Univ. of California – San Diego

30 MW CHP System

Project Profile

combined heat & power on a university campus

Quick Facts

Location: San Diego, California

Capacity: 30 MW combined cycle (two 13.5 MW Solar Turbines Titan 130 gas turbine gen-sets configured with a 3 MW Dresser-Rand steam turbine)

System Online: 2001

Fuel: Natural gas

System Efficiency: Approx 10,250 Btu/kWh heat rate for the gas turbines with gross thermal efficiency estimated at about 70%

Waste Heat Use: 120,000 lbs/hr of steam used for domestic hot water and to drive a centrifugal chiller

Availability: 95% on average

Est. Annual Cost Savings: The campus estimates that the CHP plant provides $8-10 million per year in avoided costs

Financial Arrangement: Owned and operated by the campus Capital cost for the CHP project installation was about $27 million.

Project Overview

The University of California – San Diego has a combined heat and power (CHP) system, based on the combination of two 13.5 MW Solar Turbines Titan 130 gas powered turbine-generator and a 3 MW Dresser-Rand steam-powered "bottoming cycle" turbine-generator. The system came online in 2001.

The Solar Turbine units include three-stage, axial flow turbines with rotational speeds of up to 11,200 revolutions per minute (RPM), coupled with three-phase, wye-connected, synchronous, brushless generator units.

Waste heat from the gas turbine provides steam, which is used for various uses. The first use of steam is for cooling – using a steam driven centrifugal chiller. A 4 million gallon cold-water thermal storage system helps to meet peak campus cooling needs.

The second use for the steam is to produce domestic hot water for campus buildings located near the central plant. The third priority is to run the 3 MW Dresser-Rand steam turbine for additional electricity production as a "bottoming cycle." The system achieves about 70% gross thermal efficiency, in terms of the amount of electricity and steam produced.

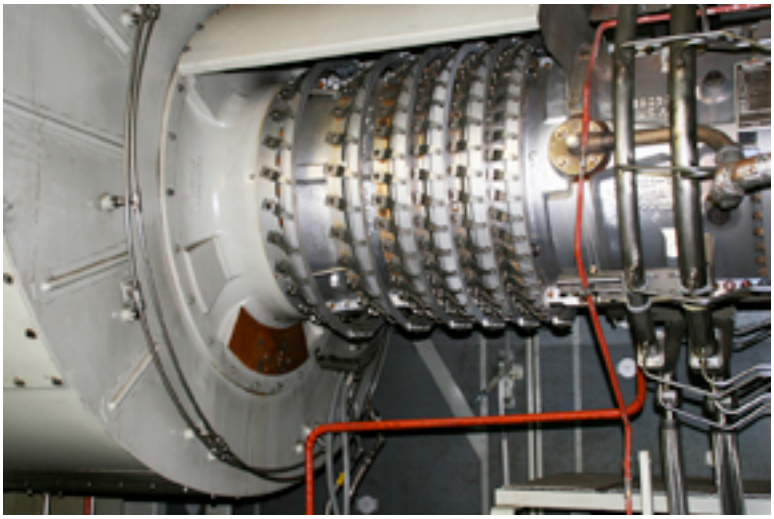
The CHP system was installed for about $27 million, or about $1,000 per kilowatt. The actual installation was performed under a third-party installation agreement with EMCOR Energy Services. Installation and interconnection with SDG&E went smoothly without major problems or issues.

Campus estimates that the system is saving approximately $0.04 per kWh compared with prevailing San Diego Gas and Electric Co. (SDG&E) rates, or about $8-10 million annually when boiler and chiller operational offset costs are also considered.

To meet campus load growth, a third Solar Turbines generator will be added in the near future. This is expected to be a 15 MW Titan 150 unit that, once added, will make the campus able to more fully meet its growing electricity and thermal energy needs.

UC San Diego Central CHP Plant

Solar Turbine Company Gas Turbine Unit



Cold Water Storage Tank

Emissions Considerations and the SoLoNO$_x$™ System

In order to address emissions concerns and the tight emissions regulatory control environment in California and other areas, Solar Turbines has developed the SoLoNOx™ system as an optional enhancement to the Titan 130 turbine gen-set package. At the UC San Diego site, the SoLoNOx™ system is controlling oxide of nitrogen (NOx) emission levels to about 1.2 ppm as an annual average, relative to a permitted level of 2.5 ppm.

The SoLoNOx™ is a called a "dry low emissions" system because it does not require water or steam injection. It makes us of a non-ammonia, passive catalyst that gets regenerated with periodic injections of hydrogen gas to scrub NOx from the catalyst and release it as inert nitrogen gas. The process uses lean, pre-mixed combustion technology and a uniform air/fuel mixture to carefully control the combustion process. Solar Turbines estimates that SoLoNOx™ has saved over 1.2 million tons of NOx emissions to date.

A Greening Campus – UC San Diego's Ambitious Efforts

UC San Diego is one of the leading campuses within the UC system in controlling the growth in campus energy needs through energy efficiency investments, developing renewable energy resources, and exploring other innovative clean energy schemes. The campus is installing approximately 1.2 MW of solar photovoltaic systems on parking garages and other buildings, is planning for the installation of a 2.4 MW high-temperature molten carbonate fuel cell system, and exploring the use of cold ocean water cooling at its Scripps Laboratory and other campus facilities.

The campus also has an agreement to purchase off-peak wind and to compensate by backing off the output of CHP plant – the first program of its kind so far in California – and has programs to analyze the energy use of data centers running on both AC and DC power, to study the prospects for bio-algae production as a fuel source, and to invest in additional energy efficiency programs.

Further Information Can Be Found At:

University of California – San Diego:
http://esi.ucsd.edu
http://sustain.ucsd.edu

Solar Turbines:
http://mysolar.cat.com/cda/files/154908/7/dscp-ucsd.pdf

PRAC: http://www.chpcenterpr.org

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UC San Diego's CHP plant is providing up to 90% of the peak campus electrical demand and 75% of its steam demand, along with steam-powered cooling that can be stored in the nearby thermal storage system.

The campus estimates that the plant is providing savings of about $8 million per year compared with the prevailing electricity and gas utility rates in the area.