Louisiana State University & Sempra Energy Services

Background

Louisiana State University (LSU) is located in Baton Rouge, Louisiana and has a population of 24,000 faculty, staff, and students, and a 650-acre main campus with 160 buildings. Sempra Energy Services, the project developer, offers commercial and institutional business energy outsourcing services.

The original central power plant at LSU serviced a limited number of buildings and the university had to maintain eight small additional facilities to supply the energy needs of the remaining buildings on campus. Over time, the combination of the central power plant and smaller satellite plants decreased in efficiency and overall reliability because of constant modifications to the system and the addition of new buildings to the system. LSU realized it needed a more modern and reliable central power plant. In November 1989, LSU negotiated an energy performance contract with Sempra to construct a cogeneration system to meet increased chilled water and steam demand on campus. The new cogeneration system was linked to the older central power plant to supplement existing chilled water and steam service.

Project Description

LSU initially envisioned chilled water generation from a turbine-driven chiller that could respond to variable campus cooling loads, coupled with waste-heat recovery from the turbine for campus-wide steam distribution. The existing contracted rate structure with the local utility precluded electric generation, but since electricity was not generated by the project this was not relevant. Sempra Energy Services' modeled their "part-load" cogeneration plant on this concept. The system consists of a 5,000 HP gas turbine direct driving a 6,300-ton chiller and producing 115,000 lb/hr of steam using a waste heat boiler and supplemental firing.

LSU Cogeneration Plant Operating Data for 1999*	
Project Design Capacity (MW_e)	3.8 (mechanical)
Power to Heat Ratio	0.5
Total Net Efficiency (HHV)	77%
% Fuel Savings[1]	14% (560 metric tons of carbon)
Effective Electricity Efficiency (HHV)[2]	71%
% NOx Decrease[3]	24% (10 tons)

∗*Data based on 8,322 annual hours of operation*

[1] Savings based on 50% efficient electric and 80% efficient thermal generation with natural gas as the primary fuel.
[2] Effective Electric Efficiency = (CHP power output)/(Total energy input to CHP system – total heat recovered/0.8). Assumes thermal output provided at 80% efficiency.
[3] Compared to electric emissions of 3.6 lb NO_x/MWh (1998 national average) and boiler emissions of 0.1 lb NO_x/MMBtu.

To ensure a paid-from-savings status, the scale of the project had to be expanded by upgrading from the originally intended 4,200-ton chiller to a 6,300-ton chiller. In order to accommodate the increased chiller capacity, several satellite plants were tied into the new system so that it now serves 100 of the approximately 160 buildings on campus. The end result is 4.5 miles of underground piping, 8,000 tons of cooling capacity, and 2.25 miles of fiber-optic cable to control the delivery of steam and chilled water.

Success Strategy

Limited state funding and strict procurement regulations had prevented LSU from implementing new systems and undertaking capital renewal projects. These difficulties were overcome in 1987 when Louisiana authorized state agencies to enter into energy performance contracts. LSU's performance contract proved to be the solution to the university's cash flow and capacity problems. Sempra provided the financing ($18 million) to meet the university's expansion needs with no additional out-of-pocket cost to the institution. The performance contract allowed project savings to pay for the investment.

Benefits

The project saves the university about $4.7 million in energy costs each year. The plant performed so well and consistently met targeted savings that the university exercised its right to opt for an early buy-out in 1994. At the time, the plant had increased in value by $10 million on a net present value basis.

The project also has significant climate benefits as it annually saves 39 million standard cubic feet of natural gas (emitting 2,200 less tons of CO_2) compared to conventional separate heat and power generation. This is the equivalent of planting 610 acres of forest or offsetting the annual greenhouse gas emissions from 200 households. The annual avoided NO_x emissions are equivalent to the annual emissions from 530 vehicles.

In March 2000, the United States Environmental Protection Agency and the Department of Energy recognized the pollution prevention benefits of this CHP facility with an ENERGY STAR® CHP Award. For more information on ENERGY STAR® CHP awards, please click here.