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The Electric Energy Society of Australia

Hot Rocks Potential

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***Explorer and Developer of Geothermal Energy***

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# ***Petratherm Outline***

- Petratherm Overview
- Key Messages
- Global context for renewables/geothermal
- Overview of Australian Geothermal Energy industry
- SA geothermal energy sector
- Challenges for geothermal energy projects
- Potential solutions
- Progress reports on selected projects
- Conclusion

# Corporate Overview



## Key Statistics

- Current shares on issue – 57.9m (plus 13.77 m options)
- Market capitalization - \$21.5m (at share price of \$0.37)
- Cash - \$3.3m
- Major shareholder - Minotaur Exploration (34%)

## Projects

- 11 projects spanning **South Australia, Spain and China** – EGS, conventional and direct heat
- **Flagship project** – Paralana
- **Exciting growth projects:**
  - Direct heat, conventional and EGS geothermal projects covering Madrid, Barcelona and the Gran Canaries
  - Exclusive government supported exploration agreement in China

## Joint Venture Partners

- Beach Petroleum (up to 36% for \$30m)
- TRU Energy (up to 30% for \$57m)

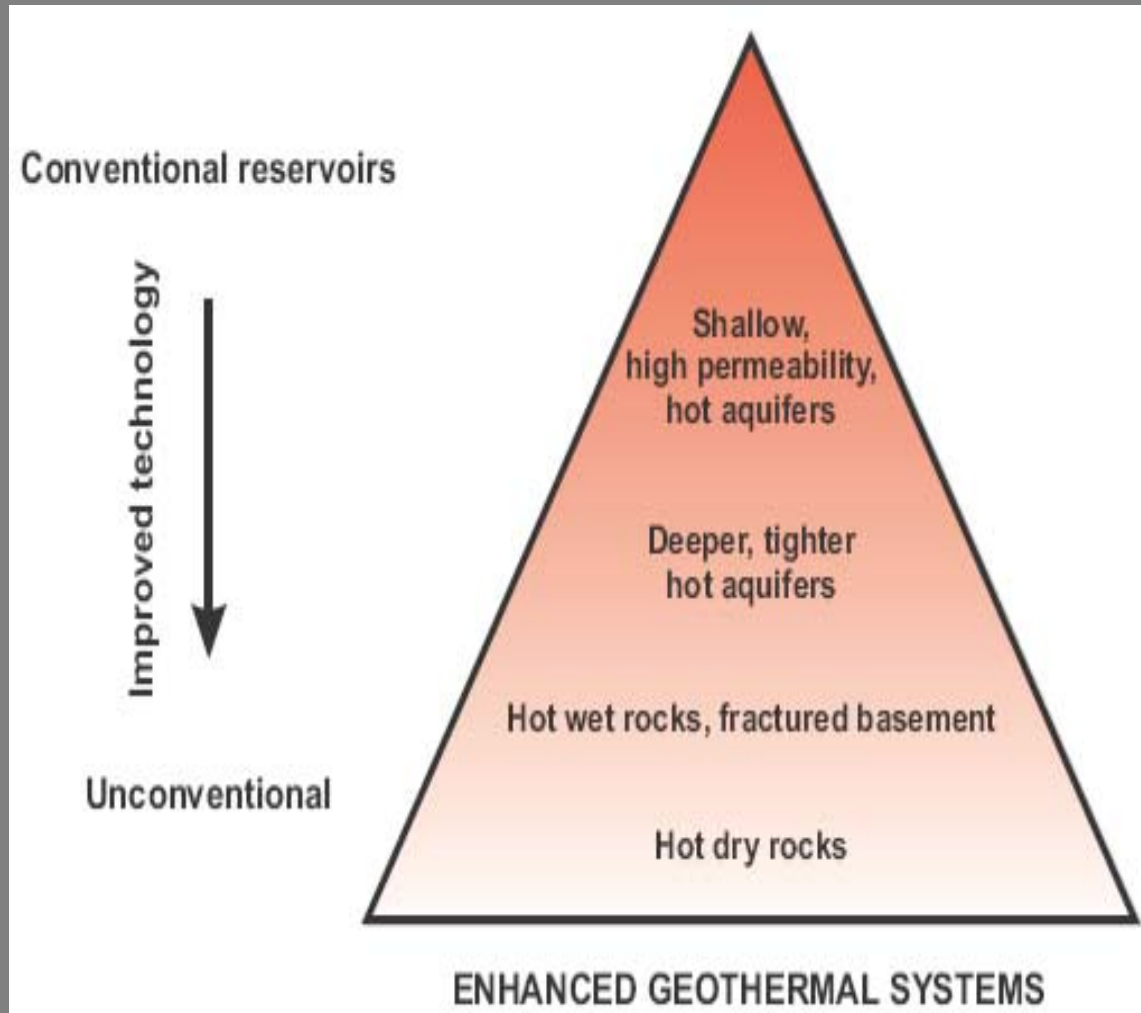
# *Key Messages*

- Geothermal energy has the potential to provide large scale, base load and low cost renewable energy.
- Australia has the key ingredients for developing successful EGS projects – high heat producing granites, continent under compression, strong commitment from government and financial markets.
- SA has the best known EGS (hot rock) geothermal resources in Australia with approximately 90% of Australia's activity focused in South Australia.
- EGS projects face a number of challenges, including but not limited to – drilling, achieving adequate flow rates, power conversion efficiency, cost of delivery to market (proximity) and water issues.
- Further government support is needed with increased capital funding coupled with increased industry cooperation (R&D, drilling and network connection).

# Geothermal Industry - Challenges

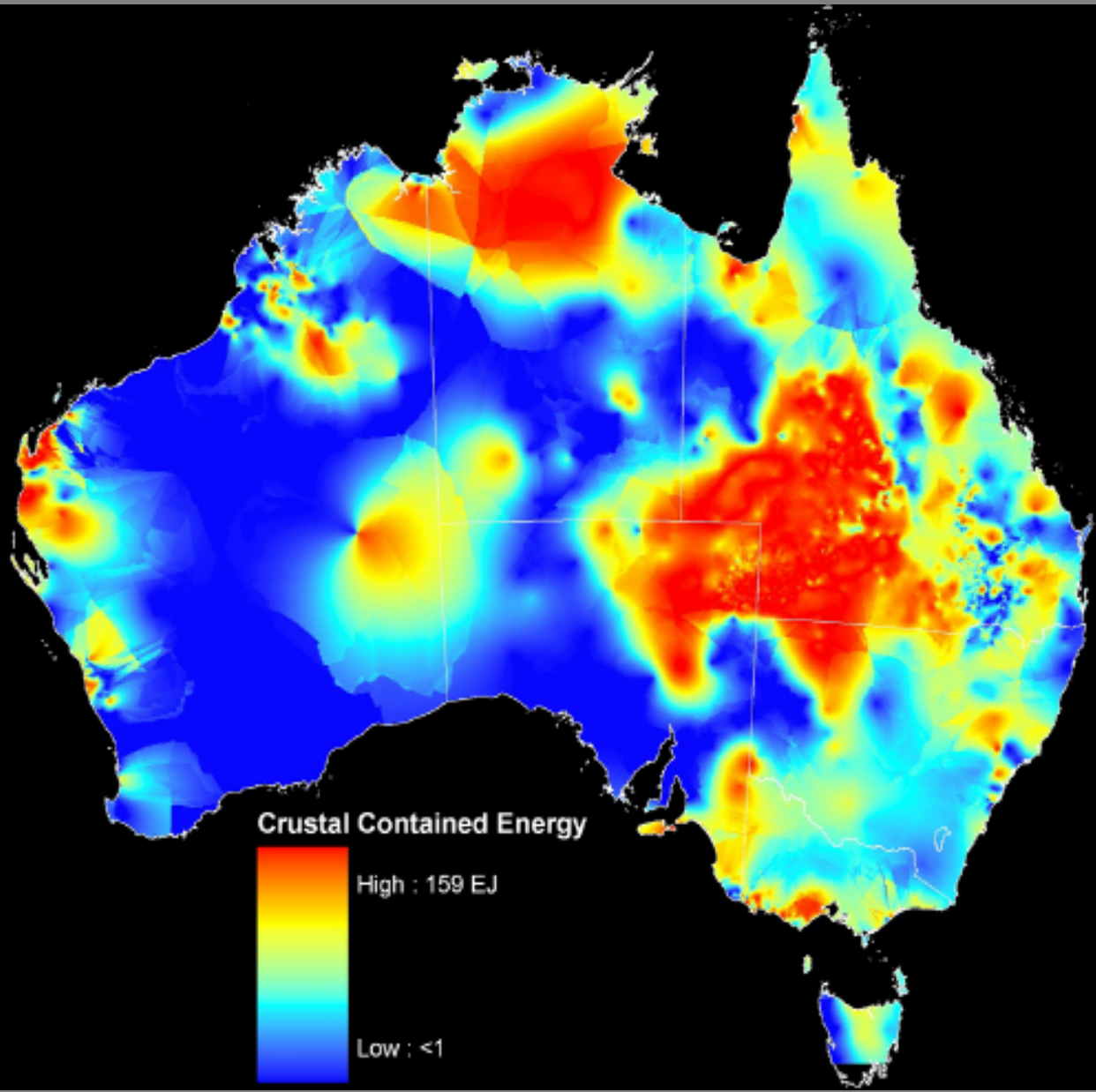
## Cost Drivers

- Temperature
- Drilling Depth
- Flow Rate
- Network Connection
- Generation Plant



High up front costs – drilling, fraccing, connection, plant  
(low O/M + no fuel costs)

# ***Drivers - The Promise of Geothermal***



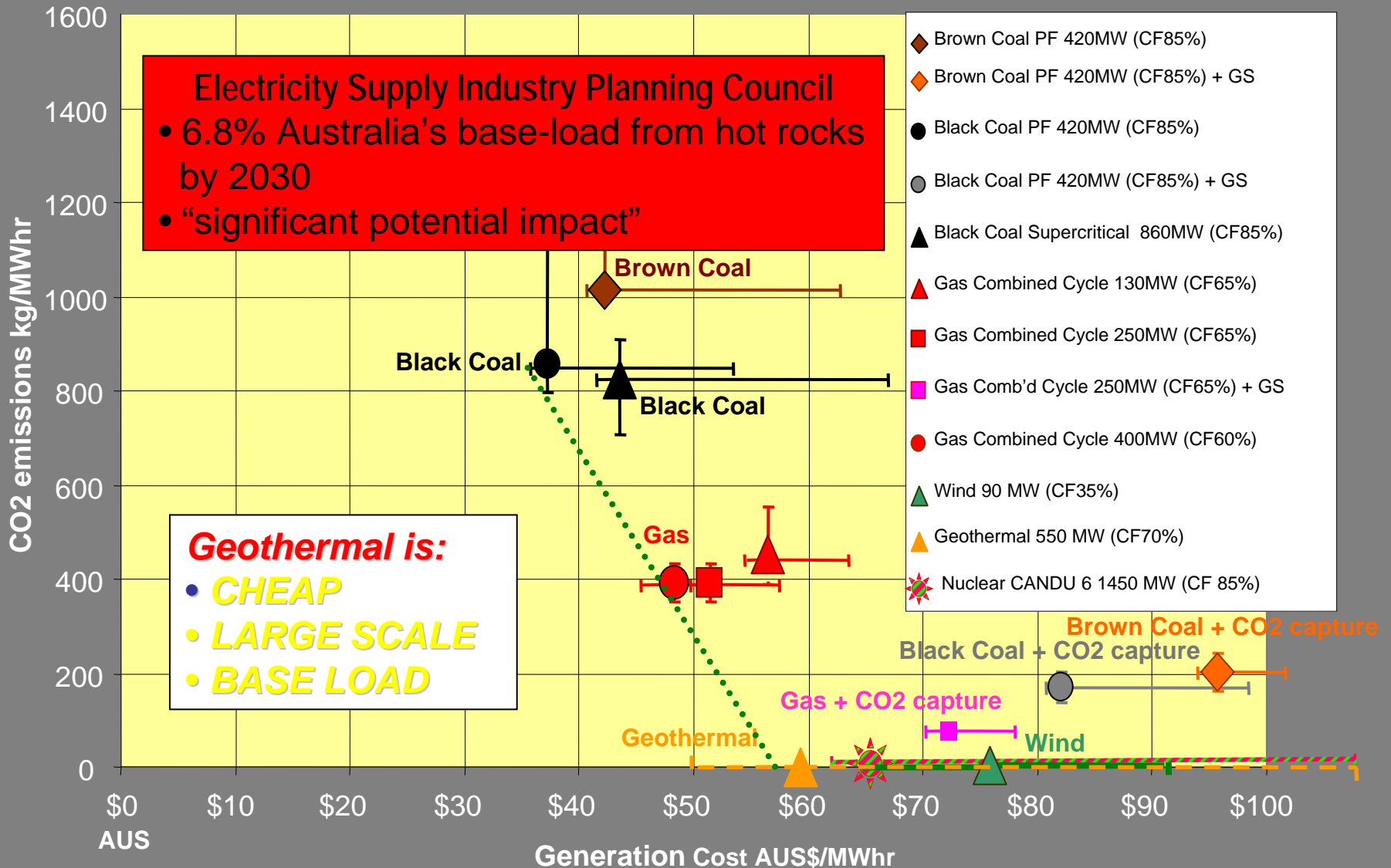
## **Indicative Resource Map**

**Australia's hot  
rock energy 150°C  
to 5km ~ 1.2  
billion PJ**

**~20,000 X annual  
primary energy  
use in Australia**

Source: Geoscience Australia (2007)

# Geothermal Energy Cost Comparison



**COMBUSTION CO2 EMISSIONS vs LONG RUN COST**  
 (Source: PIRSA Compilation of ESIPC data 2006-07)

# ***MMA Report on Geothermal - Findings***

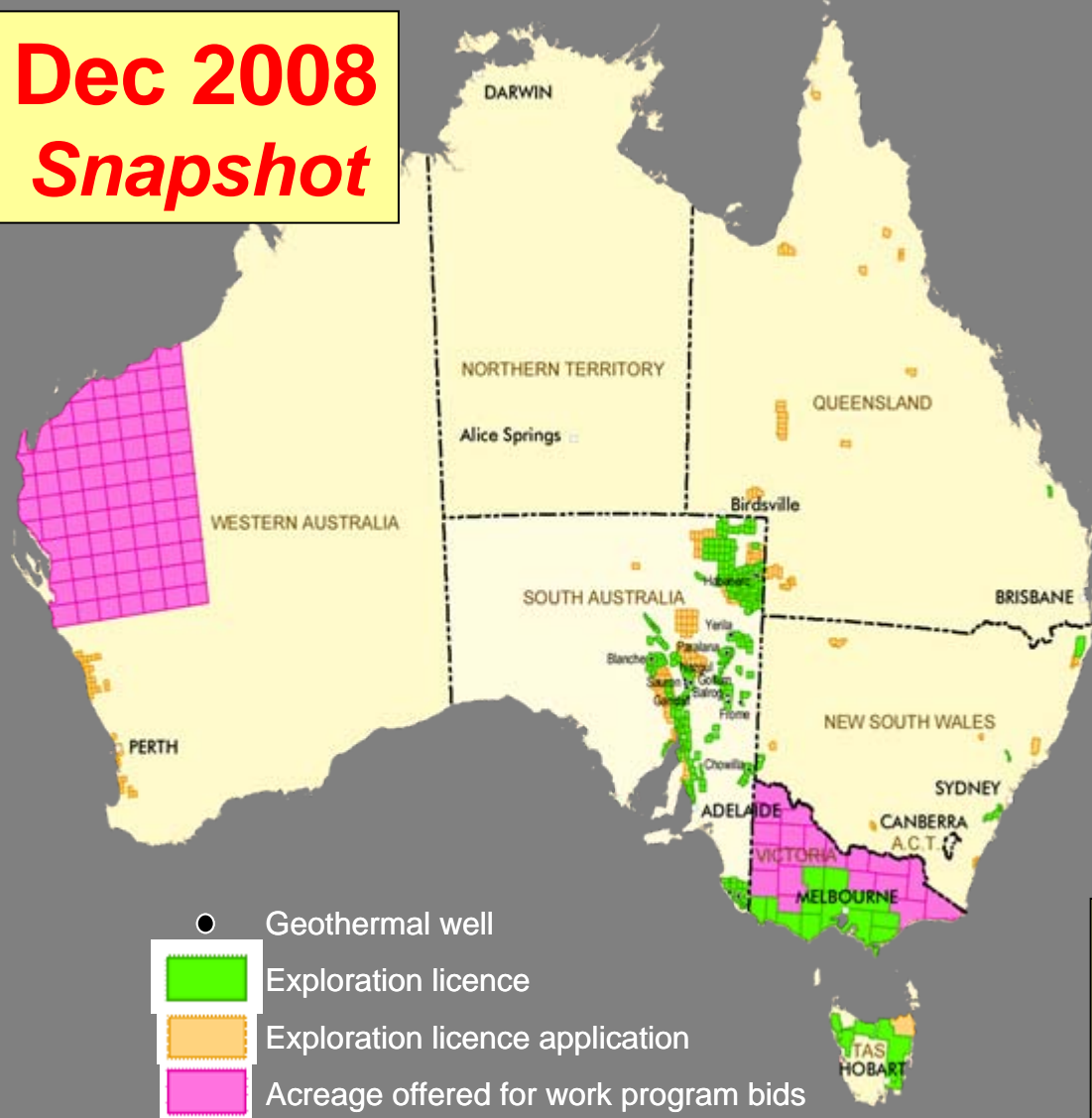
- Geothermal energy expected to build up to 2,200 MWs of base-load capacity by 2020;
- An estimated \$12 billion would be invested to develop that capacity;
- Represents up to 40% of the Federal Government's 2020 Renewable Energy target of 45,000 GWh - the equivalent of the output of around 6,000 MW of wind farms;
- Generation costs are expected to move rapidly down the cost curve from around \$120 /MWh at small scale (10 MW to 50 MW) and decreasing to around \$80/MWh at large scale (300 MW or greater) by 2020; and
- Most of the capacity is expected to come from developments in SA - other states increasing their contribution toward by 2020

# *Renewable Energy Policy & Geothermal*

- Federal Labor Government Clean Energy Plan to ratify Kyoto, Emissions Trading Scheme, 20% Renewable Energy target by 2020, \$485 M Renewable Energy Fund (\$50 M drilling initiative fund - 7 projects, demonstration project funding) & \$150 M Energy Innovation Fund
- The Australian Geothermal Energy Group (AGEG), developers/companies, academic/research institutions and government departments federal/state – collaborative work
- The Australian Geothermal Energy Association (AGEA) – developers/companies and service companies – Policy and Advocacy notably to governments.
- The Australian Geothermal Energy Industry Development Framework – Federal initiative aims to grow the Industry

# Growth of Australian EGS Industry

**Dec 2008**  
**Snapshot**



## GELS / GELAS

Aust. 367

S.A. 273

## Expenditure

Aust. > \$1000 Mill

S.A. ~ \$ 700 Mill

- **48 Companies**
- **10 ASX listed**

# Hot Rock Projects in South Australia – 31 Dec 08

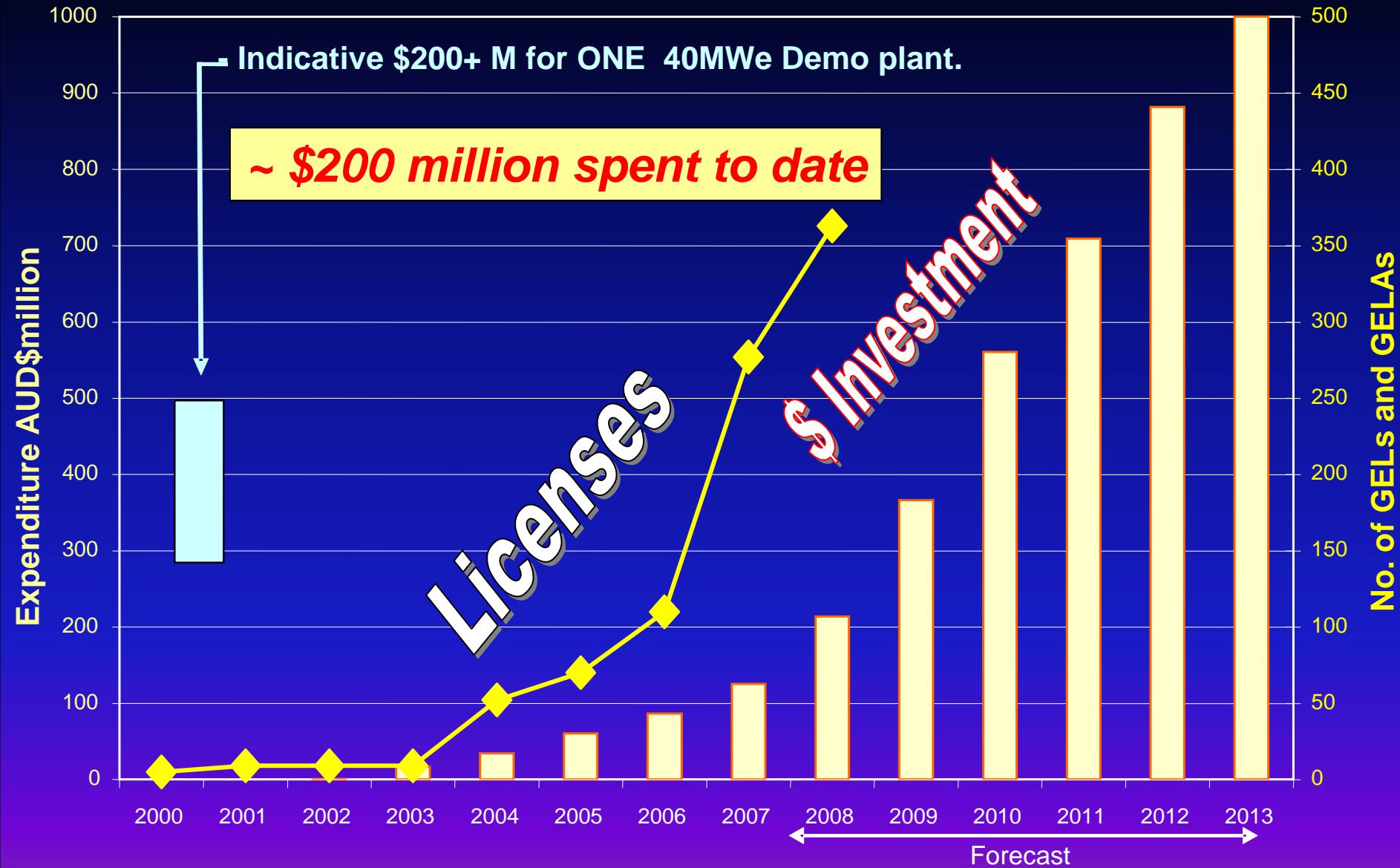
- 28 companies in the hunt in 273 licences on variety of plays covering >125,683 km<sup>2</sup>

- |                                 |                             |
|---------------------------------|-----------------------------|
| ✓ Geodynamics ✨                 | ✓ Tri-Star Energy           |
| ✓ Petratherm ✨                  | ✓ Clean Energy Australasia  |
| ✓ Geothermal Resources ✨        | ✓ Osiris Energy             |
| ✓ Green Rock ✨                  | ✓ Origin Energy ✨           |
| ✓ Torrens Energy ✨              | ✓ Callabonna                |
| ✓ Eden Energy/Terratherma ✨     | ✓ Deep Energy               |
| ✓ Panax ✨                       | ✓ Inferus (Southern Gold ✨) |
| ✓ Pacific Hydro                 | ✓ A-B-L-R Joint Venture     |
| ✓ Teck Cominco ✨                | ✓ AAA Energy                |
| ✓ Granite Power                 | ✓ Earth Heat                |
| ✓ Gradient Energy               | ✓ New World Energy          |
| ✓ AGL ✨ (w/Torrens Energy)      | ✓ Near Surface Geothermal   |
| ✓ TRUenergy ✨ (w/ Petratherm)   | ✓ Stuart Petroleum ✨        |
| ✓ Tata Power ✨ (w/ Geodynamics) | ✓ Beach Petroleum ✨         |
| ✨ ASX Listed                    | ✨ International SX Listed   |

- > A\$730 million in work programs (excludes demo & up-scaling for deployment)
- Generalised play ingredients: Amagmatic conductive heat source, geothermal reservoir and insulating cover – combining to enable economic flow rates of sufficient heat energy to meet markets



# Growth in Australian Hot Rock Projects



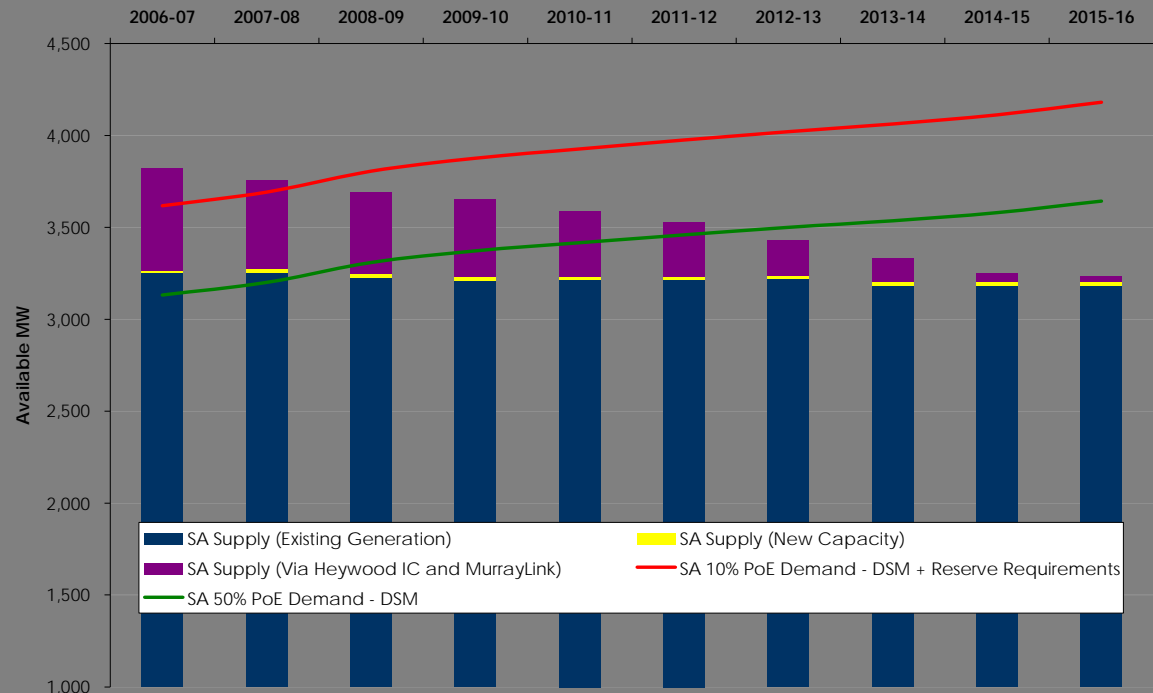
# ***Drivers - Govt. Legislation and Support***

1. Geothermal Tenure - SA, Vic, Tas, NSW, QLD, WA ( and NT soon)
2. RECS, NGACS, VRECS, Carbon Schemes
3. State and Federal Govt. grants ~ \$100 Million since 2000
4. Geothermal Industry Development Framework – COAG Initiative
5. Australian Geothermal Energy Group (AGEG)  
Australian Geothermal Energy Association (AGEA)

# SA Electricity Market

- SA NEM region electricity demand to require at least 600MW of new capacity
- Does not include potential increase of over 400MW from Olympic Dam.
- Nor the effect of depleting Leigh Creek coal.
- Demand requirements will be between 600 – 1,500MW.

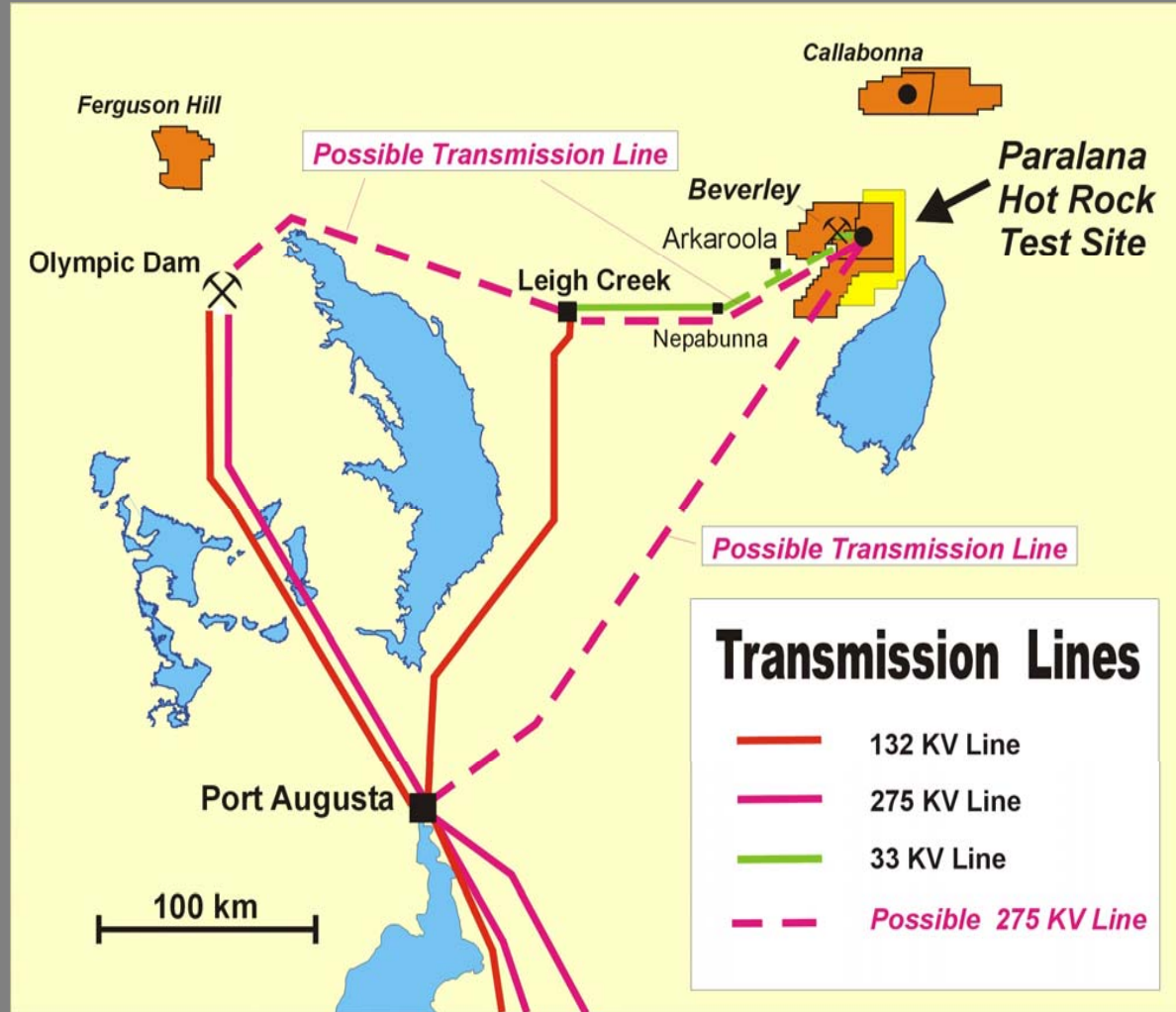
Forecast Supply  
Demand Balance for  
South Australia (source  
SA ESIPC APR 2007)



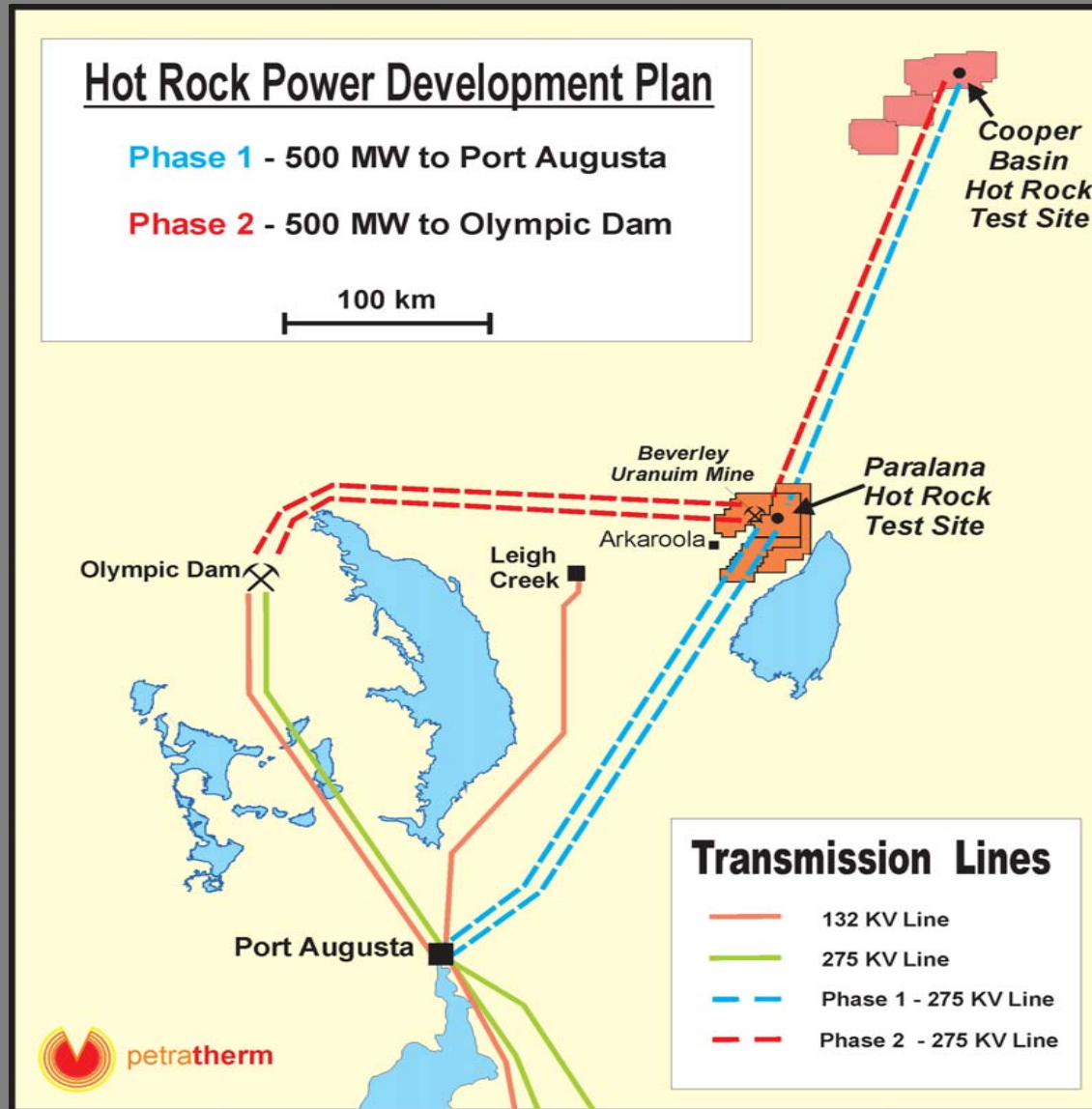
# *Challenges for EGS Projects*

- Securing a quality site – the three locations - resource, market, permits/approvals – optimizing economics in a competitive market.
- Confirming the quality of the potential resource – temperature differential, stress regime / permeability.
- Deep drilling of wells – well design, drilling rig availability and costs.
- Establishing long-term circulation between injection and production wells -permeability, fracturing, flow rate.
- Integration of above-ground generation plant with below-ground thermal resource, achieving reliable power plant output – then followed by up scaling of generation capacity.
- Electrical connection (transmission) to the National Electricity Market.
- Water quality, usage, net losses, rights, obligations, accessibility, environmental impacts – short and long term – small and large scale.

# Transmission Connection - Meshed

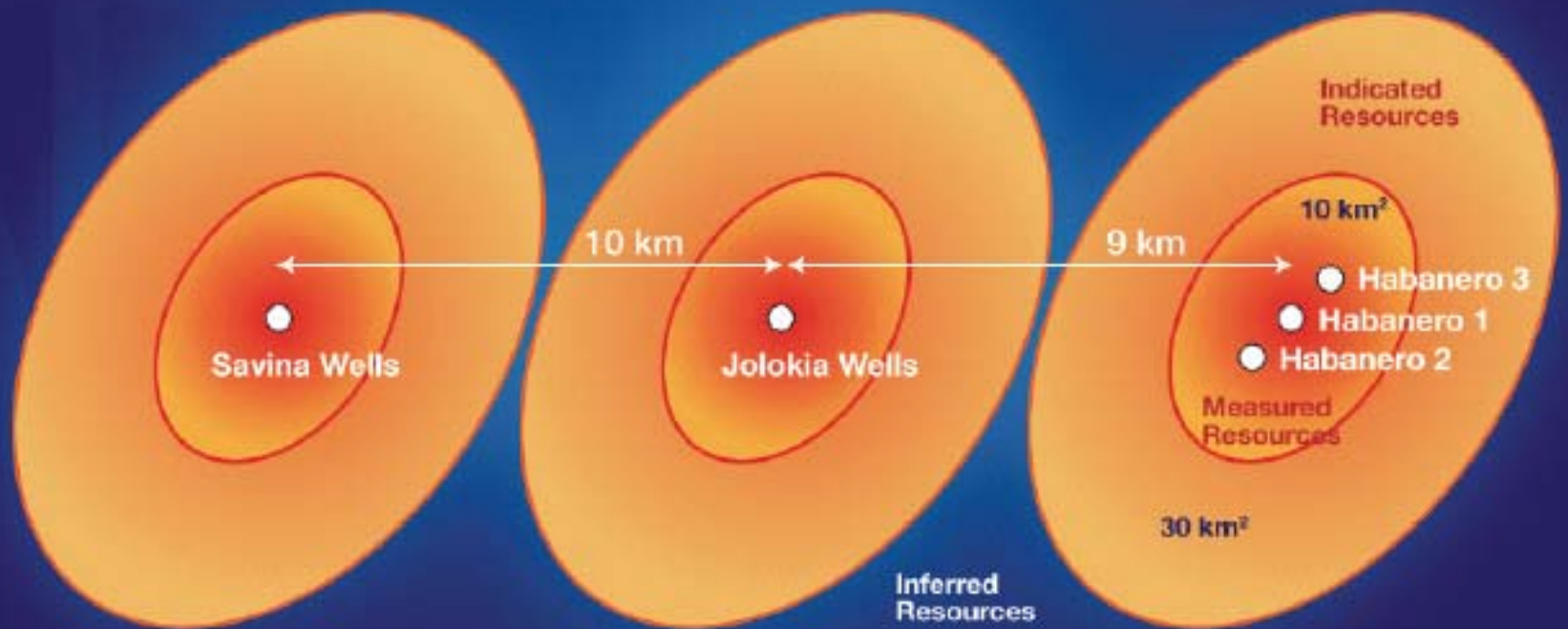


# Transmission Connection – Enhanced Meshed



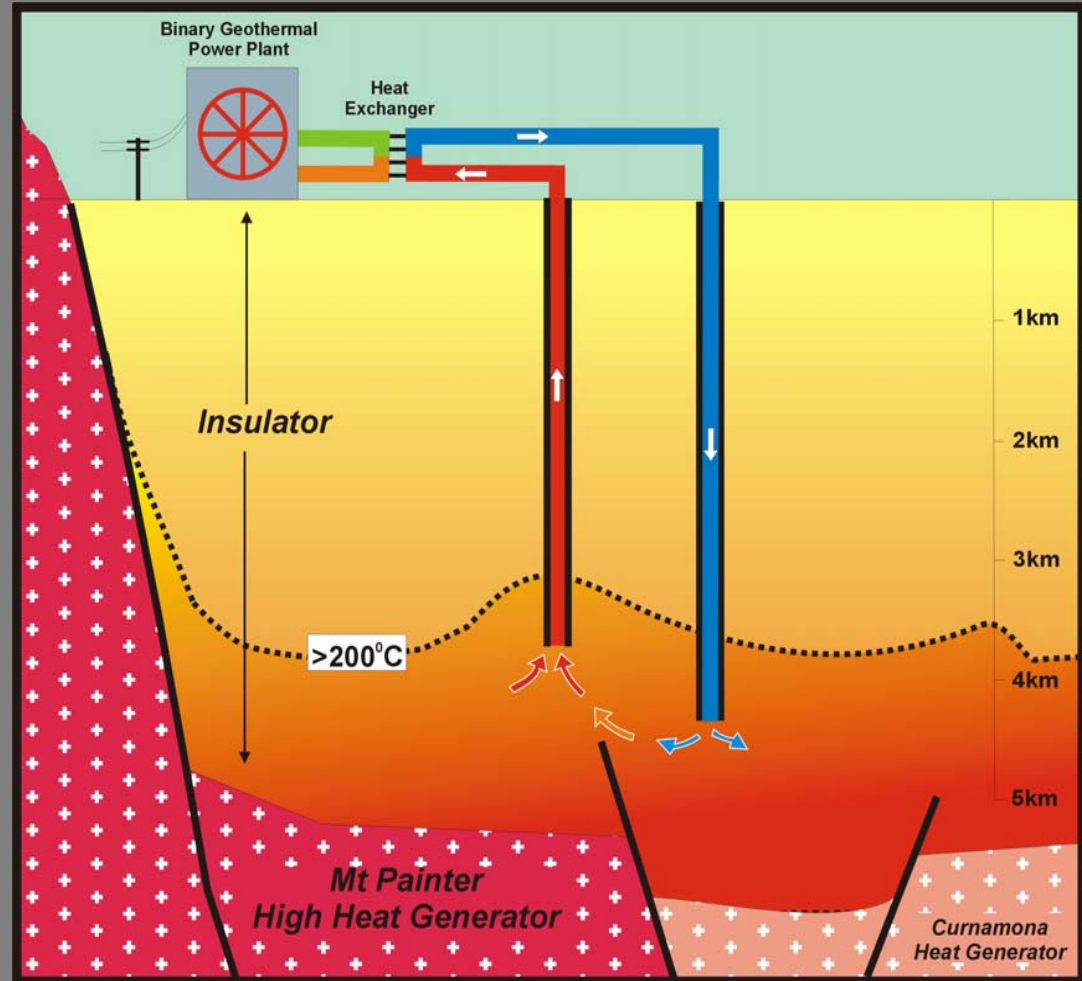
# Drilling Program & Reserves Delineation

- Savina 1 – planned completion March 2009
- Target Depth currently 4,300 m (option to extend to 5,000 m)
- Multi fracture Stimulation at Jolokia 1 or Savina 1 (TBC) - March to June 2009
- Jolokia 2 or Savina 2 (Locations TBC) - July to November 2009



# Paralana 2009 Development Plan

- *Second Quarter 09  
First Deep Well to ~  
4 Kms*
- *Well testing and  
stimulation program*
- *First Quarter 2010  
Second Deep Well*



*Heat Exchanger Within Insulator (HEWI) Model*

# *Conclusion*

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*Thank You*



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