HOT ARTESIAN WATER POWERS AN OUTBACK TOWN IN AUSTRALIA

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INTRODUCTION

The small town of Birdsville (139º53'E 25º21'S) is situated in arid south west Queensland approximately 1000 miles northwest of the state capital Brisbane (Figure 1) and on the edge of the Simpson Desert. Because of its remote location, the town is not connected to the Australian national power grid and requires its own power generation facilities. Established in the 1870s, Birdsville takes its name from the prolific bird life that soon arrives when the nearby Diamantina River intermittently fills with water. The town currently has a population of around 100 people and is sustained economically mainly by adventure tourism.

Figure 1. ***The location of Birdsville and the Great Artesian Basin.***

The town's need for electric power follows a familiar seasonal pattern with highest demand in the hot summer months when air-conditioning is used extensively and a relatively low demand in winter. This demand cycle from the town's small population sees less than 120 kW of power required in winter and upwards of 250kW needed in summer. The one exception is during the town's once yearly "races weekend" in spring when the population can swell to more than 5000. The Birdsville Races is a major tourist event that draws tourists from all over Australia, many of whom arrive in light aircraft. As a result, the town has an excellent all-weather airstrip (Figure 2) something quite unusual for a town of its size.

To cope with the annual variations in the demand for electricity an integrated mix of generation systems are used:

Figure 2. ***The town of Birdsville with its airstrip in the foreground and the Diamantina River behind the town.***

- A geothermal power station with a nominal power rating of 150kW,
- A liquefied petroleum gas (LPG) generator set with a rating of 300 kW, and
- Two 150 kW diesel generator sets.

The geothermal power system is installed on a free flowing artesian bore that was drilled to a depth of 1230 m to provide the town's water supply approximately 50 years ago. The water flows through a 6-in.casing to surface at a temperature of 98ºC and a rate of 27 L/s. The source of this water is an aquifer in the underlying Great Artesian Basin which underlies approximately 1.7 million km^2 of central and eastern Australia (Habermehl, 1980).

A geothermal power station (Figure 3) was originally installed on the bore in 1989 and commenced operation in 1992 (Burns, et al, 2000). However, the original system suffered from a number of technical problems centered on the use of R114 chlorofluorohydrocarbon as the working fluid. In 1999 the plant was upgraded with a grant of A$95,300 (US$73,900) from the Queensland Sustainable Energy Innovation Fund and support from Ergon Energy Corporation Ltd.

The upgrade shown schematically in Figure 4 involved:

- Conversion from the R114 chlorofluorohydrocarbon working fluid previously used to isopentane which is more volatile and produces a larger volume of vapor.
- Installation of a new plate heat exchanger, a new multi-stage liquid pump and larger diameter pipes and fittings to handle the larger volumes of the new working fluid.

Figure 3. ***The Birdsville Geothermal Power Station is situated on a free flowing bore a mile or so out of town (Australian Broadcasting Corporation).***

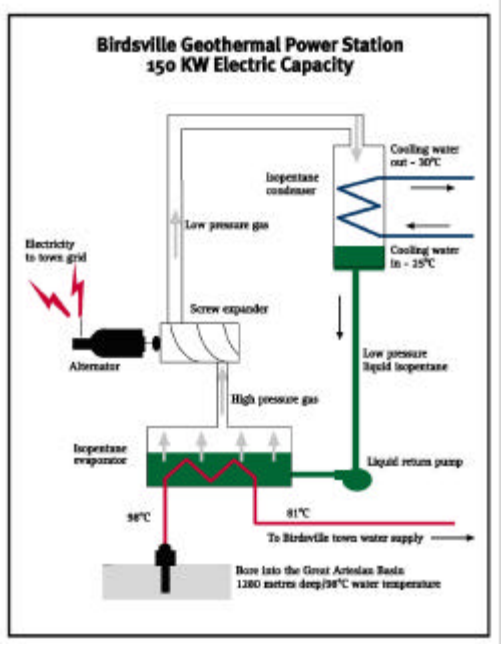

Figure 4. ***Schematic diagram of the Birdsville Geothermal Power Station (Queensland Environmental Protection Agency).***

Some of the 81°C outlet water from the power station is piped into Birdsville for the town's limited water supply requirements. The remainder is flowed into a channel (Figure 5); where, it is used to water stock animals once it has travelled far enough to cool down.

The Birdsville geothermal power plant now provides 120kW of net power output after parasitic losses of 30kW. The latter are principally associated with the operation of the plant's pumps. With a capacity factor of >95%, the geothermal power system is so reliable that it provides all of the town's electricity needs at night and during the cooler winter months when air-conditioning is not required (Queensland EPA, 2002). An automatic control system and radio telemetry links the geothermal system with the town's LPG and diesel powerhouse 1½ miles away. The powerhouse is shut down when the geothermal system is able to satisfy the town's demand for electricity.

Figure 5. ***The outlet water from the power station is flowed in a channel until it has cooled sufficiently for use by stock animals (Australian Broadcasting Corporation).***

In the 2002-03 financial year, the geothermal system provided 529,326 kWh to the town of a total power generation of 1,630,985 kWh. This saves 42,000 gallons of diesel fuel annually at a saving of A$135,000 (US$104,700) and 430 tonnes of CO_2 emitted.

The geothermal power station is currently shut down for a A$100,000 (US$75,600) upgrade to improve building ventilation and to install isopentane gas detectors for improved plant safety. It is expected that the power station will be back on-line in August 2005.

REFERENCES

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