PROJECT PROFILE

WESTERN CHP TECHNICAL ASSISTANCE PARTNERSHIPS

City of Tucson

District Energy System

1.6 MW CHP Unit

PHOTO COURTESY OF CLEARWAY ENERGY

Quick Facts

LOCATION: Tucson, Arizona
MARKET SECTOR: District Energy
FACILITY SIZE: 922,000 square feet
FACILITY PEAK LOAD: 2.1 megawatts (MW)
EQUIPMENT: 1.6 MW reciprocating engine with heat recovery, 250-ton absorption chiller, three 1,240-ton electric centrifugal chillers, and five 3 MMBtu/hr near-condensing boilers
FUEL: Natural Gas
USE OF THERMAL ENERGY: Hot water and chilled water for space conditioning
CHP TOTAL EFFICIENCY: 64%
ENVIRONMENTAL BENEFITS: Plant achieved a very large decrease in CO_2, NOx and CO emissions due to switch from coal to natural gas and high efficiency of CHP
CHP IN OPERATION SINCE: 2004

Site Description

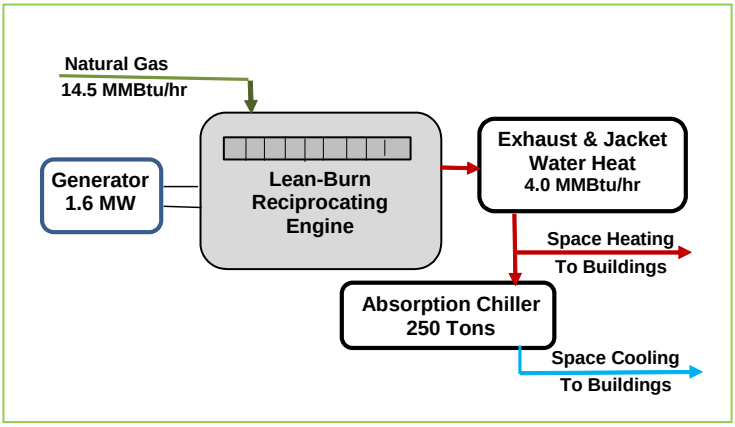
The original City of Tucson's District Energy System was commissioned in 1968 and entailed a heating/cooling plant serving municipal buildings via two heating/cooling loops. The Tucson District Energy System has since been expanded to four loops serving 922,000 square feet of building space consisting of the Tucson Convention Center, Midtown Police Station, Tucson Fire Department, Tucson Music Hall and the Roman Catholic Diocese of Tucson. The built-out heating/cooling plant is composed of three centrifugal chillers and five boilers. The Combined Heat and Power (CHP) system was added in 2004 and serves the base electric and thermal loads for the buildings network. The Central Utility Plant, which serves the District Energy System, is operated by Energy Center Tucson, a subsidiary of Clearway Energy, Inc.

Reasons for District Energy and CHP

A district energy system is a cost effective, energy efficient and space-saving approach to providing heating and cooling to a group of buildings located in proximity. It enables the use of fewer pieces of equipment that have a smaller collective footprint, are more efficient, benefit from greater load diversity and can more affordably achieve high reliability. CHP is a natural complement to a district energy system with economies of scale serving the base electric and thermal loads year-round.

CHP Equipment & Operation

The Tucson District Energy System contains five Patterson Kelly 3.0 MMBtu/hr near-condensing water heaters, three York 1240-ton centrifugal chillers, a Jenbacher 1.6 MW natural gas engine generator with heat recovery, and a York 250-ton hot water fired single effect absorption chiller. The lean-burn engine meets the local NOx limit without the need for selective catalytic reduction but has been fitted with an oxidation catalyst to control CO emissions. The engine heat recovery loop captures heat from the exhaust and engine cooling jacket.



Energy Flows for Tucson District Energy System
(Courtesy of Clearway Energy)

The priority use for the recovered heat is to preheat the return water from the district heating loops. The preheated water then flows to the boilers for supplemental heating up to the desired supply temperature. When the demand for building heating is low, the recovered heat is sent to the absorption chiller to pre-cool the return water from the district chilled water loops. The electric centrifugal chillers supplement the absorption chiller to meet the demand. There is sufficient thermal and electric demand to fully utilize the heat and electric output from the engine throughout the year with no power exported back to the grid. The CHP system is capable of grid-isolated operation to strengthen the City of Tucson's resilience.

Agreement with City of Tucson

Clearway's Energy Center Tucson owns the CHP equipment and has operated and maintained the City of Tucson's Central Utility Plant since 2003. Clearway sells the output of the system (hot water, electricity, and chilled water). There is a variable charge for the energy output (e.g., $/kWh, $/ton-hr, and $/MMBtu), plus a fixed charge. Variable charges are linked to Southwest Gas Corporation's natural gas prices and fixed charges include capital recovery, operations and maintenance.

"The addition of CHP to the City of Tucson's District Energy System has added economic, environmental and resiliency value to a living heating/cooling system that has kept current with technology advancements and growth for decades."

- *Jay Zaghloul, Director of Business Development and Customer Relations, Clearway Energy*

Key Takeaways

- The genset control panel was located inside the generator room. While the control area was adequately cooled, it made it difficult to communicate between operators during operation. A preferred location for the control panel would have been a separate room, with a viewing window to the genset room.
- The Central Plant experiences multiple grid outages every year. The system design enhances power reliability via grid independent capability, equipment redundancy and 24/7 monitoring.
- The district energy concept provides economies of scale and frees up space at individual buildings for more productive uses.

For More Information

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