

Development and Demonstration of a Biomass Boiler for Food Processing Applications

Pilot Demonstration of a Biomass Boiler that Utilizes a Combination of Wood Waste and Tire-Derived Fuel

Introduction

Boilers are a critical element of industrial operations in the United States, consuming roughly 20% of the natural gas used in the manufacturing sector. Within the U.S. manufacturing sector, the food processing industry alone utilizes over 10,000 boilers to serve its heating and power needs. More than 70% of these boilers consume natural gas, amounting to an annual consumption of 237 trillion Btu.

This project aims to reduce the food processing industry's large natural gas consumption through the research, development, and demonstration of biomass boiler applications that can be widely commercialized throughout the industry in an effective and cost-competitive manner. The project will include the design and pilot demonstration of an innovative biomass boiler system utilizing a combination of wood waste and tire-derived fuel (TDF) waste.

Through combustion and emissions controls optimization, packaging engineering, scaling development, and economic analysis, the end result of this project will be the offset of the majority of the natural gas consumption necessary to produce steam at Frito-Lay Incorporated's Topeka, Kansas processing facility. Additional research will be performed to assess alternative renewable fuel sources, particularly on-site food processing waste streams, alternate feedstock combustibility, boiler sizing, and controls and process system integration issues.

Benefits for Our Industry and Our Nation

Successful project development and demonstration is expected to have major energy, cost, and environmental benefits, including the following:

- Significant reduction in natural gas consumption at the Frito-Lay facility
- Significant cost savings to Frito-Lay through avoided natural gas purchases and reduced food processing waste handling costs
- The diversion of industrial and commercial waste streams from landfills to provide useful work as a biomass fuel source

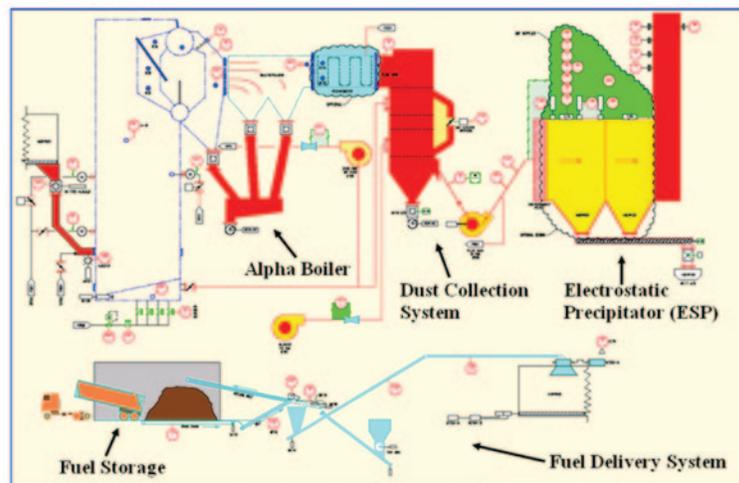


Figure 1. Planned system process flow diagram

Illustration courtesy of Burns & McDonnell Engineering Company, Inc.

Applications in Our Nation's Industry

It is estimated that up to 20% of the 10,000 boilers currently utilized in the food processing industry can be replaced by the proposed biomass boiler technology. Furthermore, the reference design developed in this project will be utilized to proactively introduce new biomass boilers into all U.S. manufacturing industries that operate industrial boilers.

Project Description

The goal of this project is to design, install, and demonstrate an innovative biomass boiler pilot project that will offset a significant percentage of the natural gas consumption used for steam generation at Frito-Lay's Topeka, Kansas processing facility. Supporting research efforts will identify and document biomass boiler controls, sizing, integration, and cost-competitiveness issues to promote wider replication and adoption of this technology within Frito-Lay's facilities and the wider food processing industry.

Barriers

- Extremely fast and significant process heat turndown requirements
- Scaling down of stoker-fired biomass boilers to meet industry requirements
- Biomass fuel supply availability, contracting, and economics
- Environmental controls, requirements, and permitting

Pathways

Based on the preliminary concept, development efforts, and assessment of biomass boiler technology options, Frito-Lay will install a 60,000 lb/hr stoker-fired (saturated steam) boiler to serve a significant portion of the process and building steam demand at their Topeka, Kansas facility. According to initial biomass fuel sourcing studies, the boiler will be designed to accommodate wood waste and TDF fuel sources, with potential for incorporating packaging and other on-site food processing-related waste into the boiler fuel stream. It is estimated that the boiler will consume 35,000 tons of wood waste and TDF fuel per year.

Milestones

This project started in April 2009.

- Year 1: Preliminary design, including sizing and specification development, controls and instrumentation specifications development, the commencement of permitting activities, and the finalization of fuel source contracts
- Years 1–2: Final design and installation task, including final design packages development; the selection of vendors; and the completion of all site permitting, site preparation, and boiler installation
- Year 2: System commissioning, including plant staff operations and maintenance training
- Year 2: Full system operation
- Years 2–3: Performance assessment, including documenting the project's ability to continuously serve the process and build heating loads with a biomass fuel source

Commercialization

The project partners will use separate but synergistic pathways to commercialize the biomass boiler, with each pathway led by each of the four project industrial partners. Three key performance specifications have been identified to help facilitate conversions from the status quo of natural gas boilers. These specifications take into consideration the specific thermal demands of different food processing applications. First, the biomass boiler technology will be able to be down-sized. Second, system components will be packaged to ease installation and reduce capital and maintenance costs. Third, adaptable controls and instrumentation will be developed. For commercialization, the project partners will support each other to successfully replicate the success of this project internally (Frito-Lay, PepsiCo) and externally through their own sales channels (Burns & McDonnell, CPL Systems, and Alpha Boilers).

Project Partners

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