Torrefied Wood Pellets Successfully Tested for Co-Firing at Gulf Power Company

Trial torrefied wood pellets were exceptionally water resistant and strong, but subsequent products were not quite as durable

New environmental regulations and mandates in the United States and Canada have led many electric utilities to explore various renewable energy options, including co-firing biomass in coal-fired power plants. One promising form of biomass is torrefied wood pellets and several EPRI members were interested in testing its effectiveness for co-firing. Southern Company volunteered one of its power plants as a test site. Southern Company and Ontario Power Generation provided staff to coordinate and manage the tests. A series of test burns was conducted in March 2013. Varying percentages of torrefied wood pellets were successfully co-fired with coal, including tests using 100% torrefied wood. These tests were the first time that a coal-fired unit in the United States was fired with 100% biomass. In addition, Southern Company set a company record by co-firing 26 megawatts of renewable energy. The tests showed that torrefied wood pellets could be successfully co-fired with coal and that carbon losses and emissions of pollutants were reduced.

Biomass Test Site Identified for Co-Firing Torrefied Wood

In the United States, many states have Renewable Portfolio Standards which mandate that a certain percentage of electricity must be generated from renewable fuels over the next 10-20 years. In addition, the new Mercury and Air Toxics Standards limit the amount of mercury and other air pollutants that can be emitted from power plants. As a result, many electric utilities including Southern Company may retire older coal-fired units due to the costs of installing environmental controls to comply with new regulations. In Ontario Canada, the government has directed utilities to cease coal-fired generation by the end of 2014. In response to these regulatory and environmental drivers, electric utilities are evaluating the potential for generating renewable energy through co-firing biomass with coal in existing coal-fired power plants.

Many forms of biomass are not efficient for co-firing but torrefied wood pellets has the potential for success. Torrefaction is a process that roasts biomass without the presence of oxygen, converting it to a relatively high-energy fuel. The resulting torrefied wood pellets handle and burn much like coal and can potentially be co-fired with coal while requiring few if any modifications to existing coal-fired units. Several EPRI members were interested in determining the effectiveness of torrefied wood pellets for co-firing and asked EPRI to conduct a test burn of the fuel. Gulf Power—a subsidiary of Southern Company—volunteered a coal-fired plant as the test facility. The plant had been

"EPRI's expertise was invaluable and pooling resources with other utilities allowed us to perform a much more robust test program and added to the value of the results."

~ Jeff Wilson
Southern Company

Challenge

Southern Company and Ontario Power Generation wanted to assess the viability of torrefied wood biomass as a potential renewable fuel source.

Solution

A torrefied wood test burn was conducted at a Gulf Power coal-fired power plant.

Results and Benefits

The test burn was the first time a coal-fired unit in the United States was fired using 100% biomass fuel.

Southern Company is evaluating the potential use of torrefied wood across its existing fleet and planning additional tests.

Ontario Power Generation is building a biomass fuel characterization database and assessing various biomass options to replace coal-fired generation.

the site of other tests and experiments in the past and its two 40-megawatt pulverized coal-fired units were considered the ideal size for a test of torrefied wood pellets. The objectives of the test were to determine the safety requirements for handling and burning torrefied wood at a power plant, firing a high percentage of torrefied wood—potentially up to 100%–and determining the effects of co-firing torrefied wood on maximum load, operations, emissions and efficiency.

Torrefied Wood Successfully Tested

Staff from Southern Company and its subsidiaries helped coordinate and manage a series of tests in March 2013. Ontario Power Generation provided assistance as well. "We saw this as a learning opportunity but we could also add value and make it more of a success because we had prior operational experience burning wood pellets in a coal fired boiler, and we had done a lot of laboratory analysis on similar fuels," says Denym Burlock, a performance engineer at Ontario Power Generation.

The fuel for these tests was manufactured by torrefying already prepared wood pellets rather than by making pellets from torrefied wood. Several preliminary tests were conducted, including testing of torrefied wood properties and grinding and explosion tests. These tests indicated that torrefied wood fuel dust needed to be treated as potentially explosive, so additional safety measures were put in place. Other challenges were the limited supply of torrefied wood due to its high cost and heavy rains that significantly increased its moisture content.

Several mill tests were conducted with varying percentages of torrefied wood being co-fired with coal. Some of these tests also measured boiler performance. Tests were also conducted that involved burning only torrefied wood blends. In addition to this being the first U.S. coal-fired unit fired with 100% biomass, the test burn was 10 times larger than any previous test using torrefied wood. Southern Company also set a company record for co-firing 26 megawatts of renewable energy. Although efficiency was reduced due to the high moisture content of the fuel, adding torrefied wood reduced unburned carbon losses and emissions of nitrous oxides, sulfur dioxides and other pollutants. Several valuable lessons were also learned about how to improve the safety and handling of torrefied wood. "The performance information evaluated in this project is critical for future users. But perhaps the most durable result from this project is the team's overall approach to safety," according to Dave O'Connor, the EPRI project manager for this effort.

Southern Company has communicated the results at several conferences and plans to test a similar product at another of its coal-fired units. Ontario Power Generation is adding the data from the tests to the biomass fuel database it is developing and also in comparative analyses between different types of advanced biomass fuels. Ten individuals from four companies were recipients of a 2013 EPRI Technology Transfer award for their leadership in coordinating and implementing the torrefied wood test burn: Doug Boylan, G. Keith Roberts and Jeff Wilson of Southern Company, Tony Crowell, Sybelle Fitzgerald, Billy Hosey, Randy Mayo, Steve Moore and Melvin Young of Gulf Power, Billy Zemo of Alabama Power; and Denym Burlock of Ontario Power Generation.

Related EPRI Products

Title	Product ID
Torrefied Wood Field Tests	3002003268
Demonstration Development Project: Assessment of Biomass Repowering Options for Utilities	1022219
Test Burns of Torrefied Wood	1017602

For more information, contact the EPRI Customer Assistance Center at 800.313.3774 (askepri@epri.com)

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