PROJECT PROFILE

WESTERN

CHP
TECHNICAL ASSISTANCE
PARTNERSHIPS

Arizona State University

16.2 MW CHP System

Quick Facts

LOCATION: Tempe, Arizona
MARKET SECTOR: Colleges and Universities
CAMPUS SIZE: 16 million square feet
CAMPUS PEAK LOAD: 36 megawatts (MW)
EQUIPMENT: Two gas turbines with duct burners and steam generators providing a total of 14.2-MW and up to 173,000 lbs/hr of steam. The CHP system also includes a 2MW steam turbine.
FUEL: Natural Gas
USE OF THERMAL ENERGY: Space conditioning, water heating and food preparation.
CHP TOTAL EFFICIENCY: 75%
ENVIRONMENTAL BENEFITS: Substantial decrease in CO_2. NOx and CO emissions.
CHP OPERATIONAL HISTORY: One gas turbine and steam turbine operational since 2006. Second turbine added in 2019.

Site Description

Arizona State University's (ASU) historic main campus in Tempe, Arizona is a thriving urban undergrad, graduate, and research campus with 51,500 students. ASU ranked first in U.S News and World Report's list of "Most Innovative Schools" and among the "Best Graduate Schools" in the nation in 2019. The Sierra Club (2018) ranked ASU fifth overall in sustainability and Times Higher Education (2018) ranked ASU in the top 1% of the world's most prestigious universities. The university is highly regarded for its programs in journalism, criminal justice, supply-chain management, environmental management, design, and the arts.

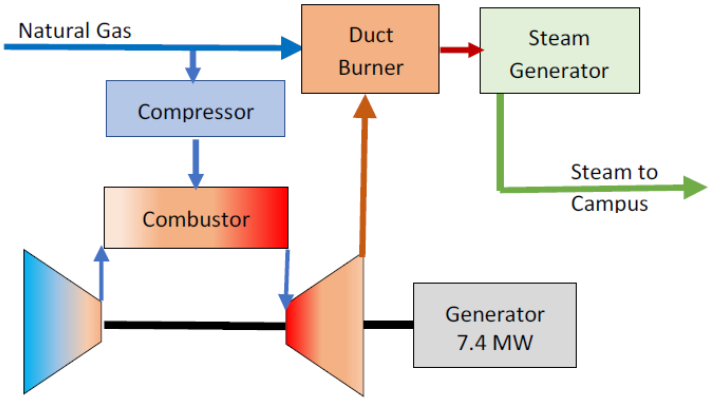
Reasons for CHP

CHP is a cost effective, energy efficient and space saving approach to providing reliable energy services to a university campus. CHP, when integrated with a central heating and cooling plant, provides substantial benefits over a distributed energy system including fewer pieces of equipment to maintain, a smaller collective footprint, higher energy efficiency, greater load diversity and affordable, highly resilient energy service.

"CHP is one of the key pieces to our overall goals of carbon neutrality, sustainability, and lowering our campus energy costs," said Rick Pretzman, ASU Director of Facilities Engineering, Energy and Utilities. Another driver for installing CHP was to have a reliable source of energy for the research facilities on campus. "CHP not only serves the current research buildings by keeping them always operational, but it is a selling point for attracting future research as well," adds Mike Buter, Plant Manager for Clearway Energy.

CHP Equipment & Operation

ASU's initial foray with CHP was in 2006 with the commissioning of a unique Solar Turbines package consisting of a 6.8-megawatt (MW) Taurus 70 turbine fueled by natural gas, a Rentech Heat Recovery Steam Generator (HRSG) and a 2 MW Dresser Rand steam turbine attached to the gas turbine generator shaft for additional electric capacity. The system was sized and dedicated to meet the electrical loads of four research buildings.



ASU's New 7.4 MW CHP Configuration

The gas turbine exhaust is equipped with duct burners capable of increasing the steam production from the HRSG from 30,000 to 80,000 pounds per hour. Some of the steam is used to run the steam turbine to produce electricity when steam heating demand is reduced during the warmer weather. The remaining steam is distributed throughout the campus via underground piping and used for heating, humidification, cleaning, cooking, pool heating and domestic hot water.

Electricity from the CHP units also power five York 2000-ton electric chillers at the CHP plant which supplements 20,000 tons of chilled water capacity and six million gallons of chilled water storage at the main Central Plant for distribution throughout the campus. With the addition of three new research facilities on campus, a new 7.4 MW gas turbine with supplemental duct firing was added in 2019, boosting steam generation capacity from the HRSGs to 173,000 pounds per hour. With this expanded steam capacity from the CHP plant, the Central Plant Boilers are only used for backup. The engineering, science and technology research buildings are served from two redundant electrical grid feeds and two emergency generators, further enhancing resiliency.

CHP Operation

The CHP system is owned by ASU and operated by Clearway Energy, in an innovative arrangement that lets each party focus on their core business. The facility is always staffed but also has remote monitoring to alert operators to any problems. Since 2007, a reliability factor of 99.99% was achieved, important for the critical loads in the research buildings.

> ***"CHP is integral to how we operate the campus, and we enjoy the benefits of its reliable and efficient operation."***
>
> ***— Rick Pretzman, Director of Facilities Engineering, Energy and Utilities, Arizona State University***

Key Takeaways

- The original CHP package with an integral gas turbine, HRSG and steam turbine offered space and capital cost savings but created a couple of reliability issues that could have been averted with a self-standing steam turbine generator set.
- The CHP system steam output was matched to the minimum campus steam demand to maintain high overall efficiency and best economic performance throughout the year.
- Steam production is distributed throughout the campus via underground piping and used for heating, humidification, cleaning, food preparation, pool heating and domestic hot water.

For More Information

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