



Geothermal Energy and Electricity Generation

The New Zealand Success Story

Pertamina Energy Outlook 2015
Jakarta - 3rd and 4th December 2014
Presenter – Brian Carey

Introduction



- **President – New Zealand Geothermal Association**
- **Chair – Geothermal Heat Pump Association**

GHANZ

Brian Carey



- **Geothermal Resource Management Specialist**
 - GNS Science
- **Mechanical Engineer**

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Geothermal Career spans 30 years

- Wairakei and Ohaaki



My Thanks

- **To PT Pertamina**
 - Invitation to present at the conference
 - Taking care of travel and accomodation
- **Jekson Simanjuntak and**
- **Organising committee**

Enjoy

Talking Today About

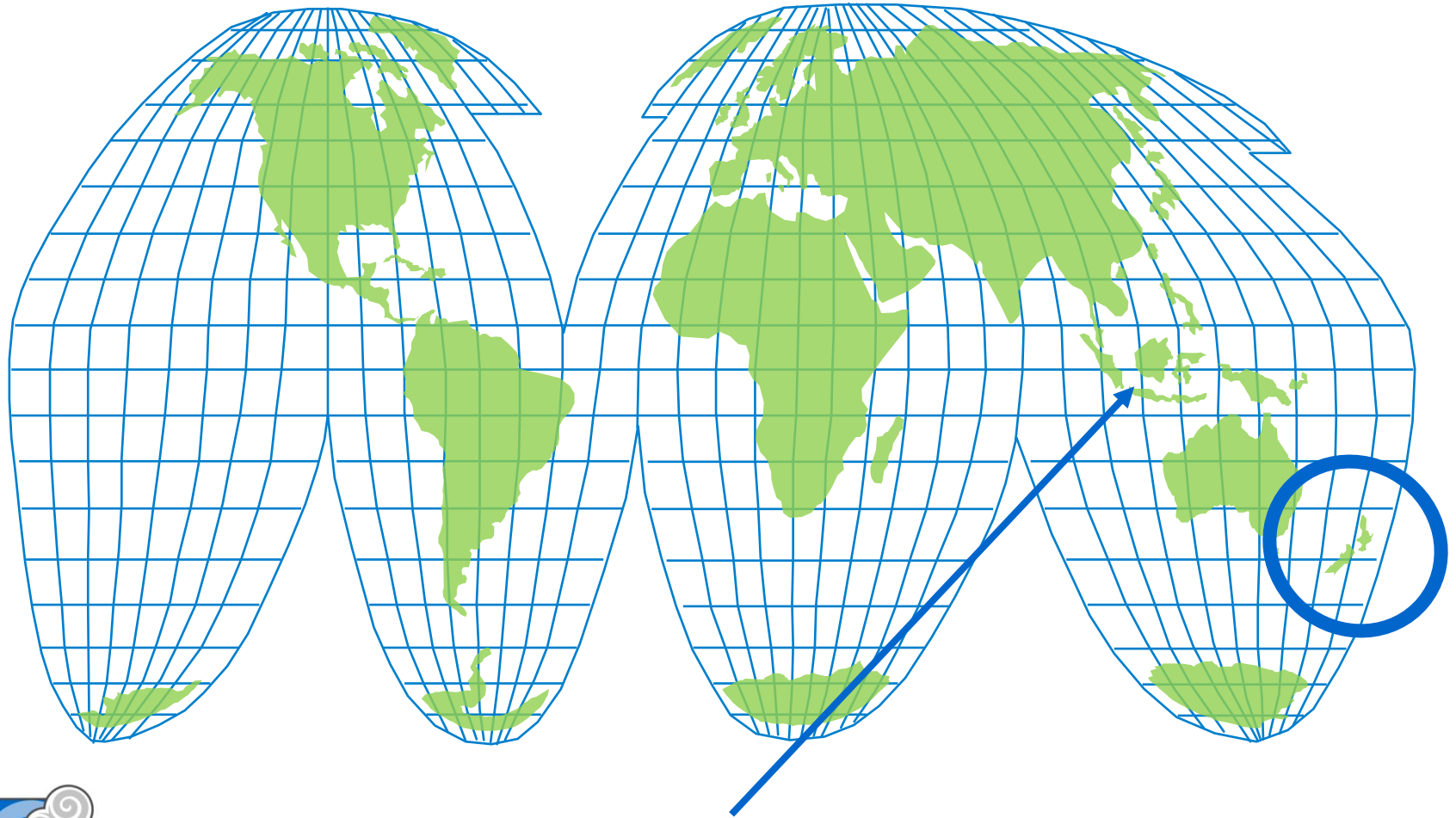
- **Working together**
 - Investing together
- **NZ success**
- **Recent Growth**
- **Renewables**
- **Sustainability**
- **Geothermal - its more than electricity**
- **WGC 2015**

The New Zealand Success Story



Working together

The New Zealand Success Story



Jakarta

NZ is Blessed as a Nation

- **Fantastic Geothermal Energy Resources**



Sharing the Success



Desire for Security of Supply

- **Post world war two**
- **Electricity demand growing rapidly**
 - Growth rate of 6% per annum
- **Significant investment in hydro power development**
- **Two dry hydrological years**
 - 1947 and 1948
- **Security of electricity supply became a significant political issue**
- **Drove a focus on NZ resources that were not reliant on imported fuel**

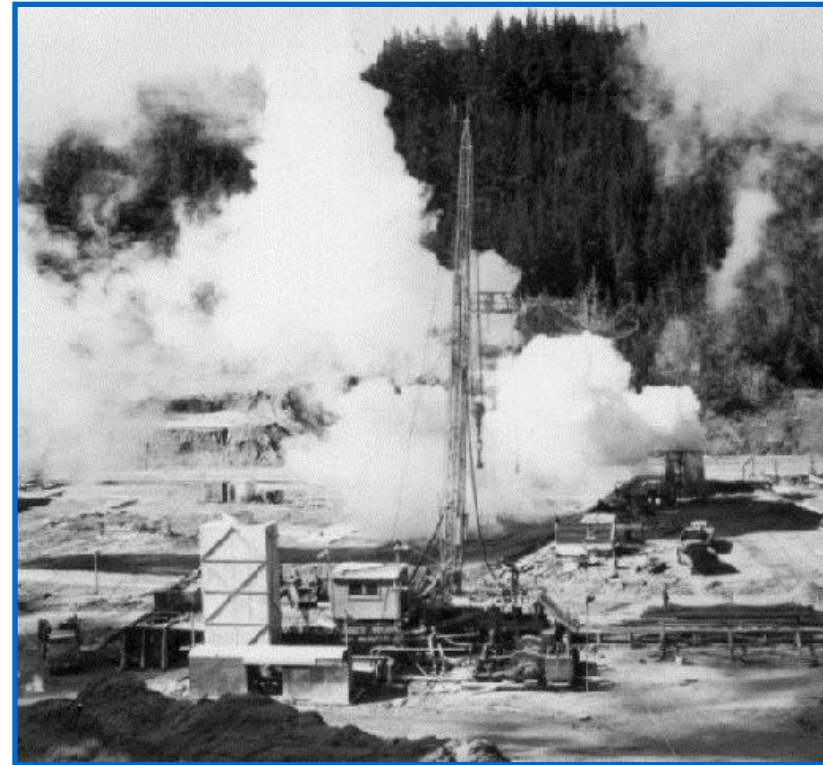
The Success Story

- **Political Desire to utilise geothermal resources**
- **Developed the technology to drill and to harness**
- **Initially Government driven**
- **Government funded exploratory drilling to de-risk projects for developers, undertook research, etc.**
- **Critical success factor and enabler for recent geothermal development in NZ**

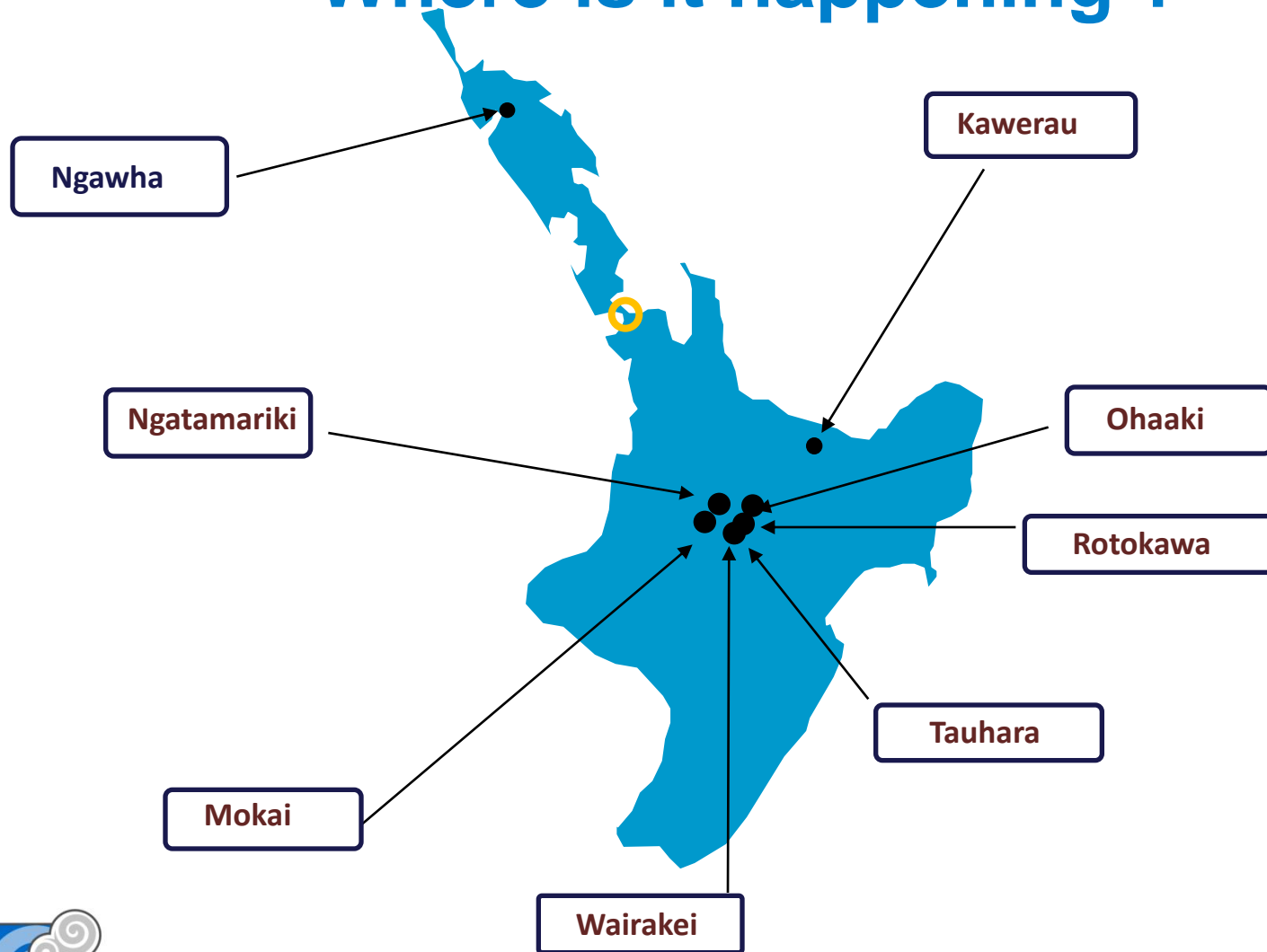
The Success Story

- **Now government enterprise and private capital investment**
- **Well developed frameworks**
 - Planning
 - Environmental
 - Health and safety
- **Clear stable framework for long term investment**
- **Geothermal increasing and significant contributor to NZ's electricity generation**
- **Wide open opportunities for more direct heat use**

Early Days



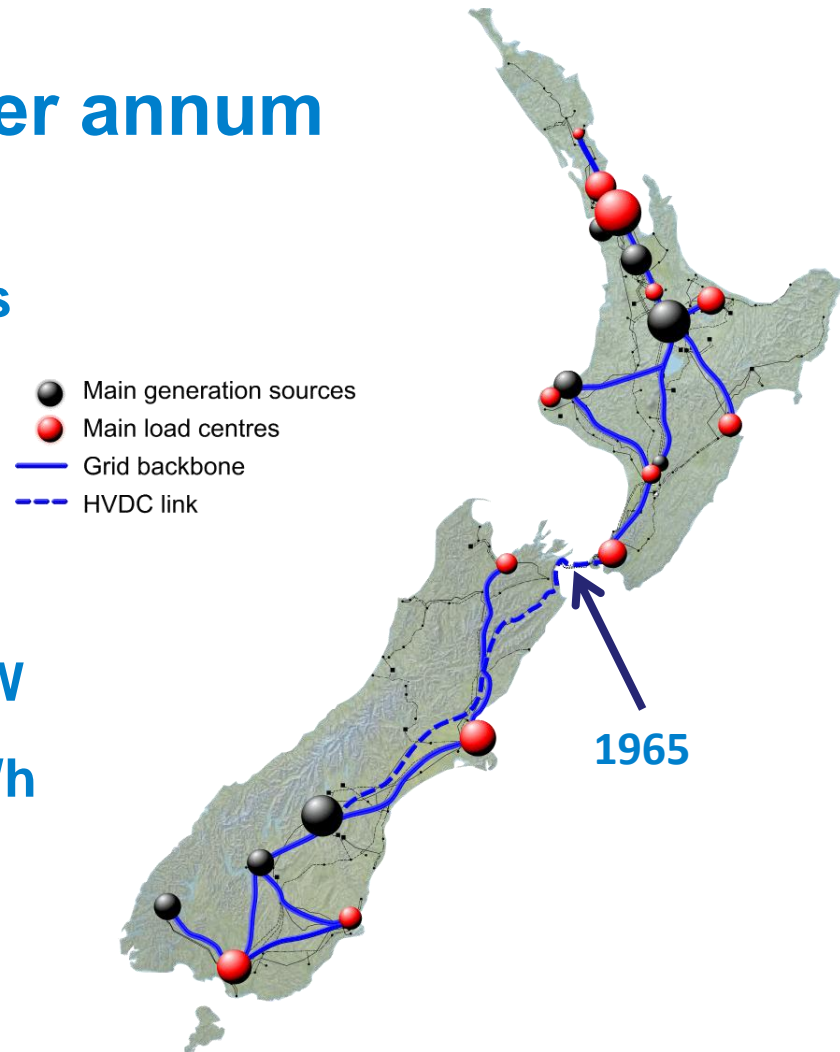
Where is it happening ?



NZ Electricity Statistics

Renewable \approx 80 % per annum

- Two AC island power systems
- 700 MW HVDC link
- NZ statistics
 - Peak Demand 7000 MW
 - Installed Capacity 9800 MW
 - Annual Energy 43,000 GWh



Small to large capacity



A few MWe - Ngawha



140 MWe – Nga Awa Purua
Worlds largest geothermal turbine

Worlds Largest Binary Plant



Ngatamariki 82 MWe

Capacity

Location	MWe
Wairakei	394
Rotokawa	174
Kawerau	140
Mokai	111
Ngatamariki	82
Ohaaki	58
Tauhara	26
Ngawha	25
	1010

Ngatamariki

- **Mighty River Power**
 - Organic Rankine Cycle – 4 Ormat Units
 - 8 turbines + 4 generators
 - Official opening October 2013
 - NZ\$475 Million (~US\$400M)
 - Energy 670 GWH / annum

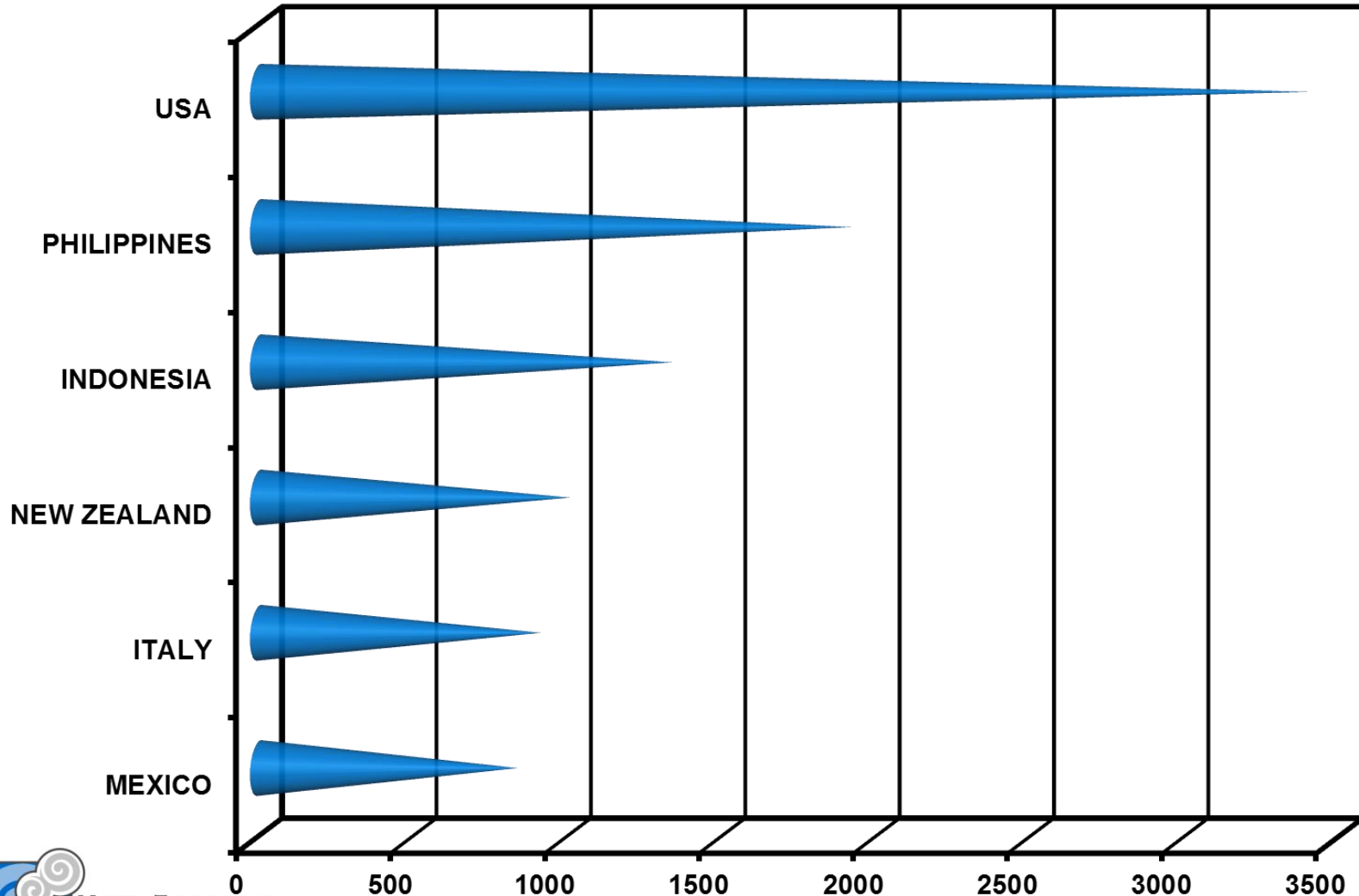


Te Mihi Uenukukopako – 166 MWe

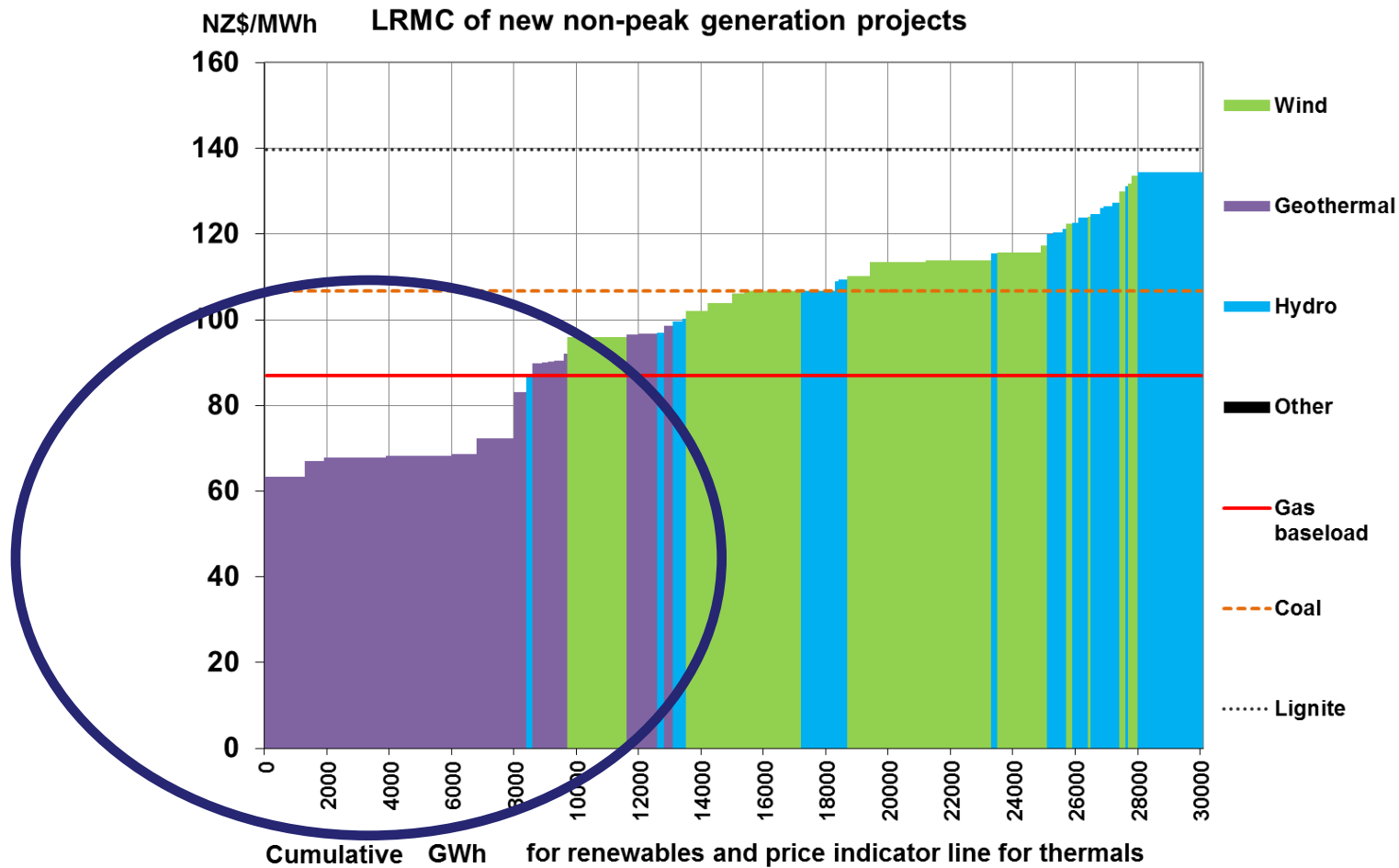
- **Contact Energy limited**
 - Two 83 MWe Toshiba Steam Turbine Machines
 - Replaces some of Wairakei so ≈ 115 MWe Increment
 - Officially Opened 14th August 2014 – Hon Bill English
 - NZD \$623 Million



Geothermal Capacity – NZ 4th in world



Geothermal Electricity is Economic

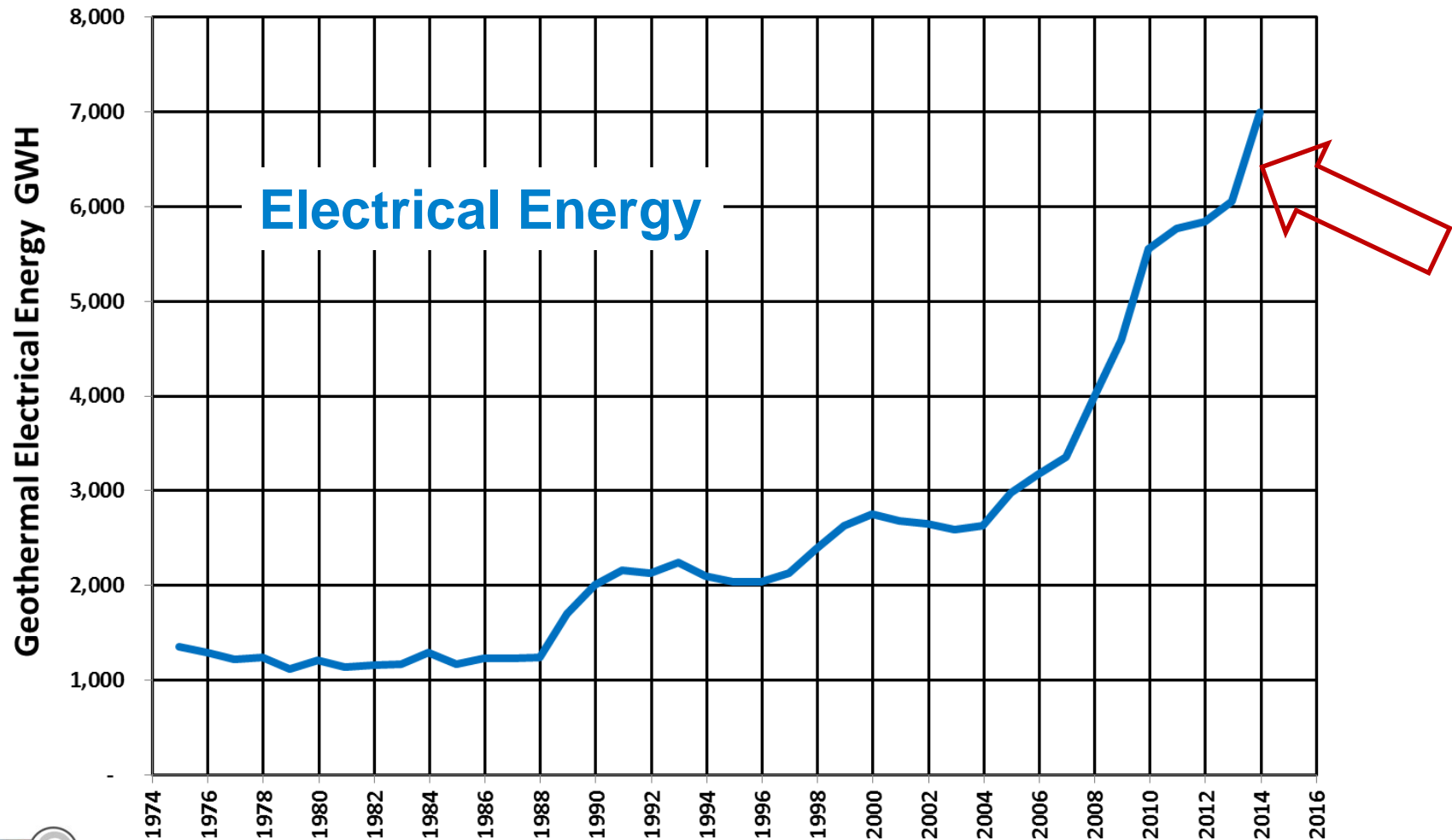


Blaze of geothermal growth

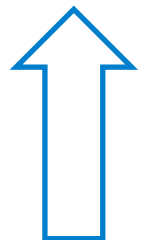
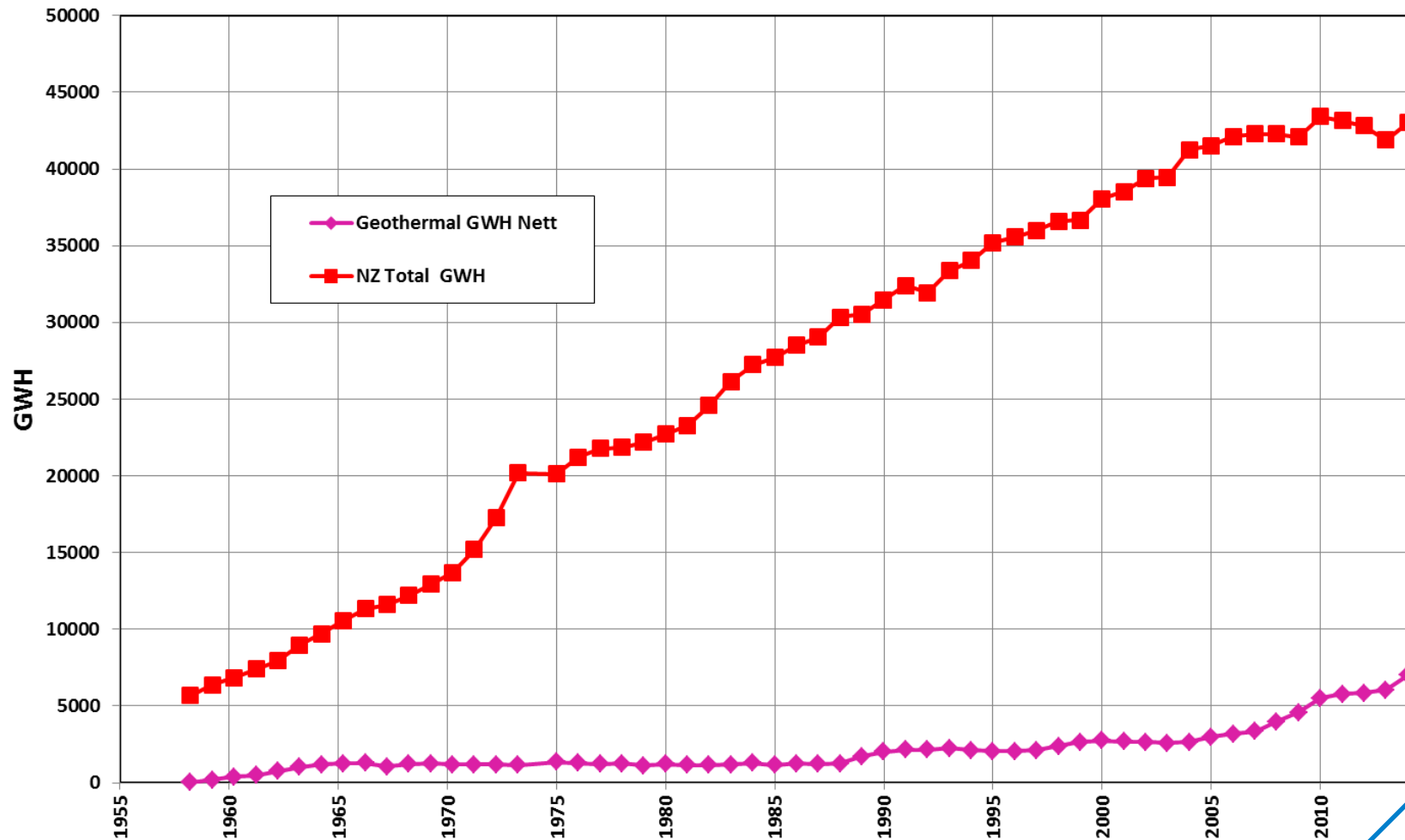


Over the last decade

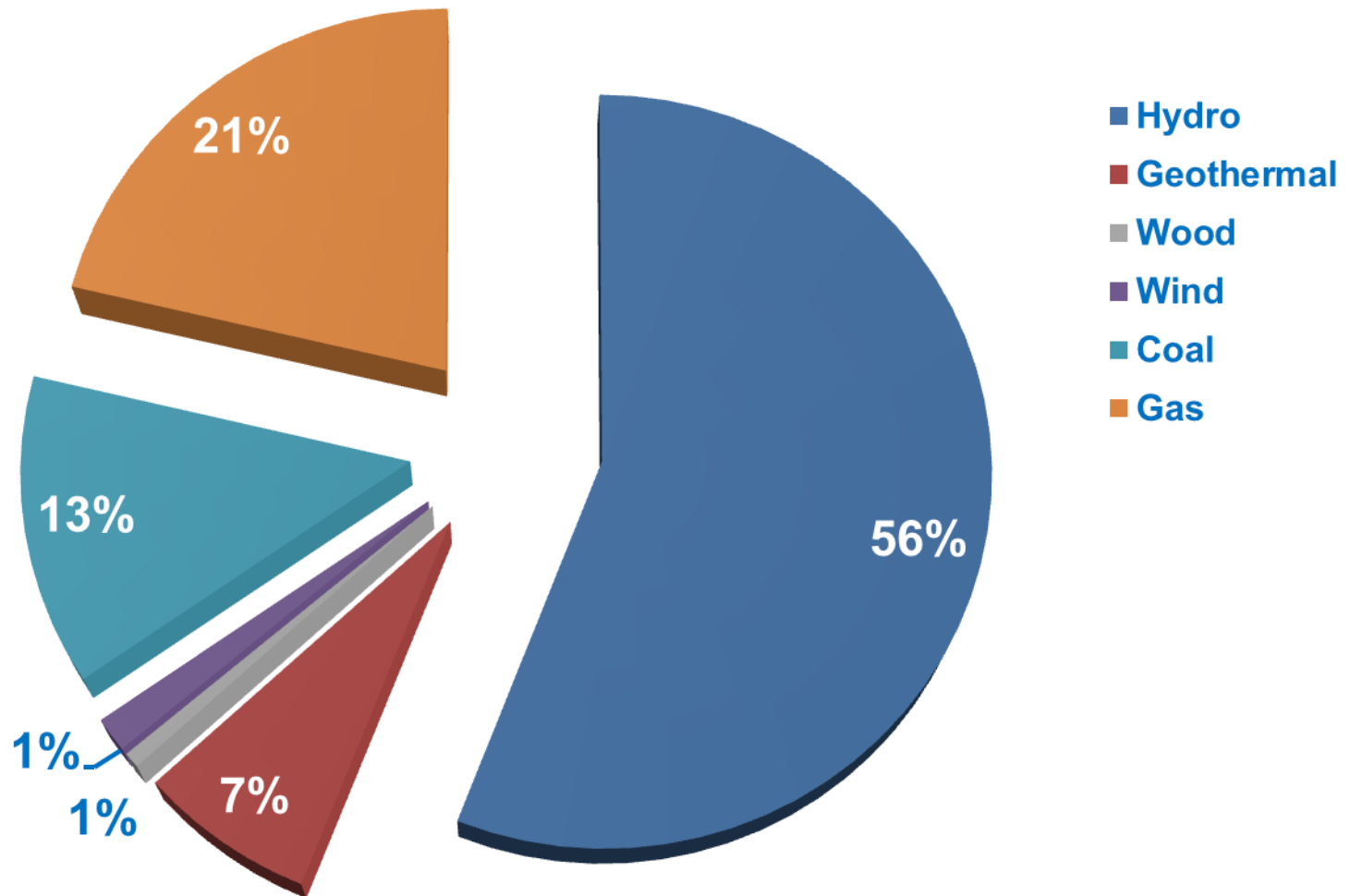
Geothermal Energy Growth



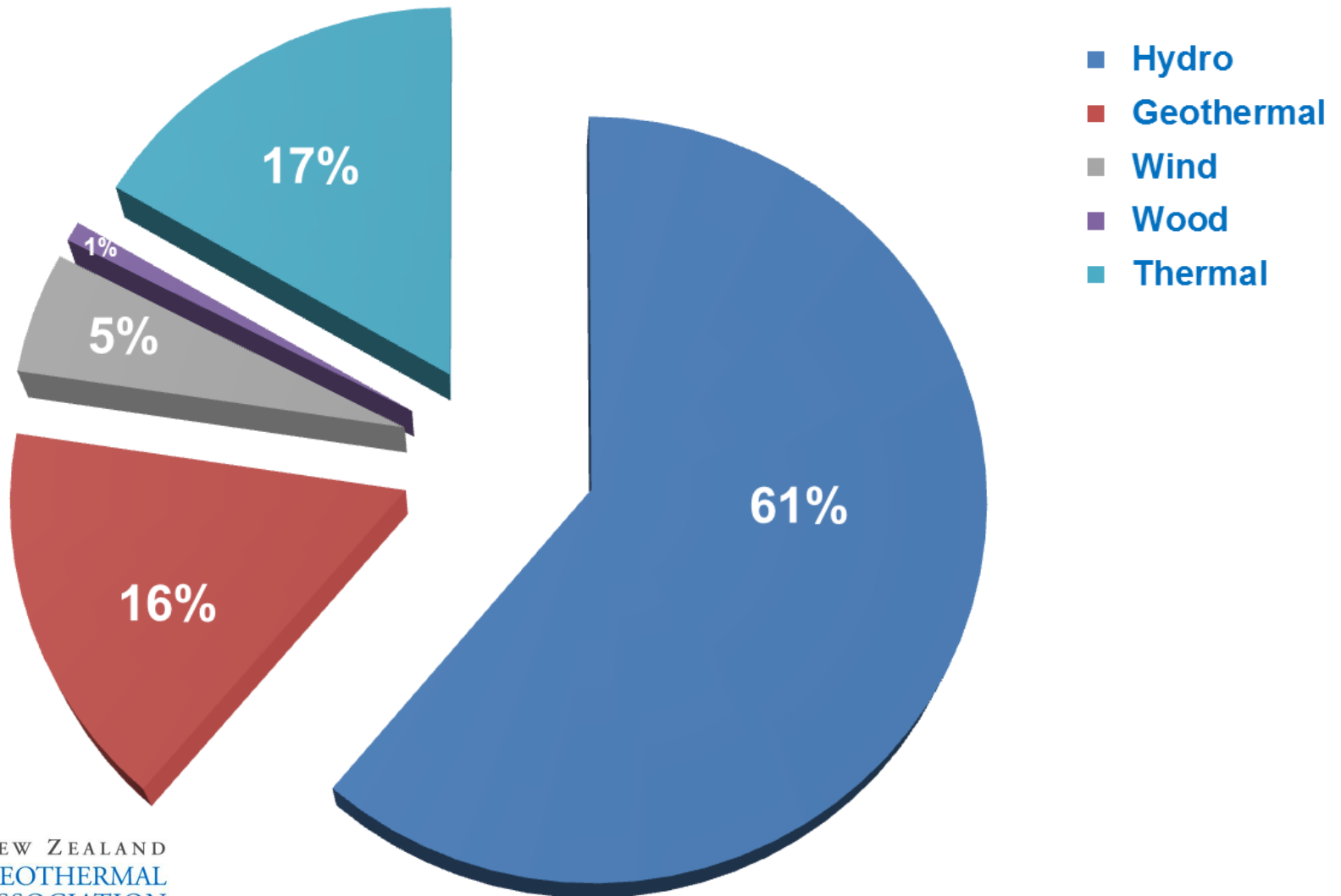
NZ Generation - GWH per year



2005 Electricity Mix



2014 Electricity Mix



Important Aspects

- **Strong relationships between landowners and developers**
- **A win-win proposition for sustainability**
- **Commercial benefits for all stakeholders**
- **Understanding the other parties key drivers (and limits)**
- **Community support**
- **Genuine engagement**

Tauhara North Number 2 Trust and Geothermal Energy

- 1993 the Tauhara North No 2 Trust was formed
- 827 members
- Landowner holding of 326ha
- Significant landholdings over geothermal resources
- JV with Mighty River Power



Trust Vision



**Kia mau Ki te whenua
(hold fast to your land)
Whakamahia te whenua
(make use of the land)
Hei painga mo nga uri
whakatipuranga
(for the future generations)**



Trust is Active in Geothermal Development

- Rotokawa and Nga Awa Puru reservoir and steam field development
 - Rotokawa JV, TN2T and MRP
- Nga Awa Purua Power Plant
 - 140 MW, Largest geothermal turbine in the world
 - Cost NZ\$430M
 - Trust is equity partner in the power station through 35% active investment
 - Commissioned 2010
- Ngatamariki
 - Involved with MRP in resource management

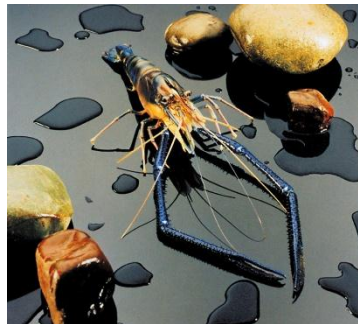


Making a Difference

- Annual dividend return on substantial investment
- Grants:
 - Education, Health, Funeral, Marae, Sports and Cultural
- Health and Wellbeing Initiatives
- Economic development
- Spreading wealth to landowners and beneficiaries
- Improving lives



Direct Use Geothermal



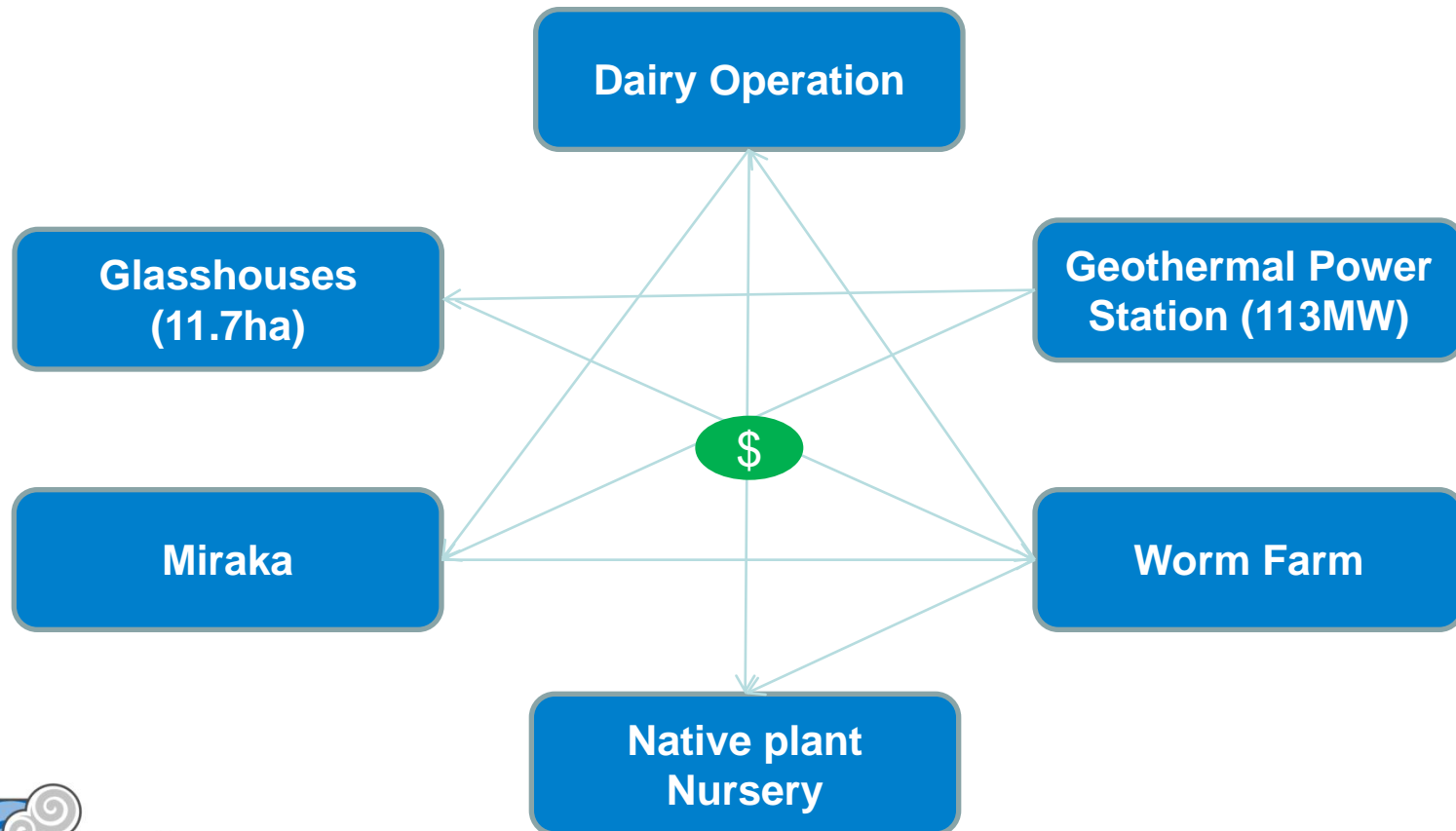
Miraka

- **Miraka uses electricity and steam from the Mokai geothermal field to run its milk processing operations**
 - world first for the whole milk powder processing industry
- **Located above the Mokai geothermal field**



Integrated Use

"We will act as a beacon of hope and prosperity for our people"





Environment and Sustainability

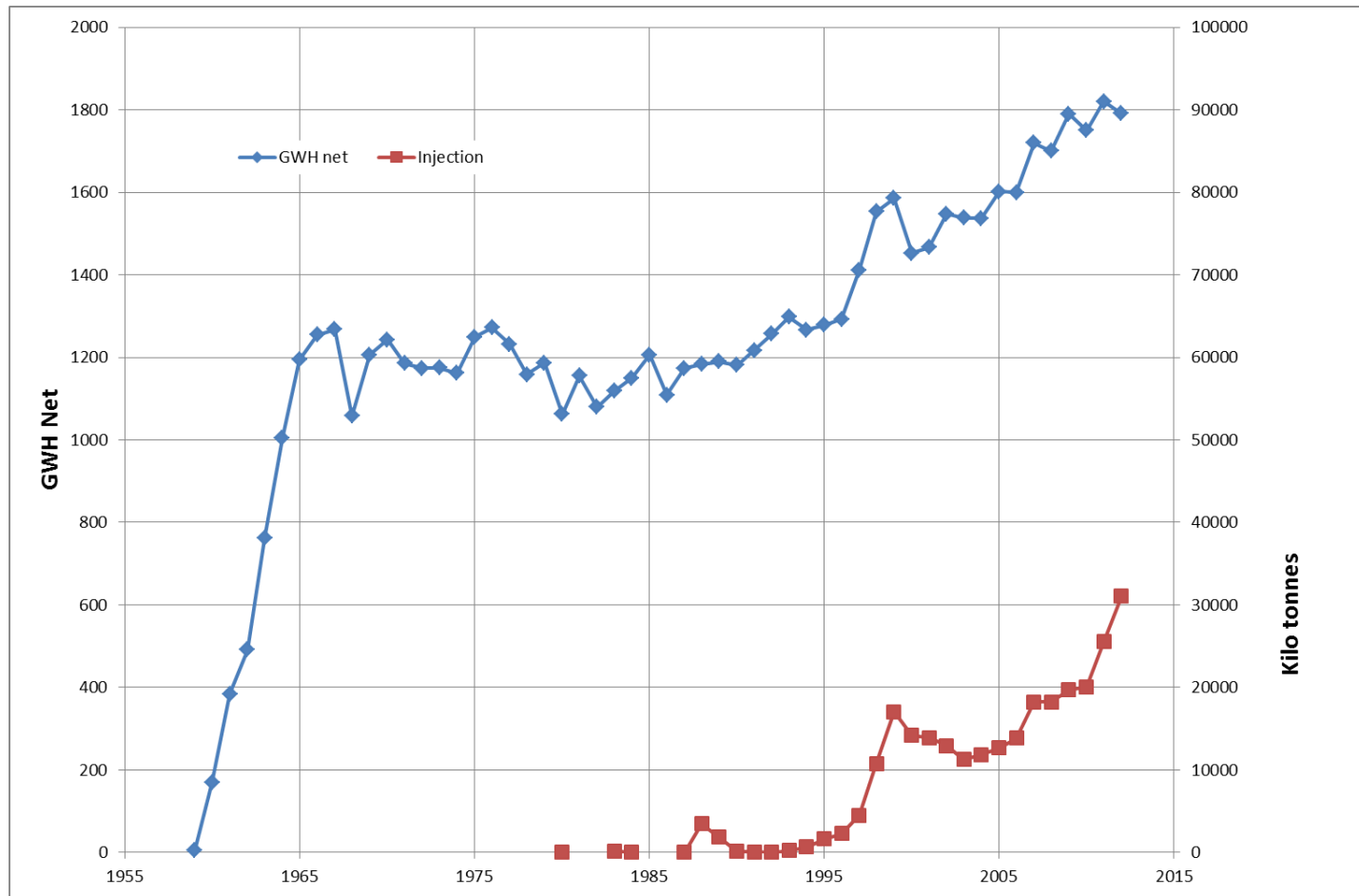
- **Sustainable resource management,**
 - Practical strategies to avoid, remedy, or mitigate adverse effects
- **Longer term planning focus**
- **Geothermal Systems classified - balancing**
 - Some for
 - Development
 - Protection
- **Classification balances differing community values**
- **When classified for development**
 - Enabling framework for development

Environment and Sustainability


- Adaptive management
- The greater the understanding of the geothermal system, the increased likelihood of sustainable management with reduced environmental effects
- Baseline and ongoing monitoring
- Active management
- Keep people with you



Sustainability – 60 years plus



The WGC 2015 Story



World Geothermal Congress 2015
 Melbourne Convention and Exhibition Centre
www.wgc2015.com.au

WORLD GEOTHERMAL CONGRESS
 19–25 April 2015 Australia – New Zealand
Views from Down Under – Geothermal in Perspective

The graphic features a large orange and red circular design with several circular inset images showing geothermal landscapes, coastal views, and cityscapes. At the bottom, there are logos for the International Geothermal Association (IGA), the Australian Geothermal Energy Group (AGEG), the New Zealand Geothermal Association, and the Asia Geothermal Energy Association (AGEA).

- **Post Congress in New Zealand**
 - Field trips
 - Short Course

Post Congress Short Course in NZ

- **Geothermal Policy and Implementation**
The New Zealand Example
- **26 – 28 April 2015**
 - Field Trip on 27 April
- **Venue:**
 - Taupo, New Zealand
- **Convener:**
 - Mr Noel Kortright
- **Fee: A\$540**
- **Book through the WGC web site**



wgc2015.com.au/registration.php

Come to NZ and Australia in April 2015

- 2015 World Geothermal Congress – Melbourne
- Post Congress Field Trips in New Zealand



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Kia Ora



www.nzgeothermal.org.nz