

ENERGY PRODUCTS OF IDAHO

EPI NEWSLETTER

EPI NEWSLETTER SUMMER - 2010

WHAT'S NEW AT ENERGY PRODUCTS

EPI completed the start-up and commissioning of a 200MMBtu/hr energy system with a fluidized bed advanced-staged gasifier. The FBSG-1628 system generates 100,000lbs/hr of steam plus up to 100MMBtu/hr of hot gas for product dryers. Fuel feed for this unit consists of wet hog fuel, dry product trim and saw dust. The dry fuel feed is injected inbed and the wet feed is introduced above bed.

Pouring refractory - above

New staged gasifier/boiler island completed - below

Prior to the addition of the staged gasifier the product dryers operated using steam as the heat source. During this project the dryers were converted to direct hot gas contact. Feedback from operations indicates the drying time has reduced significantly.



NEW PROJECTS

EPI recently completed fabrication for two new 120,000 lb/hr combined heat and power (CHP) steam plants. These units are under construction and will be ready for commissioning in the summer of 2011. These facilities will generate high pressure steam for power generation and also provide process steam. The fuel blend for these units includes biomass and shredded tires.



SPECIAL POINTS OF INTEREST:

- *Equipment Fabrication*
- *Projects in Engineering*
- *Gasifier Add-ons*
- *Staged Combustion*

INSIDE THIS EDITION

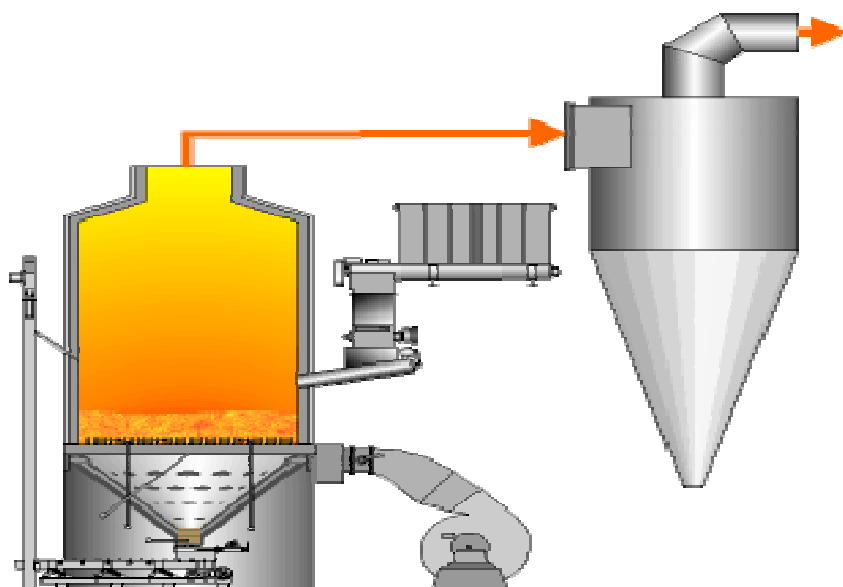
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EPI produced the first wood fired fluidized bed gasifier power plant in the US.....

Staged gasification combines the advantages of gasification and the high conversion efficiencies of fluidized bed into a single vessel.....

EPI FLUIDIZED BED GASIFICATION TECHNOLOGY

EPI fluidized bed gasifiers convert biomass waste products into a combustible gas that can be fired in a boiler, kiln or other energy load. **EPI produced the first wood fired fluidized bed gasifier power plant in the US** and continues to provide innovative gasifier solutions to unique industry applications. EPI is currently promoting the gasifier technology as an add-on to utility coal fired power plants to co-fire with a portion of the fuel coming from clean, renewable, biomass.



In a fluidized bed gasifier, the bed material can either be sand or char, or some combination. The fluidizing medium is usually air; however, oxygen and steam are also used. The fuel is fed into the system either above-bed or directly into the bed, depending upon the size and density of the fuel and how it is affected by the bed velocities. During normal operation, the bed media is maintained at a temperature between 1000°F and 1800°F.

When a fuel particle is introduced into this environment, its drying and pyrolyzing reactions proceed rapidly, driving off all gaseous portions of the fuel at relatively low temperatures. The remaining char is oxidized within the bed to provide the heat source for the drying and de-volatilizing reactions to continue. In those systems using inert bed material, the wood particles are subjected to an intense abrasion action from fluidized sand. This etching action tends to remove any surface deposits (ash, char, etc.) from the particle and expose a clean reaction surface to the surrounding gases. As a result, the residence time of a particle in this system is on the order of only a few minutes, as opposed to hours in other types of gasifiers.

The large thermal capacity of inert bed material plus the intense mixing associated with the fluid bed enable this system to handle a much greater quantity and, normally, a much lower quality of fuel. Experience with EPI's fluidized bed gasifier has proven the ability to utilize fuels with up to 55 percent moisture or ash contents in excess of 25 percent. Because the operating temperatures are lower in a fluid bed than other gasifiers, the potential for slagging and ash fusion is reduced, thereby increasing the ability to utilize high slagging fuels.

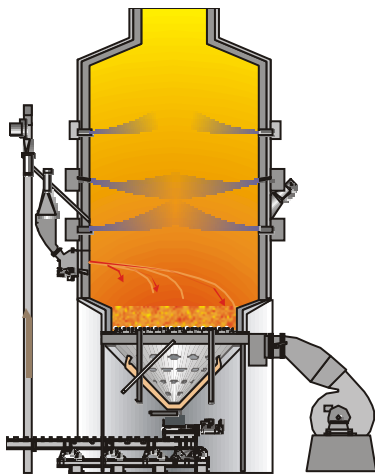
Energy densities in a fluid bed gasifier are dependent on the fuel characteristics and have been reported as high as one to two million BTU/hour/ft.² Normally, the dryer the fuel, the higher the energy density and the better the quality of low Btu gas produced.

Staged gasification combines the advantages of gasification and the high conversion efficiencies of fluidized bed thermal oxidizer into a single vessel. This technology is ideally suited for gasification applications that involve at least a portion of steam generation for power or process. In the staged gasifier, the fluid bed is operated as a gasifier (sub-stoichiometric air) and the vessel furnace (second stage) is operated as a staged, excess air oxidation zone. After the low Btu gases have been generated in the fluidized bed zone they enter into the furnace zone wherein additional air for complete thermal conversion

Gasification Cont'd.

is provided. The air is introduced in multiple levels, or stages, whereby the temperature profile of the reactant gases can be better controlled to eliminate formation of gaseous pollutants, such as nitrogen dioxide (NO_x). The design of this second stage oxidation unit provides for significant residence time, plus further mixing and enhanced turbulence in the gas stream at each stage of additional air injection. As a result, emissions are generally lower because the thermal oxidation is completed in an ideal combustion environment where residence time, turbulence and temperature are optimized. In addition, heat removal from the furnace via evaporator surface area can enhance the boiler efficiency and further control the combustion temperature.

Staged Gasifier



- ✓ **Combines a Gasifier Bottom with a thermal oxidizer upper vessel.**
- ✓ **Gasifier bed operates substoichiometricly with typically 30% of the oxygen/air required for complete combustion.**
- ✓ **Staged gasifier produces low Btu gas (LBG) @-180-200 Btu/scf.**
- ✓ **LBG is fully oxidized in the upper vapor space of the Staged Gasifier.**
- ✓ **Hot gases ducted to boiler or other thermal energy user**

A simplified diagram of the staged gasification cell shows the fluidized bed/ gasification zone of the unit located in the base section and is represented as an oxygen starved zone in comparison to the second stage zone. The balance of the air required for combustion of the gas produced by the initial gasification stage is introduced into the second stage area above the bed.

Utilizing this technology, the incoming biomass material is converted first to a gaseous fuel mixture and then to a fully oxidized, hot fluegas comprised of water vapor, air, and carbon dioxide. Because the emissions are minimized, the unit is capable of meeting environmental permitting requirements, even in non-attainment areas. EPI's advanced staged gasifier technology has been permitted in non-attainment areas such as New York state. This technology is in operation in Canada in two 200MMBtu/hr EPI fluidized bed systems and has successfully been utilized to retrofit an existing 16 MW power boiler in New England. In the latter application, selective, non-catalytic reduction, or SNCR, technology was also incorporated into the staged furnace to further reduce NO_x emissions from the oxidation zone. The technology is qualified as Advanced Biomass Conversion Technology for renewable energy credits requirements in a number of states.


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Up Coming Events in Marketing:

Jim Starkey will be presenting a paper on “Biomass Power Generation Utilizing Flexible Fluidized Bed Technology” at the Sustainable Energy and Infrastructure Forum at Caltech in Pasadena, CA on Sept 17, 2010.

Patrick Travis is presenting a paper at the Southern Biomass Conference titled “Concepts in Repowering and Co-firing Coal Boilers with Biomass Utilizing State-of-the-Art Fluidized Bed Gasifiers” on November 4th, 2010.

EPI is also exhibiting at the Renewable Energy World Conference, Tampa, FL on March 8-10th, 2011.

Technical Publications

This year Patrick Travis presented papers at Power Engineers Renewable Rondevous, Northwest Biomass Conference and Coal-gen 2010. These papers covered topics on the retrofit of coal boilers with fluidized bed thermal oxidizers and gasifiers as well as various methods of co-firing biomass in utility coal boilers.

Jim Starkey presented a paper on Gasification Systems at the International Conference on Thermal Treatment Technologies and Hazardous Waste Combustors in San Francisco, CA on May 18, 2010 and on Biomass Power Generation at the Fuel Ethanol Workshop and Expo in St. Louis on June 16th.

Visit EPI's web site for access to other technical publications including:

- Green Power Initiative - Renewable Green Energy In Fossil Fuel Fired Power Plants using Low-Impact Biomass Gasifier Additions for Coal and Oil Fired Facilities.
- Board Plant Energy Systems with Total VOC Destruction Using Closed Loop Fluidized Bed Combustion Technology
- Paper Sludge: Waste Disposal Problem or Energy Opportunity
- Flexible Fuel Boiler Curves “The Natural Gas Blues”
- Repowering Options: Retrofit of Coal-Fired Powered Boilers using Fluidized Bed Biomass
- Gasification Advancing Waste-to-Energy Technology Design and Performance of EPI Fluidized Bed RDF-Fired Power Plants