SOUTHEAST

U.S. DOE

CHP Technical Assistance Partnerships

PROJECT PROFILE

Savannah River National Laboratory

20 MW Biomass CHP System

Site Overview

The Savannah River National Laboratory (SRNL), located in South Carolina, is the applied research and development laboratory at the U.S. Department of Energy's (DOE) Savannah River Site (SRS). The laboratory applies state-of-the-art science to provide practical, high-value, cost-effective solutions to complex technical problems.

SRNL is the only national laboratory for the U.S. Department of Energy's Office of Environmental Management and is the nation's only complete nuclear material management facility. SRNL is recognized for its work in the areas of environmental stewardship, innovative technology, national security, and energy independence.

Aerial View of Biomass CHP Plant - Photo provided by Ameresco

Quick Facts

LOCATION: Aiken, SC
MARKET SECTOR: Federal Government/Biomass
FUEL: Biomass/Tire derived fuel
GENERATING CAPACITY: 20 MW
IN OPERATION SINCE: 2012
EQUIPMENT: (2) 120,000 lb/hr Rentech Boilers
(1) 20 MW TGM Steam Turbine
(1) 3 MW Caterpillar backup generator (used during outages)
USE OF ELECTRIC ENERGY: On-site
USE OF THERMAL ENERGY: Process steam
ESPC AWARD: $795 million
ESPC LENGTH: 19 years
ANNUAL SAVINGS: $34.3 million
INSTALLED COST (construction): $195 million
JOINT PROJECT BY: U.S. DOE, Ameresco
ENVIRONMENTAL BENEFITS: 400 tons/year reduction in Particulate Matter (PM),
3,500 tons/year reduction of SOx,
100,000 tons/year reduction of CO_2
2,500 tons/year reduction of NOx
1.4 billion gallons/year water intake decrease

Reasons for Installing Combined Heat & Power

The biomass CHP plant was constructed to replace an outdated and inefficient 1950's-era plant. The 1953 coal burning powerhouse also included oil fired boilers and provided steam and electricity for both nuclear and industrial activities at the Savannah River Site. Furthermore, as a Federal facility, SRNL has to comply with mandates to reduce energy intensity, emissions, and incorporate renewable energy resources. In 2009, DOE awarded Ameresco, a leading energy efficiency and renewable energy company, an Energy Service Performance Contract (ESPC) to finance, design, build, operate, and maintain a 20 MW biomass CHP facility as well as two smaller biomass steam plants at the Savannah River Site. The CHP system and smaller steam plants have been operational since January 2012.

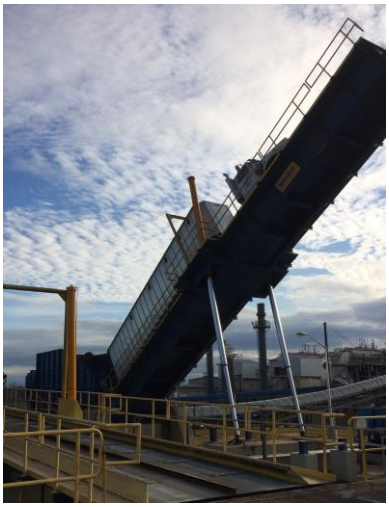
Side View of the Biomass CHP Plant at SRNL

By constructing the biomass fueled CHP plant and retiring the old coal plant, SRNL significantly reduced its overall emissions, energy intensity, and water consumption as follows:

- CO_2 emission reduction by 100,000 tons annually
- SOx emission reduction by 3,500 tons annually
- NOx emission reduction by 2,500 tons annually
- Particulate Matter reduction of 400 tons annually
- Water intake decrease from the Savannah River by 1.4 billion gallons annually
- Annual energy reductions of approximately 500,000 MMBtu/yr

Equipment & Operation

Biomass in the form of wood chips is trucked to the facility daily. Approximately 40-50 22 ton truckloads arrive at the plant each day and are emptied by off-loading pads. The pads lift the trucks at an approximately 45° angle and unload the chips into an 80-ton hopper. The wood chips are then transferred to the boiler or the stacker reclaimer that holds 32,000 tons or about 30 days worth of fuel.



Truck being unloaded on one of three off-loading pads

Biomass and a smaller percentage of tire derived fuel is mixed to fuel the CHP system's two steam boilers that provide up to 240,000 lb/hr of 800 psi steam. This high pressure steam is used to drive the 20 MW steam turbine and is then piped above ground to different facilities on site depending upon thermal needs. The CHP plant produces 100% of the site's thermal requirements and approximately 50% of the electricity needs. If power from the utility is disrupted, the system has black start capability; a 3 MW backup generator provides the needed power to restart the CHP system for operation independent of the grid.

Joint Project & Future Plans

The Biomass CHP facility was contracted through the U.S. DOE Super ESPC program and constructed under the largest renewable ESPC project in U.S. history. The facility is also the largest biomass facility in operation in the federal sector. Under the ESPC, the facility is expected to generate $944 million in energy, water, and operations and maintenance savings. The $795 million ESPC project is estimated to have sustained and created approximately 800 jobs during construction. The plant currently employs 27 full-time employees on-site.

"The Savannah River Site is committed to being good stewards of the environment. One example is our biomass cogeneration facility — the largest in the DOE — has been providing clean and efficient energy to the site for three years. Completion of phase two this spring maintains the environmental benefits, delivers steam security and power optimization to the site at reduced costs to the government."

Jack R. Craig, Jr., DOE Savannah River Operations Office Manager

In 2014, DOE awarded Ameresco a $154 million modification to the original ESPC to increase energy security. The new steam plant will increase steam security and optimize power for the site. The project includes the relocation of a backup packaged boiler and the addition of a new 55,000 lb/hr biomass boiler. The backup boiler became operational at the end of 2015, whereas the new biomass boiler is planned to be online in April 2016. This excess steam will be able to drive the steam turbine and produce 3-4 MW of power when steam from the main plant is not available.

For More Information

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