

# West Campus Cogeneration Facility



Meeting multiple energy needs through the  
efficiency of cogeneration



## West Campus Cogeneration Facility

The West Campus Cogeneration Facility (WCCF) provides reliable heating and cooling for the UW-Madison campus and electricity for MGE customers. The facility began operation in spring 2005.

Through the efficiency of cogeneration, this single facility can responsibly meet the increasing energy demands of the city and campus. The facility is capable of producing 150 megawatts of electricity, 20,000 tons of chilled water and 500,000 lb/hr of steam.



The natural gas-fired plant is one of the cleanest in the Midwest. MGE and UW-Madison worked with community members to take steps beyond current environmental regulations. Through innovative mitigation measures, the partners are offsetting air emissions and water use impacts from the plant. The plant's design reduces noise levels outside the building.

This joint effort by MGE and UW-Madison has been recognized in Wisconsin for its environmental and minority business participation efforts. Awards include the Governor's Award for Environmental Excellence for the construction recycling and the Special Partnership Award for working with minority businesses during the construction.

As a regulated utility, MGE has the responsibility to plan for and provide reliable electricity for our customers at an affordable price. The cogeneration facility offers the best balance of cost and efficiency to deliver needed electricity with the least environmental impacts.

## MGE and UW partnership

MGE and UW-Madison jointly own the power plant. MGE owns the assets related to electric production, while UW-Madison owns the steam heat and chilled-water assets. Both MGE and UW-Madison also rely on other energy facilities to meet the power needs of the city and campus.

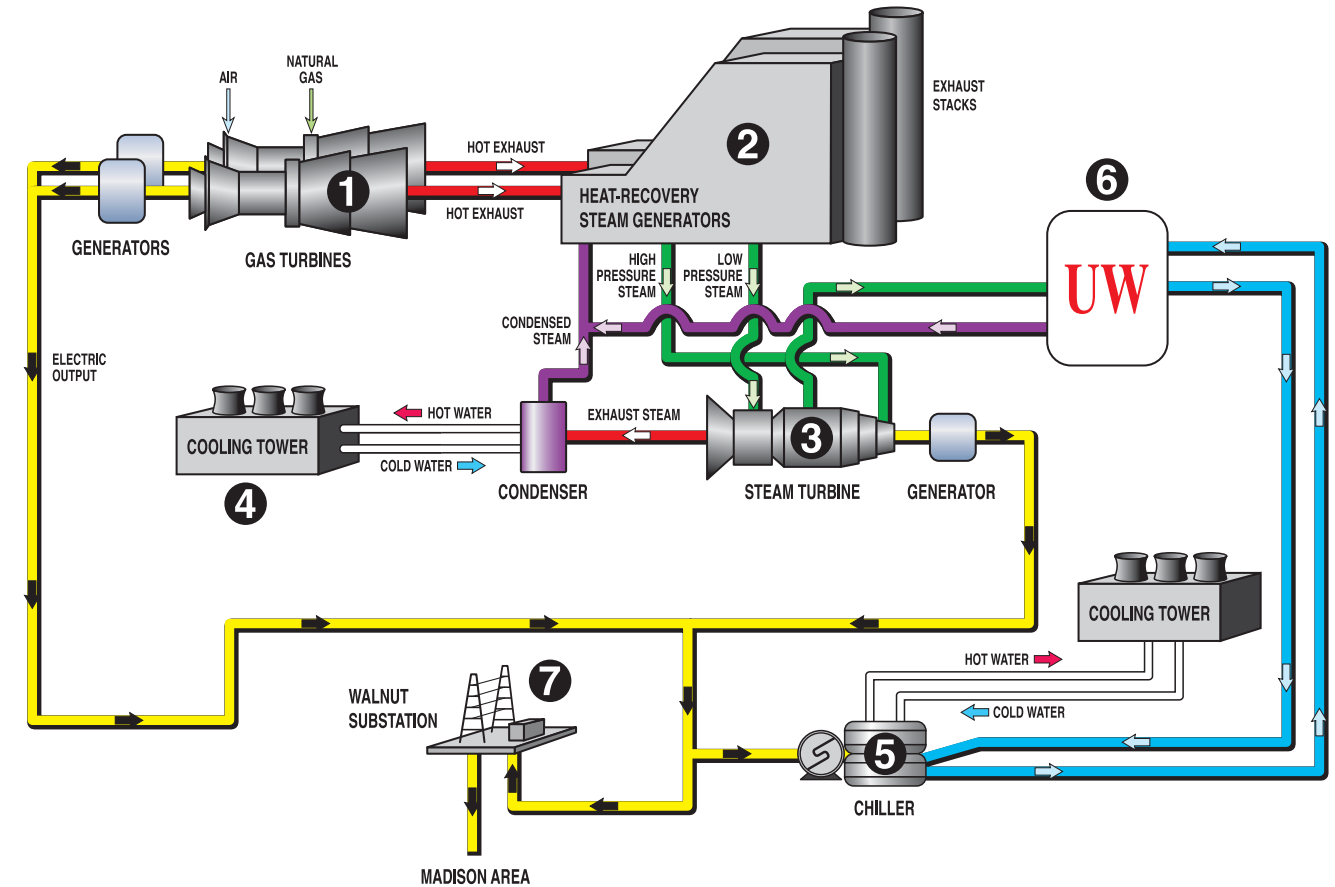
MGE operates and maintains the cogen facility under a joint plant agreement with the university. Sixteen employees work at this highly automated plant, which is staffed 24 hours a day.

The facility is located on 4.5 acres just north of the UW heating station on Walnut Street. Existing steam and chilled-water loops are located near the facility. In addition, major natural gas lines and a substation are near the site.

## How the cogeneration facility works

The highly efficient cogeneration operation uses the residual heat typically wasted in a standard power plant. This facility has an overall net efficiency rate of up to 70% when in cogeneration mode compared to a 30% to 35% rate for a conventional power plant.

- 1 Two natural gas-fired combustion turbines drive generators to produce electricity.
- 2 The hot combustion gases from each turbine pass through a corresponding heat-recovery steam generator (HRSG) to produce steam. The HRSGs contain duct burners to produce additional steam as needed.
- 3 The high- and low-pressure steam from the HRSGs passes through a single extracting/condensing steam turbine that sends heating steam to the UW and produces electricity for the Madison area.
- 4 The exhaust steam is sent to a condenser and then cooled by cooling towers. This process forms water that is reused.
- 5 Centrifugal chillers provide 20,000 tons of chilled-water capacity. Electric-driven chillers use roof-mounted cooling towers for heat rejection.



- 6 The steam heat and chilled water is used on the UW-Madison campus.
- 7 The electricity is sent to an adjacent substation and then to the Madison area.

## WCCF Fast Facts

### Dimensional data

Site: 4.5 acres

Facility footprint: 80,500 square feet

Maximum height: 116 feet

Height of exhaust stacks: 175 feet

### Components of facility

- Combustion turbine system
  - Two dual-fuel GE LM6000 combustion turbines with electric generators
  - Two dual-pressure, duct-fired Deltak heat-recovery steam generators with maximum capacity of 250,000 lb/hour of steam per unit

- Steam turbine system
  - One dual-pressure, extracting/condensing GE steam turbine with electric generator
  - Seven draft-induced Marley cooling tower cells with plume abatement technology
- Chilled water system
  - Four electric-driven York chillers at 5,000 tons of chilling capacity each
  - Four draft-induced Marley cooling tower cells
- Two natural gas Universal Compression compressors
- Process water system with two 250,000-gallon tanks—one for raw service water and one for demineralized water

## Reducing water impacts

The cogeneration facility was designed to minimize water use. Water is used for steam and chilled-water production and general use.

The facility uses about one million gallons of water a day on average. On hot summer days, when campus chilled-water demand is high, the facility may use about two million gallons a day. By comparison, on an average July day, about 54.9 million gallons of water evaporate from Lake Mendota.

The water is withdrawn from Lake Mendota and used in the cooling towers. Most of this water returns to the environment through evaporation from cooling towers. City of Madison municipal well water is used for all other purposes including boiler make-up water.

MGE took steps to reduce water use impacts from the facility after working with government, water resource experts and concerned citizens on water supplies. From this careful review, MGE implemented a water source plan that uses the least amount of water overall.

## Innovative steps to offset impacts

The facility's water withdrawal from Lake Mendota is not expected to produce a significant impact on Dane County's lakes and rivers except during times of extreme low flows. The Yahara River, south of Lake Waubesa, is an area of concern during these periods.

A group of area water resource experts helped formulate a plan to manage watershed issues related to the cogen facility:



- Pumping groundwater for a short time during periods of low water flows to supplement the Yahara River. The amount of water pumped into the river will offset the water used by the power facility during these times.
- Collect and infiltrate storm-

water runoff to recharge the groundwater system. This replenishes the water taken from the aquifer when pumping groundwater from the well. A groundwater recharge system at Odana Hills Golf Course accomplishes this goal.

## Maintaining air quality

The WCCF is one of the cleanest power plants in the Midwest. The facility meets all air quality standards with state-of-the-art emissions controls.

For example, the facility's emission levels that contribute to ozone are lowest compared to any other similar plant in the state. The controls, combined with the efficiency of cogeneration, produce markedly fewer greenhouse gases and other emissions such as heavy metals (mercury) and sulfur dioxide.

## Working with the community

MGE and UW-Madison worked with the community to take steps beyond current state and federal regulations. MGE and UW-Madison signed memorandums of understanding with various groups.

These agreements require MGE and the UW to offset the cogen facility's emissions of particulate matter, nitrous oxides and sulfur dioxide. MGE accomplishes these offsets through a variety of voluntary strategies, including fuel switching and the combustion of pre-consumer waste at other energy-producing facilities.

In addition, MGE commitments resulted in:

- An air-monitoring station for particulate matter on Madison's near-west side. Visit [www.cogenadvisory.com](http://www.cogenadvisory.com).
- \$50,000 for volatile organic compound emission reduction measures to improve air quality.
- A \$220,000 installation of thirty-seven photovoltaic fixtures that uses clean, renewable energy to light a section of a bike path along Campus Drive.

The complete memorandums of understanding are posted on [www.mge.com/about/powerplants/cogen](http://www.mge.com/about/powerplants/cogen).

