What Contribution Can Geothermal Energy Make to Australia's Renewable Energy Target

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Geothermal energy provides the renewable energy sector with an opportunity to produce base load power, whilst meeting current government objectives in relation to greenhouse gas emission and renewable energy portfolio standards. Whilst the technology is not currently at an advanced stage of commercialisation when compared to other generation technologies utilising renewable sources such as wind or solar, the fact remains that it can provide continuous, rather than intermittent generation. Industry and renewable energy associations, together with government agencies are now including geothermal energy within their calculations of available generation capacity by 2020.

However, conflicting policy initiatives between State and Federal Governments, together with delays in proving commercial viability of the technology may see the sector miss out on many funding opportunities. This research looks at whether the current proposed Federal policies will provide the incentives needed to drive the deployment of geothermal energy within the 2020 timeframe or whether the current barriers will see deployment occur much later. This paper will also consider whether the delays may actually be advantageous given the conflicting policy objectives.

Finally the paper will consider the current development sites and whether policy could see deployment closer to the point of end use. Whilst the need to develop pilot plants is crucial, the need to develop sites closer to existing networks is also important given the costs associated with establishing grid connection, a cost that must be borne by the generator. This may see the need for additional State based policy measures to drive both additional development and deployment of those identified resources close to existing infrastructure.

For the purpose of illustration any examples will relate to the State of Queensland.

Keywords: Renewable Energy; Government Policy; Transmission

Renewable Energy in Australia

Australia's renewable energy sector is still in its infancy when compared to most other developed countries. For many European countries renewable energy started being deployed in the 1980's to combat energy security concerns. With Australia being resource rich, our renewable energy sector is being developed as a result of combating climate change concerns.

Current policy is aimed at the period to 2020 with the target being set at 45,000 GWh of renewable energy being generated annually at that time. In addition most electricity retailers are offering "green" electricity options, with that electricity sold not counting towards the portfolio standard, increasing the actual target above that required by the legislation.

Wind technology is at an advanced state of commercialisation and within Australia has been the most widely deployed large-scale renewable technology in the past decade. Most recent announcements on new renewable generation have also focused on this technology.

Whilst all renewable energy resources have benefited from REC income some renewable or clean energy technologies, such as solar and gas, have received additional financial subsidies at a State level. The deployment of wind has also occurred without the need for additional ongoing subsidies. The wind sector has also benefited from Australia's population being predominately located on the coast with this generally being the area of greatest wind potential. This has enabled the selection of wind farm sites close to existing grid infrastructure and due to the design of the electricity market they are able to ensure that all generation is dispatched.

Many State Governments are also providing additional incentives, in relation to the deployment of solar technologies through feed-in tariffs or equipment subsidies. Whilst most of the feed-in tariffs adopted are based on the net amount of electricity exported to the grid rather than gross generation, it has resulted in conjunction with equipment subsidies, a higher than expected uptake of the technology.

Geothermal energy can however provide base load generation capacity capable of replacing existing coal-fired plants, unlike their intermittent counterparts. The only other renewable technologies capable of this are hydro and biomass, however this supply has reached the upper end of possible deployment due to the lack of additional resources.

It must not be forgotten that geothermal is not a new energy source for power generation having been around for over a century, with the first

electricity generation plant constructed in Larderello, Italy in 1904 (Australian Institute of Energy, 2004). What is new is the technology surrounding how the available resource is to be exploited within this country. Whilst many of the current companies are looking at similar proposals, there is still a degree of differentiation.

The problems encountered by the geothermal sector are different to the other technologies noted above within Australia, due to the areas of greatest potential being located at great distance from the end point of energy use. However, as those sites where resources can be easily and economically exploited already taken, particularly in relation to wind, or where solar thermal becomes an economic option, development of sites further inland will become an option.

Government Policy

The Government has identified the policy measures that they believe will drive the deployment of renewable energy within Australia, being the Carbon Pollution Reduction Scheme (CPRS), a cap and trade system, together with the Renewable Energy Target (RET), being a portfolio standard.

In addition to these schemes, the various States are also introducing policy measures of their own, targeting resources where they have an economic advantage. These policy measures may actually benefit the geothermal industry with modelling undertaken to date showing that the increased deployment of wind and various small scale solar technologies will result in a surplus of REC's in the early years (particularly due to the multiplier effect to apply to small solar generation), as shown in Figure 1. The RET also includes electricity displacement options, such as solar hot water, as an accredited renewable energy generator.

Based upon the current position of technological development, large-scale deployment of geothermal is not anticipated until late in the next decade, which coincides with the shortfall in renewable generation. The industry will be in a position to meet this shortfall with an anticipated higher REC price than will be achieved in the earlier years.

If we consider PV deployment rates in Europe when their market was in a similar position of maturity, an annual growth rate of 10% is not considered unreasonable. Together with proposed wind farms would see a surplus in the REC market until 2017, based on no geothermal contribution.

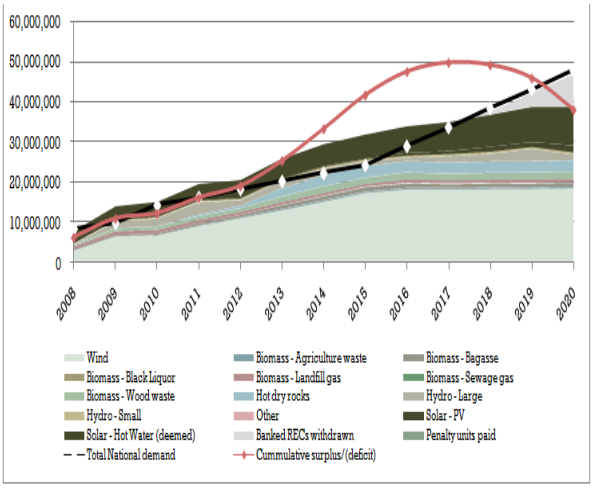

Figure 1 - National REC Supply v Demand (with banking)
Source: (Herd, 2009)

In addition to the CPRS and RET discussed above, the Federal Government has also established the $50 million Geothermal Drilling Program as part of the $500 million Renewable Energy Fund. This program is merit based and is capped at $7 million per project, with the aim to provide funding to demonstration proof-of-concept projects in a number of locations. It was further stated that this program could make small-size plants possible, allowing for generation projects where sites close to current transmission infrastructure have been identified.

State Governments have also been active in their support for the geothermal sector, particularly in South Australia and Queensland.

Current Issues

There are two major issues currently facing the geothermal industry effecting their future contribution to Australia's renewable energy target. The first relates to the development of the technology to the point where it can be commercially deployed. Once the technology is proven, there will still be some delay before it can be deployed to the extent that it can make a contribution to base load generation. Until pilot plants are operational it is still hard to determine with any pinpoint accuracy this time frame.

Major investors in renewable, such as AGL (see www.agl.com.au) have also focused their attention on wind farms acquiring the rights to a number of sites still going through the planning stage. This will enable them meet their corporate renewable targets based upon existing technology with a known cost base.

The second (and more costly) issue is the construction of transmission networks, a cost which must be borne by the generation company. With existing coal and gas-fired plant, the actual generation plant relies upon the fuel being delivered to it, with on-site storage generally available. Geothermal, like most renewable

technologies requires that the generation plant be located at the site of the resource.

Similarly looking at the coal or gas sector, the majority of generation plant is based upon similar or the same technological design. The same may be true for the above-ground geothermal plant, however there are currently a number of proposed options as to how the underground resource can be best utilised.

Geodynamics (Grove-White, 2009) have already identified that the cost of transmission will be a major problem and that it may be better to bring the customers to the source of the generation, rather than vice-versa. Whilst this will allow for the generation to be scaled up on-site whilst delaying transmission infrastructure costs and assist in the meeting of the Federal portfolio standard, it will not reduce base load generation required from existing coal and gas-fired plant, supplying the major coastal population base, unless those customers are relocating from an existing site rather than establishing additional facilities.

The alternative to the construction of new transmission infrastructure is to locate geothermal power plants closer to existing infrastructure.

The issue of transmission and plant location will be discussed later in this paper.

Industry Outlook

A report by MMA (2008) on the capacity expectations of the industry by 2020 recognised that the technology deployed needed to be viable, with this being defined as being cost competitive with other renewable technologies, including a margin deemed sufficient by providers of capital.

A REC market that will be in surplus will result in a REC price that will be much lower than that currently anticipated. This may work to the ultimate advantage of the geothermal sector.

Figure 2 indicates that the installed geothermal capacity will start to increase significantly from 2015, however due to technical problems with some pilot plants; it is considered that this will be delayed by two to three years, which may provide opportunities for the sector.

The MMA report (2008) also identified that a substantial amount of the RET must still be available when geothermal projects are at the stage of being ready for deployment. Much of the current State and Federal policy has been aimed at the deployment of existing commercially viable technologies, such as solar PV and hot water systems, through the Federal Solar Bonus Scheme and various State schemes, focusing on hot water rebates and fees-in tariffs. As noted above, modelling set out in Figure 1 indicates that that this will create a surplus of REC's and dependent on the uptake of the technology, may result in this surplus remaining until 2017. The data presented allows for no geothermal energy being exported to the grid, but does show the shortfall of REC's that the geothermal sector can take advantage of.

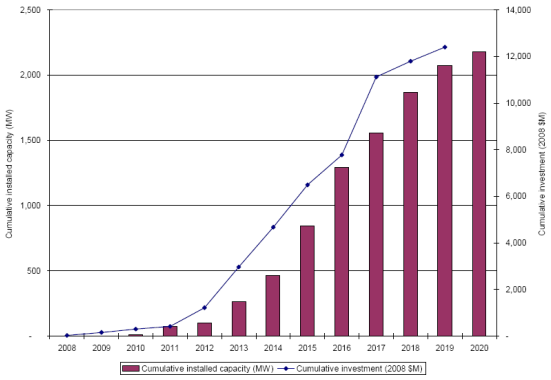

Figure 2 - Cumulative installed capacity and investment
Source: (McLennan Magasanik Associates, 2008)

Many electricity retailers also anticipate that wind generation will pick-up the shortfall, with an additional 29 wind farm projects currently under consideration, however, many of these may find that the wind availability in some of these areas under investigation is not economically viable particularly given that the majority are located in South Australia and Victoria where there is already a high presence of this technology.

Research has previously indicated (Froome, 2009) that existing and proposed Federal policy measures will not be sufficient by themselves to drive renewable energy deployment to the targets proposed. With retailers also offering 'green energy' programs, the actual shortfall will be much greater than indicated. Like the solar examples provided, additional State measures will be required, based upon the individual needs of the State in meeting their own economic and social policy objectives.

Looking specifically at Queensland the policy decisions being faced may be whether to provide support through a feed-in tariff to those generators located close to existing infrastructure or subsidise new infrastructure to those areas where the resource is more plentiful.

Transmission

The Queensland Government has already released 29 sites for tender as shown in Figure 3, with only one site west of Gladstone having already been awarded. There are currently a further 26 tenders under consideration by the Department of Mines and Energy. Whilst many of these sites are considerably smaller than the major sites being developed in South Australia, having existing transmission and distribution infrastructure in close vicinity, together with forecast demand growth for many of the regions surrounding these sites, the economic return

required or investment hurdle point will be much lower.

The information shown in Table 1 indicates the increased interest in geothermal energy, both through the number of tenders lodged compared with land releases and the number of companies ultimately gaining preferred tender status. There still remain two land releases (one from each of rounds one and two) that no tenders were received for.

However this will also result in competition for the limited amount of private funding available to progress the proposed projects.

	Rnd 1	Rnd 2	Rnd 3
Tender Closing Date	**3/06**	**4/07**	**2/08**
Land Released (No.)	6	10	35
Tenders Received (No.)	6	11	13
Preferred Tenders (No.)	5	9	13
No. Of Tendering Company's	2	3	6

Table 1 - Queensland Geothermal Tenders
Source: (Office Of Clean Energy, 2009a)

It is also interesting to note that the land released in round three is located furthest from the coast and will therefore incur greater capital requirements when considering transmission infrastructure costs, but all land releases progressed to the preferred tender stage.

Also looking at this from a Queensland perspective, locations that have been identified as suitable for new solar thermal or wind generation are also located near identified geothermal resources. This will provide a number of shared infrastructure opportunities.

If we consider where the Queensland Office of Clean Energy believes that our renewable resources may come from by 2020, as shown in Figure 4, there will be significant investment in both of the above technologies.

An interesting observation is the extent of the deployment of solar hot water (being a current Queensland Government priority) which is electricity displacement rather than generation, which adds weight to earlier conclusions in relation to the surplus of REC's in the early RET program.

Geothermal, solar thermal and wind are expected to add approximately 2,000 MW of generating capacity, with the majority of generation plant to be located in areas currently not connected to the transmission grid.

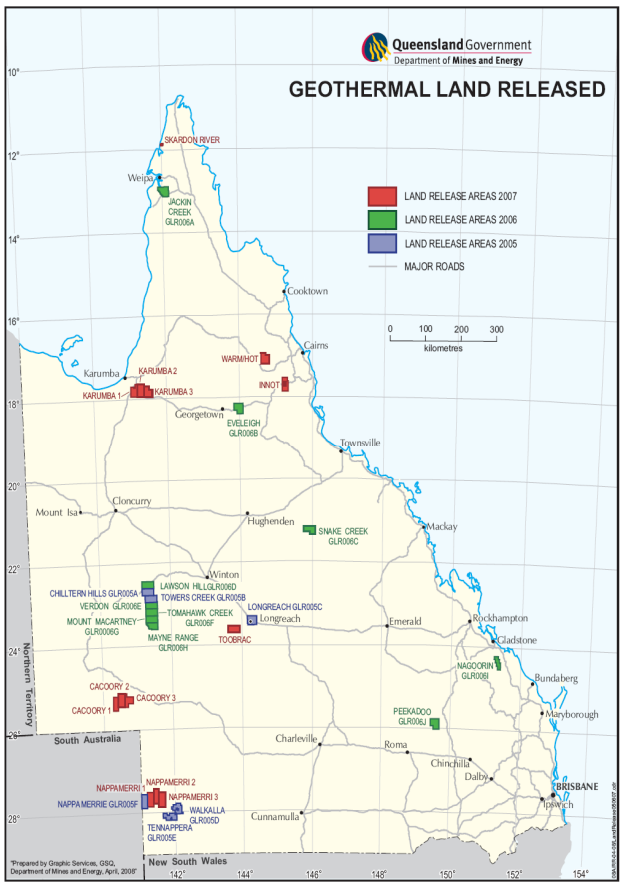

Figure 3 - Queensland's Geothermal Sites
Source: (Department of Mines and Energy, 2008)

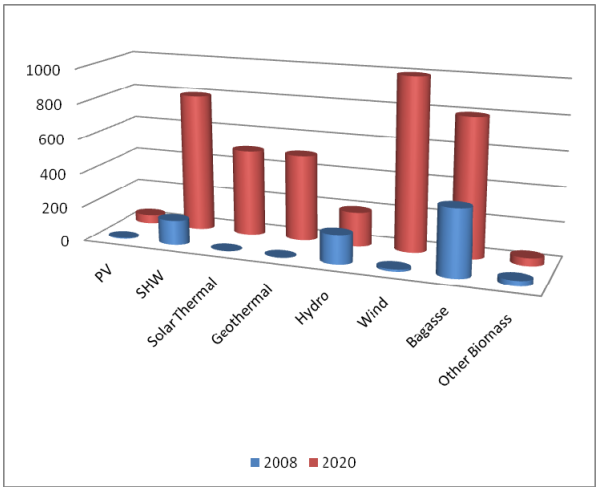

Figure 4 - Queensland's Clean Energy Future
Source: (Office Of Clean Energy, 2009b)

It may therefore be more appropriate to look at policy measures that fund additional transmission and distribution infrastructure to bring forward the deployment of these smaller sites, than looking at policy measures that support the final generation output.

Summary

Current policy measures would appear to be working well for the geothermal sector, with funding being made available for research, exploration and drilling. The deployment of other renewable technologies already commercialised will be driven by State subsidies and will keep the REC price relatively low in the early years due to anticipated deployment rates, stalling investment in those marginally economic technologies. Based upon industry forecasts, much of the planned geothermal generation plant will start to come on-line when the REC surplus has been expended and there is short-fall with the price increasing accordingly, resulting in greater 'profit' opportunities for this sector.

This paper has highlighted the need for further research looking at the effect that subsidised transmission and distribution infrastructure may have on the deployment rates of renewable technology. As other technologies, particularly wind and solar thermal also look at siting generation plant further from the coastal population bases, the need for a structured plan to develop the necessary infrastructure requirement of the national electricity market as a whole needs to be looked at in much greater detail.

The renewable energy sector cannot move forward without considerable support from all levels of government, but what the sector must determine what form that support should be.

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