NEW ENGLAND CHP Technical Assistance Partnerships

PROJECT PROFILE

University of Connecticut

24.9-MW CHP System

University of Connecticut's Central Utility Plant (CUP)
PHOTO COURTESY OF UNIVERSITY OF CONNECTICUT

Quick Facts

LOCATION: Storrs, CT
MARKET SECTOR: College/University
FACILITY SIZE: 12 million sq. ft.
FACILITY PEAK LOAD: 26.5 megawatts (MW)
EQUIPMENT: Three 7.5 MW Solar Taurus 70 gas turbines; three 67,000 lb/hr RenTech HRSGs; 4.6 MW Dresser Rand backpressure turbine, 330,000 lb/hr of boilers, 13,500 tons of chillers
FUEL: Natural gas (primary), #2 heating oil (backup)
USE OF THERMAL ENERGY: Heating & Air Conditioning
CHP TOTAL EFFICIENCY: ≥ 80%
ENVIRONMENTAL BENEFITS: Reduced CO_2 emissions by 10,300 tons/yr and NOx emissions by 90%
TOTAL PROJECT COST: $81 million
CHP IN OPERATION SINCE: 2006
ENERGY SAVINGS: $10 million/yr

Site Description

The University of Connecticut (UConn) is the State of Connecticut's sole land-grant university and offers degrees in 116 undergraduate majors and 88 research and professional practice fields of study. Situated on 3,100 acres in Storrs, CT, UConn's flagship campus serves approximately 27,000 faculty, staff, and students working and living in 12 million sq. ft. of academic, residential, research, and administrative space within 370 buildings.

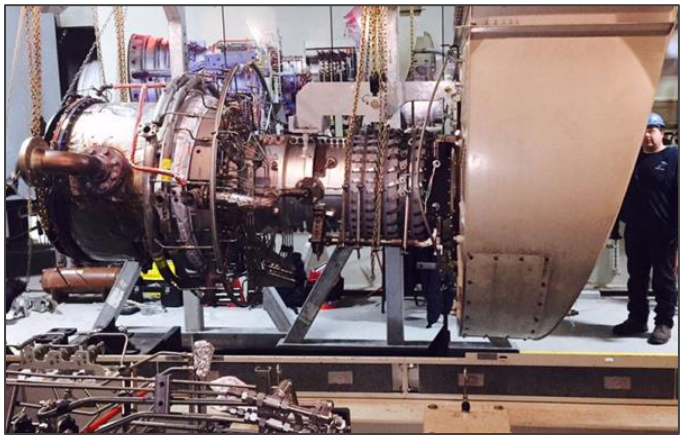
Beginning with its founding as an agriculture school in 1881, UConn has a long tradition of environmental stewardship and innovation. As part of this tradition, UConn commissioned their 24.9 MW Combined Heat and Power (CHP) *(aka "cogeneration")* system in 2006. The CHP system is located in UConn's Central Utility Plant (CUP) and produces electricity for the entire campus, steam for 156 buildings *(7.3 million sq. ft.)*, and chilled water for 26 buildings *(three million sq. ft.)*. UConn's CHP system in Storrs, CT has reduced carbon dioxide (CO_2) emissions by 10,300 tons/yr, reduced nitrous oxide (NOx) emissions by 90%, and saved $10 million/yr in energy costs.

Reasons for CHP

Dr. Lee Langston, a UConn Mechanical Engineering Professor Emeritus, was a leading advocate for CHP after observing that European CHP systems were more efficient and cost less to operate than comparable separate heat and power systems. Additionally, UConn was a good CHP candidate due to consistent thermal loads (*i.e.*, heating in winter, cooling in summer), and UConn's resiliency and environmental stewardship objectives.

CHP Equipment & Configuration

UConn's Clean CHP system consists of three 7.5-MW Solar Taurus 70 gas-fired turbines, three 67,000-lb/hr supplemental-fired RenTech Heat Recovery Steam Generators (HRSGs) with ammonia-fed Selective Catalytic Reduction (SCR) units, and a 4.6-MW Dresser Rand backpressure steam turbine. The HRSG's 200,000 lb/hr of steam capacity is augmented by five conventional boilers, bringing the total steam capacity to 530,000 lb/hr. Eleven chillers provide a total of 13,500 tons of chiller capacity, of which 8,000 tons are provided by four 2,000-ton steam-driven chillers.



One of three 7.5-MW Solar Taurus 70 gas-fired turbines used to generate electricity and thermal energy.
PHOTO COURTESY OF UNIVERSITY OF CONNECTICUT

Thermal energy management starts with the HRSGs producing 200,000 lb/hr of 600-psi steam, which is fed through the backpressure steam turbine to produce 4.6 MWs of power and reduce the steam pressure to 125 psi. Five 125-psi boilers produce 330,000 lb/hr of steam, increasing the total 125-psi steam capacity to 530,000 lb/hr. During the cooling season, the 125-psi steam is fed through four 2,000-ton steam-driven chillers to produce 42°F chilled water for space cooling. The 125-psi steam is also reduced to 65 psi, which is distributed to campus for process and space heating requirements.

CHP Operation

UConn's Clean CHP system provides resilient power for campus loads, is the centerpiece of the black-start-capable micro-grid, and has reduced operating costs for more than 13 years. Tangible benefits include a reduction of energy costs by more than $10 million per year; reducing carbon dioxide (CO_2) emissions in half, representing a reduction of 10,300 tons/yr; and reducing nitrous oxide (NOx) emissions by 90%/yr.

UConn's Clean CHP Facility is a registered CT Class 3 Renewable Energy Credit (REC) generator and uses the $2.5 million annual funds received for extensive energy and water conservation programs. For example, 2019 REC-funded projects conserved an additional 5.7 million kWh/yr, which will save $1.2 million/yr.

> ***"UConn's operational and economic success with our 2006 Clean CHP Facility has enabled, if not mandated, designing a supplemental CHP Facility into our Campus Master Plan 2015-2035 to manage energy needs. It is exciting to be part of the team implementing the newest improved technology for our Next Generation Connecticut expansion."***
>
> ***- Stanley Nolan***
> ***Director of Utility Operations & Energy Mgmt.***

Lessons To Share

- **Hardened infrastructure has a real value.** UConn's CHP-based micro-grid was able to maintain operations during 2011's Tropical Storm Irene and multiple other storms. This value was recognized in CT's 2013 Comprehensive Energy Strategy (CES).
- **Facilities can increase resiliency by allowing simultaneous operations and maintenance.** For example, during student breaks, two Solar turbines can carry campus loads, allowing the third Solar turbine to be serviced.
- **Design the facility to allow future modular expansion and upgrades.** For example, an additional chiller footprint and spaces for auxiliary equipment and electrical connections were provided during initial construction to enable an additional chiller to be quickly added when campus growth required the additional capacity.

For More Information

U.S. DOE New England CHP TECHNICAL ASSISTANCE PARTNERSHIP (CHP TAP)
David Dvorak, Ph.D., P.E.
(207) 581-2338
dvorak@maine.edu

UNIVERSITY OF CONNECTICUT
Stanley Nolan
Director of Utility Ops. & Energy Mgmt.
(860) 486-3208
Stanley.Nolan@uconn.edu

More CHP Project Profiles:
http://www.nechptap.org

Date produced: July 2019