SOUTHWEST

U.S. DOE

CHP TECHNICAL ASSISTANCE PARTNERSHIPS

PROJECT PROFILE

University of Colorado at Boulder

32-MW CHP System

Located at the foot of the Rocky Mountains, the University of Colorado at Boulder uses combined heat and power (CHP) as a key part of its carbon reduction strategy. PHOTO: UNIVERSITY OF COLORADO-BOULDER

Quick Facts

LOCATION: Boulder, CO
MARKET SECTOR: Universities
FACILITY SIZE: 30,000 students
FACILITY PEAK LOAD: 20 megawatts (MW)
EQUIPMENT: Two 15 MW combustion turbines, two heat recovery steam generators (HRSG), one 2.5 MW condensing steam turbine
FUEL: Natural Gas
THERMAL ENERGY USE: Steam
NUMBER OF BUILDINGS SERVED: 105
SQUARE FEET SERVED: 8 million
TOTAL EFFICIENCY: 70-75%
ENVIRONMENTAL BENEFITS: Reduces campus carbon dioxide emissions by over 16,000 Metric-tons per year
CHP IN OPERATION SINCE: 1992; reconfigured in 2015

Site Description

With top-10 national rankings in aerospace engineering, ceramics, environmental law, geology, physical chemistry and quantum physics, the University of Colorado-Boulder is a hub for the region's strengths in technology, innovation, and startup businesses. Eleven Nobel Laureates, nine MacArthur Fellows, and 18 astronauts have been affiliated with The University of Colorado-Boulder as students, researchers, or faculty. Today the flagship campus in Boulder supports 30,000 students and 4,000 faculty across more than 150 academic fields.

Reasons for CHP

The University of Colorado-Boulder has used district energy with steam distribution since 1909. It installed a CHP system in the early 1990s with goals of high reliability and power quality, in addition to energy cost savings. The CHP system was designed to export excess power to the grid, as a qualifying facility (QF). The university had a 15-year Power Purchase Agreement (PPA) with the local utility and a long-term natural gas contract, ensuring stable and cost-effective campus utility rates. The CHP systems where changed to economic dispatch-only due to high operating expenses and low export pricing when the PPA and gas contract expired. In 2009, the university began evaluating how it could reconfigure the system to economically provide for some of its own power needs while reducing the campus carbon footprint.

CHP Equipment & Configuration

The University of Colorado's CHP system includes two 15-MW combustion turbines and two heat recovery steam generators (HRSG), coupled with a 2.5 MW condensing steam turbine. The HRSG produces 300 psi steam—part of which goes through a pressure reducing valve to produce 130-psi steam used by the university's heating system, and part of which goes to the condensing steam turbine to generate additional electricity. The steam turbine is used to offset additional power needs in the summer months.

The University of Colorado-Boulder has a summer peak demand of 20 MW, so the CHP system could provide all the campus' electricity needs. However, to be cost-effective, the campus nominates the operational season (Summer, Winter, or both) with the local utility. The repowered CHP is base loaded, with one of the two combustion turbines operating at a time at about 10 MW of output. The waste heat is captured to produce 40,000 pounds per hour of steam to generate additional power and extract baseload steam requirements through the 2.5 MW steam extraction-condensing turbine. When the CHP system is not running, the university's steam needs are met by two conventional boilers which operate at 130 PSIG.

Emission Reductions

As a signatory to the American College and University Presidents' Climate Commitment, the campus developed a plan in 2009 to move towards carbon reduction, using a combination of a repowered and upgraded CHP system and renewables. The CHP is a valuable asset that provides the University operational flexibility to achieve their carbon, cost and conservation goals. The CHP system can reduce campus carbon dioxide emissions by over 16,000 metric tons per year.

For More Information

U.S. DOE SOUTHWEST CHP TECHNICAL ASSISTANCE PARTNERSHIP (CHP TAP)
www.southwestCHPTAP.org

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MORE CHP PROJECT PROFILES:
www.southwestCHPTAP.org

DATE PRODUCED: 2015

The university's Power House (top), built in 1909, first generated steam for distribution throughout the campus and then housed the CHP system starting in 1992. A new 2.5-MW steam turbine (middle) runs off the waste heat from the combustion turbines, increasing CHP system's efficiency and cost-effectiveness. A new East Plant (bottom) will expand the campus's district energy system to help meet increased cooling demands.

PHOTOS: CHRISTINE BRINKER