or exceeded plant availability goals while maintaining 100% compliance with all regulatory permit requirements.

Construction of the plant and its support equipment took about two years. The biomass facility, which is located on 65 acres of land near Woodville, Texas, provides 28 full time jobs. Fuelling the operation requires delivery of about 6,000 tonnes of woodchips each week, supporting about 75 timber supply and transportation jobs in the region. The facility exclusively burns chipped forest waste.

The steam generation system was designed and supplied by Riley Power,a Babcock Power company. The boiler nominal capacity is 431,400lbs of steam per hour at superheated conditions of 1,550 psig and 513°C. The boiler's furnace design allows for additional residence time for staged combustion to enhance reduction of the products of combustion, particularly carbon monoxide (CO), nitrogen oxides (NOx) and particulate matter.

> Integral to the steam generator is the lower combustion system, manufactured by Detroit Stoker Company

Technology

Integral to the steam generator is the lower combustion system which incorporates a water-cooled, vibrating grate system manufactured by Detroit Stoker Company. The vibrating grate system is a modular design for easy installation, which for this project required four modules for a total active combustion area of 730ft^2.

In addition to the grate system, a staged fully automated secondary air system, specifically designed for this furnace, was provided. Fuel is distributed into the furnace with air swept distributors to maintain a consistent fuel and ash bed to mitigate fluctuations in boiler performance related to changes in fuel quality.

In the process of tuning and refining the operation of the plant during the first months of operation, Gemma Plant Operations and Riley personnel struggled with maintaining a constant boiler pressure during rapid fuel moisture changes. The team worked together and developed a unique and effective refinement to the combustion control system.

The system takes advantage of the firing rate (FR) indication provided by Riley, which measures the rate of change of the average steam drum metal surface temperature. The FR measurement is sensitive to changes in actual firing rate so corrections to fuel flow and forced draft (undergrate) airflow are made

Bioenergy biomass boilers

Owner/developer	ETEC
Operator	Gemma Plant Operations
Engineers/architect	Bibb Engineers
EPC	Gemma Power Systems
Steam generator supplier	Riley Power
Steam generator type and design	• Single drum, field erected • 431,400lbs of steam/hr • 1,550 psig and 513°C steam conditions • Economizer • Tubular air heater to 260°C • Mechanical dust collector
Combustion system supplier	Detroit Stoker Company
Combustion system type	• Water-cooled, vibrating grate • Air swept fuel distributors • Secondary air system
APC provider	Babcock Power Environmental
APC system	• SCR – NOx and CO reduction • Bag house – particulate matter
Emissions permit requirements	NOx: 0.075lbs/MMBtu CO: 0.070lbs/MMBtu PM: 0.025lbs/MMBtu HCl: 0.003lbs/MMBtu VOC: 0.010lbs/MMBtu SO_2: 0.025lbs/MMBtu NH_3: 15 ppm
Turbine generator supplier	Shin Nippon/Brush
Turbine generator	Extraction condensing 49.9MW gross
Fuel handling	Jeffery Rader (TerraSource Global)

long before boiler pressure is affected. The result is a stable boiler that maintains pressure precisely and is able to compensate for rapid changes in fuel moisture without impacting power production, ash generation or stack emissions.

Due to ETEC's environmental stewardship, compliance with state and federal rules for air emissions were key in pursuing this project. Subsequently, the major pollutants of concern were reviewed and evaluated based on published compliance values. Of greatest concern were CO, acid gases (HCl), NOx and particulate matter. Post combustion reduction in both CO and NOx was required and compliance was ensured with the design and supply of a Multi-Pollutant Catalytic Reactor (MPCR) reduction system by Babcock Power Environmental (a Babcock Power company), commonly referred to as Selective Catalytic Reduction (SCR).

Evaluation of particulate matter emissions revealed that a fabric filter arrangement would ensure compliance. CO emissions often associated with high moisture content of biomass fuels and lower furnace combustion was addressed by high pre-heated combustion air temperatures provided by a split air heater design to achieve high air temperatures while maintaining sufficient flue gas temperature to operate the MPCR.

Additionally, conservative boiler and grate thermal release rates were included in the design to obtain the required temperatures and residence times required to ensure permit compliance values. A continuous emission monitoring system is installed to measure the following pollutants: NOx, CO, CO_2, O_2, NH_3 as well as opacity. To ensure that the plant is entirely compatible with ETEC's environmental stewardship goals, no secondary fuel capabilities were installed and no fossil fuels are used at any time.

For more information:
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ETEC's 50MW biomass power plant in Texas, US