JEA Large-Scale CFB Combustion Demonstration Project

Participant
JEA (formerly Jacksonville Electric Authority)

Additional Team Members
Foster Wheeler Energy Corporation—technology supplier

Location
Jacksonville, Duval County, FL (JEA's Northside Station, Unit No. 2)

Technology
Foster Wheeler's atmospheric circulating fluidized-bed (ACFB) combustor

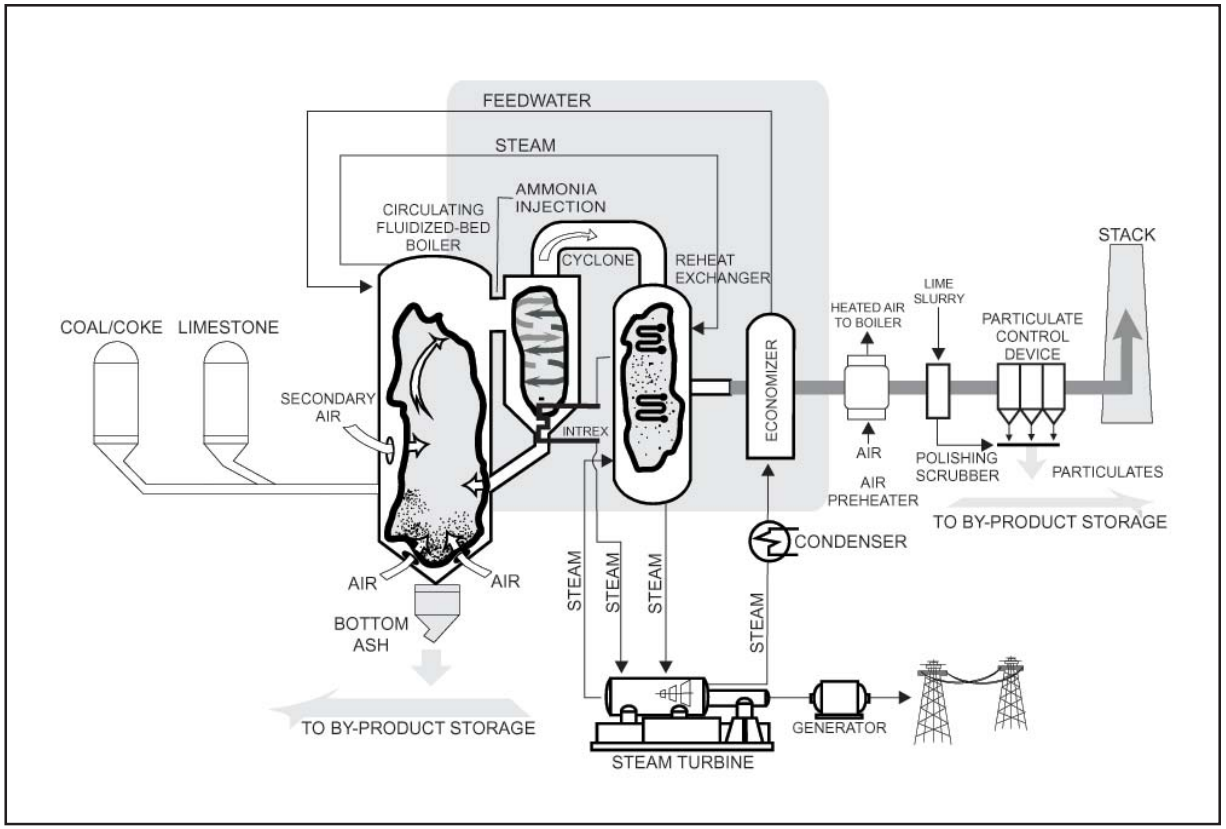
Plant Capacity/Production
297.5 MWe (gross), 265 MWe (net)

Coal
Eastern bituminous, 3.39% sulfur (design)

Project Funding

Total	$309,096,512	100%
DOE	74,733,633	24
Participant	234,362,679	76

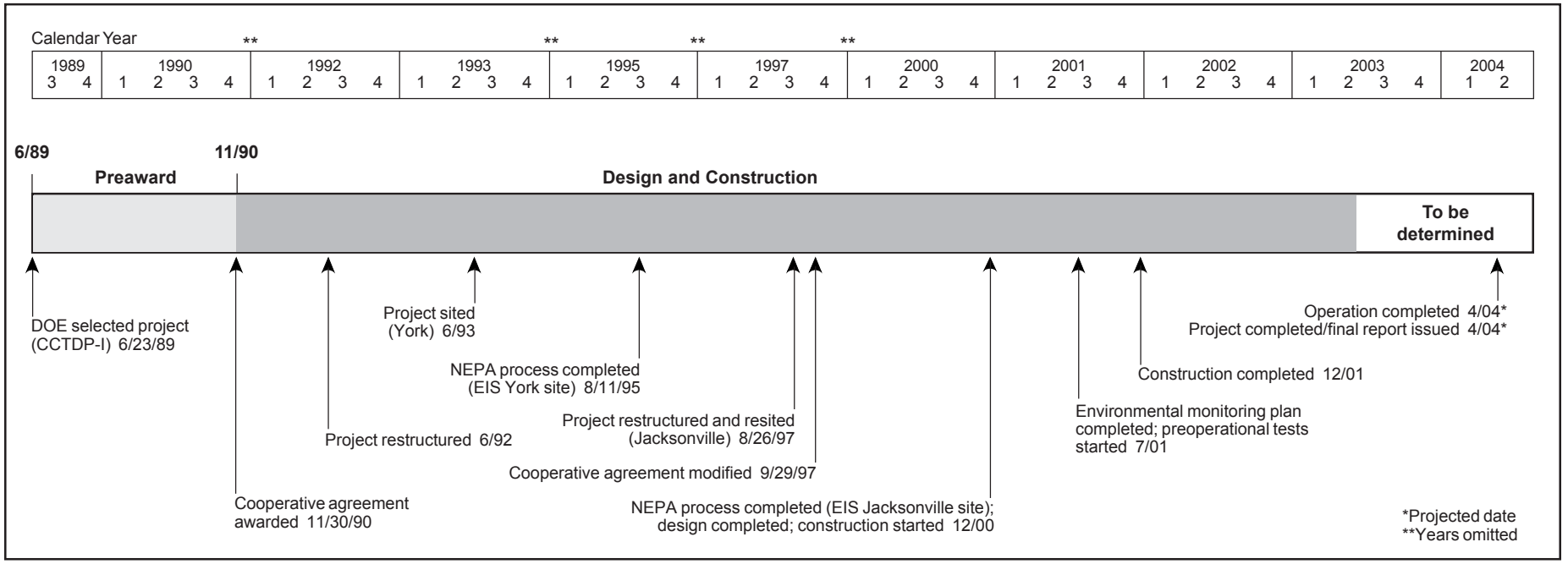
Project Objective
To demonstrate ACFB at 297.5 MWe gross (265 MWe net) representing a scale-up from previously constructed facilities; to verify expectations of the technology's economic, environmental, and technical performance; to provide potential users with the data necessary for evaluating a large-scale ACFB as a commercial alternative; to accomplish greater than 90% SO_2 removal; and to reduce NO_x emissions by 60% when compared with conventional technology.



Technology/Project Description
A circulating fluidized-bed combustor, operating at atmospheric pressure, will be retrofitted into Unit No. 2 of the Northside Station. In this process coal or the secondary fuel (petroleum coke), primary air, and a solid sorbent (such as limestone), are introduced into the lower part of the combustor where initial combustion occurs. As the coal particles decrease in size due to combustion, they are carried higher in the combustor when secondary air is introduced. As the coal particles continue to be reduced in size, the coal, along with some of the sorbent, is carried out of the combustor, collected in a cyclone separator, and recycled to the lower portion of the combustor. Primary sulfur capture is achieved by the sorbent in the bed. However, additional SO_2 capture is achieved through the use of a polishing scrubber to be installed ahead of the particulate control equipment.

Steam is generated in tubes placed along the combustor's walls and superheated in tube bundles placed downstream of the particulate separator to protect against erosion. The system will produce approximately 2 x 10^6 lb/hr of main steam at about 2,500 psig and 1,005 ºF, and 1.73 x 10^6 lb/hr of reheat steam at 600 psig and 1,005 ºF. The steam will be used in an existing 297.5-MWe (nameplate) steam turbine.

The heat rate for the retrofit plant is expected to be approximately 9,950 Btu/kWh (34% efficiency; HHV). Expected environmental performance is 0.15 lb/10^6 Btu for SO_2 (98% reduction), 0.09 lb/10^6 Btu for NO_x, and 0.011 lb/10^6 Btu for total particulates (0.011 lb/10^6 Btu for PM_{10}).



Project Status/Accomplishments

The project was successfully resited to Jacksonville, Florida after York County Energy Partners and Metropolitan Edison Company terminated activities on the ACFB project in September 1996. On August 26, 1997, DOE approved the transfer of the ACFB Clean Coal Project from York, Pennsylvania to Jacksonville, Florida. On September 29, 1997, DOE signed a modified cooperative agreement with JEA to cost-share refurbishment of the first (Unit No. 2) of two units at Northside Generating Station.

The National Environmental Policy Act process was completed when the Record of Decision was issued on December 7, 2000. The facility was dedicated on October 14, 2002. The operation and reporting period has been delayed and a new scheduled has not been set.

Following a two-week unscheduled outage, Unit No. 2 was returned to service on January 8, 2003. The unit was taken offline on January 28, 2003, to repair external tube leaks on one of the cyclones. On February 11, 2003, the fuel was switched to an 80/20 blend of petcoke/coal. The unit operated on the 80/20 blend for six weeks without experiencing an unscheduled outage. A planned 22-day outage started on April 1, 2003, to incorporate modifications and upgrades necessary to prepare the unit for the summer peak period. The work items included the repair of the INTREX™ inlet expansion joint from the cyclone and the INTREX™ outlet refractory shielding pillows. The schedule for the demonstration operations is yet to be determined.

The project moves atmospheric fluidized-bed combustion technology to the larger sizes of utility boilers typically considered in capacity additions and replacements. The nominal 300-MWe demonstration unit in the JEA project will be more than double the size of the Nucla unit (110-MWe). Features include an INTREX™ integrated recycle heat exchanger in the furnace, steam-cooled cyclones, a parallel pass reheat control, an SO_2 polishing scrubber, and a fabric filter for particulate control.

The project received *Power* magazine's 2002 Power Plant Award. The Florida Engineering Society awarded JEA's project manager the Technical Achievement Award 2002 for his work on the project.

Commercial Applications

The ACFB technology has good potential for application in both the industrial and utility sectors, whether for use in repowering existing plants or in new facilities. Also, ACFB is attractive for both baseload and load-following power applications because it can be efficiently turned down to 25% of full load. While the efficiency of ACFB is on par with conventional pulverized coal-fired plants, the advantage of ACFB is that coal of any sulfur or ash content can be used, and any type or size unit can be repowered. In repowering applications, an existing plant area is used, and coal- and waste-handling equipment, as well as steam turbine equipment, is retained, thereby extending the life of the plant.

In its commercial configuration, ACFB technology offers several potential benefits when compared with conventional pulverized coal-fired systems: lower capital costs; reduced SO_2 and NO_x emissions at lower costs; higher combustion efficiency; a high degree of fuel flexibility (including use of renewable fuels); and dry, granular solid by-product material that is easily disposed of or potentially salable.