

Biomass Cofiring: A Renewable Alternative for Utilities

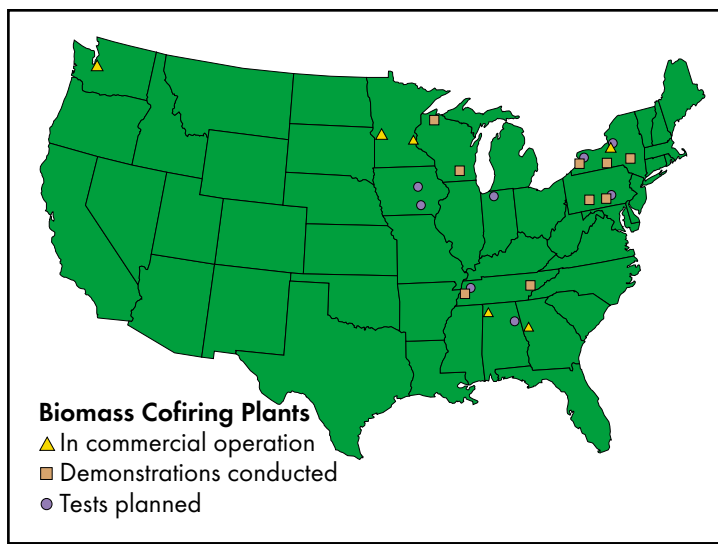


Biomass Cofiring

Cofiring is a near term, low-cost option for efficiently and cleanly converting biomass to electricity by adding biomass as a partial substitute fuel in high-efficiency coal boilers. It has been demonstrated, tested, and proved in all boiler types commonly used by electric utilities. There is little or no loss in total boiler efficiency after adjusting combustion output for the new fuel mixture. This implies that biomass combustion efficiency to electricity would be close to 33%-37% when cofired with coal. Extensive demonstrations and tests also confirmed that biomass energy can provide as much as 15% of the total energy input with only feed intake system and burner modifications. The opportunities for biomass cofiring are great because large scale coal-powered boilers represent 310 gigawatts of generating capacity. Cofiring biomass with coal offers several environmental benefits. Cofiring reduces emissions of carbon dioxide, a greenhouse gas that can contribute to the global warming effect (see picture on the reverse side). Also, biomass contains significantly less sulfur than most coal. This means that cofiring will reduce emissions of sulfurous gases such as sulfur dioxide that will then reduce acid rain. Early test results with woody biomass cofiring showed a reduction potential as great as 30% in oxides of nitrogen, which can cause smog and ozone pollution.

During the 1990s, electric utilities across the country implemented biomass cofiring demonstrations and commercial operations. Five power plants started the year 2000 regularly cofiring coal with wood residue products. Another plant closed in 1998 after 10 years of operating successfully with biomass. Five additional plants were planning tests in the year 2000. More than 10 years of experience produced information that is now available on the technical and economic performance of cofiring biomass with coal.

The Dunkirk Power Station will use hybrid willow grown by New York farmers to generate renewable electricity.



Economic Considerations

Cofiring economics depends on location, power plant type, and the availability of low-cost biomass fuels. A typical cofiring installation includes modifications to the fuel-handling and storage systems and possibly the burner to accommodate biomass. Costs can increase significantly if wood needs to be dried, size needs to be reduced, or the boiler requires a separate feeder. Retrofit costs range from \$150 to \$300 per kilowatt (kW) of biomass generation in pulverized coal boilers. Cyclone boilers offer the lowest cost opportunities, as low as \$50 per kW.

Fuel supply is the most important cost factor. Costs for biomass fuels depend on many factors such as climate, closeness to population centers, and the presence of industries that handle and dispose of wood. Low price, low shipping cost, and dependable supply are paramount. Usually the cost of biomass fuels must be equal to or less than the cost of coal per unit of heat for cofiring to be economically successful. Some utilities reduce fuel costs by cofiring with biomass; the Tennessee Valley Authority, for example, estimates that it will save \$1.5 million per year in fuel costs cofiring with biomass at its Colbert plant.

Technical Challenges

Several technical questions about fuel feed, boiler chemistry, and ash deposition and disposal have been raised and are approaching resolution. Losses in boiler efficiency caused by cofiring are small and are usually due to high moisture content in the biomass fuels. A consensus

is emerging that cofiring is feasible at most coal-fired power plants.

Many power companies sell fly ash as a portland cement ingredient. An American Society for Testing and Materials standard (C618) requires that only “coal ash” be used in the mixture. Work by DOE and several utilities targets a change in the standard that would allow the use of cofiring ash in portland cement. Success of this effort may encourage many utilities to use biomass because they will still be able to sell their ash.

Customers Support Clean Energy

Biomass cofiring is an opportunity for consumers and power companies. Recent polls found that consumers are willing to support renewable energy programs with a higher price for electricity made from renewable sources. This is sometimes called “green pricing,” and is offered in some areas where consumers may elect to pay a premium for renewable energy (typically 10% or less of their entire bill). For power generators, biomass may represent the most plentiful and affordable supply of locally available renewable energy.

Cofiring may also be an opportunity for power companies to provide new, environmentally responsible services to important customers. This opportunity provides industries, such as construction and transportation, with a way to manage large quantities of wood waste. Cofiring can also provide industries such as forestry, wood products,

pulp and paper, agriculture, and food processing with a way to divert large quantities of combustible biomass residues. The cost of biomass fuels can be low when large amounts of wood and agricultural waste are available. Thus, cofiring can simultaneously provide a service to industrial customers and renewable energy for environmentally conscious electricity consumers.

Planned Cofiring Demonstrations

Utility	Plant	Boiler Type	Features
Alliant Energy	Ottumwa Station	PC	Dedicated switchgrass on CRP Land
AES Corp.	Greenidge	PC	Dedicated willow crop
NRG Energy	Dunkirk	PC	Dedicated willow crop
Southern Company	Gadsden	PC	Co-pulverized switchgrass
GPU	Seward	PC	Increase capacity; minimize NO _x
NIPSCO	Bailey	Cyclone	Tri-firing; gasifier cofiring with NG
TVA	Allen	Cyclone	Gasifier cofiring

For More Information

Visit the Biopower Web Site:

<http://www.eren.doe.gov/biopower>

For copies of print documents on renewable energy, call DOE's Energy Efficiency and Renewable Energy Clearinghouse (EREC) 1-800-DOE-EREC (1-800-363-3732)

