AUSTRALASIA: GEOTHERMAL REPORT 2015

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AUSTRALIA

- Ground source heat pump installation rapidly increasing
- Hot spring spa industry emerging in Victoria
- Increased direct use of thermal groundwater, especially in Perth.
- Completed: Ground Water Cooling project in Perth that involves the rejection of waste heat from a supercomputer into a shallow aquifer
- Birdsville Geothermal Power Plant continues to generate 80 kWe net from a 98°C artesian well in Central Australia.

Lack of large scale development due to:
- unsupportive and risk-averse investment markets
- unexpected technical issues
- unstable policy settings.

8 October 2013
Completion of 1 MWe Habanero Pilot Plant demonstration
Key Points
- 1 MWe Habanero Pilot Plant Trial was successfully completed and the plant shut-down on Monday 7 October. Plant operated for 160 days following commissioning on 30 April 2013.

Beardsmore et al, Proceedings World Geothermal Congress 2015
NEW ZEALAND ELECTRICITY SCENE

80% renewable

16% geothermal

- Hydro
- Geothermal
- Wind
- Wood
- Thermal

61%

17%

5%

16%
OUR GEOTHERMAL SYSTEMS

Large scale convecting geothermal systems

Liquid dominated

Reservoirs at ~ boiling point for depth

High rainfall, high permeability = high recharge & mass flow rates

220°C - 320°C

Reservoir temperature

From Bernal et al, Geochimica et Cosmochimica Acta 126 (2014) p 265-283
NZ GEOTHERMAL GENERATION

Installed Geothermal Electricity Generation Capacity, New Zealand

- Weirakei
- Ohakiki
- Pohipi
- Rotokawa
- Mokai I
- Mokai II, Weirakei Binary
- Kawerau
- Mokai III
- Te Huka
- Nga Awa Purua
- Te Mihi
- Ngatamariki

Electricity Generation (MW)

Cumulative Capacity (MWe)

Projected
2006

KAWERAU
+8 MWe

NGAWHA
+15 MWe

2008

KAWERAU
+100 MWe

NGA AWA
+138 MWe

2010

2012

KAWERAU
+23 MWe

NGATAMARIKI
+82 MWe

2014

PURUA
+15 MWe

KAWERAU
+8 MWe

KAWERAU
+23 MWe
Recent drilling program

102 new wells

Why:
- Make-up
- New production
- Reinjection
- Exploration
- Appraisal
- Direct heat
- Subsidence investigation

Result:
- Reinjection capacity: 3 * increase
- 2 super-wide wells, casing 18-5/8”
- Contact’s deepest well (3020 m)
- Hottest wells yet > 300 °C

From Winmill et al, Proceedings World Geothermal Congress 2015
**Challenges:**

- Ultimately supply 3 stations with different pressure requirements
- Flexible swing of steam between 3 stations
- Dual redundant & dual modes of reinjection capacity
- Commissioning Te Mihi while maintaining baseload to other stations
- Optimize capacity of older plant to accommodate project deferrals
- Land scarcity with power station & well-pad requirements
- Scalability for a 3rd Te Mihi turbine

From Harwood et al, Proceedings World Geothermal Congress 2015
Old Wairakei Power Station has direct contact condensers using river water

Wairakei Bioreactor

Achieves the required reduction in $\text{H}_2\text{S}$ discharges to the Waikato River from the Wairakei Power Stations
• Total pipe length 378 km
• Water flow at 13 m³/s
• Water takes ~ four minutes to travel the 378 km of pipes

- Over three million litres of treated water being returned to the river every four minutes
- Largest industrial-scale biofilm facility of its type in the world proven to reduce the amount of hydrogen sulphide in the cooling water from a geothermal power plant
Increased use of geothermal heat in rebuilding from Christchurch 2010 & 2011 earthquakes

**2010**
Svenska Cellulosa Aktiebolaget Tissue mill Clean steam supply (Ngati Tuwharetoa Geothermal Assets)

2006 Tauhara
20 MW<sub>th</sub> timber drying

2007 Mokai
11.7 hectares of glasshouses

2010 Mokai
Miraka milk drying plant
PROFESSIONAL WORK 2010 – 2014
(who did it?)

Data from Carey et al, Proceedings World Geothermal Congress 2015

Professional person-years of effort
FUTURE

Geothermal is the most cost-effective electricity generation option, but electricity demand flat

3 new power plants consented (315 MW)

Optimizing use of the consented fluid take

Managing the reservoir in a sustainable manner

Increased direct use of heat

Researching & teaching geothermal

Innovative ways to use excess hot water

Thursday, July 16, 2015

Laurence McMichael

Taupō DeBretts Resort had a problem. Timed hot water. What to do? Find a way of using up that excess hot water that is leaking a gaseous, offshore. So DeBretts came up with an innovative and environmentally sustainable solution - it’s the world’s first geothermal-powered hot water swimming and spa complex. The resort extracts geothermal water from a bore 1.5km deep. It 90°C, was not hot enough to simply boil the water to steam, but heating the excess heat, the challenge was to find a way of harnessing the energy. So, two years ago, DeBretts began researching innovative ways to use excess hot water, which use the heat from the geothermal water to heat both water and air, saving the resort from the cost of an expensive boiler system. The resort invested in innovative green solutions that use the geothermal water to heat both water and air, saving the resort from the cost of an expensive boiler system. The resort invested in innovative green solutions that use the geothermal water to heat both water and air, saving the resort from the cost of an expensive boiler system.
Thank you

Photo of Wairakei by Dr Fabian Sepulveda, Contact Energy Ltd.