

# A town called Crown

**This month, HVAC&R Nation® takes a look at Crown, the Southern Hemisphere's largest and most successful entertainment complex located in Melbourne, Australia. Behind the buzz of the casino floor, opulent hotels and glamorous restaurants is a remarkable engineering achievement.**



The Crown Entertainment Complex is Australia's single largest site, and remains one of the largest civil engineering projects ever undertaken in Australia since it opened to the public in May 1997.

Completing the vision for Melbourne's Southbank arts and tourist precinct, Crown transformed what was formerly an industrial site into a 500-metre long destination fronting the Yarra River.

Covering 510,000 m<sup>2</sup> (the equivalent of two city blocks), it is one of the largest and most diverse entertainment complex's of its kind in the world, housing two hotel properties – the five-star Crown Towers and the four-star-plus Crown Promenade Hotel. Both are within easy access to in excess of 40 restaurants and bars, emporium of over 30 retail boutiques, several night clubs, cinema complex, interactive entertainment arcade, a live cabaret-style venue, plus the 24-hour Crown Casino, the biggest gaming facility in the Southern Hemisphere featuring 2500 gaming machines and 350 gaming tables including 50 poker tables.

Such is its popularity Crown receives more than 15 million visitors per year and has become a key part of Melbourne's identity since its opening in 1997.

## A big county town on two city blocks

Crown is often compared to a country town. When you drive into a country town with a population of 40,000 to 50,000, think about the fact that this represents roughly the population of Crown on any given day. Both "towns" have to be supplied with power generation sewerage, water and gas.

Powering Crown is quite a feat, given the property contains such a diverse range of spaces and uses. Along with two award-winning hotels offering 947 rooms,

## Inside Crown

<b>Visitors:</b>	15 million per year
<b>Size:</b>	510,000 m <sup>2</sup>
<b>Staff:</b>	7500 hospitality, gaming and administration employees
<b>Lifts and Escalators:</b>	36

it houses the largest gaming facility in the Southern Hemisphere, stretching more than half a kilometre in length and featuring over 350 gaming tables and 2500 gaming machines.

The western end of the Crown Entertainment Complex includes nightclubs, a 800-seat theatre, a 14-screen cinema complex, a multimedia entertainment arcade as well as a host of retailers; while two levels along the Crown riverside also incorporate 6500 square metres of retail and restaurant space.

Operating 24 hours a day, seven days a week ensures that an enormous amount of power is required to power, light and condition the variety of spaces and provide the appropriate facilities for the various restaurants on site.

## Co-generation project that was ahead of its time

In 1994, as part of the design phase, Lincolne Scott was commissioned to undertake a feasibility study into cogeneration as part of the Crown development.

It was thought that cogeneration could provide significant return on investment, as well as satisfy strict government requirements for a suitable backup and emergency power generation on-site, to continuously provide power to the gaming floor. The study concluded that a gas-fired cogeneration plant would tick all the boxes, and installation began on the \$6 million project.

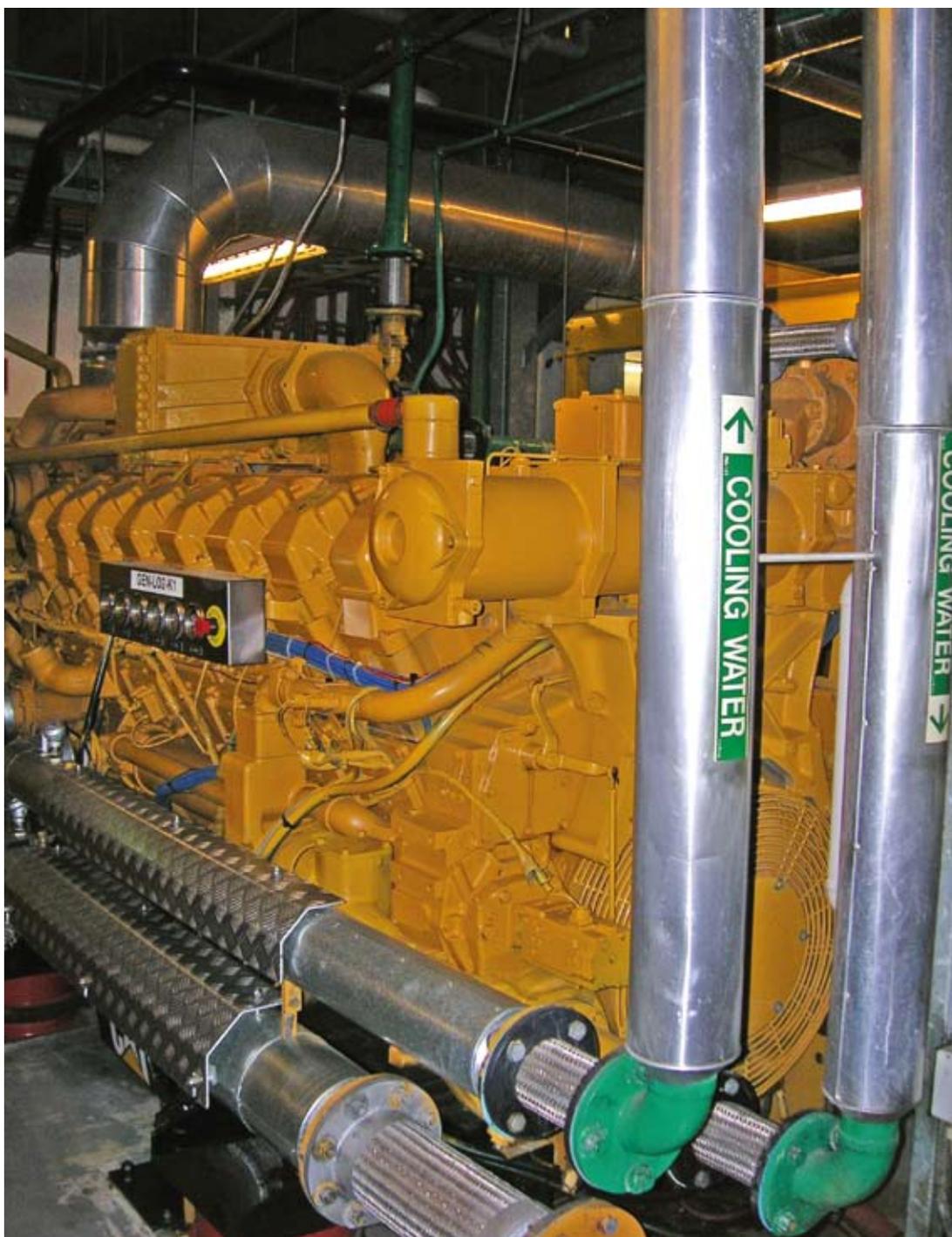
The chosen plant consists of six Caterpillar G3516 LE lean burn reciprocating gas engines, each able to generate 933kW of power.

These engines generate sufficient power to meet around 30% of the casino's power needs, with all power generated being consumed at site. The maximum electrical load at Crown is up to 17MW; additional power is imported from the grid through three high voltage feeders.

The plant was completed in 1997. It ran on standby until 1999.

Since that time, the plant has operated Monday to Friday between 7am and 11pm during the peak electrical tariff period, to provide 16 hours of cost-effective power.

The cogeneration plant is fully automated and remotely monitored, the control room is unmanned. Operators and managers receive SMS messages to their mobile



One of the six Caterpillar co-generation gas engines



Standby boilers

## Crown's Co-Generation

**Configuration:** Six G3516 Caterpillar natural gas-fired engines

**Electrical Output:** 933kW each

**Electrical Generation:** 22,000MW/h per year

**Commissioned:** 1997

**Annual Greenhouse Gas Reductions:** 25,000 tonnes

phones in the case of a fault. Each morning, all six engines start up, synchronise with the grid and up to load automatically, over 250 times per year.

## Waste not, want not

The waste heat from the gas engine exhaust and jacket water system is utilised to generate hot water for space heating, domestic hot water and absorption cooling for the casino. Each gas engine produces approximately 400 kW of useful heat from the exhaust, and another 600 kW from the jacket water cooling circuit. Hot water is generated at about 105-110°C at 250 kPa.

The primary use of waste heat is for two large absorption chillers but also provides heating and domestic hot water. The heat demand is seasonal, peaking in winter at about 12 – 14 MWth. Crown also operates a sizeable electric cooling plant to cope with Melbourne's infamous hot summer days.

The cogeneration plant is backed up by standby boilers. Crown has 5 back up boilers installed of 2.5 MWth each (down-rated from the original 3.5 MWth).

Waste heat can also be sent to dump heat exchangers in case of emergency, as the primary focus is on the cogeneration plant providing backup power. With a thermal efficiency of around 77%, the cogeneration installation results in significant greenhouse gas reductions, of approximately 25,000 tonnes of CO<sub>2</sub> per year.

## Looking to the future

Eleven years is a long time, particularly in the world of HVAC&R equipment where operating times are 24 hours



*Ventilation stack*

a day, seven days a week, all year round. As such, much of the plant is considered to be nearing the end of its useful life, having lived the life of equipment double its age largely because of the constant operation it has ensured.

Crown is set to undergo a multi-million dollar upgrade over the next few years, which will see the complex

revamped, it is probable that a large amount of equipment will be replaced.

Constantly upgraded and maintained, the Crown Entertainment Complex stays ahead of its time in many ways. ▲