SOUTHEAST

U.S. DOE

CHP Technical Assistance Partnerships

PROJECT PROFILE

UNC Chapel Hill

28 MW CHP and District Energy System

Project Overview

The cogeneration facilities at the University of North Carolina at Chapel Hill provide steam, chilled water and electricity to 175 buildings within the campus. UNC uses district heating and cooling on campus and at the UNC Hospital. Beneath the University run more than 45 miles of steam pipe and 22 miles of chilled water pipe.

The steam is used for heating, humidification, domestic hot water, sterilization and for making distilled water. The cogeneration facility creates and distributes this steam while producing up to one third of the required electricity for the campus. The electric distribution is managed by UNC, which receives power from Duke Energy and the cogeneration plant, then delivers it to the campus through 3 sub stations.

In 2003, UNC was awarded the U.S. EPA's Energy Star CHP Award to recognize the leadership, innovation, and energy efficiency qualities of this project.

Reasons for Installing CHP and District Energy

UNC has been generating electricity on site since 1895 and operating CHP systems since 1939. In the early 1990s, faced with increasing energy needs and a desire to reduce energy costs, UNC replaced its cogeneration system with one based on circulating fluidized bed combustion technology. The newer CHP system provides many benefits to the University including:

- Providing electricity and steam to the University at greater than 70% efficiency
- Uses 13 percent less fuel than traditional electricity and thermal power generation
- Emission reductions estimated at 0.23 million metrics tons less carbon equivalents of separate heat and power, comparable to planting 16,482 acres of forest or removing the emissions of 10,988 automobiles
- The CHP system allows the university to save money by purchasing more electricity from the grid when prices are low or generating more of its own electricity when prices are high.

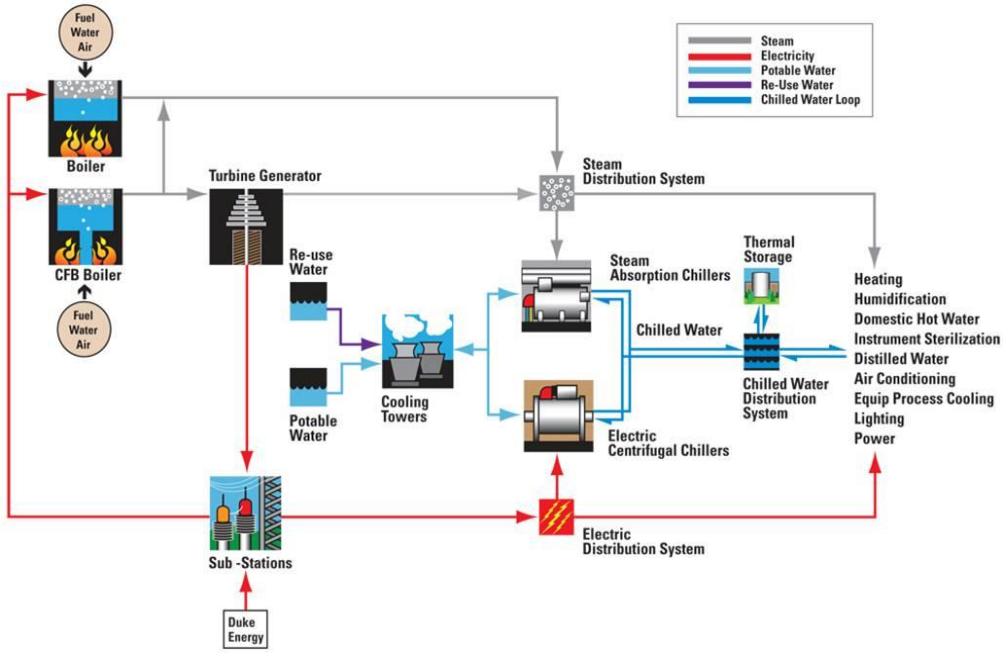
Quick Facts

LOCATION: Chapel Hill, North Carolina
MARKET SECTOR: University/Hospital
IN OPERATION SINCE: new 1992 (original 1939)
GENERATING CAPACITY: 28 MW, 750,000 lbs/hour steam
EQUIPMENT: (1) Backpressure Steam Turbine
(2) Circulating Fluidized Bed (CFB) Boilers
(1) Gas-fired Packaged Boiler
THERMAL ENERGY USES: District space and domestic water heating, sterilization, absorption chillers
PRIMARY FUEL: coal, testing biomass cofiring
SECONDARY FUEL: natural gas, fuel-oil, diesel
POLLUTION: Very low emissions with CFB technology, cyclonic separator, baghouse filter system
ENVIRONMENTAL BENEFITS: Reduction of more than half from conventional power and heat generation by 0.23 million metric tons of carbon equivalents

Equipment and Configuration

Generation Equipment:

- 28 MW Steam Turbine
- Two – 250,000 lb/hr Circulating Fluidized Bed Boilers
- One – 250,000 lb/hr Gas-fired Packaged Boiler
- 50,385 Ton Cooling Capacity with 19 electric and 5 absorption chillers



The district heating system provides steam to the campus and hospital at 40 and 150 psi. The steam is extracted from the turbine at the second and last expansion stage. This steam turbine is capable of providing up to 28 MW of electricity to the campus.

All of the systems are monitored and controlled by an advanced digital control system (DCS) and are integrated to provide the greatest efficiency. The system controls the boilers and chillers remotely and runs an algorithm to choose the most efficient arrangement of equipment to have online.

Since the installation in 1992, the UNC energy facilities have gone through intensive upgrades. The original 28 MW steam turbine was rebuilt to produce 28 MW. This allowed for greater electrical generation capacity without additional input. Numerous upgrades to substations have taken place over the years increasing the safety and reliability of the system and adding the capability to switch transmission lines. Additional upgrades have taken place to insure that noise stays below 45 dB. A new peak demand steam plant was constructed in order to raise reliability to 100% and add more peak capacity.

Future Plans

UNC's Climate Action Plan was published in 2009, and set a goal of being climate neutral by 2050. In an effort to further reduce greenhouse gas emissions, UNC began testing co-fired biomass at their CHP facility in 2010. At the time, they evaluated both dried wood pellets and torrefied wood. The university has made a commitment to fire 20% biomass by the end of 2015, but due to complications in finding a supplier of torrefied wood –the preferred coal substitute– they will have to delay biomass implementation. In order to reach the 20% co-firing goal the plant will need 26,000 tons of pellets per year so UNC is considering creating their own torrefied wood pellet supply.

UNC has also undertaken a 1 MW Landfill Gas to Energy project that requires piping otherwise wasted gas from a nearby landfill to a facility on the Carolina North campus. There are plans to convert the energy project to CHP once campus construction is finished. The emissions reductions of this project are equivalent to removing 7,860 cars from the road.

For More Information

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www.energy.gov/chp

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