NORTHEAST

U.S. DOE

CHP Technical Assistance Partnerships

PROJECT PROFILE

University of Massachusetts

16 MW CHP Plant

Site Description

The new UMASS Central Heating Plant is housed in a 45,000 square foot building. Its power systems include a 10 MW Solar combustion gas turbine, 4 MW and 2 MW steam turbines, a heat recovery steam generator, three package boilers and various auxiliary equipment. A 100,000 lb/hr Heat Recovery Steam Generator (HRSG) uses the exhaust heat from the gas turbine to produce steam for campus heating and cooling year-round. Three package boilers, each rated up to 125,000 pounds per hour steam, provide additional steam capacity to meet campus demand in the spring, fall, and winter months. Two 20-inch main steam transmission lines connect the new plant to the campus. When the gas turbine is generating power at its full 10 MW capacity, the HRSG is capable of producing 37,000 lb/hr without any additional firing. Additional duct burners increase the capacity to the full 100,000 lbs/hr rating.

Quick Facts

LOCATION: Amherst, Massachusetts

FUEL: Natural Gas and Oil

MAX CAPACITY: 16 MW

POLLUTION CONTROL: Selective Catalytic Reduction (SCR)

ENVIRONMENTAL BENEFITS: 99.3% SOx Reduction, 93% NOx Reduction, 96% CO Reduction

AVERAGE CAPACITY FACTOR: ~ 75%

ENERGY OUTPUT: 100,000 MWh per year

IN OPERATION SINCE: April 2009

EQUIPMENT: 10 MW Solar Gas Turbine; 4 MW and 2 MW Steam Turbines

USE OF ELECTRICAL ENERGY: Displaces campus loads previously supplied by the local utility

Reasons for Installing CHP

The old coal fired central heating plant, built in the early 1900's and expanded over the years, could no longer obtain operating permits from the state due to emissions issues. The only fuel that could get an operating permit in the state was now natural gas. This meant a new natural gas fired central heating plant was going to have to be built. Faced with the prospect of transitioning from a relatively inexpensive fuel (coal) to a more expensive fuel (natural gas) the University decided it would be best to get the maximum value from this new fuel and the way to do that was through a combustion turbine based CHP system.

New Central Heating Plant

Heat Recovery Steam Generator

Boiler Feedwater Pumps

Exhaust Stack

During 2010, UMASS is expected to require ~1,100,000,000 pounds of steam and 100,000,000 kWh of electric power to supply its over 200 buildings and nearly 10 million gross square feet of building space. The new central heating plant will satisfy the entire campus steam demand and almost the entire electric demand. Additionally, the plant will conserve 65 million gallons of clean drinking water each year by using approximately 200,000 gallons of treated grey water daily from the Amherst wastewater treatment plant, rather than clean drinking water, to replace water lost in steam distribution and use. The Central Heating Plant uses the latest pollution control technologies including an advanced combustion turbine, low NOx burners and advanced Selective Catalytic Reduction and Oxidation Catalyst pollution control technologies. This advanced pollution control, combined with the switch from coal to natural gas, allowed the University to reduce its output of Sox from 307 tons/yr to 2 tons/yr, NOx from 143 tons/yr to 10 tons/yr and Carbon Monoxide from 45 tons/yr to 2 tons/yr. this equals and approximately 97% pollution reduction when taken as a whole

NE CEAC Role

The Northeast Clean Energy Application Center was involved in two aspects of the plants design. The first project used a commercially available software package, Gate-Cycle, to optimize system size and performance of the system. The results of this analysis allowed the designers to reduce the number of package boilers initially installed in the plant from four units to three. The second project involved modeling the steam distribution system using another commercially available software package, HEATMAP. The model of the low-pressure steam distribution system developed in this process allowed physical plant managers an opportunity to evaluate system performance during peak load. The goal was to evaluate current system operations and explore system modifications.

Currently the NECEAC is working with the University of Massachusetts physical plant on a customized software package that will allow real time modeling of the system performance. The goal is to optimize the energy efficiency of various processes in the plant and eventually the plant as a whole.

For More Information

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