Geothermal Electricity Generation in Australia: Recent Developments and Future Potential

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Recommendations for Government Policy and Pre-Competitive Studies

A recent Australia-wide census by the Australian Geothermal Association (AGA) showed that geothermal energy is already making a useful contribution to the Australian energy mix; direct-use geothermal is a successful and growing industry. Geothermally generated electricity can also play a role in Australia's energy transition, but to achieve progress it is critical that government policy acknowledges and supports this potential.

The Australian geothermal industry experienced a sustained surge in activity from 2000-2013 focussed on developing innovative technologies with huge potential. Although these efforts were not commercially successful, more conventional approaches to generating electricity with geothermal energy remain viable. For example, a new geothermal electricity power plant was recently commissioned in Winton, Queensland. The 310 kW plant is currently the only operating project in Australia, although a similar geothermal power plant in Birdsville, Queensland provided over 20 years of reliable service until it was decommissioned recently. These two successful projects demonstrate that lingering perceptions that geothermally generated electricity is not possible in Australia are inaccurate.

The Australian Geothermal Association (AGA) recently completed a white paper that examines the current state of the geothermal industry in Australia and internationally. The paper reviews what developments have occurred in the last 5 years and identifies the potential contribution that geothermally-generated electricity could make to Australia's energy transition. It also reviews the advantages that geothermal energy offers, outlines the challenges faced by the industry in realising the available potential and recommends some actions that can be taken to address these challenges.

The rapidly expanding role of wind and solar PV is creating issues with intermittency and maintaining system stability of our electricity networks. Geothermal energy can provide around the clock, low emission, sustainable, synchronous base-load power that will help stabilise networks as they integrate increasing amounts of solar PV and wind generation. Geothermal power generation has a small surface footprint, creates ongoing local jobs and does not require backup power or storage.

Multiple recent evaluations conclude that geothermal power – particularly Hot Sedimentary Aquifer (HSA) projects - can be cost competitive with conventional fossil fuel generation as well solar PV and wind generation when energy storage costs are included.

In the short to medium term, efforts should be focussed on identifying and developing low-medium temperature (<170^{o}C) HSA geothermal resources with access to markets. Previously, the Australian geothermal industry focussed primarily on the potential of a different type of geothermal power – high temperature resources in Engineered Geothermal Systems (EGS); however, most of the potential resources identified at that time were very remote from markets or the commercial and logistical challenges were substantially underestimated. Although EGS remains an area of active research internationally, significant technology advances are required before it becomes commercially viable in Australia.

Development of HSA geothermal projects generally requires the use of binary power plants. This technology has been operating reliably for many years, but recent improvements in the power conversion efficiency have greatly enhanced the commercial potential of power generation from moderate temperature geothermal sources.

HSA geothermal energy requires a geologically and geographically favourable setting with proximity to an appropriate market (either local or network access) to ensure commercial viability; however, the market need not be large. In remote areas, such projects could provide baseload generation capacity to displace diesel generators cost effectively or improve grid performance. The Winton and Birdsville projects mentioned previously are two examples.

Multiple studies conducted in recent years highlighted that government funded pre-competitive studies aimed at identifying and quantifying Australia's geothermal sources would be an effective way to stimulate commercial investment into geothermal power and would be a good use of public resources.

In addition, every country that currently has a viable geothermal industry has required government support to get through the capital-intensive early stages. The critical government role is to ensure the drilling is completed to demonstrate the presence of a geothermal source. Once this aspect of a project has been de-risked, commercial funding avenues become available. However, agencies such as ARENA and CEFC are currently very reluctant to consider funding for this early drilling phase. This is a major barrier to the development of the geothermal industry in Australia, whereas this challenge is being addressed through a variety of innovative financial mechanisms internationally.

The following actions would facilitate the identification and development of Australia's potential geothermal resources:

1. Geothermal energy should be included as an option considered by Federal and State government agencies in the network generation planning process.
2. Pre-competitive studies should be undertaken using existing regional evaluations of sub-surface temperatures and heat flow to identify potential reservoirs - and more specifically permeable zones where sub-surface temperatures exceed 80^{o}C. The Great Artesian Basin provides one clear example but other Basins may also be prospective (e.g. Otway Basin in South Australia and Victoria, Gippsland Basin in Victoria, Carnarvon and Perth Basins in Western Australia). These areas would be the subject of detailed follow up investigations aimed at mapping reservoir quality and deriving permeability estimates that could be used to quantify extractable energy.

3. This information can be used in economic modelling to identify commercially viable geothermal resources based on the temperature, flow rate, extraction costs and potential market.
4. Government programs need to include mechanisms for funding support during the early phase of geothermal projects – including sufficient drilling to demonstrate that an adequate and sustainable geothermal source is present to support commercial development. Every country with a viable geothermal industry today relied on such government support to facilitate early progress.
5. A clear set of guidelines and milestones should be established that define what sub-surface technical results need to be achieved before a geothermal prospect is considered adequately de-risked to qualify for government-sponsored drilling subsidies.
6. Australia has abundant intermittent solar and wind resources. Investigations should continue as to possible ways to develop complementary solutions using geothermal power in conjunction with solar and wind generation.
7. State governments should develop technical and legal frameworks to set out how existing petroleum wells in areas where geothermal resources occur could be repurposed for geothermal use.

For additional information regarding these conclusions and recommendations, the reader is referred to a white paper recently completed by the AGA. Please contact the AGA for more details:

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