IRENA – OLADE workshop in Lima

Investment in geothermal sector - Example Chile & Tolhuaca project

MIGHTY RIVER POWER

November 2013

STRICTLY CONFIDENTIAL

About Mighty River Power

- A leading integrated New Zealand energy generator and retailer
  - Market capitalisation NZ$3.1 billion
  - More than 90% of generation from renewable sources – New Zealand's only large, renewables dominated energy company with both hydro and geothermal generation (geo over 40% of production)
  - Generates c.17% of New Zealand's electricity
  - Ownership 51% NZ government, 49% publicly traded
- Diversified and flexible generation portfolio
  - Largest hydro system in the North Island
  - Base-load geothermal, flexible hydro and gas-fired generation
- Investment track record and proven geothermal expertise
  - Mighty River Power is one of the world's largest geothermal power station owners & operators
  - Successfully developed and commissioned over 330MW of new 'premium' renewable geothermal generation since FY2008 (total investment over US$1.1 billion), including completion of 82MW Ngatamariki geothermal plant in mid-2013
  - The Company is applying this capability and experience – gained through domestic geothermal exploration, development, construction and operations – to invest in international growth opportunities
  - Over 50 specialist staff in geosciences, reservoir engineering, geothermal engineering and drilling, plus a further 60+ people in geothermal operations

NZ domestic geothermal partnerships

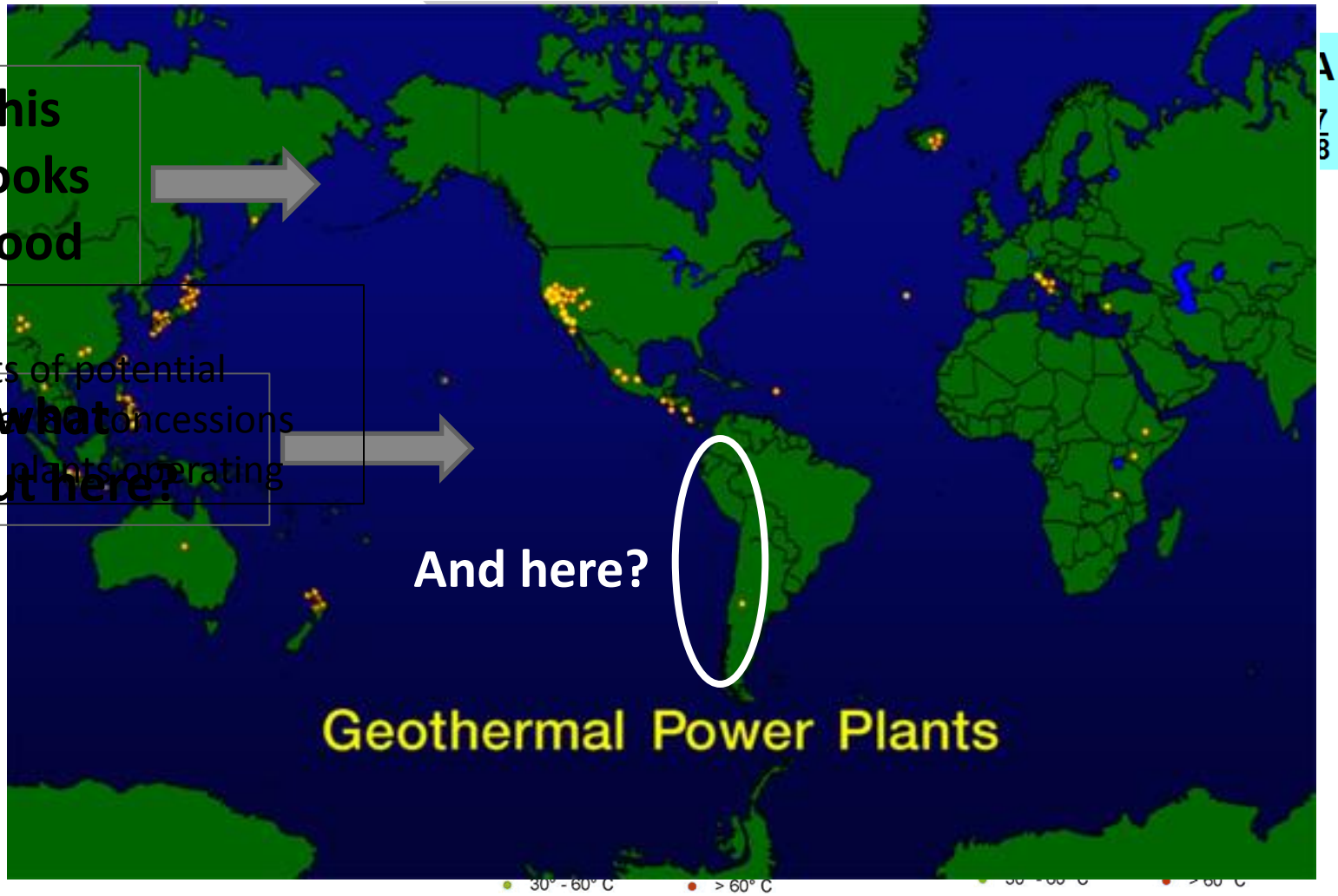
Power Station	Size	Partner/s	Commercial arrangement
Mokai 	112MW	Tuaropaki Trust	Owner: Tuaropaki Power Company Tuaropaki Trust 75% Mighty River Power 25%
Rotokawa 	34MW	Tauhara North No.2 Trust	Owner: Mighty River Power
Nga Awa Purua 	140MW	Tauhara North No.2 Trust	Owner: Nga Awa Purua JV Tauhara North No.2 Trust 35% Mighty River Power 65%
Kawerau 	100MW	Ngati Tuwharetoa (BoP) Settlement Trust Putauaki Trust Norske Skog Tasman	Owner: Mighty River Power
Ngatamariki 	82MW	Tauhara North No.2 Trust	Owner: Mighty River Power

OPPORTUNITIES

Looking at Latin America from New Zealand

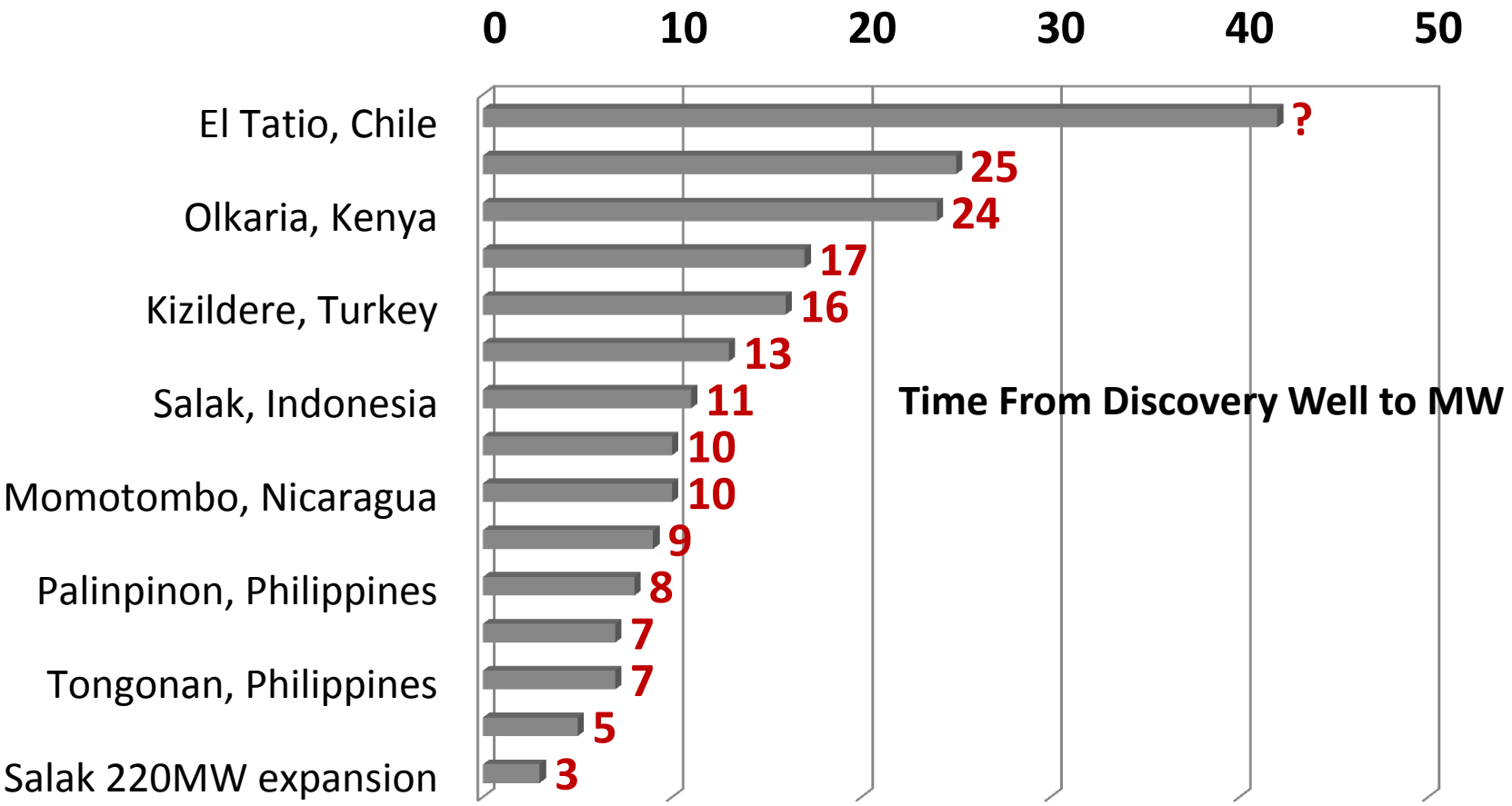
OPPORTUNITIES

Latin-American geothermal development

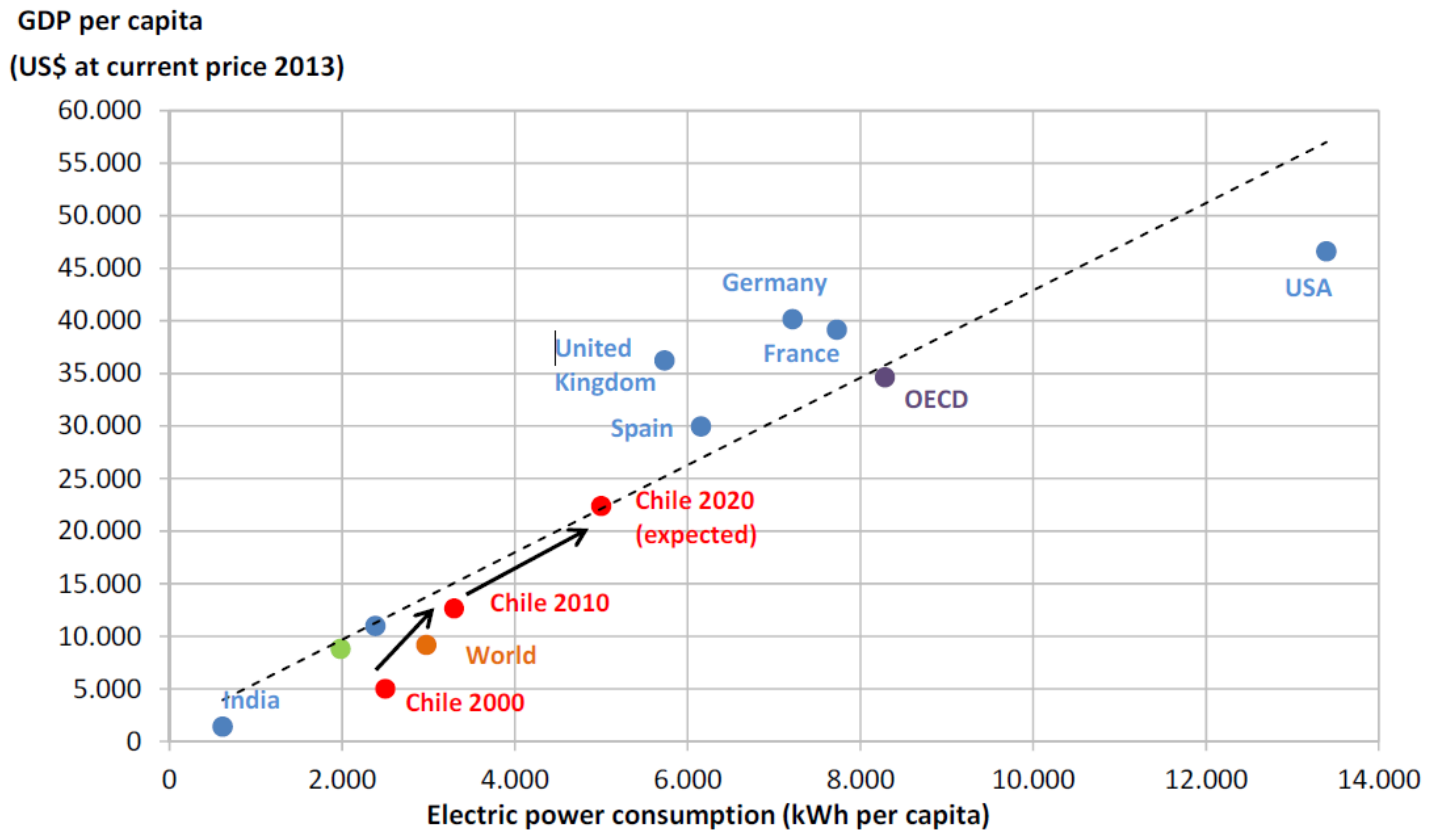


OPPORTUNITIES

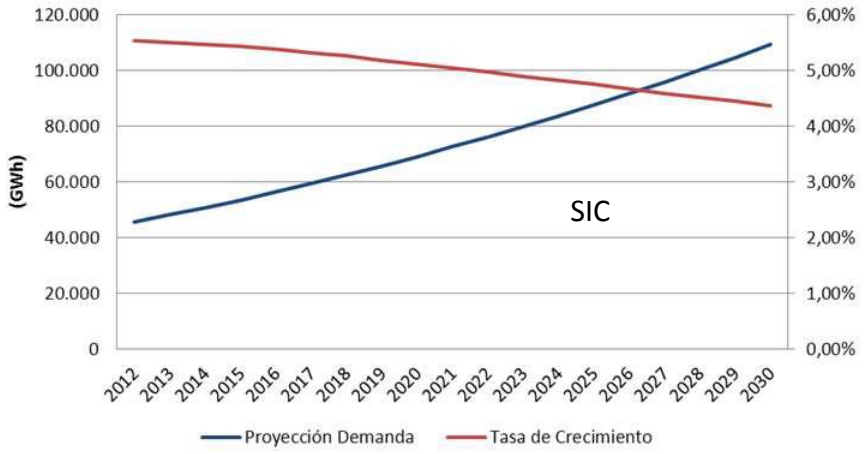
Latin-American geothermal development

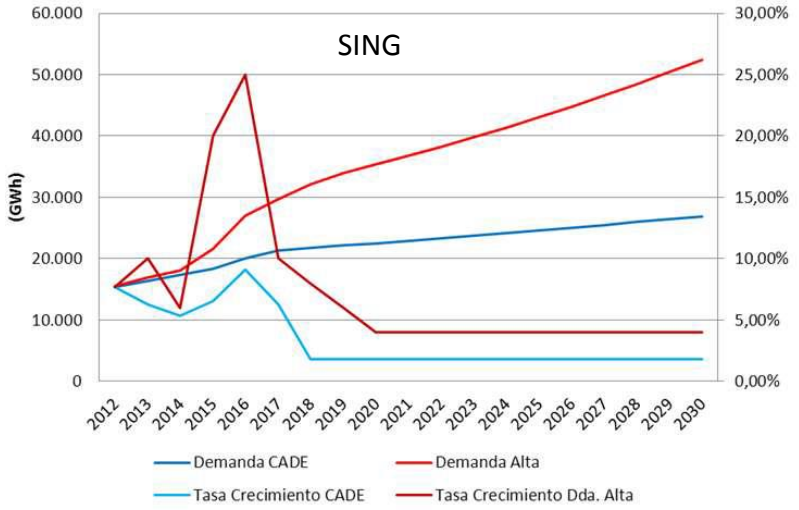


Economic growth and electric power consumption



Electricity demand growth





What does this mean?

- Today's demand = 60 TWh/y
- Demand in 2030 = 140 TWh/y

→ **huge opportunity!**

- 20% NCRE = 28 TWh/y
- Intermittent sources (40%) = 8000 MW installed capacity
- Better mix:
  - **2000 MW geothermal**
  - 3000 MW intermittent

OPPORTUNITIES

Prices are high and will probably stay that way

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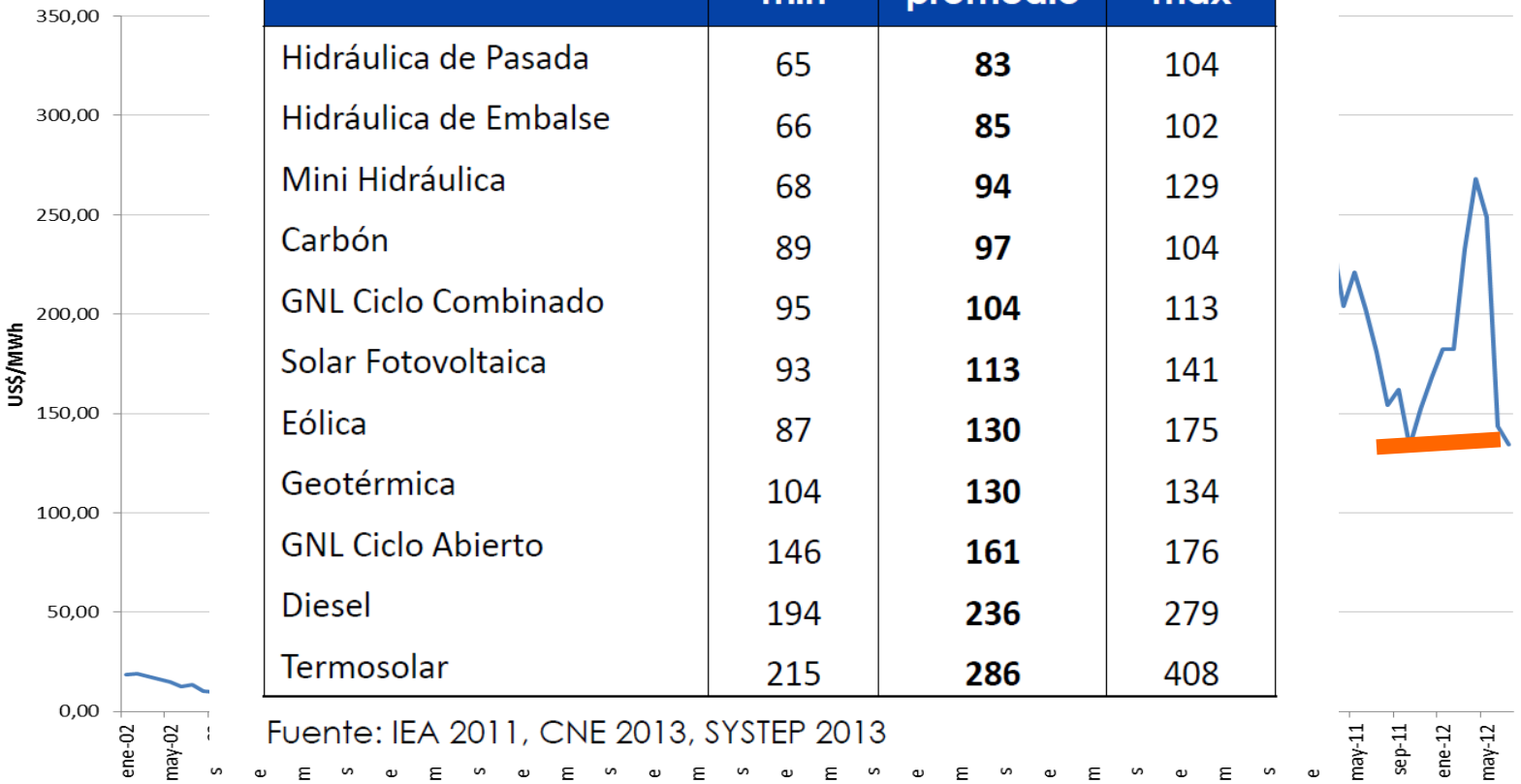
Tecnología	Costo de desarrollo [US$/MWh]		
	min	promedio	max
Hidráulica de Pasada	65	**83**	104
Hidráulica de Embalse	66	**85**	102
Mini Hidráulica	68	**94**	129
Carbón	89	**97**	104
GNL Ciclo Combinado	95	**104**	113
Solar Fotovoltaica	93	**113**	141
Eólica	87	**130**	175
Geotérmica	104	**130**	134
GNL Ciclo Abierto	146	**161**	176
Diesel	194	**236**	279
Termosolar	215	**286**	408

Fuente: IEA 2011, CNE 2013, SYSTEP 2013



OPPORTUNITIES

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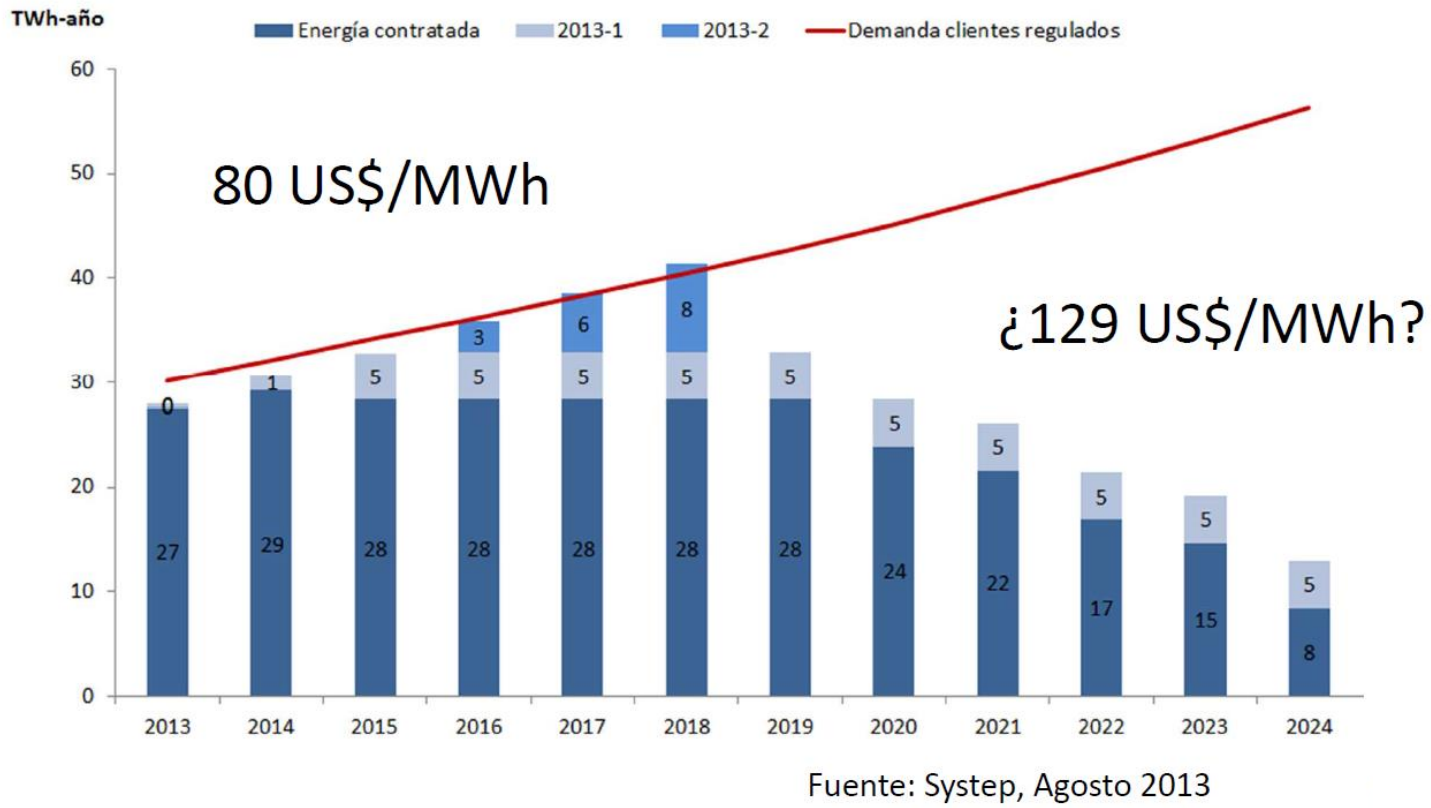
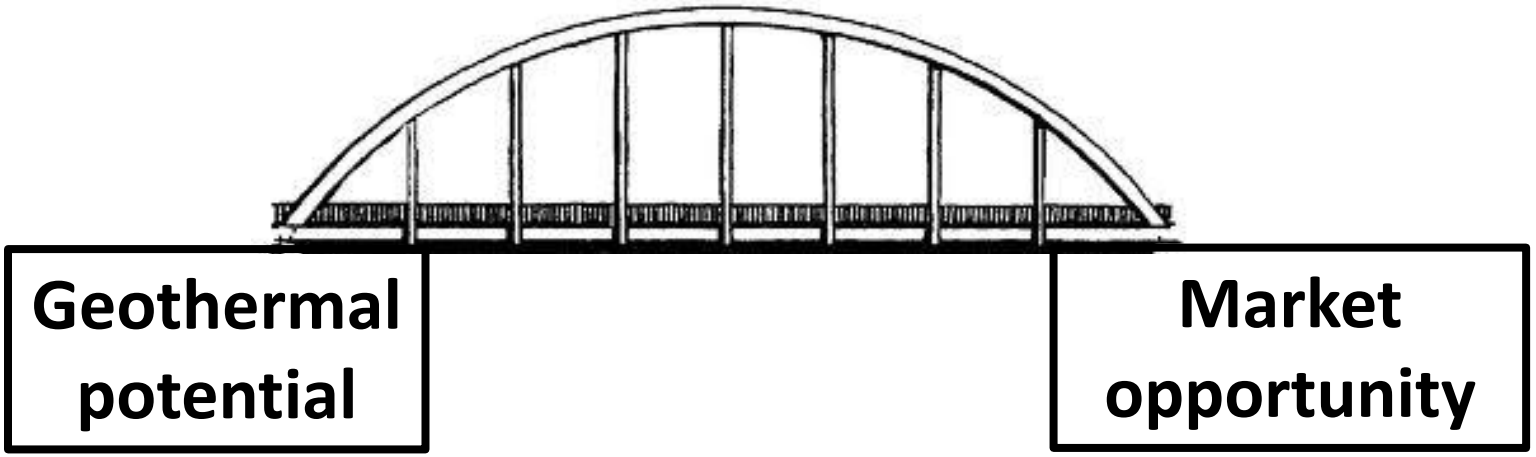


Fuente: Systep, Agosto 2013

ANALYSIS

How do we bridge the gap ?

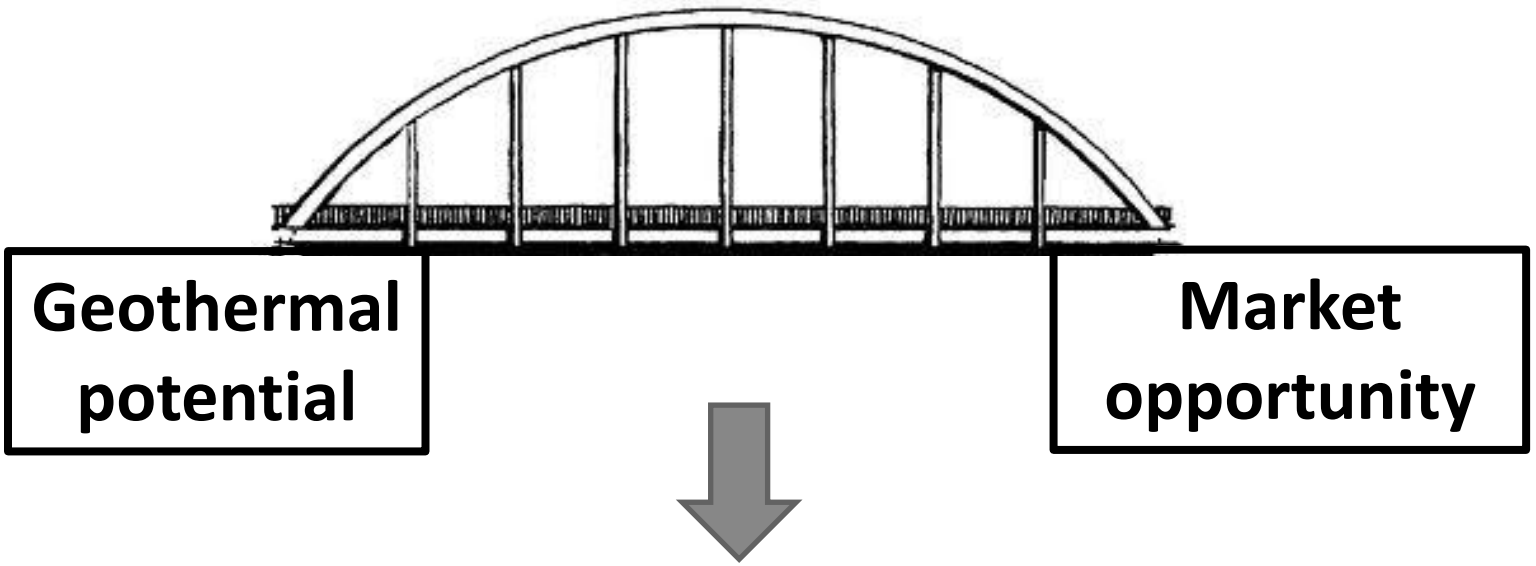


ANALYSIS

How do we bridge the gap ?

		The gap		
Externalities				
Physical	• Interesting resources			X
	• Very limited knowledge ► greenfield development ► high exploration risk	X		
	• Remote and difficult locations ► High drilling cost	X		
	• No transmission lines ► High cost and delays	X		
Legal	• Laws and regulations		X	
	• Environmental permitting		X	
Market	• Rather high structural price level in the SIC			X
	• Strict conditions at tenders for regulated clients ► No access to 65% of market	X		
	• Private clients need planning certainty	X		

How do we bridge the gap ?



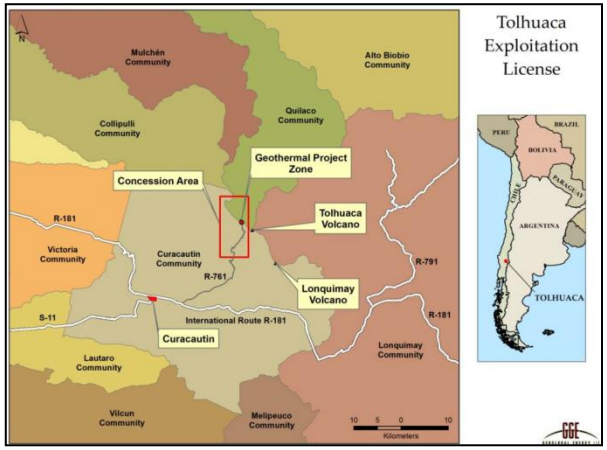
Most important actions required:

1. Cooperation between developers and authorities to reduce exploration risk.
2. Facilitate market access.

Tolhuaca general project description

- Located on the border between Araucanía and Biobío Regions of Chile, near the town of Curacautín, on the northwest flank of the dormant Tolhuaca Volcano.
- Situated within the San Gregorio (Tolhuaca) geothermal exploitation concession granted in January 2010 (7,800 ha), which replaced the exploration concession granted in 2005.
- Well positioned to be the first geothermal plant in Chile´s Central Interconnected System (*Sistema Interconectado Central, SIC*).
- MRP has already invested significantly, including:
  - Drilling of exploration and production wells.
  - Investment in geological mapping and resource study; construction of access roads; and installation and construction of a camp for more than 100 people.

Project snapshot	
Location	Southern Chile, 8th & 9th regions
Gross capacity	70.0 MW
Net capacity	65.3 MW
Annual net expected generation	535 GWh per year (expected plant factor 95%)
COD	**2018**
Investment	Over US$400 million
Technology	Flash
Tx line	2x220 kV, 68 km., dedicated Tx line Connected directly to the SIC near the city of Victoria



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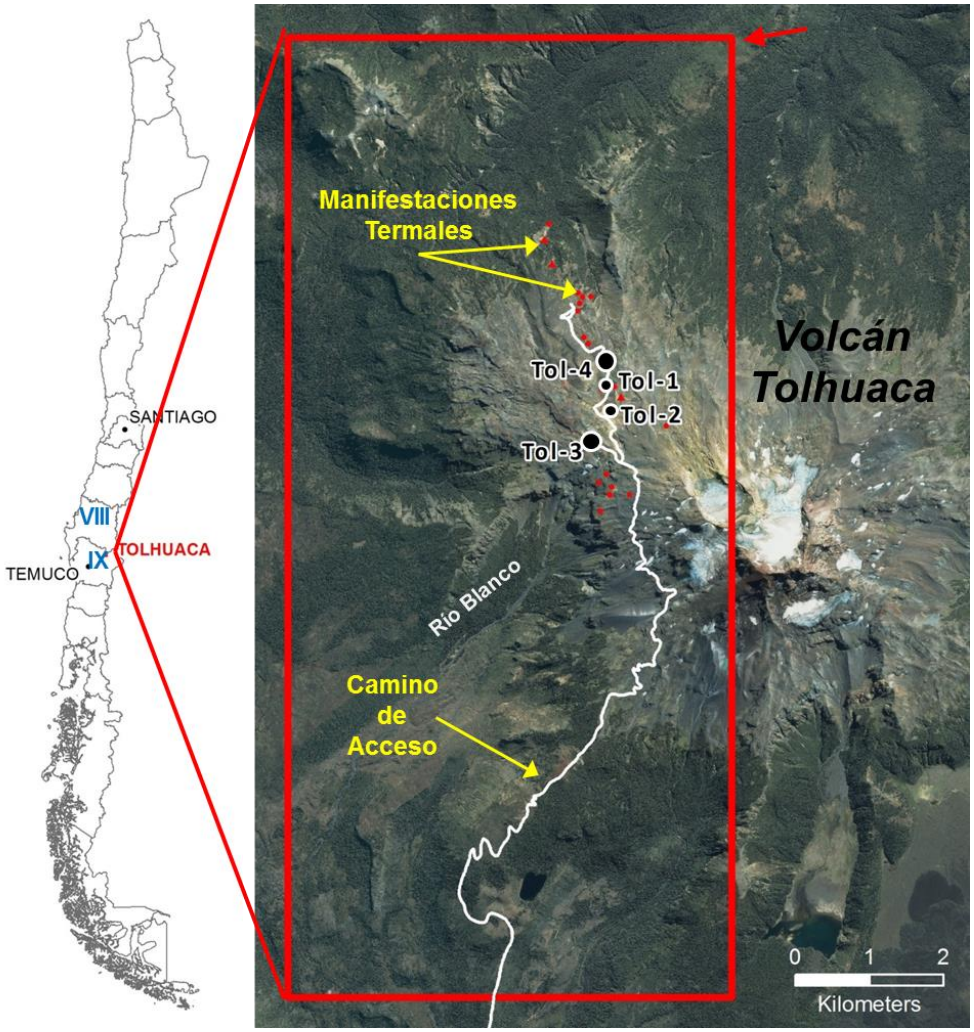

Work done to date

- Two exploration slim-holes drilled in 2009/10 proved the existence of a deep benign-fluid high-temperature geothermal reservoir.
- Access via a mountain road, drilling pads, camp and other installations were built in 2011.
- Two full-size exploration wells drilled in 2011/12 to 2.400 meters depth reached the reservoir.
- Geophysics show a sizable geothermal field with a potential capacity of 70 MW. Additional geoscientific work is planned for summer 2013/14 to support this assumption.
- Planning and basic engineering done for a 70 MW case and a 35 MW case (as fall-back position).
- Environmental study completed for a 70 MW plant, permit (RCA) received in May 2013.
- Connection to the grid is planned through a 220 kV line to be built to a new substation in Victoria.

Work done to date

Feasibility analysis

Detailed feasibility studies conducted for:

- 9-12 MW wellhead generator:
  - technically possible as back-pressure or condensing unit
  - 35 km local 23 kV transmission line required
  - not economically viable as stand-alone project
- 35 MW plant:
  - possible as first block
  - full 220 kV transmission line required
  - economically viable only as fall-back position
- 70 MW plant:
  - as per environmental permit
  - 220 kV transmission line with development partners
  - returns acceptable with high-price PPA


THANK YOU