Cogeneration Plant

In 2006, the University of Redlands commissioned a cogeneration plant (Cogen) to provide electricity and thermal energy to the campus. It runs in tandem with electricity supplied by Southern California Edison. Cogen produces 1,500 kilowatts while in operation. During the summer, it delivers approximately 50% of the campus' electricity needs, while in the winter it provides about 75%. In addition to electricity production, Cogen uses thermal energy to cool and heat water for use in a third of campus buildings.

What is Cogeneration?

Cogeneration is an efficient, reliable, and cost effective form of energy production. It uses a single fuel source to generate both energy and thermal power at the site of consumption.

In a traditional model, institutions, businesses, and homes purchase electricity from a centralized utility company. The electricity is produced off-site and transported to the point of consumption, with efficiency losses occurring at the point of production and along transportation paths. Thermal energy for heating and cooling, on the other hand, is traditionally produced at the site of consumption. This model, however, requires the purchase and transportation of additional energy and fuel, resulting in extra atmospheric waste heat, high emissions, and fiscal costs associated with this higher energy consumption.

In combining the production of electricity and thermal energy in one plant located at the site of consumption, cogeneration increases energy efficiency, reduces emissions and atmospheric waste heat, and provides significant fiscal savings.

How does the Cogeneration Plant Work?

The cogeneration plant located on-site at the University of Redlands uses a natural gas engine to turn a generator, which can produce 1.5 megawatts (1500 kilowatts) of electricity. A water-filled casing surrounds the engine and the water inside keeps the engine cool by absorbing engine-created heat. This heated water, otherwise known as jacket water, circulates through the cogeneration plant.

As the jacket water leaves the engine, it is directed through a heat exchanger located in the exhaust system, where it picks up an additional 10 degrees of heat from the exhaust produced by the engine. This heat transfer results in significantly less heat being released into the atmosphere, as the exhaust heat is reduced by about 50%, from 1000 degrees to 450 degrees.

From there, the heated jacket water circulates through an absorber, which, in a process similar to that used by an air conditioner, chills a separate supply of water for use on campus. Cogen creates 350 tons of cooled water per day for use on campus.

After the jacket water leaves the absorber, it goes through a second heat exchanger, this time transferring the heat to another separate source of water, in order to create hot water for heating campus buildings and for the Thompson Aquatic Center pool.

The jacket water has now cooled enough to return to the engine where, once again, it picks up thermal heat from the engine and the process starts again.

How does the Cogeneration Plant Benefit the Campus?

The cogeneration plant benefits the University by:

- Reducing the University's yearly carbon footprint by 30%
- Reducing emissions and atmospheric waste heat (with emissions no higher than 11 parts per million)
- Providing a reliable source of back-up power
- Heating and cooling water for a third of the University's buildings and the Thompson Aquatic Center pool
- Significantly reducing costs for electricity use on campus

Like all sources of energy, Cogen does have some limitations:

- Cogen is not a stand-alone system to meet the full electrical needs of the University. It runs in tandem with electricity purchased from Southern California Edison.
- The current cogeneration system cannot run below 80% of its operating capacity of 1500 kilowatts or it will automatically shut off in order to prevent the engine from overheating and over polluting emissions. There are times during the year when the campus demand is close to 80%.