

Biomass cofiring: Technology development through the cooperative agreement between EPRI and USDOE

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The Electric Power Research Institute (EPRI) and the National Energy Technology Laboratory (NETL) of the U.S Department of Energy (USDOE) initiated a cooperative agreement to develop biomass cofiring in coal-fired boilers. This Cooperative Agreement, created in 1995, obtained significant funding from NETL and the Office of Energy Efficiency and Renewable Energy (EERE) of USDOE. The cooperative agreement significantly advanced the initial technology developments of EPRI and its primary contractor, Foster Wheeler. Further, it permitted EPRI to bring its substantial participating partners to the USDOE biomass program. Those EPRI members and cofiring partners included The Tennessee Valley Authority (TVA), GPU Genco, Northern Indiana Public Service Company (NIPSCO), and other significant electricity generating utilities in the US.

The EPRI-USDOE Cooperative Agreement capitalized upon initial cofiring research and testing at TVA sites: the Allen Fossil Plant, the Kingston Fossil Plant, and the Colbert Fossil Plant. These sites included a cyclone boiler, a tangentially-fired (T-fired) pulverized coal (PC) boiler, and a wall fired PC boiler. The initial research and testing also included the GPU Genco Shawville Generating Station, where cofiring occurred in both T-fired and wall fired PC boilers. In addition to the testing program, the EPRI cofiring demonstration effort included the development of supporting information in such areas as fuel characterization, fuel flow characteristics, the influence of biomass on coal pulverizer performance, the spontaneous combustion characteristics of biomass in power plant settings, and related issues of significance to power plant managers and personnel.

Once in place, the EPRI-USDOE Cooperative Agreement permitted the development of test and demonstration programs at the Michigan City and Bailly Generating Stations of NIPSCO, and the Seward Generating Station of GPU Genco. Further supporting studies and computer modeling efforts were achieved as a consequence of the cooperative agreement; and these led to successful programs now funded directly by NETL and the Office of Energy Efficiency and Renewable Energy (EERE) of USDOE. These tests and demonstrations were of sufficient duration to bring cofiring to a technical point where the issues associated with commercial deployment could readily be identified and resolved.

The technology developments resulting from the USDOE-EPRI Cooperative Agreement included the following (not exhaustive):

- ?? Design and development of a cofiring system for wall-fired PC boilers that separately injects the biomass into the boiler in order to achieve higher biomass cofiring percentages, and in order to avoid the significant problems associated with blending biomass and coal on the coal pile for firing in PC boilers
- ?? Supporting the switchgrass cofiring tests at Madison Gas & Electric Company, and at Southern Company, where biomass contributed >10 percent of the fuel to the boiler
- ?? Development of “designer opportunity fuels” for cyclone boilers, blending biomass with other alternative fuels such as petroleum coke in order to maximize the technical potential of both fuels

- ?? Development of complete biomass fuel profiles for selected biofuels, including determinations of chemical structure and reactivity as well as traditional fuel analyses
- ?? Development of a biomass fuels database to be used by prospective cofiring installations in evaluating the possibilities available
- ?? Development of curves and supporting technical data documenting the potential of biomass to reduce NO_x emissions from cyclone and PC boilers, and development of sufficient fuels data and combustion modeling to provide an understanding of some of the global mechanisms involved in this NO_x reduction
- ?? Development of a complete assessment of cofiring test programs throughout the US in EPRI programs and non-EPRI programs, and achieving an understanding of the technical and economic results of those programs

This paper reviews the cofiring program resulting from the USDOE-EPRI Cooperative Agreement. It identifies the accomplishments, and documents how this program set the stage for commercializing this successful technology development.