NORTHWEST

CHP TECHNICAL ASSISTANCE PARTNERSHIPS

PROJECT PROFILE

Brigham Young University Rexburg, Idaho

5.7 MW Gas Turbine CHP System

New Central Energy Facility with 5.7 MW Gas Turbine CHP System

Photo Courtesy of Big-D Construction

Quick Facts

LOCATION: Rexburg, Idaho
MARKET SECTOR: University
FACILITY SIZE: Educates 34,000 students
FACILITY Total Electrical Energy Production: 38.4 million kWh/year
EQUIPMENT: 5.7 MW Solar Taurus 60 gas turbine with 50,000 lbs/hour heat recovery steam generator (HRSG)
FUEL: Natural gas-fired, with dual fuel oil-firing capability for both the gas turbine and HRSG
USE OF THERMAL ENERGY: Steam distribution loop plus 1,000-ton steam turbine-driven chiller.
PAYBACK: Estimated at 8 years
CHP IN OPERATION SINCE: August 2015

Site Description

Brigham Young University—Idaho (BYUI) is a private, four-year university affiliated with The Church of Jesus Christ of Latter-day Saints. BYUI is Idaho's largest private university, educating a total of 34,000+ students on a 430 acre campus with a district heating loop providing space heating for 40 buildings. The University is located in Rexburg, Idaho, a city of 28,000 located about 50 miles from Yellowstone National Park.

Reasons for CHP

Historically, the University had purchased their electrical energy and relied upon coal and natural gas-fired boilers for steam production. The U.S. Environmental Protection Agency (EPA) and the Idaho Department of Environmental Quality (DEQ) were putting into place more stringent emissions regulations, which would have required the University to install scrubbers and other advanced emissions control equipment. This prompted the University to consider improving both energy efficiency and reducing emissions from their central heating plant. The university's design team had the goals of becoming more energy efficient, eliminating dependence on coal, reducing emissions, and minimizing reliance on the electrical grid.

CHP met their requirements as the university ultimately constructed a new energy center adjacent to the old central steam plant, containing two Cleaver-Brooks 45,000 lbs/hour natural gas-fired watertube boilers with low-NOx burners; a single 25,000 lbs/hour firetube boiler; and a 5.7 MW gas turbine with a heat recovery steam generator (HRSG) capable of supplementary or fuel oil firing. The HRSG is rated to provide 50,000 lbs/hour when natural gas-fired duct burners are used. The auxiliary steam boilers are used to meet peak thermal demands plus provide redundancy as they provide a backup source of steam to the CHP system.

CHP Equipment & Configuration

The CHP project was installed as part of a major central heating plant upgrade. The upgrade consists of a new 28,000 sq. ft. central energy facility featuring a 5.7 MW Solar Taurus 60 gas turbine. The 950°F turbine exhaust is routed through a heat recovery steam generator (HRSG) capable of producing up to 50,000 lb./hr. of steam when fired with supplementary gas or fuel oil in duct burners to meet campus building heating needs. An 80-foot tall stack is provided to disperse emissions. The CHP system reduces emissions significantly and is viewed as a green source of power.

Enclosure for 5.7 MW Solar Taurus Gas Turbine with 50,000 lbs/hour Heat Recovery Steam Generator

CHP Design, Installation, and Operation

The RMH Group out of Lakewood, CO served as the mechanical, electrical, and controls engineer for the CHP portion of the project. Its design features a fully enclosed evaporative cooling system to increase turbine electrical generation during the summer, as well as a turbine enclosure heat reuse system. The HRSG is capable of producing about 29,800 lbs/hour of steam from the turbine exhaust alone, and can provide up to 50,000 lbs/hour when the duct burners are in operation. Both the gas turbine and the HRSG have dual-fuel capability and can operate with fuel oil from an 80,000 gallon underground storage tank.

Energy Efficiency Benefits

The University Operations Managing Director notes that the campus uses an average of 60,000 lbs/hour of steam to heat the campus on the coldest nights—most of which is supplied by the CHP project. The university had a history of losing grid power during times of severe Idaho weather when heating demands are crucial. To provide resiliency, the gas turbine and HRSG can be operated in "islanding" mode when utility power is lost, meaning that the university is completely self-sustaining during disasters or any interruption in power. The operators also note that the working environment is safer and that less maintenance is required, as compared to the old coal system. The net annual electrical output of the CHP facility of about 38 million kWh is sold to PacifiCorp at an average price of about $55/MWh (2017).

Chiller Operations

Steam loads at the campus decline during the hot summer months, meaning that over 45% of the gas turbine exhaust heat is bypassed around the HRSG and wasted. Backing off on gas turbine operation is not desirable as electrical loads peak during the cooling season. The optimal solution is to operate at full electrical output and use surplus steam in a newly installed 1,000 ton steam turbine-driven chiller.

"We will be able to support the future energy needs of BYU-Idaho and its students with this new facility for many years to come."
---Wayne Clark, Utility Operations Managing Director

For More Information

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More CHP Project Profiles:
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