Asia Pacific Clean Energy Summit

Challenges and Opportunities in Geothermal Development in New Zealand and Indonesia

Jon Lorentz  AECOM
## World Market for Geothermal Energy (WGC)

<table>
<thead>
<tr>
<th>Country</th>
<th>Installed 2010 (MW)</th>
<th>Forecast by 2015 (MW)</th>
<th>Increase to 2015 (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Indonesia</strong></td>
<td>1179</td>
<td>3500</td>
<td>2300</td>
</tr>
<tr>
<td>USA</td>
<td>3087</td>
<td>5400</td>
<td>2300</td>
</tr>
<tr>
<td><strong>New Zealand</strong></td>
<td>628</td>
<td>1240</td>
<td>610</td>
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<tr>
<td>Philippines</td>
<td>1904</td>
<td>2500</td>
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<td>Kenya</td>
<td>167</td>
<td>530</td>
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<td>Iceland</td>
<td>575</td>
<td>800</td>
<td>225</td>
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<tr>
<td>Mexico</td>
<td>958</td>
<td>1140</td>
<td>180</td>
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<td>Chile</td>
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<td>Nicaragua</td>
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<td>240</td>
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<tr>
<td><strong>Turkey</strong></td>
<td>82</td>
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<td>El Salvador</td>
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<td>Italy</td>
<td>843</td>
<td>920</td>
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<td>Ethiopia</td>
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<td>45</td>
<td>40</td>
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<tr>
<td>Costa Rica</td>
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<td>200</td>
<td>30</td>
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<td><strong>Papua New Guinea</strong></td>
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<td>75</td>
<td>20</td>
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<tr>
<td>Japan</td>
<td>536</td>
<td>535</td>
<td>0</td>
</tr>
</tbody>
</table>
Geothermal Energy

- Geothermal power generation is based on established technology.
- Average generation cost of geothermal is significantly lower than most other clean energy sources.
- Geothermal generation costs are mostly affected by:
  - The quality of the resource
  - Financing terms
  - The knowledge and experience of the development team.
- The cost of generation is comparable to gas combined cycle plants.
- Geothermal has a capacity factor of over 90% (Wind is 30-40%) making it ideal for base load power generation.
- It is renewable and relatively benign environmentally.
Project Risks

- Geothermal Risk
  - Resource risk
  - Reinjection risk
- Resource ownership and access risk
- Environmental and H&S risks
- Construction risk – Contracting methodology (EPC Delivery)
- Financial risk – Financing structure
- Market risk – Security of Power Purchase Agreement (PPA)
- Country and political risk – Insurance available.
- Project management and technical development risk - Knowledge and experience.
The Project Cycle – Risk and Reward
Ex World Bank Presentation

The Valley of Death!

Equity
Debt

Bankability
The New Zealand Geothermal Market

- New Zealand power market – no incentives for geothermal
- A long history of Geothermal investment in exploration and test wells.
- Most developments have been associated with “brown-field” sites. Resource knowledge reduces development risk.
- New Zealand Govt. Has fully funded geothermal projects (Ohaaki and Wairakei.
- Indigenous Maori have invested in many smaller developments.
- Large scale developments:
  - MRP (SOE) in “JV” with Maori
  - Contact Energy – Private sector corporate.
New Zealand – Planning and Permitting

- Resource Management Act – based on the principle of Sustainable Development
- Resource consent application
- Environmental Impact Assessment
- Public consultation
- Public Notification & submissions
- Council hearings
- Appeal process – lodged with the Environment Court

Time frame:
- Application preparation 2 years
- Council hearings 1 year
- Another 1-2 years if appeal to Environment Court
Tauhara North No. 2 Trust Geothermal Development

- Tauhara North No.2 Trust established to manage the Tauhara land block on behalf of the indigenous Maori owners.
- Trust vision: Hold fast to your land; make use of your land; for future generations.
- 34.5 MW Rotokawa GPP (Operating)
- In 1999, established a JV with MRP (Major power utility) & purchased the rights to Ngatamariki
- 140 MW, Nga Awa GPP (Online 2010)
- 82 MW Ngatamariki GPP. (Online 2013)
- 80-110 MW Rotakawa GPP extension planned.
- 2012 the Trust increased equity in Nga Awa from 10% to 35%.
Approximately 80 million people in Indonesia have no access to electricity.

Generation is predominantly coal and gas and electricity is subsidised.

Indonesia has a geothermal resource potential of 27,500MW (T > 250 C). 44 Projects in development.

Exploration, test wells and 1st Plant funded through NZ AID.

Development issues:

- State Electricity Co. is the single buyer – favour coal.
- Sovereign risk.
- Land ownership and access.
- Concessionaires have difficulty raising equity exploration.
Indonesia - Planning and Permitting

- Structured environmental reporting:
  - EIA
  - Environmental Base Line Report
  - Environmental Management Plan
  - Environmental Monitoring Plan
- Decision making by central Government (Ministry of Mines and Energy).
- Limited third party input into decision making
- Use of Environmental Standards
- Emphasis on environmental management and monitoring.
- Ability to vary permits
Indonesia - Development Progress

Indonesia Government Sector
- Exploration by earlier donor support
- Pertamina Geothermal Energy (PGE) State Oil Co. funded exploration
- World Bank, Asian Development Bank, KfW, JBIC, assisted in funding projects

Indonesia IPPs
- Chevron with PGE
- Supreme Energy – JV with GDF Suez and Sunitomo (JBIC)
- Star Energy – Funding off balance sheet.
- Origin / Tata JV. Funding off balance sheet.