

# Current Directions for Geothermal Energy Development in Australia

Graeme BEARDSMORE<sup>1</sup>, Charles DAVIDSON<sup>2</sup>, Ludovic RICARD<sup>3</sup>, Martin PUJOL<sup>4</sup>, Adrian LARKING<sup>5</sup> and Betina BENDALL<sup>6</sup>

1. *Hot Dry Rocks*
2. *Peninsula Hot Springs*
3. *CSIRO*
4. *Rockwater*
5. *Australian Geothermal Association*
6. *SA Dept Energy and Mining*



## Direct-use Census

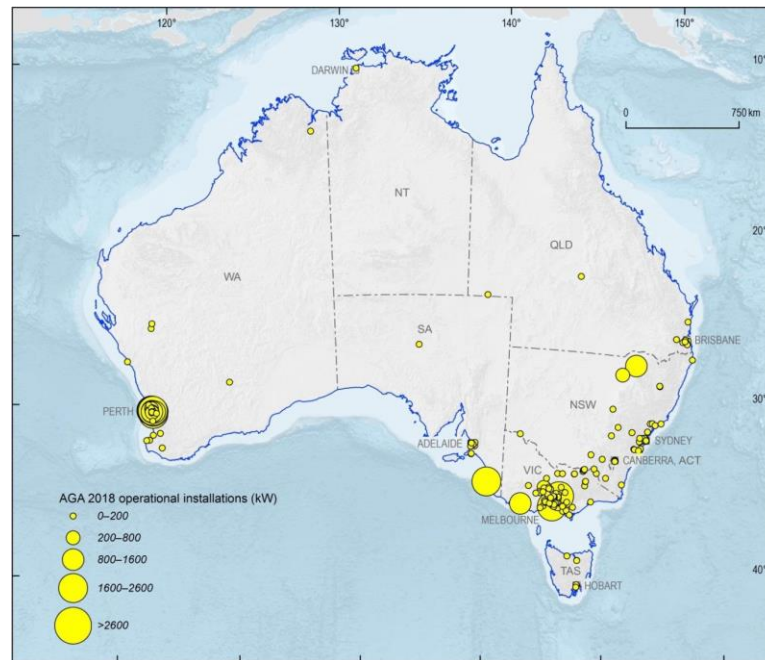
Location : Australia-wide

Year : 2018-2019

Status : Available (on AGA website)

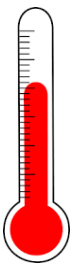
See also Paper 01007

Session 7A: Country Updates 7 -- Asia-Pacific

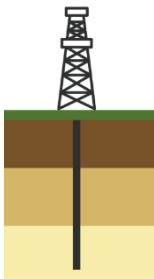


AGA Census 2018-2019 operational installations

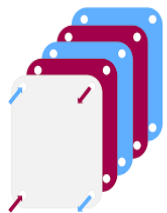
Prod:  
up to 71°C



Prod:  
up to 1,500 m

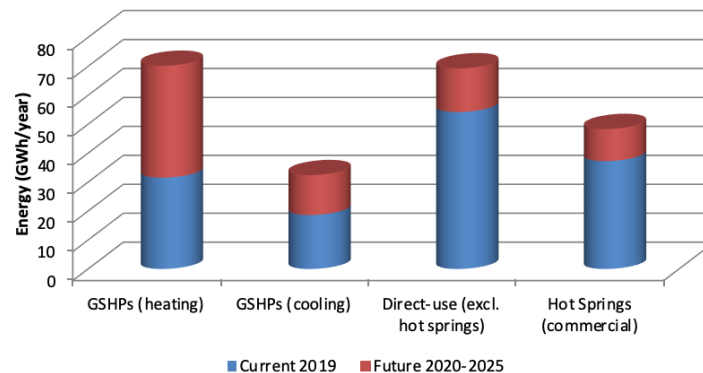


Owners:  
>330 (2019)



Power:  
85.3 MWt (2019)

Output Energy:  
161 GWh (2019)



AGA Census Produced Energy

AGA Contact: Adrian Larking (President)

[australiangeothermal@gmail.com](mailto:australiangeothermal@gmail.com)



## Electricity White Paper

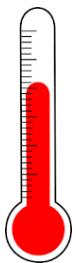
Location : Australia-wide

Year : 2020

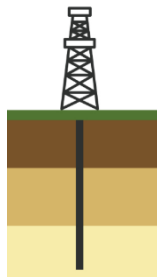
Status : Available (on AGA website)

See also Paper 01007  
Session 7A: Country Updates 7 -- Asia-Pacific

Prod:  
84°C



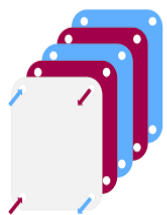
Prod:  
886 m



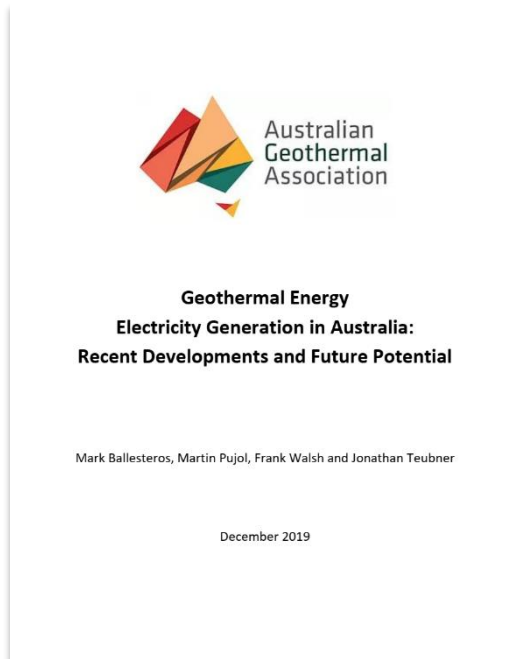
Owner:  
1 (2019)



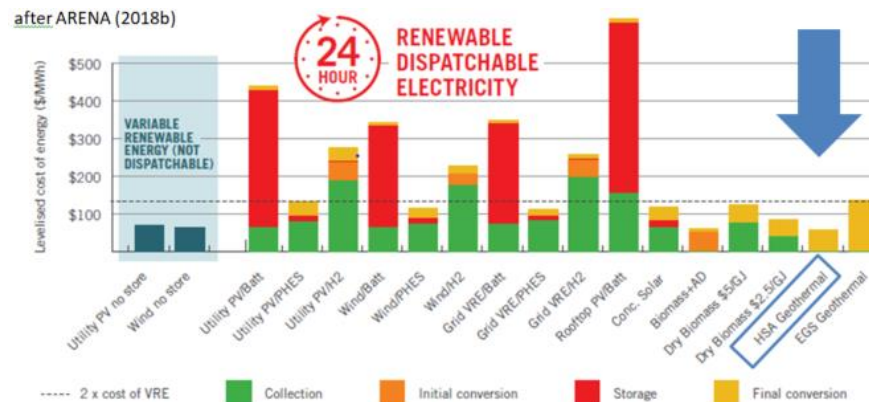
Power:  
300 kWe



Output Energy:  
6,720 MWh



### AGA Geothermal Electricity Generation White Paper



LCOE of HSA Geothermal compared to other renewable dispatchable electricity sources in Australia

AGA Contact: Adrian Larking (President)

[australiangeothermal@gmail.com](mailto:australiangeothermal@gmail.com)



## Riverton Leisureplex

Location : Perth, Western Australia

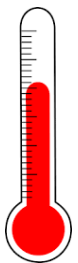
Year : 2015

Status : Operating

Type : Direct-use for pool heating

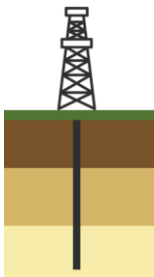
Consultant : Pennington Scott

Driller : JSW



Prod:  
44°C

$\Delta T$ :  
 $\leq 9^\circ\text{C}$

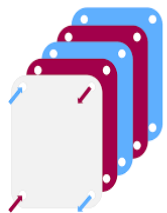


Prod:  
1,050 m

Inj:  
780 m



Owner:



Max Power:  
715 kWt

Output Energy:  
1,900 MWh



Riverton Leisureplex opening (photo source: Your local examiner)

AGA Contact: Martin Pujol (Rockwater)

[mpujol@rockwater.com.au](mailto:mpujol@rockwater.com.au)



## Scarborough Beach Pool

Location : Perth, Western Australia

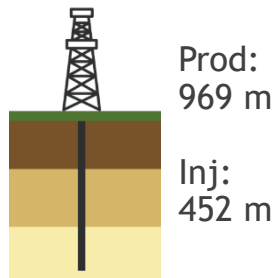
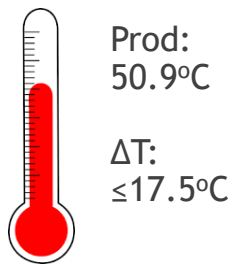
Year : 2017

Status : Operating

Type : Direct-use for pool heating

Consultant : Rockwater Pty Ltd

Driller : Welldrill



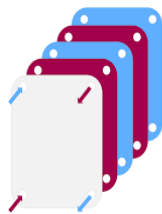
An aerial view of Scarborough Beach Pool, Western Australia, which has a geothermal heating system (photo source: Douglas Mark Black Photography)



View of the drill site only 150 m away from the Indian Ocean (photo source: Australian Mud Consultants)



Owner:



Max Power:  
2,550 kWt

Output Energy:  
4,500 MWh

AGA Contact: Martin Pujol (Rockwater)

[mpujol@rockwater.com.au](mailto:mpujol@rockwater.com.au)



## Cockburn ARC

Location : Perth, Western Australia

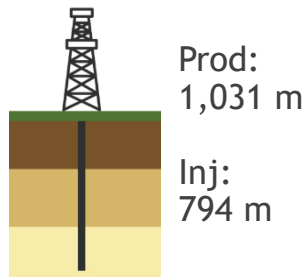
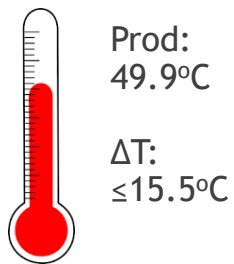
Year : 2017

Status : Operating

Type : Direct-use for pool heating

Consultant : Rockwater Pty Ltd

Driller : Drilling Contractors of Australia



An aerial view of Cockburn ARC, Western Australia, which has a geothermal heating system (photo source: NDY)



View of the drill site (photo source: Rockwater)

AGA Contact: Martin Pujol (Rockwater)  
[mpujol@rockwater.com.au](mailto:mpujol@rockwater.com.au)



## Armadale Fitness and Aquatic Centre

Location : Perth, Western Australia

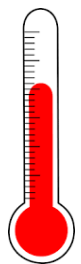
Year : 2018

Status : Operating

Type : Direct-use for pool heating

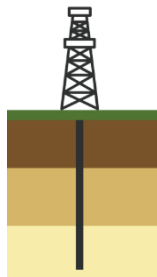
Consultant : Rockwater

Driller : Drilling Contractors of Australia



Prod:  
43.7°C

$\Delta T$ :  
 $\leq 13.5^\circ\text{C}$



Prod:  
1,002 m

Inj:  
474 m

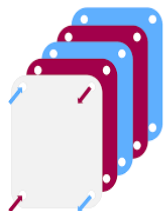


View of the drill site (photo source: Rockwater)



Owner:

CITY OF  Armadale



Max Power:  
2,400 kWt

Output Energy:  
4,000-6,000 MWh

AGA Contact: Martin Pujol (Rockwater)

[mpujol@rockwater.com.au](mailto:mpujol@rockwater.com.au)



## Aegis Age Care Group

Location: Perth, Western Australia

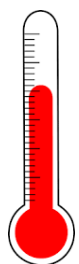
Year: 2018

Status: Operating

Type: Ground Source Heat Pump (open-loop)

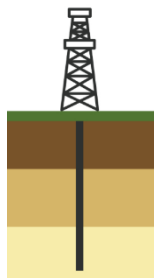
Consultant: Rockwater

Driller: Harrington Drilling



Prod:  
23°C

$\Delta T$ :  
7.5°C

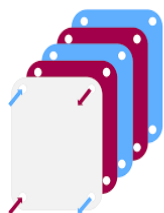


Prod:  
155 m

Inj:  
165 m



Owner:  
Aegis  
age care



Max Power:  
800 kW

Output Energy:  
900 MWh



View of the drill site (photo source: Rockwater)



Completed development (photo source: Rockwater)

AGA Contact: Martin Pujol (Rockwater)

[mpujol@rockwater.com.au](mailto:mpujol@rockwater.com.au)





## Rivergum Residential Treatment Centre

Location : Ararat, Victoria

Year : 2018

Status : Operating

Type : District Heating & Cooling (GSHP & Dry Cooler)

D&C Contractor : Direct Energy Australia

Driller : Direct Energy Australia

Ground Loop: Radial vertical closed loop

Owner: Victorian Department of Justice & Regulation

System Capacity: 300 Kw

Supply Cooling Temp: 6.5°C

Building Cooling COP: 5.2

Building Heating COP: 4.9

Server Room Cooling COP: 12.65 to 28.56



Photo Courtesy of Direct Energy Australia & KANE Constructions



## Pawsey Centre

Location : Perth, Western Australia

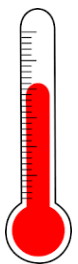
Year : 2018-2019 (workover)

Status : Operating

Type : Direct-use for supercomputer cooling

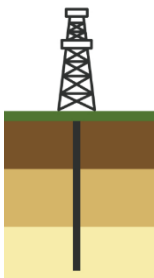
Consultant : Rockwater Pty Ltd

Driller : Age Developments



Prod:  
22°C

$\Delta T$ :  
 $\leq 10^\circ\text{C}$

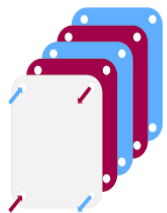


Prod:  
139 m

Inj:  
139 m



Owner:



Max Power:  
2,400 kWt

Output Energy:  
7,000 MWh



Tube heat exchanger used to cool the supercomputer (photo source: Rockwater)



Aerial view of the drill site (photo source: CSIRO)

AGA Contact: Martin Pujol (Rockwater)

[mpujol@rockwater.com.au](mailto:mpujol@rockwater.com.au)



## Sydney Light Rail Transport NSW

Location : Randwick, Sydney Australia

Year : 2018-2019

Status : Operating

Type : Cooling (GSHP & Natural Air)

D&C Contractor : Direct Energy Australia

Driller : Direct Energy Australia

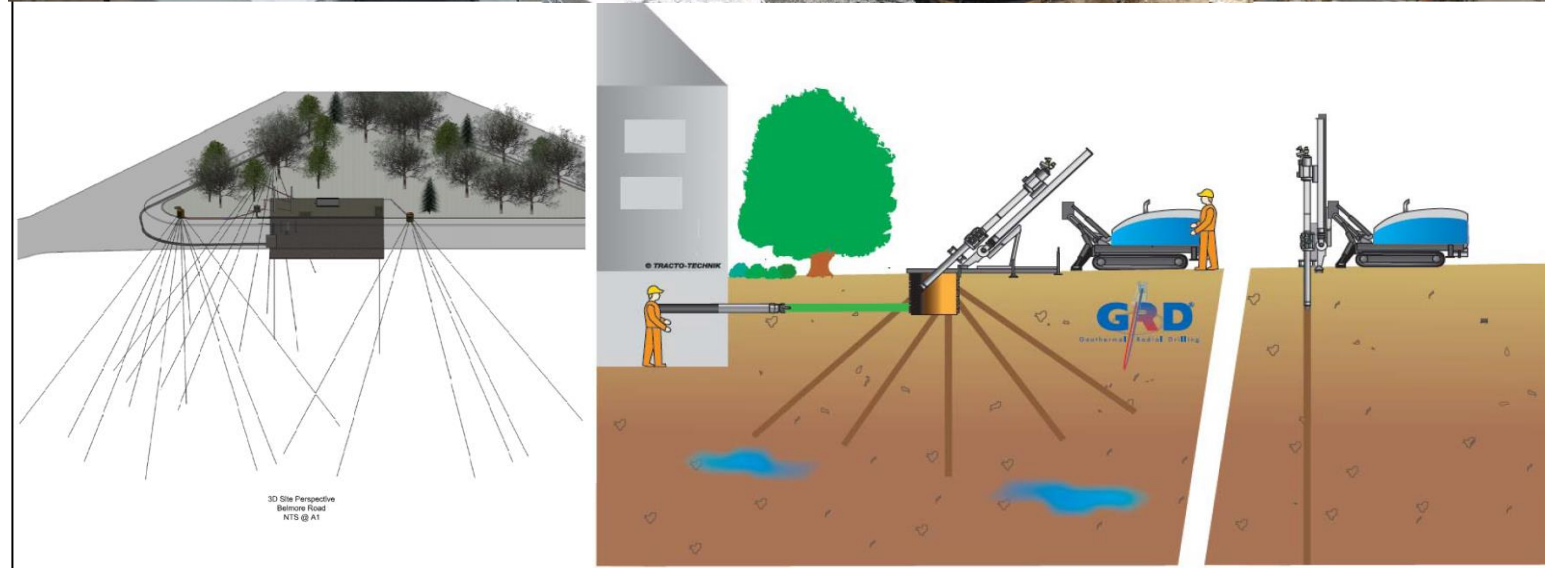
Ground Loop: Radial vertical closed loop

Owner: Transport NSW

System Capacity: 70 Kw

Supply Cooling Temp: 6.5°C

Cooling COP: 4.8



Direct Energy Australia

AGA Contact: Marcus Wearing-Smith (Direct Energy)

[marcus@directenergy.com.au](mailto:marcus@directenergy.com.au)



## Fiale Well Testing

Location : Lake Asal, Djibouti

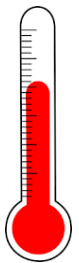
Year : 2018-2020 (well testing)

Status : Exploration/Testing

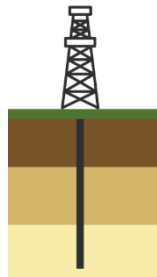
Type : Production Wells (Electricity Generation)

Consultant : JRG Energy (Brisbane)

Driller : Iceland Drilling (technical oversight provided by Geologica)



Prod: ~ 360°C



Prod: ~3000 m  
Inj: ~3000 m



Owner:  
Electric de  
Djibouti



Max Power: TBD  
Output Energy: TBD



Performing PTS runs on 1 of 3 exploration wells drilled (photo source: JRG Energy)



Distance view of the drillsite and surrounding landscape (photo source: JRG Energy)

AGA Contact: John Gilliland (JRG Energy)

[john@jrgenergy.com](mailto:john@jrgenergy.com)

## Winton Shire Council

Location : Winton Queensland Australia

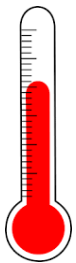
Year : 2019

Status : Operating

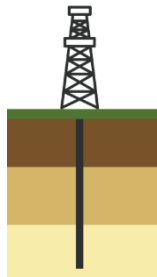
Type : Power Generation & Town Water Cooling

Installation : gTET

Driller : Existing bore (>50 yrs old)



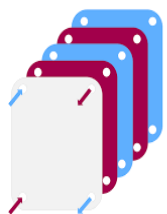
Prod:  
84°C



Prod:890 m



Owner:



Max Power:  
300 kWe

Input Energy:  
6,720 MWh



An aerial view entire power station



View inside the power station

AGA Contact: Paul Keen (gTET)

[pkeen@g-tet.com](mailto:pkeen@g-tet.com)



## University of Melbourne/Lend Lease Melbourne Connect

Location : Carlton, Melbourne, Australia

Year : 2019-2020

Status : Under Construction

Type : Baseload Heating, Cooling pre-heat  
domestic hot water (GSHP)

D&C Contractor : Direct Energy Australia

Driller : Direct Energy Australia

Ground Loop: Radial vertical closed loop

Owner: Lend Lease

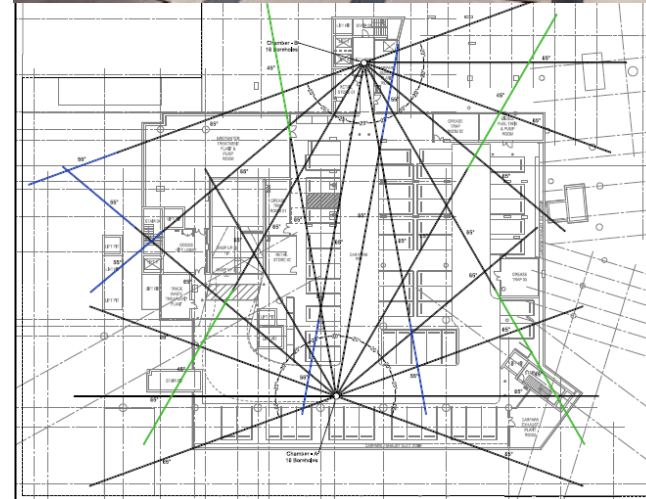
System Capacity: 250 Kw

Supply Heating Temp: 45°C

Supply Cooling Temp: 6.5°C

Heating COP: 5.57

Cooling COP: 5.15



University of Melbourne – Melbourne Connect (Lend Lease)



## Craigie Leisure Centre

Location : Perth, Western Australia

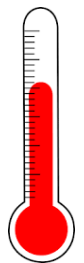
Year : 2020 (workover)

Status : Operating

Type : Direct-use for pool heating

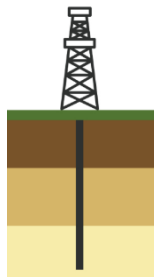
Consultant : Rockwater Pty Ltd

Driller : Age Developments



Prod:  
38.5°C

$\Delta T$ :  
 $\leq 10^\circ\text{C}$

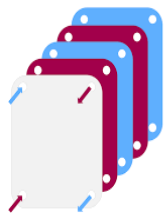


Prod:  
800 m

Inj:  
450 m



Owner:



Max Power:  
800 kWt

Output Energy:  
4,200 MWh



High pressure jetting tool used for screen redevelopment (photo source: Age Developments)

AGA Contact: Martin Pujol (Rockwater)

[mpujol@rockwater.com.au](mailto:mpujol@rockwater.com.au)



## Gippsland Regional Aquatic Centre (GRAC), Traralgon

Location: Victoria

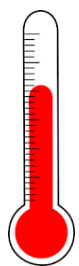
Year: 2021

Status: Operating since 25 March 2021

Type: Direct-use for pool heating & space heating

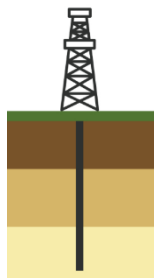
Consultant: Rockwater Pty Ltd

Driller: Drilltec



Prod:  
68°C

$\Delta T$ :  
 $\leq 20^\circ\text{C}$

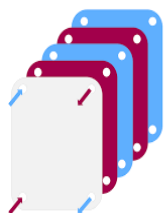


Prod:  
636 m

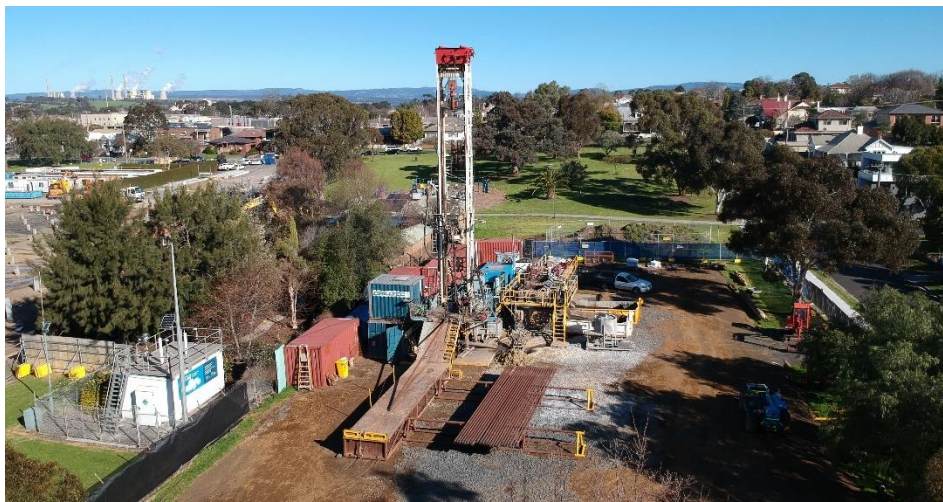
Inj:  
610 m



Owner:



Max Power:  
3,000 kWt



Aerial view of the GRAC production bore drilling site in 2019 (photo source: Drilltec)



GRAC project design (photo source: Peddle Thorp)

AGA Contact: Martin Pujol (Rockwater)

[mpujol@rockwater.com.au](mailto:mpujol@rockwater.com.au)





## North Perth Basin

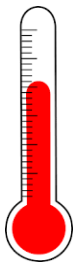
Location : Western Australia

Year : 2021

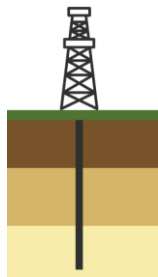
Status : Appraisal

Type : Hot Sedimentary Aquifer  
Power Generation

Owner : Mid West Geothermal Power Pty Ltd,  
Perth

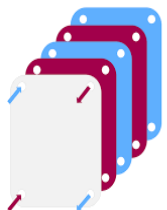


Prod:  
150+°C

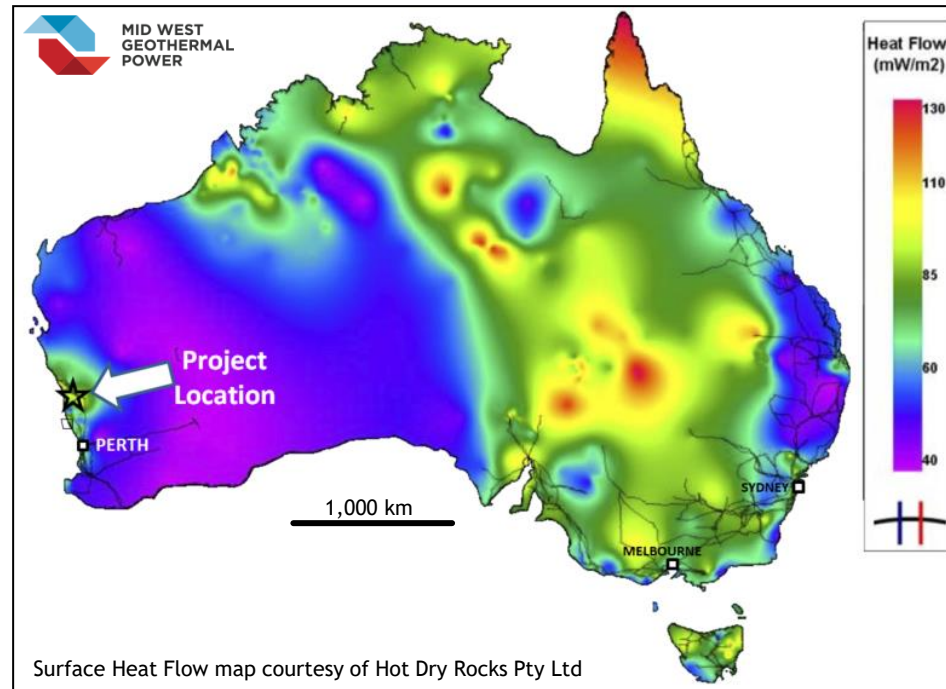


Prod:  
3500-5000 m

Inj:  
3500-5000 m



Potential Power:  
100+ MWe



- Located in an area of high heat flow about 350 km north of Perth, Western Australia.
- Hidden geothermal system demonstrated by a substantial petroleum exploration and production database in the area.
- Geothermal source target is natural permeability identified within the Permian Kingia and High Cliff Sandstones.
- Project located within the integrated electricity grid that supplies power to Perth and southwestern Western Australia.

AGA Contact: Mark Ballesteros (MWGP Pty Ltd)

[m.ballesteros@mwgp.com.au](mailto:m.ballesteros@mwgp.com.au)



**MID WEST  
GEOTHERMAL  
POWER**



## Riserless ESP in the Netherlands

Location : Various locations in the Netherlands

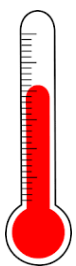
Year : 2020-2021

Status : Planning

Type : District heating and greenhouse heating

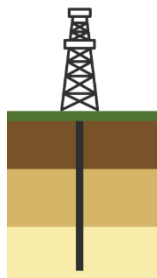
Consultant : HOTS bv

Production : Riserless ESP and inflatable packer



Prod:  
80-110°C

$\Delta T$ :  
 $\leq 10-18^\circ\text{C}$

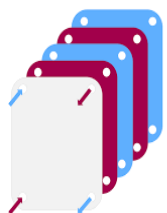


Prod:  
2500-3500 m

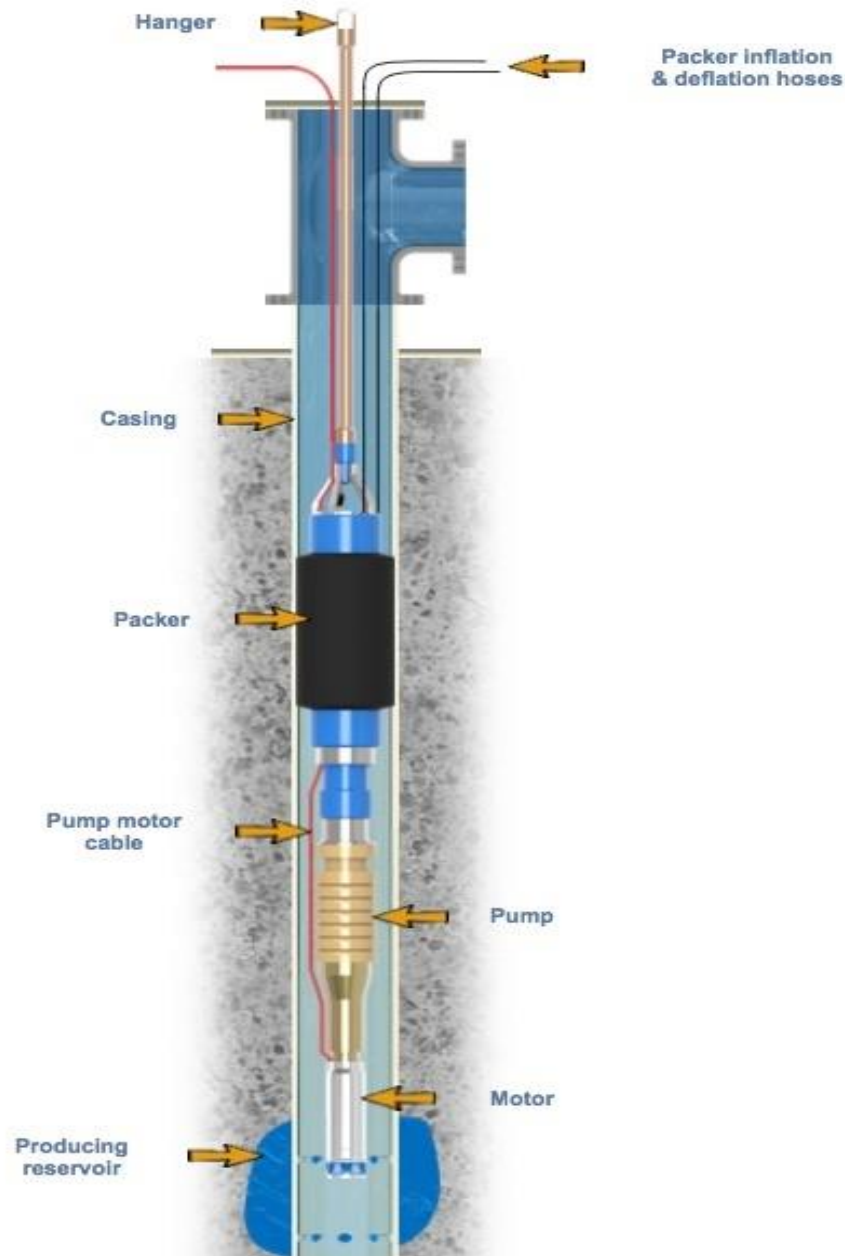
Inj:  
2500-3500 m



Owner:  
Cities and private owners



Max Power:  
10,000 kWt



AGA Contact: Harry Pollemans (independent ESP consultant)

[cnssp@westnet.com.au](mailto:cnssp@westnet.com.au)



## Alba Thermal Spring and Spa

Location: Mornington Peninsula, Victoria

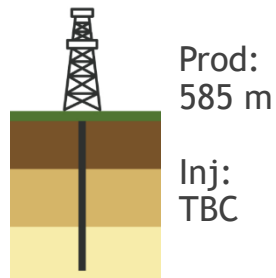
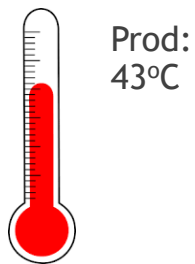
Year: Opening 2022

Status: Bore completed, facilities under construction

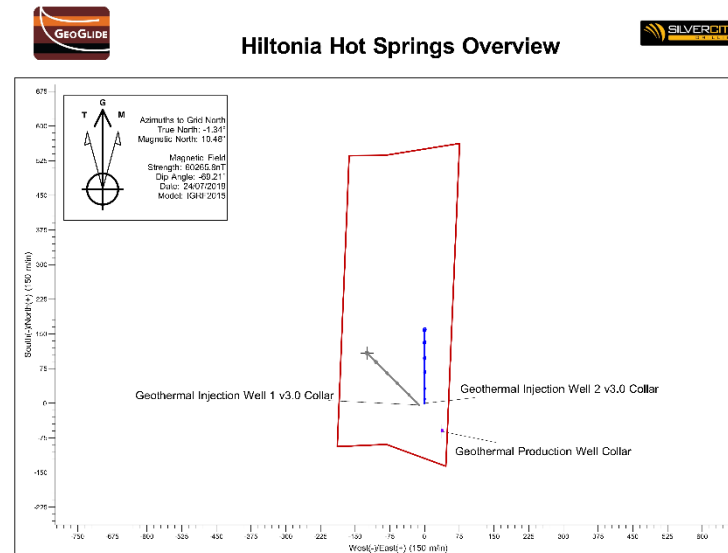
Type: Commercial Thermal Spring

Consultant: Rockwater Pty Ltd

Driller: Silver City



Proposed Pools (photo source: Mala)



Directional Plan (photo source: Geoglide/Silver City)

AGA Contact: Matthew Bevil (Alba)

[matthew.bevil@albathermalsprings.com.au](mailto:matthew.bevil@albathermalsprings.com.au)



## The Heat Needle

Location : Victoria

Status : In development

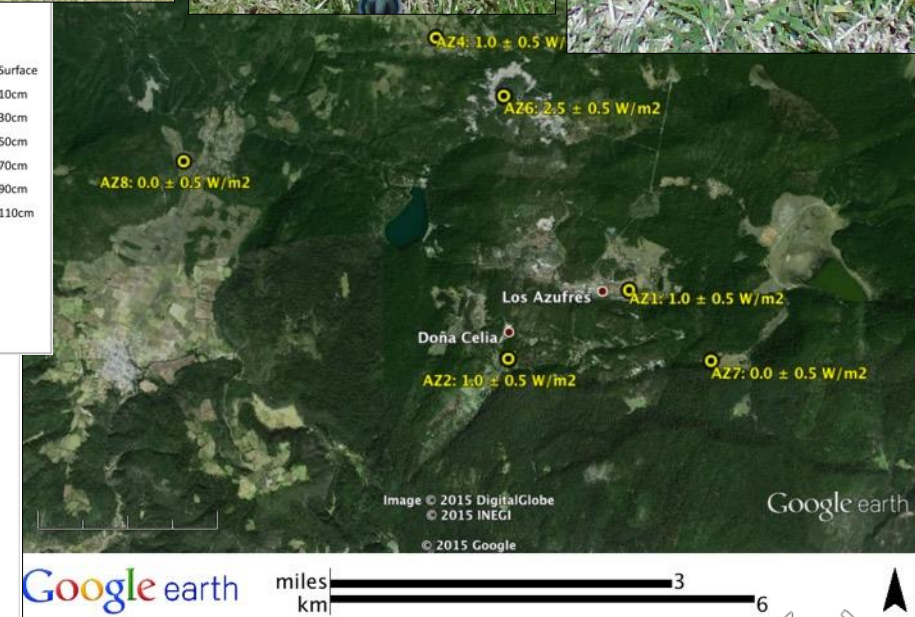
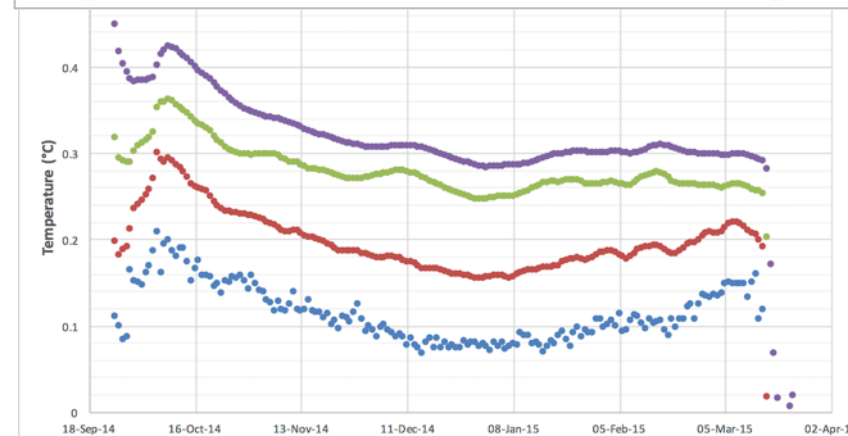
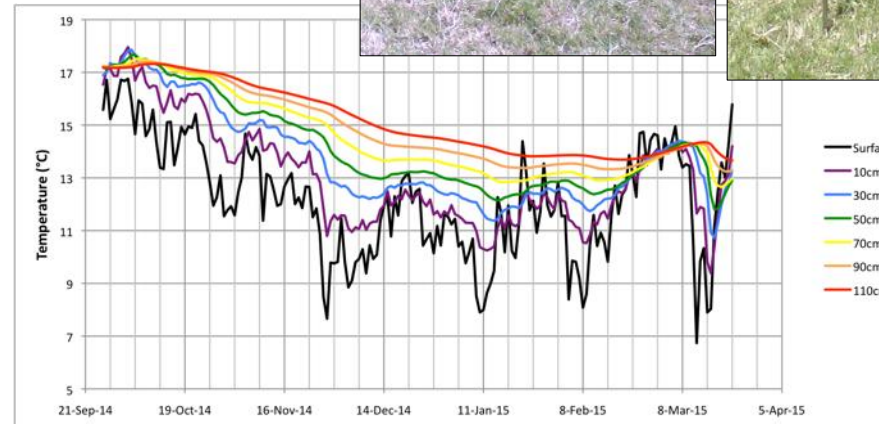
Type : Geothermal exploration tool

Developer : Hot Dry Rocks Pty Ltd

Collaborators:

- Green Rock Energy
- University of Adelaide
- Barrick Gold
- Oz Minerals
- Mexican Center for Innovation in Geothermal Energy
- University of Melbourne
- Fleet Space Technology

Paper 13028  
Session 8P: Poster 2



AGA Contact: Graeme Beardsmore (HDR)  
[graeme.beardsmore@hotdryrocks.com](mailto:graeme.beardsmore@hotdryrocks.com)



## Great Artesian Basin

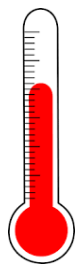
Location : Central Australia

Year : Under investigation

Status : Power Generation

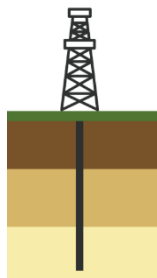
Type : Xatech International Pty Ltd

Supplier : Electratherm Inc



Prod:  
96°C

Flow:  
40 L/s

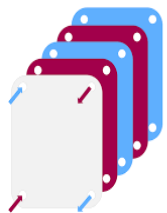


Prod:  
1,221 m

Units :  
2 x Power +  
6500B ORC



Owner:  
TBC



Max Power:  
80 kWe

Output Energy:  
660 MWe



Great Artesian Basin geothermal well (photo : Xatech International)



ElectraTherm unit installed in Japan on an onsen geothermal resource

AGA Contact: David Knight (Xatech international)

[dknight@xatech.com.au](mailto:dknight@xatech.com.au)



## Lemont Project

Location : Tasmanian Midlands

Status : Inferred Geothermal Resource

Geothermal gradient: 40°C/km

Flow rate: Targeting 100 L/sec

Next Steps: A slimline hole to ~2km to verify the structure and resource parameters

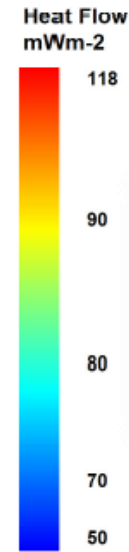
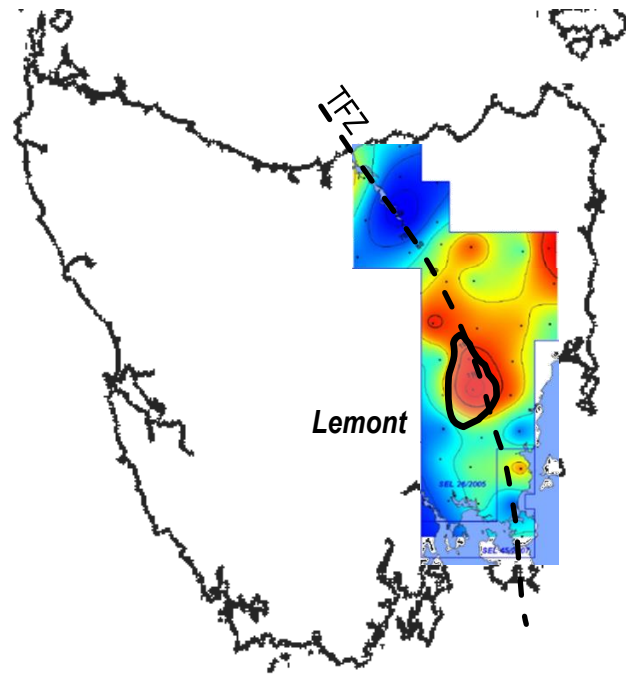
Owner: Spa\*ark Energy Pty Ltd

Comment:

Lamont target is a saturated reservoir like conventional projects, with a non-volcanic heat source. Inferred Resource is potentially tens to hundreds of megawatts of electricity for many decades.

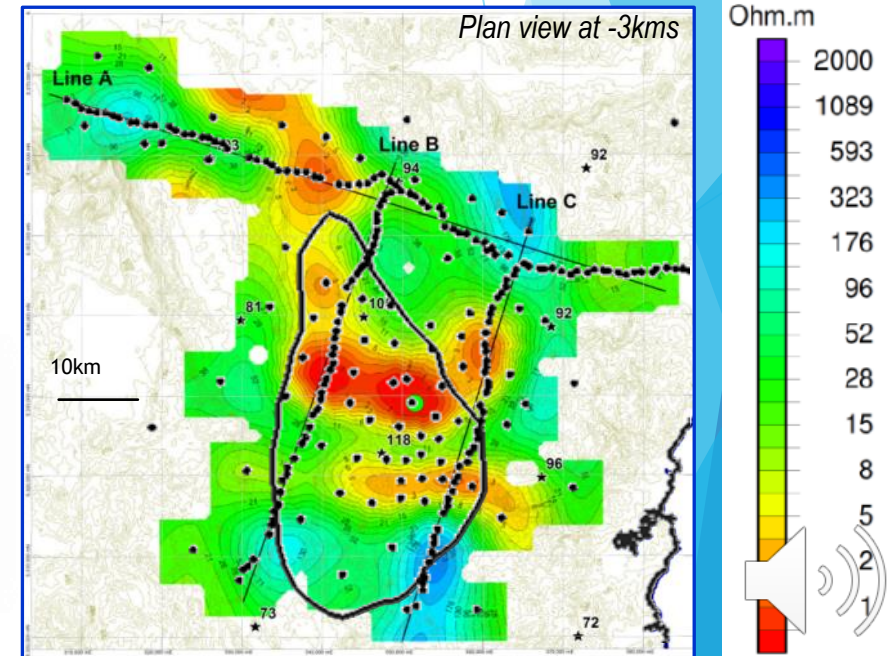
AGA Contact: John Bishop (Spa\*ark Energy Pty Ltd)

[john.bishop@spaarkenergy.com.au](mailto:john.bishop@spaarkenergy.com.au)



Some of Australia's highest heat flow values recorded at Lemont over the Tamar Fracture Zone, a paleo-plate boundary associated with radioactive granites, the heat source.

MT defined a large low resistivity volume interpreted as hot brines from ~2 km to several kms below surface. The resource area (solid black line) is defined by the 150oC contour 4 kms below surface.



## Hot Springs PhD

Location : Australia

Year : 2020-2023

Status : Commenced

2020-2023 Sponsors

# Australian Hot Springs Industry PhD



## Study Outline

Review the social, environmental and economic impacts of hot springs on communities across Australia.

## Partners

Australian Geothermal Association

Victoria University, School for the Visitor Economy

(10x) Hot Springs tourism operators

## Objectives

1. Trace the development of the hot springs industry in Australia
2. Identify measures of regional well-being relevant to the existence and operations of hot springs and wellness facilities such as those relating to employment, income, environment, health and services;
3. Applying these measures, identify the contribution of hot springs developments to the wellbeing of local and regional communities;
4. Explore the relationship between hot springs and community wellbeing;
5. Identify opportunities for future development to enhance regional development objectives.



# Hot Springs Strategy

Location : Australia

Year : 2021

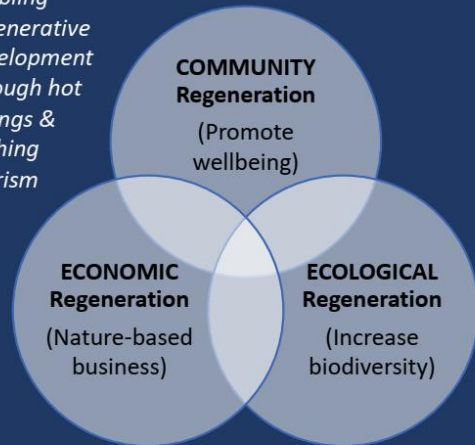
Status : Proposed

## Australian Hot Springs Trail Strategy

Community wellbeing can start with one transformational experience



Enabling regenerative development through hot springs & bathing tourism



### Strategic Industry Development

The proposal for a 900km Great Victorian Bathing Trail, linking hot springs and bathing facilities, has sparked interest for wider industry development across Australia.

**Hot Springs Studio**, a tourism consultancy focusing on bathing projects has been founded to lead further development, especially in Australia and New Zealand. The business is a partnership between Charles Davidson (Chairman & Co-founder of Peninsula Hot Springs) and Matt Sykes (Author of the Great Victorian Bathing Trail).



1. West Australian Hot Springs Trail



2. Outback Hot Springs Trail



3. Great Victorian Bathing Trail



[www.australiangeothermal.org.au](http://www.australiangeothermal.org.au)

