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## Hot Rock Limited (including an update on Chile and Peru)

presented by:

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All amounts are in American Dollars (USD ) unless otherwise stated.



## HRL Business model

- Hot Rock is a public company, listed in 2007 on the Australian Stock Exchange (ASX code HRL)
- HRL mission is to pursue exploration and development of geothermal resources in jurisdictions that :
  - Have quality conventional geothermal resources
  - Provide a secure commercial environment for exploration, development and generation
  - Have ready access to power markets with a growing demand for electricity
  - Place value on electricity from renewable sources
- The company blends:
  - Australia commercial expertise in large scale development of natural resources
  - New Zealand expertise in geothermal technology
- Is able to raise funds from capital markets in Australia and elsewhere
- Is able to joint venture with larger energy companies for advancing projects to commercial scale beyond feasibility stage in the exploration and resource proving process



## HRL geothermal resource targets

- Targeting conventional, geothermal resources:
  - Volcanic systems at Pacific Rim plate margins
  - Hot Sedimentary aquifer targets in Australia
- Much lower risk and cost than 'unconventional' plays, due to large global installed capacity and long operational history



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#### Koroit HSA flagship project

## HSA resources in Otway Basin, Victoria

- Numerous sedimentary "depo centres" with thick (1 to 3+km) accumulations of quartz sandstones occur throughout the onshore Otway Basin
- These rocks are water saturated and subject to elevated heat flow through thinned crust (from rifting) with temperature gradients of 40 to 45°C/km
- This setting yields hot water at 125° C to 185°C, within porous / fractured sandstones, between 2500 and 4000m
- Represents a large, regional, medium grade geothermal resource of the Hot Sedimentary Aquifer (HSA) type, with:
  - some 550,000 PJ in-place heat
  - power generation potential of some 3500MWe\* for 30 years
- HRL flagship HSA resource at Koroit now drill ready:
  - 390km<sup>3</sup> / 67,000PJ in-place heat, with power generation potential of 450MWe\*





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## **Chile /Peru - High quality geothermal prospects**

- More than 200 Pleistocene & Holocene volcanoes (of which 100 are in Chile) located along western margin of South America, in four segments
- Associated with subduction of oceanic Nazca plate below the continental lithosphere of Central Andes
- High geothermal development potential in Peru and Chile within the Central and Southern Volcanic Zone segments
  - Southern Peru: Six geothermal regions identified with the major one in central Andes of SE Peru where 300 geothermal areas with a wide range of surface activity occur
  - Northern Chile: approximately 90 geothermal areas, largely of chloride type, frequently solfataric, located along the high Andes and Altiplano
  - Southern Chile: more than 200 sites with acidicsulfate, bicarbonate and chloride type springs, restricted to 4° volcanics in the Andean Cordillera
- Geothermal potential of Chile alone estimated to be in the order of 16,000 Mwe for 50 years\*





## Chile / Peru – strong and rapidly developing economies

- Chile is ranked as South America's most stable and prosperous economy, leading Latin America in human development, competitiveness, income per capita, globalization, and economic freedom.
- GDP 2011 todate is 8.4%.
- Peru is currently one of the world's fastestgrowing economies owing to stable politics and an economic boom that has gradually developed over the past decade.
- GDP 2011 to date is 7%



- Key economic drivers in both countries are very large copper mining industries:
  - Chile is the largest producer of copper in the world and Santiago has recently become the de facto mining capital of the world
  - Peru is rapidly following Chile's economic development path anchored on large scale mining developments



## **Chile Power Sector**

- ~60% of generated energy from hydro, 20% gas and 20% coal
- Increased power costs due to recent gas shortages & ongoing power shortages
- Large existing and forward power market (15,000 MWe and needs to be doubled in next 10 years)
- Development of large hydro and coal plants in pipeline but facing public opposition
- Strong support for renewables of which geothermal viewed increasingly as a serious contender for large scale base load power generation



- Good opportunities for geothermal to provide both on-grid and off-grid power
- Robust geothermal law in place (2000)
- Additional support for geothermal sector from "Renewable Energy Law of 2008" calls for at least 5% of the energy produced by the medium and large generator sector to be from non conventional renewable energy sources, increasing to 10% by 2024



## **Peru Power Sector**

- Generation capacity of 7,200 MWe with mix similar to Chile – 60% hydro, 40% thermal
- Forward demand for a further 4,500MWe of generation by 2017
  - \$56 billion to be spent on mining developments over next decade
- Future renewable energy development capacities are estimated at:
  - Hydro: 59 GWe
  - Wind: 22 GWe
  - Geothermal: 3GWe
- In spite of large gas reserves and the very large hydro potential, there is strong support for non-hydro renewable power through the Renewable Energy Law 1002 (2008), which offers:
  - 20 year, inflation indexed, "take or pay" power sales contracts awarded through bidding against "same type" renewable projects
  - (e.g. recent 80MW PV Solar project awarded 20yr contract at US\$224/MWh)
  - priority connection for renewables to grid





# Huge interest in geothermal development opportunities in Chile and Peru – both domestic and international

#### Chile

- 49 geothermal concessions granted through direct application with 20 still under process
- 33 concessions awarded through two rounds of competitive bidding, in 2009 and 2010, raising \$106m + \$251m in committed work programs
- Hot Rock holding 13 concessions in 7 projects

#### Peru

- 8 projects awarded to 4 companies
- HRL holding 3 large projects with granting of a further 2 imminent

#### Hot Rock Limited

 Now the largest geothermal concession holder in Sth America





# Current geothermal exploration and development activities in Chile and Peru

#### Peru

- First tenements awarded only in January 2011
- Land access and surface exploration in progress by 4 companies

#### Chile

- HRL surface exploration completed at 2 of 7 projects and resource assessments published
- Drilling undertaken or in progress by:
  - ENEL (Apacheta)
  - GGE (Tolhuaca)
  - Energia Andina (Tinguiririca & Puchildiza)
  - Magma (Laguna del Maule)
  - Collahuasi Mine (Volcan Olca)
- Firm plans published by ENEL for commissioning a 50 MWe first stage power plant at Apacheta in 2014





## Industry Status – significant advances being made

- A geothermal association of Chile has been formed, ACHEGEO, and will hold its first annual geothermal conference next week
- Major showing by Chilean geothermal community at recent 2011 GRC conference in San Diego – full morning session on Chile projects
- Chile government is formulating a drilling risk insurance scheme giving 50% cover on up to three exploration well failures
- CEGA Andean Geothermal Centre of Excellence has been recently established at University of Chile with research interests in magmatic processes / heat-water-rock interaction / fluid geochemistry / structural controls / geophysics / reservoir and surface processes
- Consultant and contractors taking up strategic positions in Chile in anticipation of a major geothermal industry developing
- An informal working geothermal association has been formed in Peru by HRL and others
- JICA have just completed a nation wide inventory of geothermal resources in Peru



## Outlook

#### Hot Rock

- Well established in both Chile and Peru
- Benefiting from first mover advantage in acquiring quality concessions ahead of the competition
- Moving forward this summer with detailed geoscience and MT surveys at a further two projects in each of Chile and Peru
- Expect to commence exploration drilling in summer of 2012/13

### **Chile Geothermal Industry**

- High level of international interest in the emerging Chile geothermal industry which is rapidly growing in capacity and stature
- Real exploration drilling successes have been achieved over past 2 years at each of 5 prospects
- These successes are propelling the sector forward with a realistic likely commissioning date for geothermal generation in Chile of 2014
- Excellent long term opportunities for NZ consultancies and contractors





