NEW ENGLAND CHP Technical Assistance Partnerships

PROJECT PROFILE

University of New Hampshire

8.5-MW CHP System

Southwest part of the UNH Durham Campus. The CHP Plant is shown in the top right corner.

PHOTO COURTESY OF UNIVERSITY OF NEW HAMPSHIRE

"Our project has succeeded in cost reductions and improved system efficiencies which are more important to us now more than ever."

- Matt O'Keefe
Director of Energy and Utilities

Quick Facts

LOCATION: Durham, NH
MARKET SECTOR: College/University
FACILITY SIZE: 6 million sq. ft.
EQUIPMENT: 7.9 megawatt (MW) Siemens SGT 300 turbine, gas-fired HRSG, 0.6 MW backpressure steam turbine
FUEL: Processed landfill gas (primary), natural gas (backup), #2 fuel oil (backup)
USE OF THERMAL ENERGY: Heating/Cooling
CHP TOTAL EFFICIENCY: 78%
ENVIRONMENTAL BENEFITS: Reduced Greenhouse Gas (GHG) emissions by 34,000 metric tons CO_2e/year; Helped UNH achieve AASHE's STARS platinum sustainability rating.
TOTAL PROJECT COST: $69 million
ACTUAL PAYBACK: <10 years
CHP IN OPERATION SINCE: 2005; 2009 EcoLine *(biogas)*

Site Description

Established in 1866, the University of New Hampshire in Durham, NH (UNH) is New Hampshire's flagship research university. UNH currently serves more than 16,000 students in 6 million sq. ft. of research, educational, residential, and administrative space. UNH has a long history of environmental stewardship and has committed to reducing greenhouse gas (GHG) emissions by 80% by 2050.

In 2005, UNH installed a $20-million combined heat and power (CHP) *(or "cogeneration")* plant to generate electricity for UNH's 6-million-sq.-ft. campus, and heat and cool 80 campus buildings *(4 million sq. ft.)*. In 2009, UNH replaced the CHP's natural gas fuel source with processed landfill gas via the $49-million "EcoLine" project, which cleans landfill gas at the Turnkey landfill in Rochester, NH and transports processed landfill gas 12.7 miles to UNH's CHP system.

Reasons for CHP

The University has a long tradition of implementing sustainable, cost effective systems such as CHP. Further, UNH is designated as critical infrastructure and provides essential services and functions during natural disasters, emergencies, and storm-related grid outages, which are common in the fall and winter months.

CHP Equipment & Configuration

Operating since 2005, the CHP Plant produces power via a 7.9-MW Siemens SGT 300 gas turbine. Waste heat from the turbine is used to generate 45,000 lb/hr of 150-psi steam within a Heat Recovery Steam Generator (HRSG). A duct burner within the HRSG can produce an additional 53,000 lb/hr of 150-psi steam. The 150-psi steam feeds a 595-kW backpressure steam turbine, absorption chillers *(during cooling season)*, and after a pressure reduction, heats campus buildings. Cooling is provided by 6,900 tons of chiller capacity, of which 2,600 tons are steam-operated absorption chillers. In 2009 the 7.9-MW gas turbine was modified to operate on PLG.

CHP Plant control room.
PHOTO COURTESY OF UNIVERSITY OF NEW HAMPSHIRE

CHP Operation

The CHP Plant cost $20 million in 2005 and has operated for 14 years. Operation savings paid for the original CHP system in less than 10 years, and the CHP system reduced UNH's greenhouse gas emissions by 21%.

The $49 million EcoLine project was completed in 2009 and was paid for within 10 years by operational savings. Additionally, the EcoLine project had significant environmental benefits, including a reduction of 36,000 tons of carbon dioxide equivalent (CO_{2e}) per year, and the ability for UNH to sell Renewable Energy Credits (RECs). RECs were additionally beneficial because UNH used REC-generated revenue to partially fund UNH's energy efficiency measures, which have generated an additional $3 million in energy savings and have helped UNH to be on track to achieve a 50% reduction in CO_{2e} emissions by 2020.

Largely thanks to the CHP Plant and the EcoLine project, UNH earned the STARS-platinum rating from the Association for the Advancement of Sustainability in Higher Education (AASHE). This rating is truly remarkable as only five universities in the world have earned the STARS-platinum rating.

UNH power plant building.
PHOTO COURTESY OF UNIVERSITY OF NEW HAMPSHIRE

Lessons To Share

- A thorough analysis of year-round thermal and electric demand was crucial to designing the CHP system.
- Fuel flexibility is essential to having reliable and redundant energy systems.
- Continuous improvement is key to operating a high-performance CHP system. For example, UNH is currently seeking to increase CHP system efficiency by adding Thermal Energy Storage (TES) to optimize usage of steam-driven absorption chillers.

For More Information

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Date produced: July 2019