PROJECT PROFILE

University of Arizona

12-MW CHP System

Site Description

The University of Arizona in Tucson is one of the top twenty research universities in the nation, with a student enrollment of over 37,000 and a faculty and staff of over 13,000.

The main campus and the Arizona Health Sciences Center campus together have 216 buildings on 378 acres. The university has three utility plants:

- Central refrigeration building (CRB)
- Central heating and refrigeration plant (CHRP); and
- Arizona Health Sciences Center central heating and refrigeration plant (AHSC/CHRP).

These are all connected and optimized by a building automation system from Trane.

Quick Facts

LOCATION: Tucson, Arizona

MARKET SECTOR: Universities & colleges

TOTAL PROJECT COST: $7 million

MONTHLY ENERGY SAVINGS: $93,000

EQUIPMENT: 4.5-MW Solar Taurus 60 and 7.5-MW Solar Taurus 70 turbines; heat recovery steam generator; 100-tank 15,000-ton hour thermal ice storage system

FUEL: Natural gas

USE OF THERMAL ENERGY: 125-pound steam

CAMPUS SIZE: 13 million square feet of building

CAMPUS PEAK LOAD: 44 MW

CAMPUS AVERAGE LOAD: 30.7 MW

CHP PROVIDES: 25% of electrical load

CHP IN OPERATION SINCE: 2002

ENVIRONMENTAL BENEFITS: PM10 reduced 53%, NOx reduced 62%, and VOCs reduced 82%

Reasons for CHP

The University of Arizona's primary reason for installing CHP was to save money: CHP saves the university about $93,000 per month on energy costs. In addition, the university replaced six inefficient old boilers that only produced heat and higher pollution levels. Less reliance on grid power was cited as another reason.

University of Arizona campus in Tucson, Arizona

CHP System Equipment & Configuration

Two gas turbine systems provide heat and power. The first is a Solar Taurus model 60 that is dedicated to the Central Refrigeration Building (CRB) and runs in "island mode"—not connected to the electrical utility grid. It produces an average of 3.7 MWe and 24,000 pounds per hour of 125-pound steam. The second is a Solar Taurus model 70 that runs in parallel with the electrical grid. It produces an average of 6.6 MWe and 33,000 pounds per hour of 125-pound steam.

The gas turbines have a dedicated utility delivery pipe that supplies 305 psi natural gas. The university negotiated a special lower rate for this gas. Standard pressure gas, used by conventional boilers, is purchased at a higher rate. The two units are about a mile apart and feed into a completely interconnected steam grid.

The university has also installed an innovative ice storage system to help level its heat and electric loads and ensure the whole system runs at peak efficiency. Cogeneration runs most efficiently when both electrical needs and thermal needs are fairly level. At the university, daytime loads were well-balanced but nighttime loads were not: nighttime electrical usage fell but thermal needs from the medical center for sterlization and laundry remained constant. By installing ice storage, the campus boosts its electrical usage at night and uses the ice to cool buildings the following day.

CHP Operation

The CHP units have been operating since 2002, and they run 24 hours a day, seven days a week. Every three months they are taken down for maintenance. Other operational details include:

- Steady state reliability has been 98-99%.
- The electrical output carries 25% of the university's load.
- Turbine inlet air is cooled with chilled water coils.
- A $49,000 per month maintenance contract includes new engines and gearboxes at 30,000 hours.

Lessons To Share

- Multiple prime movers connected to a single generator shaft in island mode can cause control challenges.
- Natural gas pricing for CHP can be significantly lower than for traditional uses.
- Fuel prices can change dramatically over time, so make sure the system is designed to be flexible with components that can easily be brought on- or off-line.
- "Islanding" has proven to present restrictions and complexities during plant operations.

For More Information

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PHOTOS: Courtesy of GLHN, Architect and Engineer of Record

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