earths energy

ASX Announcement

10 July 2024

Australia's Most Advanced Geothermal Projects

HIGHLIGHTS

- **Geothermal energy projects reliably produce green baseload energy to power grids around the world**
- **The USA's annual geothermal power production of 17.2 terawatt hours would meet all Western Australia's annual electricity demand[1]**
- **The annual geothermal electricity production of the USA, Indonesia and Philippines combined would meet over 17% of Australia's annual electricity demand[2]**
- **EE1 holds Australia's most advanced geothermal projects, each with significant development potential**
- **Paralana Project:**
    - Drilled to a depth of 3,685m with a bottom hole temperature of 171°C[3]
    - Significantly high gradient of >46°C per km of depth (1.84x Australian average)[4]
    - **Commercial Power Potential:** Between 97 and 233 GWhs[5] per annum potential based on conservative conventional analogous US projects (representing between 10,450 and 25,102 households' power consumption per annum[6])
    - **Geothermal System Options:** Enhanced Geothermal (EGS) and Advanced Geothermal (AGS) type systems expected to improve commercial development
    - **Potential for New Drilling in 2025:** Potential for Paralana 2 extension at depth
- **Flinders West Project:**
    - Drilled to a depth of 1,934m with a bottom hole temperature of 85°C[7]
    - Significantly high gradient of >43°C per km of depth (1.72x Australian average)[8]
    - **Commercial Power Potential:** The upper range of the power density at Flinders West Corridor was independently estimated at 7 MWe/km[2,9] which has the capacity to support commercial power production
    - **Grid Access:** Selling power and grid services directly onto the South Australian and East Coast power networks is realistic from Flinders West
    - **Carbon Storage Attributes:** Developed for the potential of its Captured Carbon Storage (CCS) attributes
    - **Next Generation Technology:** Potentially suited for Next Generation Project (NGP) technologies beyond EGS and AGS

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1 Australian Energy Council (2020) and US Energy Information Administration via www.gridinfo.com.

2 Various sources totalling 43.552 TW(h) production and 245 TW(h) Australian demand.

3 Spudded June 30, 2009 by Petratherm Limited (ASX: PTR). Drilled and tested with an average of 46°C per km; up to 80°C per km at top.

4 Based on an average Australian thermal gradient of 25°C per km (G R Beardsmore & Cull, 2001).

5 Based on analogous groups of operating power plants with similar power densities and temperatures, detailed on page 7.

6 Based on a family of 5 consuming 9,282 kWh per annum in Australia.

7 Drilled October 3, 2005 by Green Rock Energy Limited.

8 Based on an average Australian thermal gradient of 25°C per km (G R Beardsmore & Cull, 2001).

9 Independent power density assessment contained in the Company prospectus dated 8 November 2023.

Earths Energy Limited (**ASX: EE1**) (**Earths Energy, EE1** or the **Company**) is pleased to announce updates regarding its South Australian projects.

Following the recent appointment of the Company's Chief Executive Officer, Mr. Josh Puckridge, the Company has undertaken a review of its South Australian projects.

This review was conducted internally and by geothermal consultancy JRG Energy (JRG) who have acted as independent technical advisors with respect to this announcement.

The work recently completed has focused on evaluating the development potential of the Company's South Australian portfolio ensuring the Company maintains projects capable of being developed into world class geothermal projects for the purpose of commercial electricity production.

"This recent work completed by EE1 and JRG confirms that the Company holds some of Australia's most advanced geothermal projects. The work completed at Paralana makes it a prime development candidate and beneficiary of the innovations made in US based EGS projects."

Josh Puckridge, Company CEO

EXECUTIVE SUMMARY OF WORK COMPLETED

The recent work completed confirms that the Company's projects in South Australia are not just significant by Australian geothermal project standards but are also projects that maintain global development potential (see Figure 2 on page 4).

Recent work completed by US groups in Nevada show that the Company's South Australian projects contain significant development potential by incorporating recent developments in both Enhanced and Advanced Geothermal Systems.

Based on a relatively conservative group of analogous projects operating in the US (see Figure 2 and Figure 5), the Company could readily begin assessing the feasibility of 40MWe to 80MWe installed capacity projects at multiple sites within South Australia.

Initial work completed also indicates the potential for Captured Carbon Storage project development. This is an enticing opportunity for the Company as South Australia is one of few Australian jurisdictions with legislation in place to support the development of projects such as Paralana and Flinders West.

Finally, the Company has identified further strategic opportunities from its coverage of the power grid between Port Augusta and Olympic Dam, which enhances development potential and attractiveness.

SOUTH AUSTRALIAN PROJECT AREAS

The Company's South Australian assets have been defined into two new project areas:

1. Paralana (300 kms to the northeast of Port Augusta), and
2. Flinders West (beginning 45 kms northwest of Port Augusta to Olympic Dam).

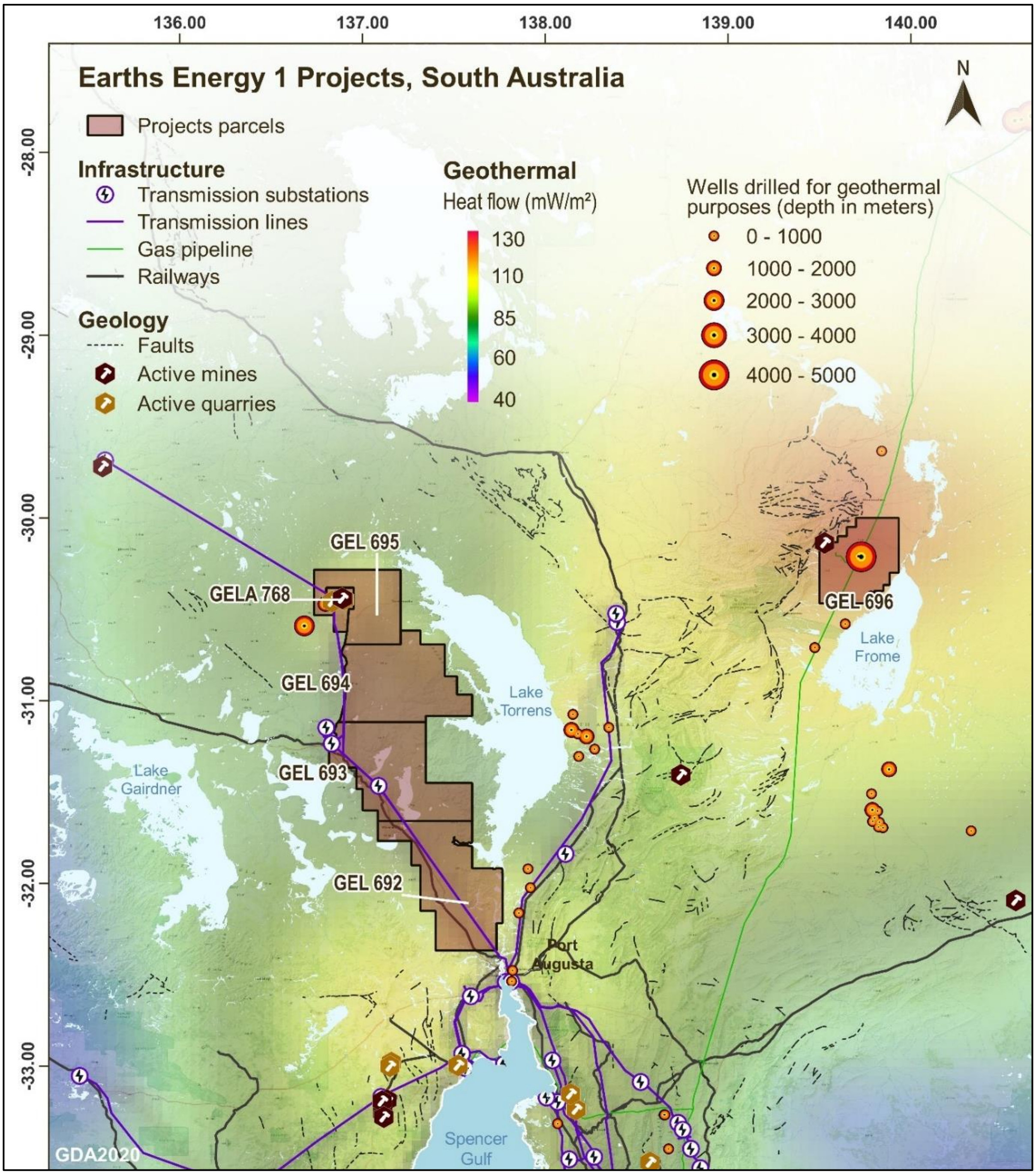

Figure 1: South Australian Projects with historical Geothermal Wells and Heat Map

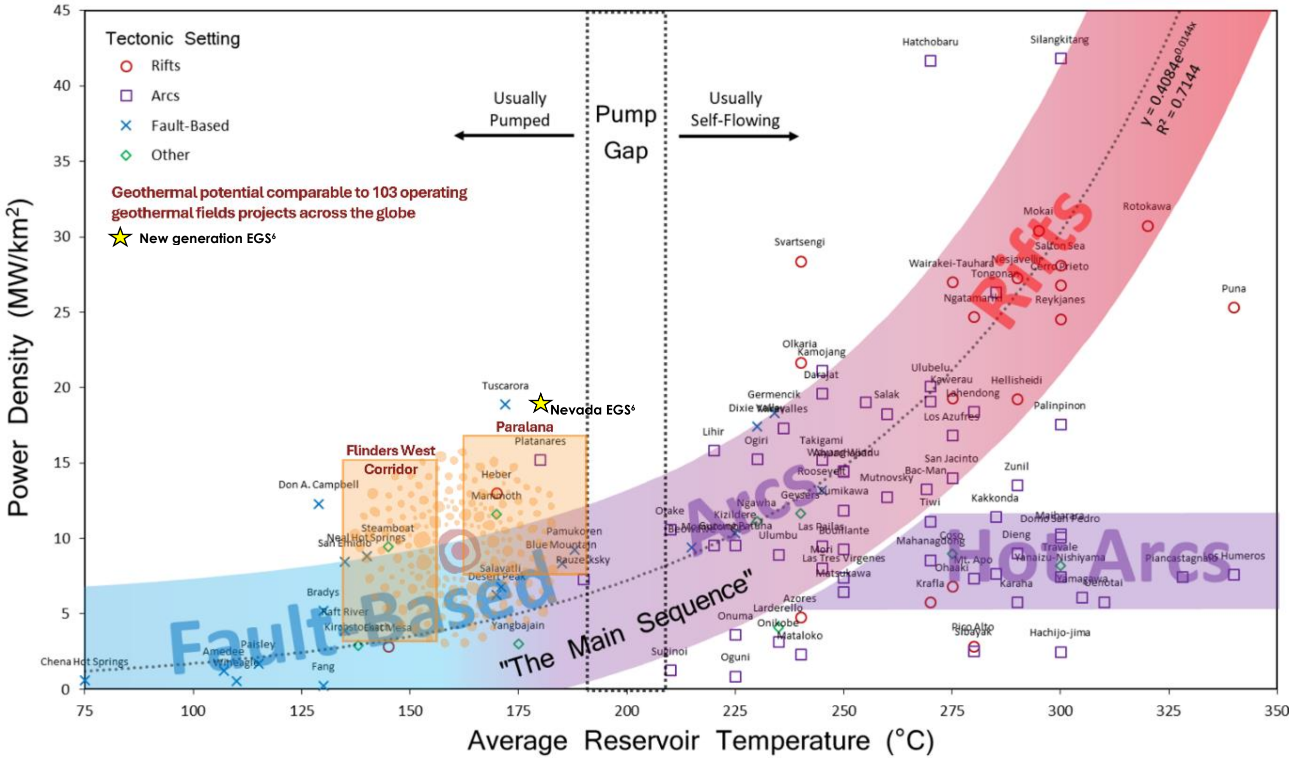

Figure 2: Potential Power Density Range of EE1 Projects[10] compared to other global Geothermal projects[11] – orange box are current indicative bands of the power density range for EE1's South Australian projects

These two project areas are represented in Figure 2 above. Figure 2 shows the Company's South Australian projects in the context of operating geothermal projects around the world. This shows clearly that the Company's already established power density is sufficient by global standards to be developed (this is further expanded on in this announcement).

Favourable CCS Legislation: work completed by the Company has confirmed that the process and legislation is in place in South Australia to commercially develop a CCS project under a strategic gas storage licence.

Favourable Logistics to Grid Access in South Australia and the East Coast of Australia: recent reports by the Australian Energy Market Operator (AEMO)[12] confirms that the regulatory approvals are in progress that would see the likely points of grid access available at the Flinders West Corridor project also be connected to Australia's East Coast power network. This greatly improves the viability of any project considered at Flinders West.

10 Company Prospectus dated 8 November 2023.
11 Wilmarth, M. and Stimac, J. (2020). "Power Density in Geothermal Fields, Update 2020".
12 AEMO's 2024 Integrated System Plan released June 26, 2024.

PARALANA PROJECT

Project Highlights:

- Drilled to 4,012m depth with a reservoir temperature of 190°C
- Heat gradients as high as 80°C per km of depth in initial shallow areas
- Perfect candidate for new EGS engineering and methods from the US
- Potential for new drilling in 2025 to extend Paralana 2's well depth

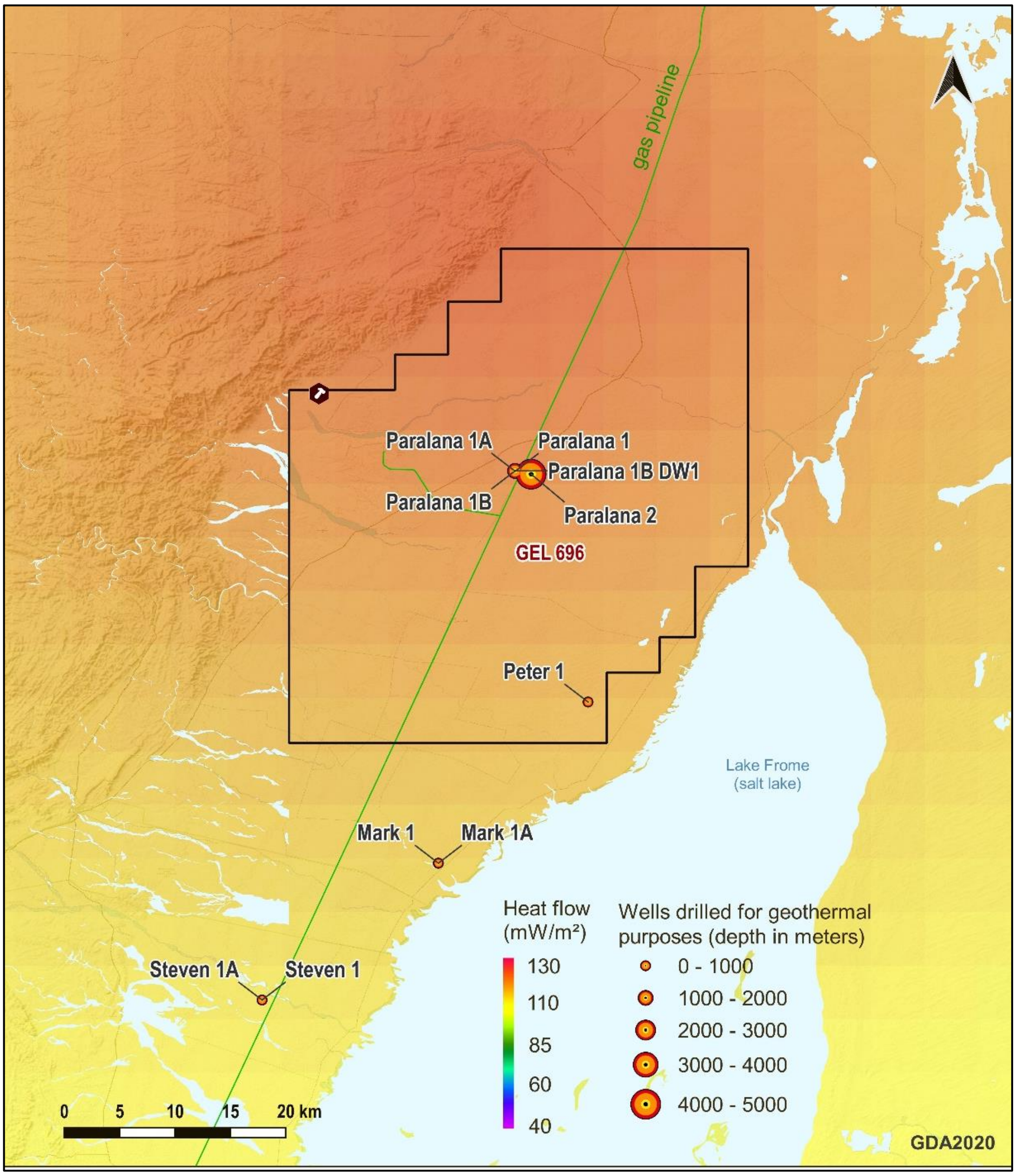

Figure 3: Paralana Project contains multiple geothermal wells drilled between 2,000m to 4,000m depth

The Paralana project contained Australia's second EGS project to be drilled to reservoir depth. The area was originally targeted from the known high heat production of the Mount Painter Inlier, the Paralana Hot Spring with 62°C water at the surface and the presence of insulating sediments. The Paralana 1B shallow heat flow well was drilled in September 2005 to a depth of 492m. The measured temperature gradient was over 80°C per km. The well was then deepened to 1,807m in June 2006, recording a bottom hole temperature of 109°C, and a calculated heat flow of 129 mW/m^2.

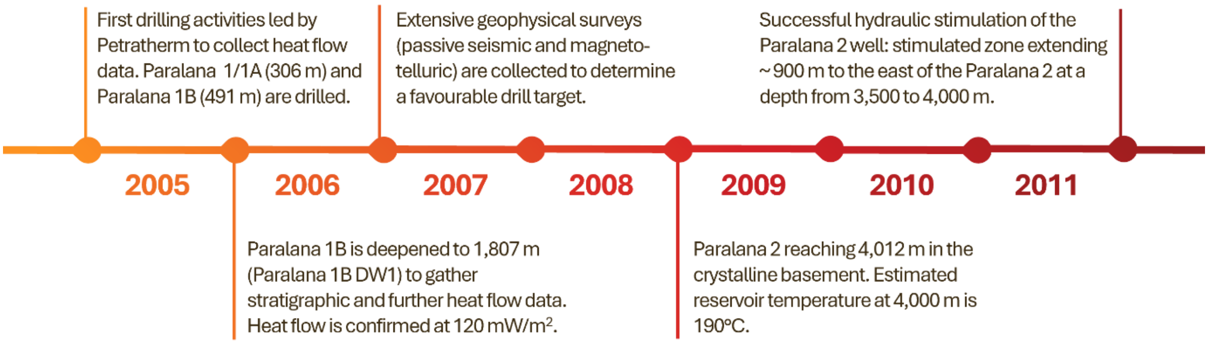

Figure 4: History of Paralana's development[13]

The Paralana 2 well was spudded in late June 2009 and the rig was released in December 2009 after reaching a total depth of 4,012m. Highly fractured ground in the lower part of the well resulted in a partial well collapse, with 7-inch casing cemented in the well to a depth of 3,725m and could not be developed further. A temperature of 176°C was measured at a depth of 3,672m. Overpressures of approximately 3,300 psi in geothermal brines were found at depths between 3,670m and 3,864m.

In January 2011, the well was perforated over the interval 3,679m to 3,685m and a diagnostic fracture injectivity test was run. After stimulation, the measured well head pressure was 3,940 psi indicating that the injectivity test had successfully connected with over-pressured reservoir fluids. A larger stimulation was conducted in July 2011. 3.1 ML of fluid was injected over a five-day period. Initial injection rates were only 2 to 4 l/s (1-2 bpm) but increased to 20 l/s (10 bpm) after the injection of several acid stages. More than 10,000 microseismic events were recorded, with a complex distribution. The stimulated zone extends to the northeast and east of the Paralana 2 well by up to 900m with depths between 3,500m and 4,000m.

Unlike the recent successful EGS projects in Nevada, Paralana 2 (in 2011) was drilled vertically and stimulated conventionally to achieve self-flow of 6 l/s and up to 20 l/s during injection. Using a horizontal well pair development concept similar to that pioneered in Nevada, there is potential to increase these rates significantly.

[13] Geothermal Energy in Australia, Dr Cameron Huddlestone-Holmes, CSIRO, 2014.

Paralana Analogs from the US[14]			
Name	Location	Installed Capacity	Annual Production
Mammoth	California, USA	40 MW	211 GWh
Tuscarora	Nevada, USA	32 MW	144 GWh
Heber	California, USA	81.5 MW	174 GWh
Desert Peak	Nevada, USA	26 MW	97.7 GWh
Blue Mountain	Nevada, USA	63.9 MW	233 GWh

Figure 5: US based operating geothermal project operating within the same power density band as the Paralana project (see Figure 2)

Figure 5 identifies operating projects based in the USA which share similar power densities and temperatures (see Figure 2). The majority of these projects have been in operation since the late 1980s and early 1990s; significant developments have since been made in geothermal reservoir modelling and engineering. None of these projects represent an Enhanced or Advanced Geothermal System or project.

The relationship between Installed Capacity and Annual Production for this group of projects highlights how the Installed Capacity (or the 'Nameplate Capacity') does not necessarily represent a consistent relationship to Annual Production across projects. Mammoth's 40 MW capacity, for example, outproduces the Heber project's annual production even though its installed capacity is almost twice that at 81.5 MW of capacity. Modern engineering and project characteristics can result in meaningful power production from lower installed capacities.

Key Technical Summary: Paralana is a well-developed geothermal project with significant drilled and proven heat and pressure. EGS engineering and methods were not as advanced as exists today and, as such, the Company can quickly reassess and establish the potential of Paralana as a modern EGS project.

Next steps at Paralana:

- Modelling work to support a new generation EGS project at Paralana
- Refine Paralana's power density modelling and likely energy production compared to US analogues utilising more modern engineering
- Assess the feasibility of further drilling at Paralana 2 in the context of further developing the project's potential EGS development
- Assess potential joint venture opportunties

[14] US Energy Information Administration, US Federal Energy Regulatory Commission, United States Geological Survey via www.gridinfo.com.

FLINDERS WEST PROJECT

Project Highlights:

- Existing well drilled to 1,934m depth with a reservoir temperature of 85.3°C
- Excellent Grid Access with Grid Services potential
- CCS Exploration and Development Potential
- Next Generation Geothermal Production Potential

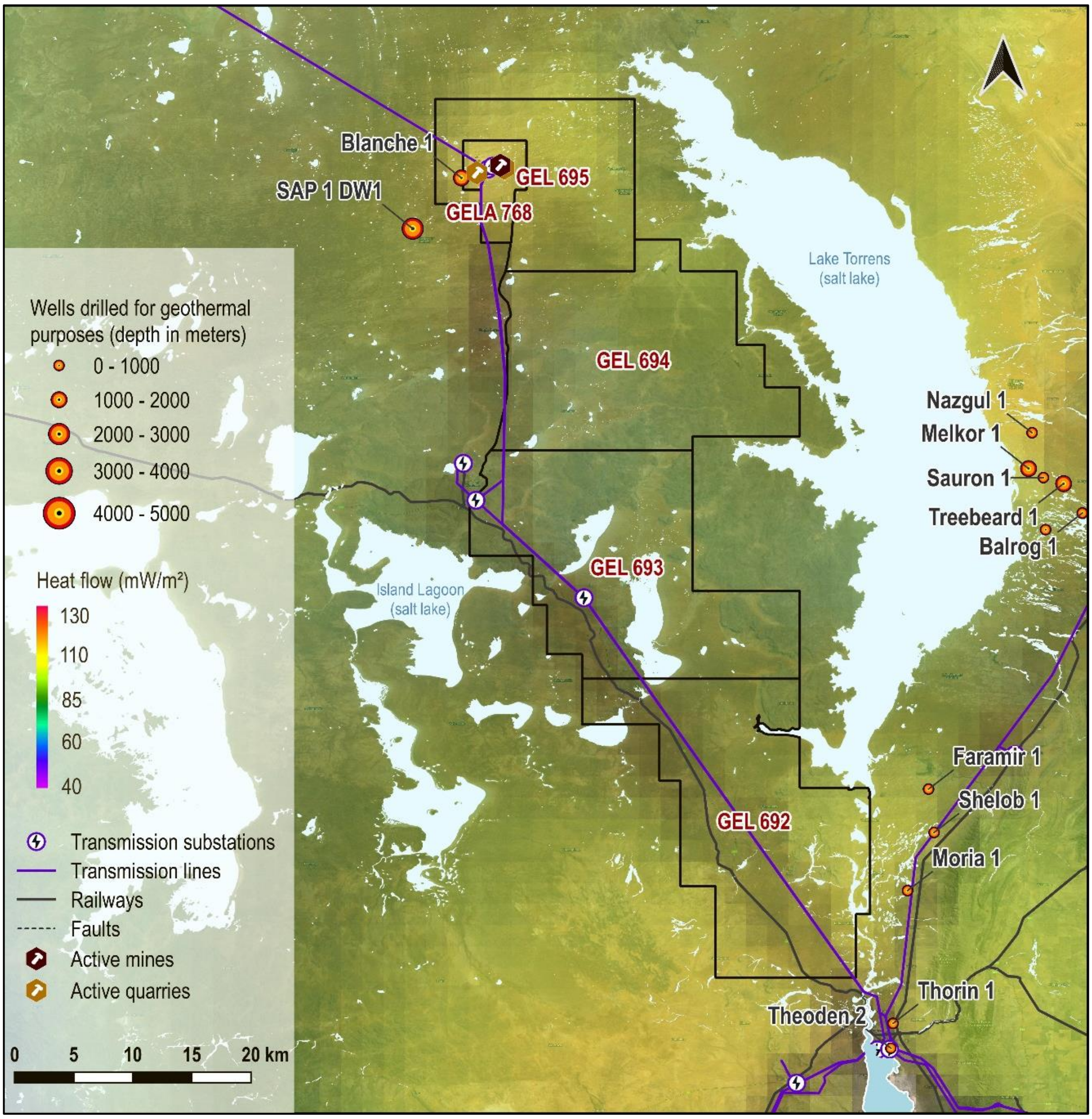

Figure 6: Flinders West Project Area containing Blanche 1 at Olympic Dam

In the early 2000s, the growing interest in renewable energy led to initial investigations of the geothermal potential in the Flinders West Corridor. In 2005, Green Rock secured GELs over the area surrounding the Olympic Dam mine and drilled Blanche 1.

Blanche 1 reached a terminal depth of 1,934m below ground level and reported the following:

- 718m sedimentary rock cover,
- Geothermal gradient estimated to 43°C per km of depth,
- Underlying the sedimentary rock is the crystalline basement composed of fractured granitic rocks (Gawler Craton, 1,217m thick), geothermal gradient estimated to 30°C per km, and
- Measured maximum downhole temperature was 85.3°C at 1,934m.

The exploratory surveys and drilling completed to date across the northern GELs 695 and 768 suggest the potential for an Enhanced Geothermal System (EGS) project. The extrapolated depth to 150°C (necessary for power generation) is ~3.5 km suggesting some potential for an engineered geothermal system project using stimulated horizontal well pairs as pioneered by US operations in Nevada. However, these Nevada wells are ~2.5 km and ~175°C, as a result, additional work will be needed to demonstrate viable economics for an EGS project in the Flinders West Corridor.

Simultaneously, other companies were awarded surrounding GELs, along the western shoreline of Lake Torrens southward to Port Augusta. Exploration activities in that area focused on acquiring temperature and thermal conductivity (TC) data from mineral drillholes, which reported geothermal gradients between 30°C and 40°C per km, and a sedimentary cover of >1,000m across the southern GELs 692, 693 and 694.

Next Generation Geothermal Power Production Potential: Flinders West shows early signs of suitability for other Next Generation Geothermal Power production innovations beyond EGS and AGS. The Company is also assessing the suitability of new plant and systems designs such as supercritical carbon dioxide (sCO_2) systems that utilize liquid CO_2 instead of H_2O as the fluid circulating in the geothermal reservoir to excavate heat. These designs are in early development but are being progressed and developed by multiple highly reputable engineering firms around the globe.

Captured Carbon Storage Potential: low TC sedimentary units (such as Tregolana Shale and Tapley Hill Formation) can act as an insulator / a low permeability caprock with potential for exploration and development of CO_2 subsurface storage should a suitable reservoir be identified in future exploration work in the underlying sandstone or fractured basement.

Flinders West Corridor Analogues from the US[15]			
Name	Location	Installed Capacity	Annual Production
Steamboat Hills	Nevada, USA	84 MW	252 GWh
East Mesa	California, USA	93 MW	301 GWh
San Emidio	Nevada, USA	11.8 MW	94.7 GWh
Raft River	Idaho, USA	18 MW	100.8 GWh

Figure 6: US based operating geothermal projects within the same power density band as the Flinders West project (see Figure 2)

Similarly to Figure 5, Figure 6 illustrates US based operating geothermal projects analogous to the Flinders West Corridor based on shared heat characteristics and power densities. The potential for non-linear annual power output relative to the project's installed capacity is further highlighted by the annual production of GWhs by the San Emidio and Raft River projects.

Key Technical Summary: Flinders West is a promising geothermal site, drilled to 1,934m with a temperature of 85°C and a high gradient of 43°C per km of depth. It offers excellent grid access and potential for Enhanced Geothermal Systems (EGS) and carbon capture. Analogous US projects confirm its scalability, with future plans for subsurface exploration and leveraging next-generation engineering potentially beyond EGS and AGS.

Next Steps at Flinders West:

- Identify and appoint appropriate subsurface exploration team for CCS and geothermal development
- Progress assessment and discussions regarding grid access and grid services along the Flinders West Corridor
- Continue techno-economic assessment of new technologies and engineering such as Next Generation Geothermal Power Production
- Assess potential joint venture opportunities

[15] US Energy Information Administration, US Federal Energy Regulatory Commission, United States Geological Survey via www.gridinfo.com

For, and on behalf of, the board of directors of the Company,

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About JRG Energy Consultants Ltd

The information included in this report that relates to exploration results and geothermal resource assessment (**Information**) has been compiled by specialists from JRG Energy Consultants Ltd (**JRG**), an independent geothermal consultancy with over 10 years' experience in the geothermal industry. The Information was compiled by employees and consultants of JRG, across a number of disciplines, including geology, hydrogeology, geophysics, reservoir engineering and drilling engineering. The individuals from JRG that compiled the Information were Charlene Joubert MSc Hydrogeology and Geothermal, University of Neuchatel (Switzerland), Kenneth Alexander M.Sc. Geological Sciences, University of Texas (USA) B.S. Geology, Virginia Tech, (USA), Martin Pujol, M.S. Hydrogeology, ENSG – Institute National Polytechnique de Lorraine (France), Neale Young MEng Mechanical Engineering at Heriot-Watt University (UK), Pablo Aguilera PhD Geophysics, University of Auckland (NZ) and John Gilliland who holds a BSc Mechanical Engineering from the University of Gonzaga (USA).

JRG was engaged by Earths Energy as an independent consultant and none of its employees or consultants are employed by the Company.