

## Melton Recycled Water Treatment Plant

The wastewater treatment facility in the shire of Melton in Melbourne is Australia's first to install a microturbine with a combined heat and power (CHP) system, which helps transform sewage water into carbon-neutral recycled water, electricity, and heat.

Electricity generated by the onsite Capstone CR200 MicroTurbine®, which is fueled by sewage digester methane gas, provides power for the recycled water facility. In addition, thermal heat produced by the microturbine is captured and used by the digester to further improve its efficiency. Together, these two technologies comprise the cogeneration system that helps make the wastewater treatment plant energy efficient.

The township of Melton is one of Australia's fastest growing municipalities, with a population expected to double in the next 20 years as the boundaries of Melbourne expand. With Melbourne's reservoirs dropping to their lowest water levels in a decade, recycled water plays a key role in the government's strategy to reduce overall water consumption. The region's water supply from lakes and reservoirs is only at 30 percent of capacity, meaning recycled water is vital to sustain the local community's needs.

The wastewater treatment facility, operated by Western Water, currently provides recycled water and sewage services to 145,000 people throughout Melton's outer regions. With rapid regional population growth expected, plant executives knew they needed a strategy to manage the future volume of waste in an eco-friendly way.

The result was a greenhouse reduction strategy to address how Western Water will cope with accelerated population growth and, at the same time, limit the company's overall carbon footprint among its



At Western Water's wastewater treatment plant in Melton, Victoria, a CR200 Microturbine burns biogas from the anaerobic digester to produce 1,700MWh of electricity each year. The electricity offsets the plant's overall power consumption by an estimated 60 percent.

### At a glance

#### Location

Shire of Melton, Melbourne, Victoria, Australia

#### Commissioned

July 2010

#### Fuel

Methane biogas from an anaerobic digester

#### Technologies

- Capstone CR200 Microturbine fueled by waste methane gas from the wastewater treatment plant.
- Capstone Heat Recovery Module installed on the CR200 to capture exhaust heat.
- 3 activated carbon filters that remove hydrogen sulfide, siloxanes, and moisture from biogas.
- Condensate traps and a chiller removes moisture from biogas.

#### Results

- CR200 generates 1,700MW-hour (MWh) of electricity each year.
- Capstone Heat Recovery Module paired with a supplementary burner creates approximately 276kW of heat energy and delivers 2.3 million kW-hour (kWh) of thermal energy.
- Waste heat energy is reused to maintain the digester's 35 degrees Celsius (95 degrees Fahrenheit) temperature.
- The 200kW of electricity delivered offsets the facility's utility power consumption by about 60%.
- The efficiency of the biogas-fueled CHP system can be as high as 90%, compared to 25–35% if the biogas is burned in a stand-alone boiler.
- Western Water has reduced its greenhouse gas emissions.



*“Capstone’s clean-burning, low-emission microturbine allows us to turn waste into a resource in the most innovative way.”*

— Rob Franklin, General Manager, Sustainability,  
Western Water

several plants. Reducing greenhouse-gas emissions is a focal point for Western Water as the company strives to achieve carbon neutrality by 2017.

At the plant, officials set high goals – to treat 100 percent of biosolids, use 100 percent of resulting methane biogas as a clean-and-green energy source, and produce 100 percent recycled water. The Capstone CR200 CHP system has helped meet these targets.

In July 2010, Capstone distributor Aquatec Maxcon commissioned the biogas-fueled Capstone CR200 Microturbine at the wastewater treatment facility to begin producing electricity onsite. By November, the complete CHP system was fully operating.

“When we conducted a full life-cycle analysis, we found that the high availability and low projected maintenance costs of the Capstone microturbine, together with the reliable power produced, made it the best option for us,” said Rob Franklin, Western Water’s General Manager, Sustainability. “We took energy efficiency into account, along with the availability of the equipment, which is well over 99 percent when compared to other cogeneration technologies in the marketplace.”

During the project’s planning phase, engineers estimated a Capstone CR200 would reduce this one plant’s greenhouse gas emissions 1,800 tons each year, or about 7.5 percent of Western Water’s total emissions among all its treatment plants.

The plant is a 10 million litre/day (2.6 million gallon/day) activated sludge treatment plant with tertiary lagoon treatment. At the facility, an anaerobic digester breaks down the biosolid sludge, which creates biogas with a methane content of about 70 percent. Before the 200kW microturbine was installed, the plant used some of the gas to heat a boiler for the digester, and then flared any excess gas. Unfortunately, flared methane gas has a greenhouse-gas impact on the atmosphere 21 times greater than carbon dioxide.

The Capstone CR200 burns biogas from the anaerobic digester to produce 1,700MWh of electricity each year. The electricity offsets the plant’s overall power consumption by an estimated 60 percent.

The Capstone microturbine is designed to tolerate high levels of hydrogen sulfide and siloxanes in the biogas when compared to traditional reciprocating engine technology. The biogas produced at the wastewater facility has up to 3,500 parts-per-million (ppm) of hydrogen sulfide.

Waste heat from the CR200’s external waste-heat exchanger maintains the required 35°C (95°F) temperature in the digester. The Capstone Heat Recovery Module will provide approximately 276kW of heat from the microturbine’s exhaust and deliver 2.3 million kWh of thermal energy. The efficiency of thermal generation to supply hot water to heat the plant’s digesters results in the production of even more biogas that can be converted to energy generation.

The biogas-fueled CHP system features an overall energy efficiency level as high as 90 percent, compared to about 25–35 percent if the biogas is burned in a stand-alone boiler.

Because of the projected reduction in energy costs and environmental impact from the installation of the microturbine, the plant secured grants for the project totaling AUD\$750,000 (US\$668,000) from Sustainability Victoria and the Department of Sustainability.

The cogeneration plant, officially opened by Energy and Resources Minister Peter Batchelor at the facility’s launch, will serve as a model for similar projects at wastewater treatment facilities throughout Australia.

The emissions reduction is equivalent to taking 450 cars off the road annually. Microturbine technology produces a waste gas with less than 9 ppm NOx and 40 ppm carbon emissions, which is significantly cleaner than the surrounding urban air environment.

Plant managers from Western Water predict that cost savings from the onsite generation of electrical and thermal power, plus “green” incentives offered by the government, will justify the installation of a second CR200 system, and ultimately a third as demand increases.

“We aim to become a zero-waste recycling plant by 2017,” Franklin said. “Capstone’s clean-burning, low-emission microturbine allows us to turn waste into a resource in the most innovative way. The reliable and low maintenance turbine has surpassed our expectations. This great success has motivated us to continue looking for other opportunities to further reduce greenhouse-gas emissions within other recycled water treatment plants.” ■