Hot Rocks Thaw Eurøskeptics

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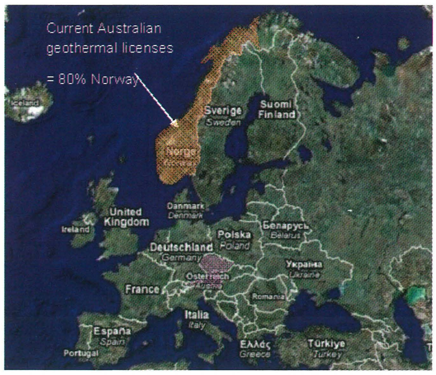
One of the notable observations from the IGC Geothermal Symposium in Oslo was the significant divergence in opinions on the topic of Engineered Geothermal Systems (EGS) and the rapidly changing perceptions of EGS viability. Despite the fact that the European Union has, and continues, to fund developmental EGS work at the Soultz site in France (which is now producing 3.5 MWe), the northern European countries, particularly Scandinavian countries, tend to remain quietly reserved about the technical and economic viability of EGS. This is clearly not shared by the French and Germans who gave quite optimistic assessments of the EU EnGINE project.

In contrast, Norway's only attempt at EGS development (at Rikshopitalet in 1999) was described by a Norwegian Geological Survey speaker as a "failure" – although when queried, the speaker didn't know why the project failed. The project was attempting to drill 5 km through Proterozoic gneiss and hornfels using a highly unusual approach to create a reservoir through the drilling of multiple inclined (45°) holes to act as the heat exchanger (ie no hydraulic fracturing) - no wonder they think EGS is costly! The well was abandoned after tools were lost downhole at 1600 m (surprisingly!).

In addition to this I subsequently discovered that the main well only achieved thermal gradients of 22-25°C/km – perhaps not unexpected given that the well was drilled entirely within gneiss and hornfels with high thermal conductivity. The project exhibited all the hallmarks of both high engineering complexity and poor pre-drill geological risk mitigation (particularly thermal conductivity measurement and heat flow modelling). Consequently northern scepticism is a classic example of present day perceptions being driven by poorly reasoned projects in the past.

The dichotomy of opinion between very close European neighbours is symptomatic of the poor understanding of EGS basics. Most people are vaguely aware of the few big developmental EGS projects around the world, such as Soultz, Habanero and Landau, but are not aware that EGS exploration and development covers a broad range of play types from low enthalpy shallow plays to high enthalpy deep plays. The well known pilot EGS projects tend to be high cost as a function of their developmental nature. However this does not mean that all commercial EGS projects will have the same risk and cost structure, simply because of the range of play types, depth and temperature targets, flow rate and other site specific considerations.



Current Australian geothermal licenses (granted and under application) comprise approximately 246,000 km² which is equivalent to ~80% of the land area of the Kingdom of Norway (orange polygon). The current Victorian geothermal gazettal round comprises 153,000 km² which is equivalent to the combined land area of Austria and the Czech Republic (pink polygon).

Consequently, when the mainly Norwegian and Swedish audience at day one of the IGC Geothermal Symposium were informed that there are actually 33 registered geothermal companies in Australia, 10 listed with a combined market capitalization of $566 million, exploring for a range of play types across the country at different depths and temperature targets – there was a deafening silence of disbelief! In fact Australia presently has 322 licenses (soon to be as many as ~360 licenses) covering ~246,000 km² and this is equivalent to about 80% of the total land area of the Kingdom of Norway.

Ultimately, the economics of EGS projects will largely depend upon the balance between development cost and power output. The best way to reduce cost is to limit drilling depth and bit rotation time and to reduce stimulation risks. The best approach to optimise output for a pumped system is to maximise flow rate and to target a working fluid at an optimal pumping temperature. In a nut shell these both mean that EGS projects located in areas of high heat flow with shallow non-crystalline reservoir targets, good flow rates and water temperature in the range 150-190°C will have the lowest technical and cost risk. Indeed this was the finding of a recent (2007) numerical reservoir modelling study of the Desert Peak EGS project in the USA conducted by our strategic partners at GeothermEx Inc. The project involved modelling the stimulation of a semi-permeable reservoir at a shallow depth (<3000 m) to achieved high flow rates for pumped wells. The minimum calculated levelised cost for the project, excluding tax and royalties etc, was US$54.30 per MWh. This means, that under current technologies, EGS power, in the best case, may become cost competitive with conventional carbon-based electricity generation in the very near future, and will be more cost effective than all other forms of renewable energy generation.

Whilst the realisation of the growing viability of EGS technology to tap huge resources of renewable energy was emphasised by the French and Germans, the most surprising presentations came from the Philippines and New Zealand, the homes of both conventional volcanic geothermal exploration and EGS scepticism. Both countries are now openly stating that they will consider exploring the potential of EGS. Indeed the GNS delegate Colin Harvey officially announced that the New Zealand Government has awarded NZ$1 million to GNS to commence the exploration of EGS potential in both convective and conductive areas of New Zealand geothermal fields. This means that GNS will establish a high temperature chemistry lab to investigate the geothermal potential between 3 and 6 km depth. There was also significant EGS interest from delegates from India and Korea.

By the end of the symposium, the sceptical Scandinavians were left scratching their heads and openly muttering about perhaps having another look at EGS. ■