



A Short History – 60 YearsTM

NEW ZEALAND



Brian Carey

25 June 2013

APEC Geothermal Workshop

Presentation 1 - 2



Thanks for the invitation to participate in Taipei



Hongey Chen
Taiwan National University



Short History - 60 Years

- **Introductions**
 - GNS Science
- **The Topic**
- **New Zealand Scene**
- **Assisting other nations**
- **Training**
- **Geothermal New Zealand**
- **Concluding Remarks**

Introduction

- **Brian Carey**
- **Mechanical Engineer**
- **Geothermal Resource Management Specialist**
GNS Science
- **Career in Geothermal Energy**
Spans over 30 years
- **GNS Science for 6 years**



GNS Science



- **Crown Research Institute (CRI)**
 - Governed by Board of Directors
 - Reports to two Government Ministers
- **Successor to**
 - NZ Geological Survey
 - Department of Scientific and Industrial Research (DSIR)
- **~ 400 staff**
- **Te Pū Ao**
 - the foundation, origin, and source of the world

GNS Science and Geothermal Sciences



Mike McWilliams
Chief Executive

Geological Time
Hydrocarbons
Geothermal
Minerals
Geomicrobiology
Ocean Exploration



Kevin Faure
Group Manager Geological Resources



Greg Bignall
Head of Department
Geothermal Manager

geothermal@gns.cri.nz

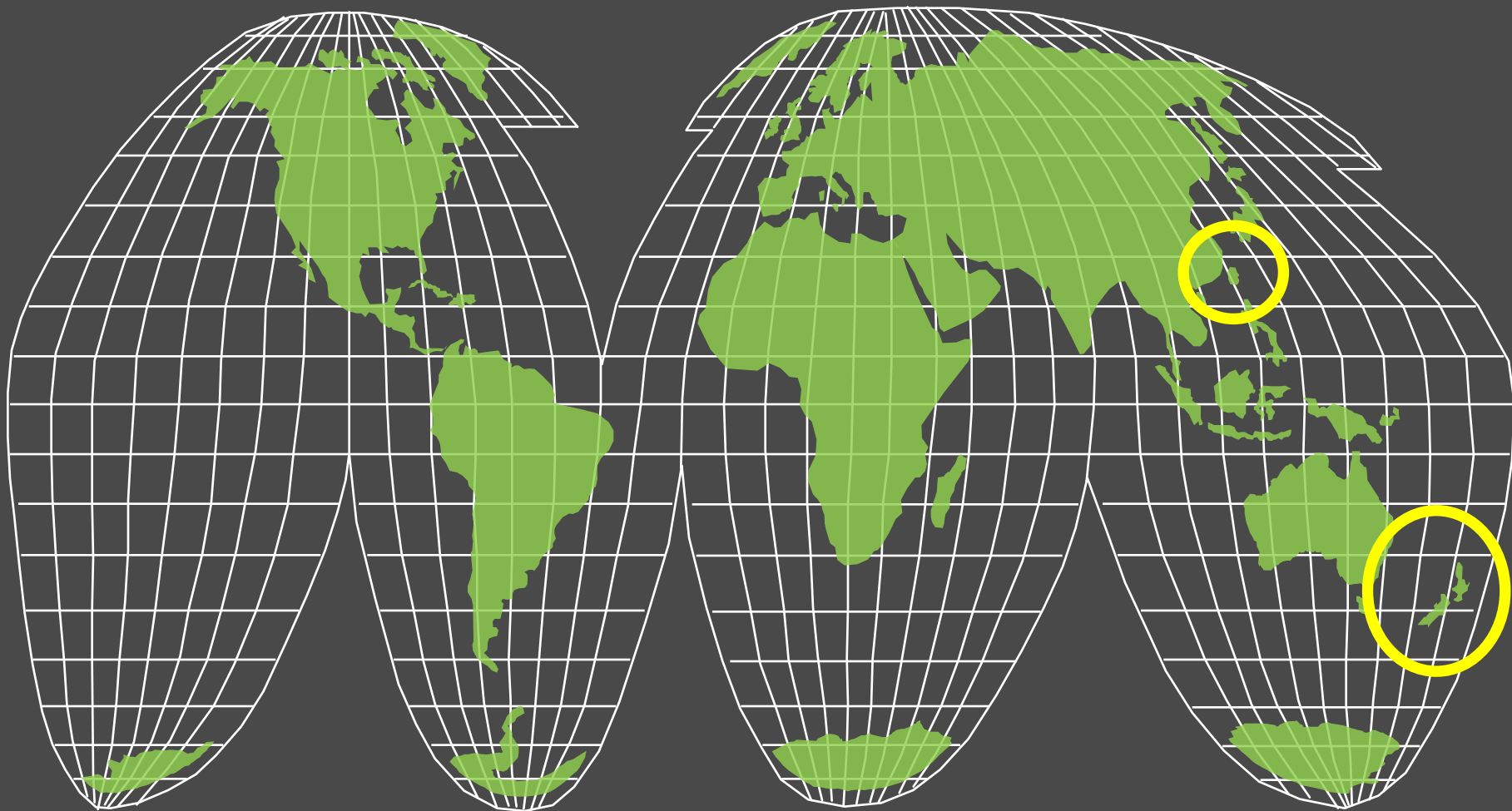
Trust you enjoy today's presentation

STAFF PICNIC



Where shall we go

Taipei - Taiwan



New Zealand

What shall we talk about

STAFF PICNIC



Sailing

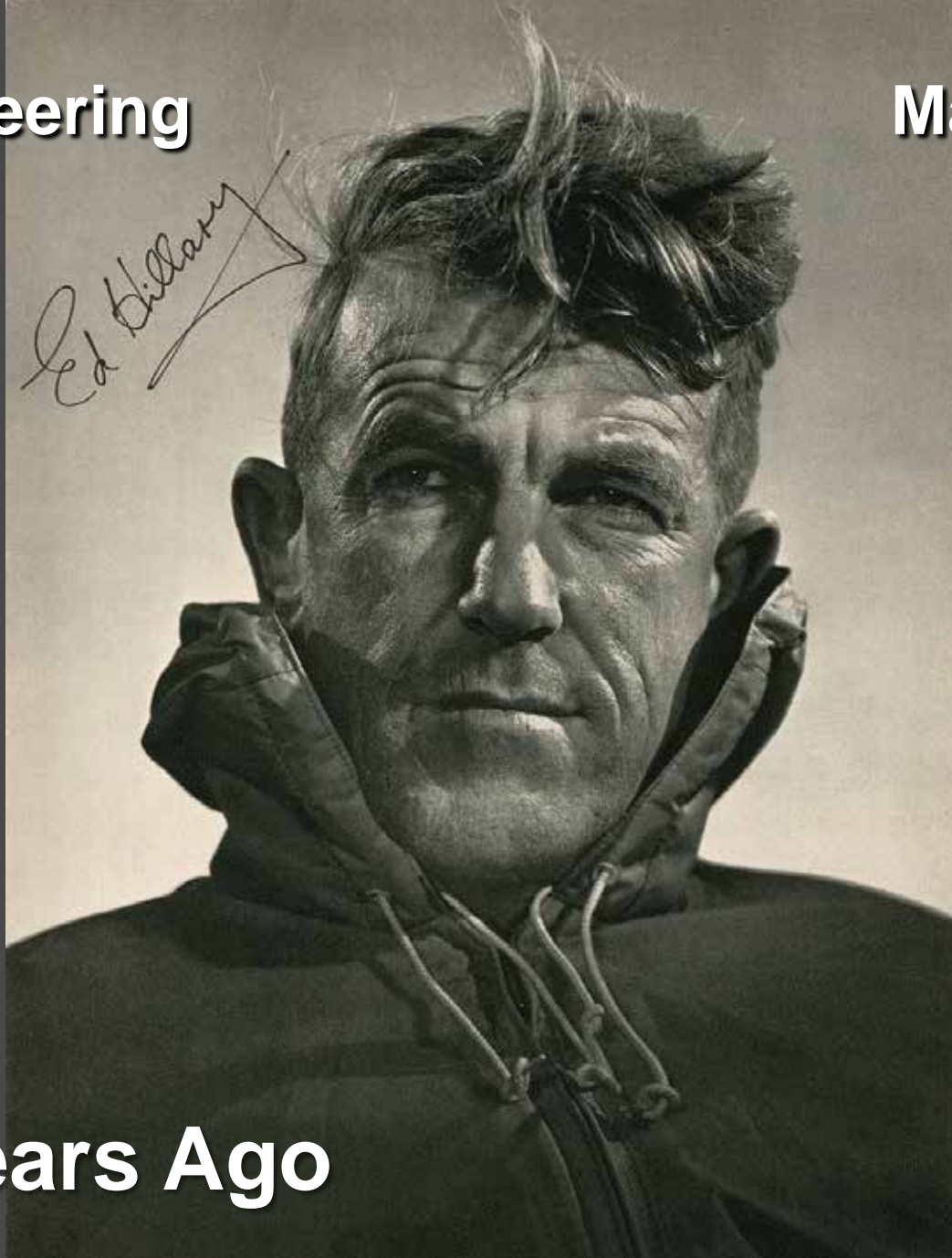


Rugby



Mountaineering

May 1953



60 Years Ago

Wairakei - July 1953 - WK 19 Discharge



DSIR Geothermal Exploration

Late 1940s thru 1950s

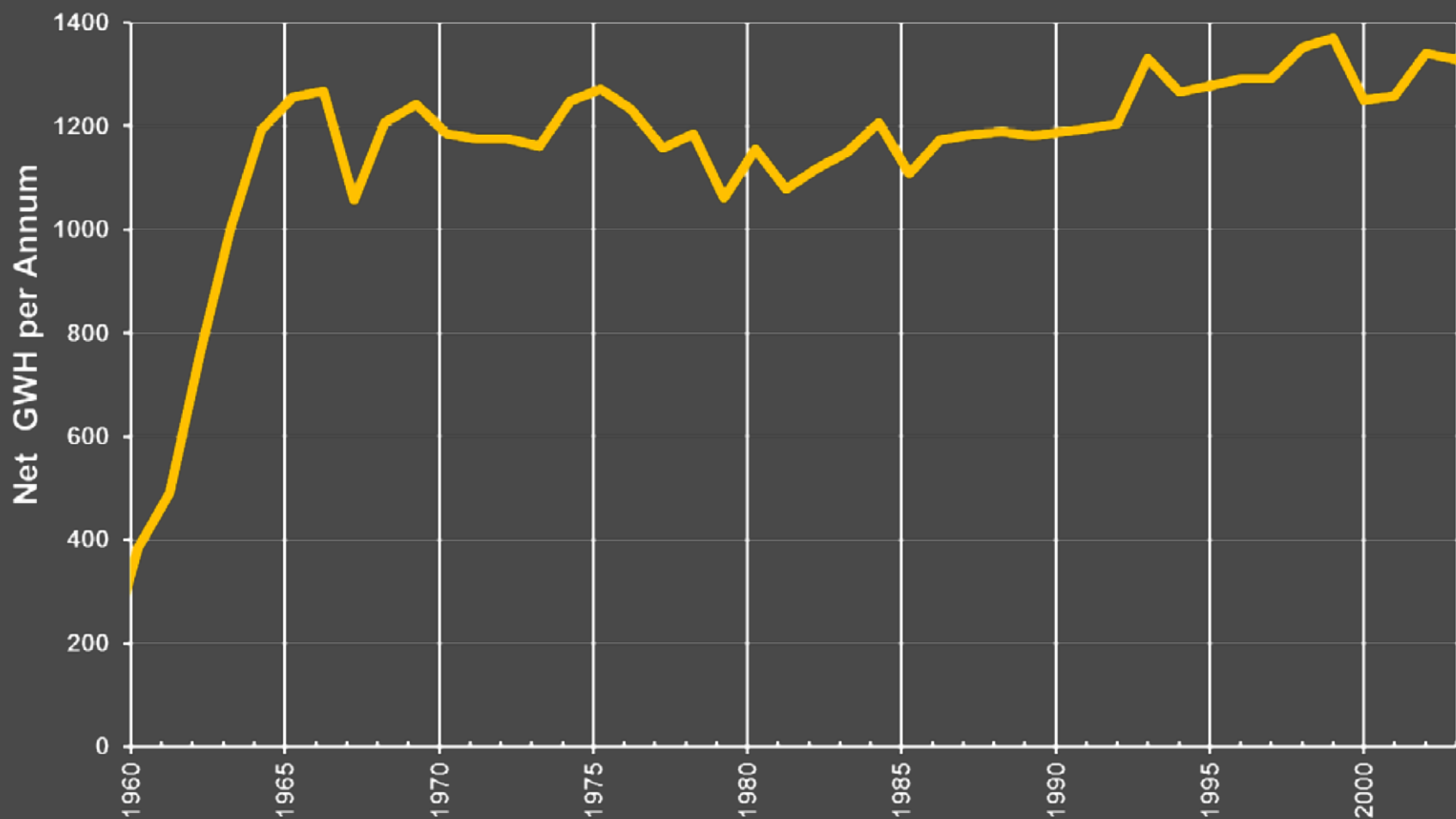


Wairakei

- Birth place of liquid dominated geothermal resource development for electricity generation



Wairakei - Faithful, Consistent and Reliable

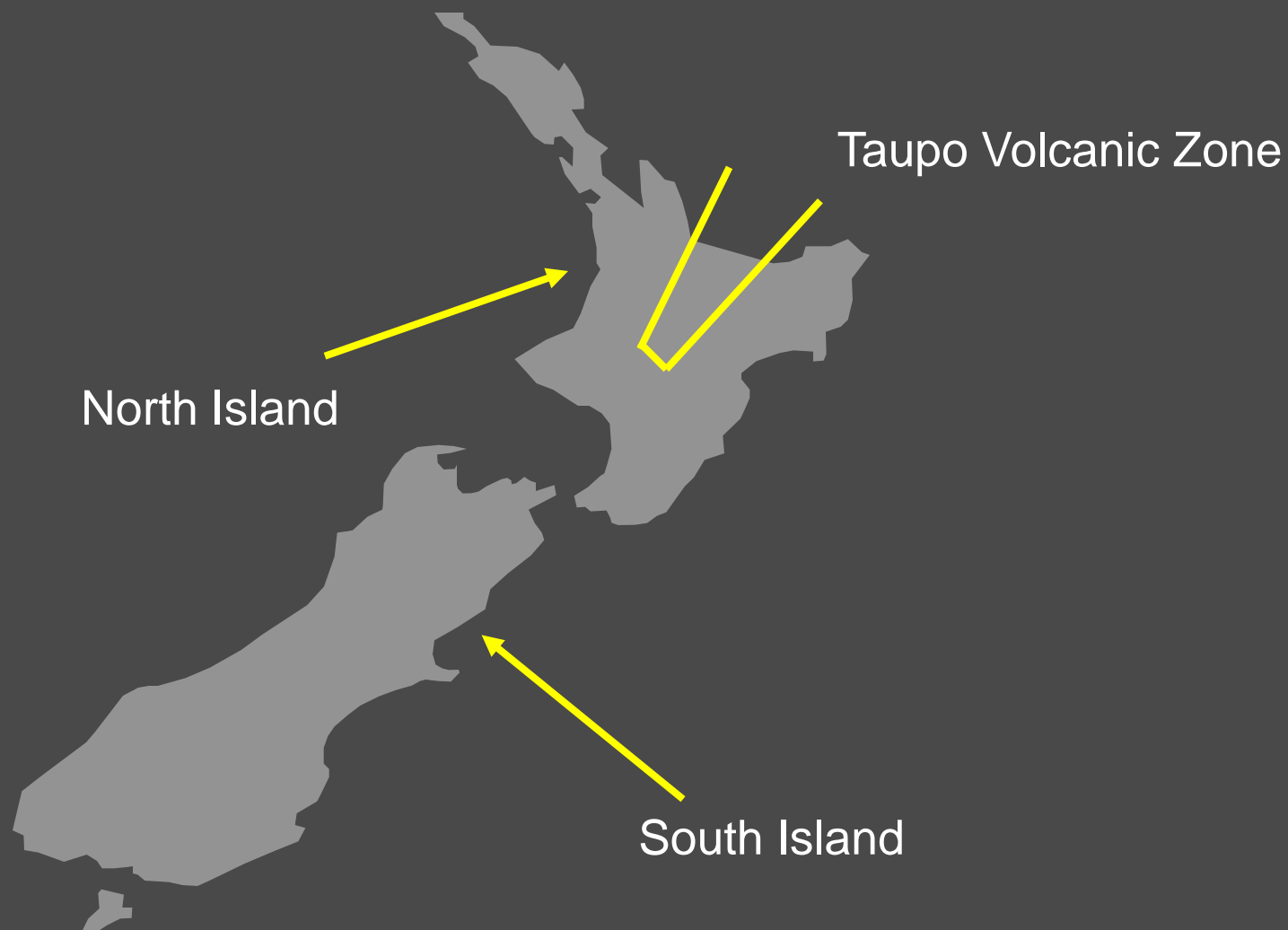


Terms and Units

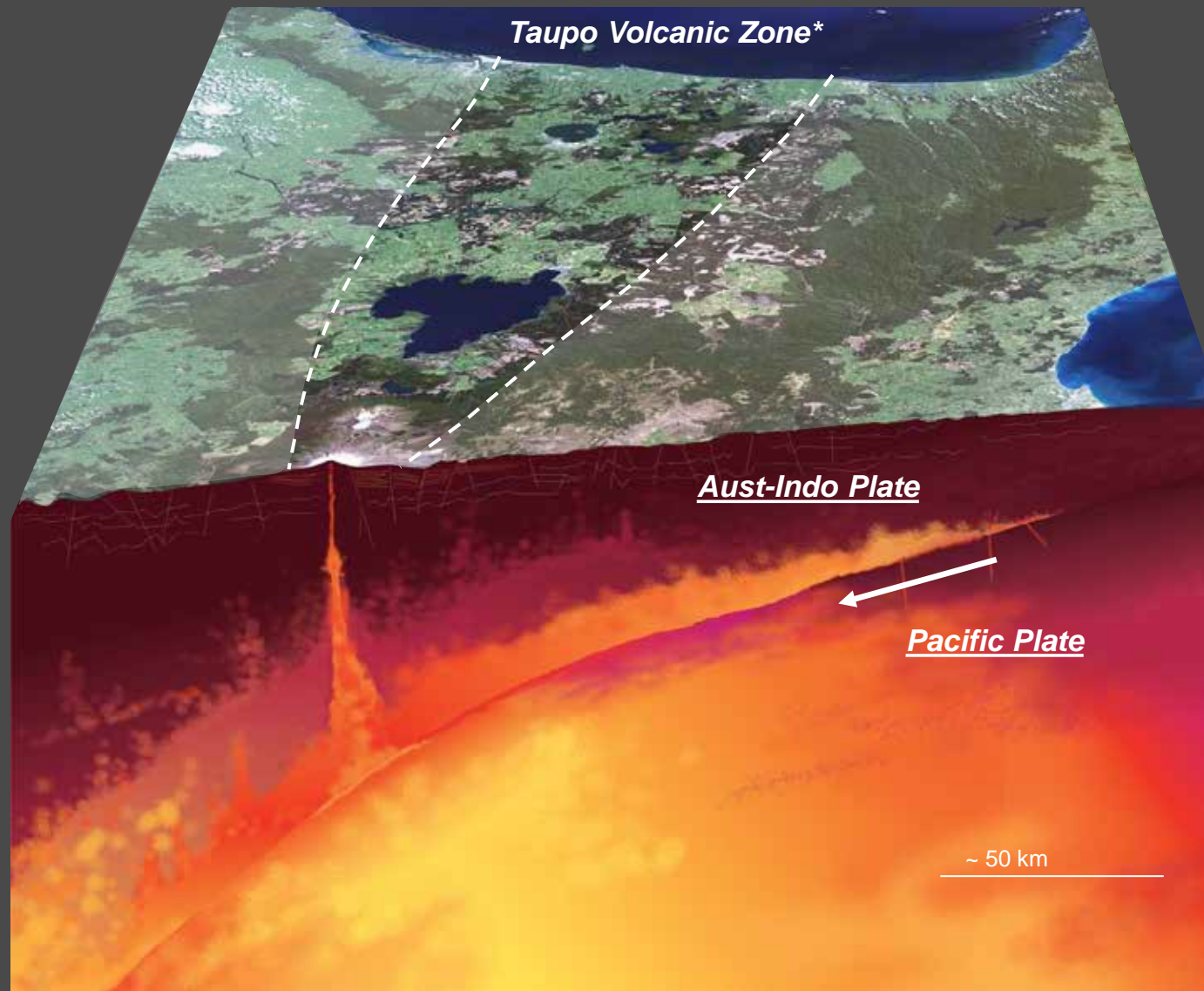
- **Capacity**
 - kW, MW, GW, TW
- **Energy – Capacity times Time**
 - kWh, MWh, GWh
 - kJ, MJ, GJ, TJ, PJ,
- **Electricity and heat**
 - Same units but different quite different energy forms
 - Electricity higher quality form



Taupo Volcanic Zone – the heat engine



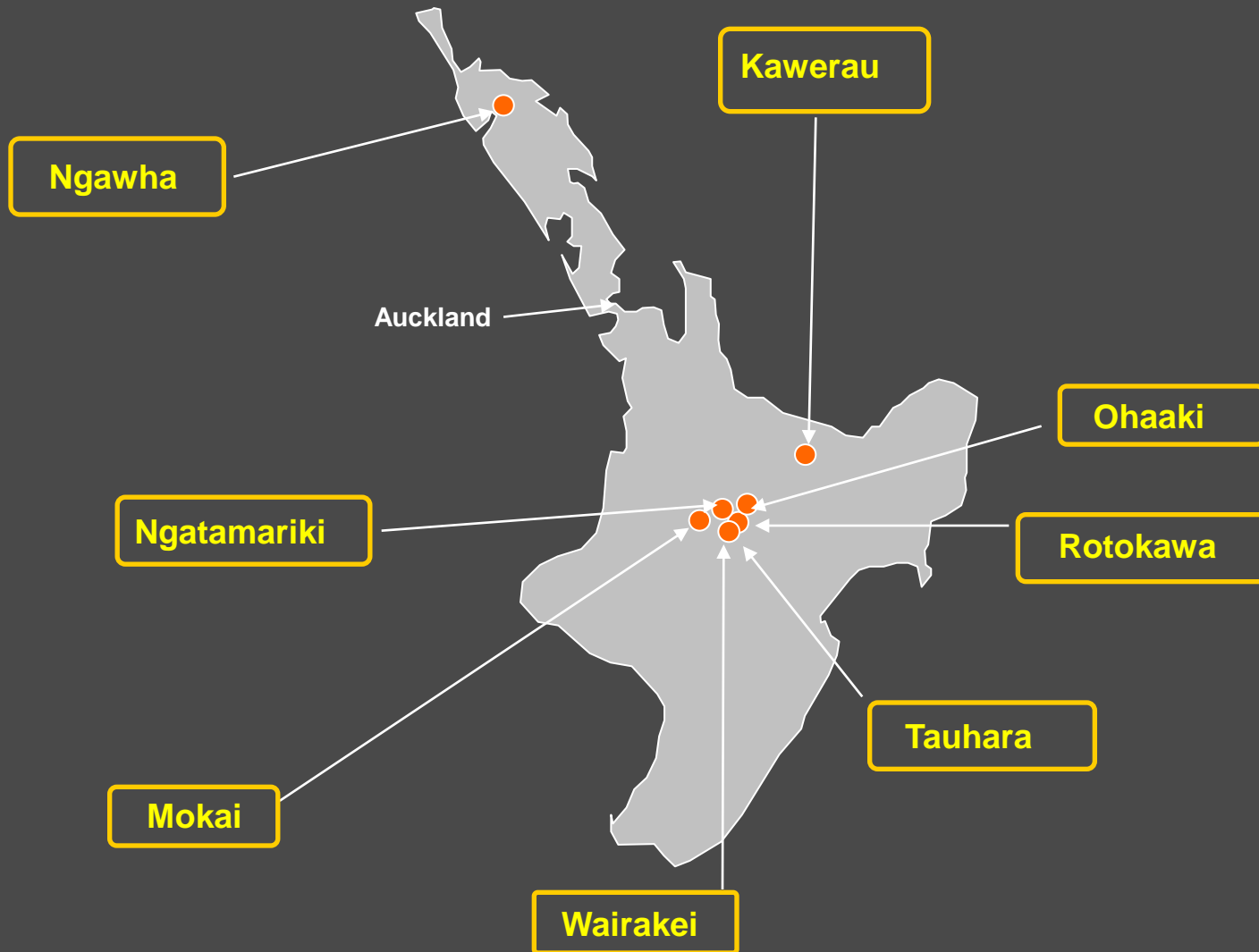
An Amazing Heat Engine



Current New Zealand Scene



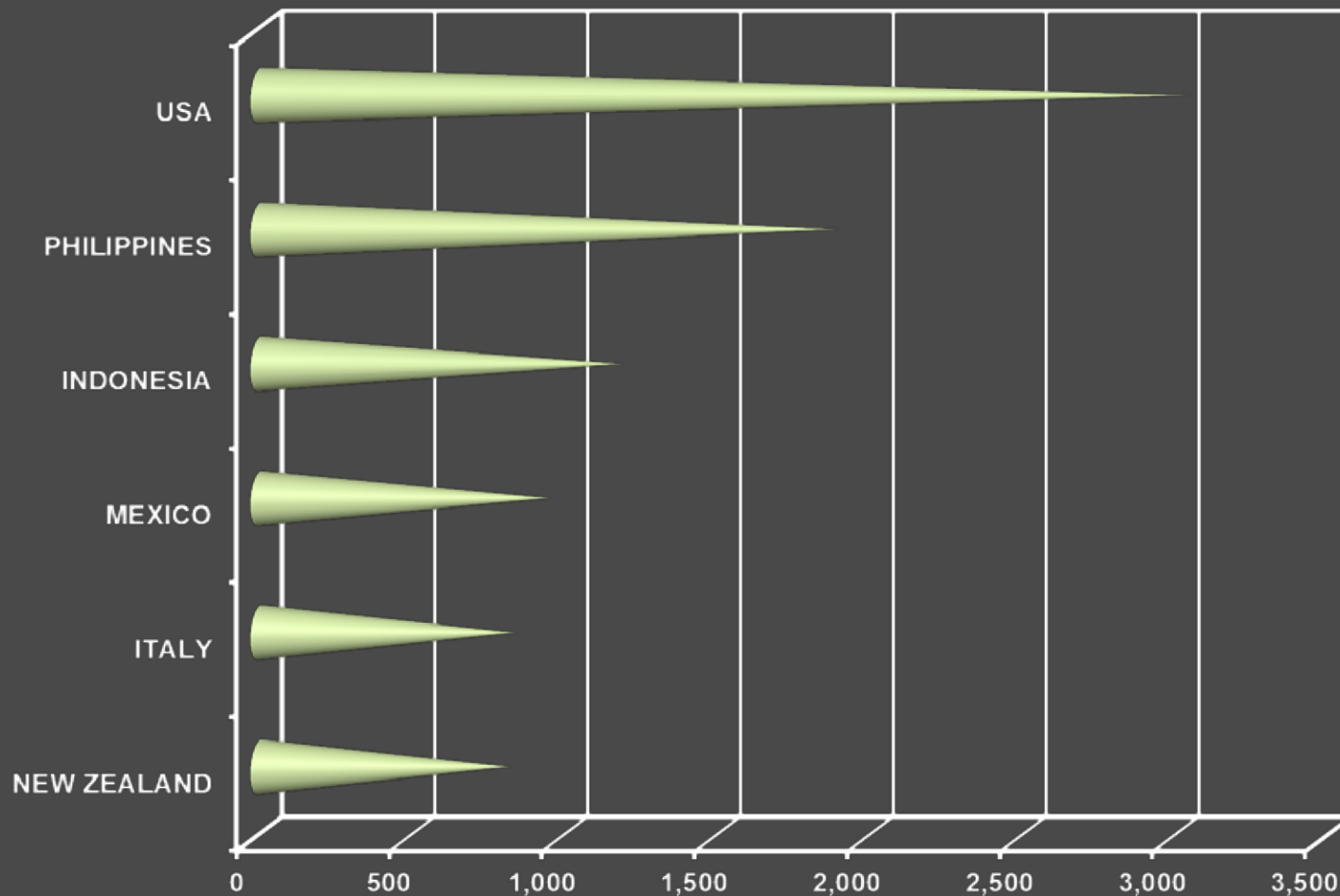
Locations for Power and Large industrial



New Zealand Scene

- **Number 6 in geothermal electricity generation Capacity**
 - Soon will be number 5
- **Worlds largest geothermal heat use at one site**
 - Kawerau
- **However**
 - Slow in other direct use and Geothermal Heat Pumps
- **Support for other Nations**

Moving up the Capacity Ladder – 6TH now

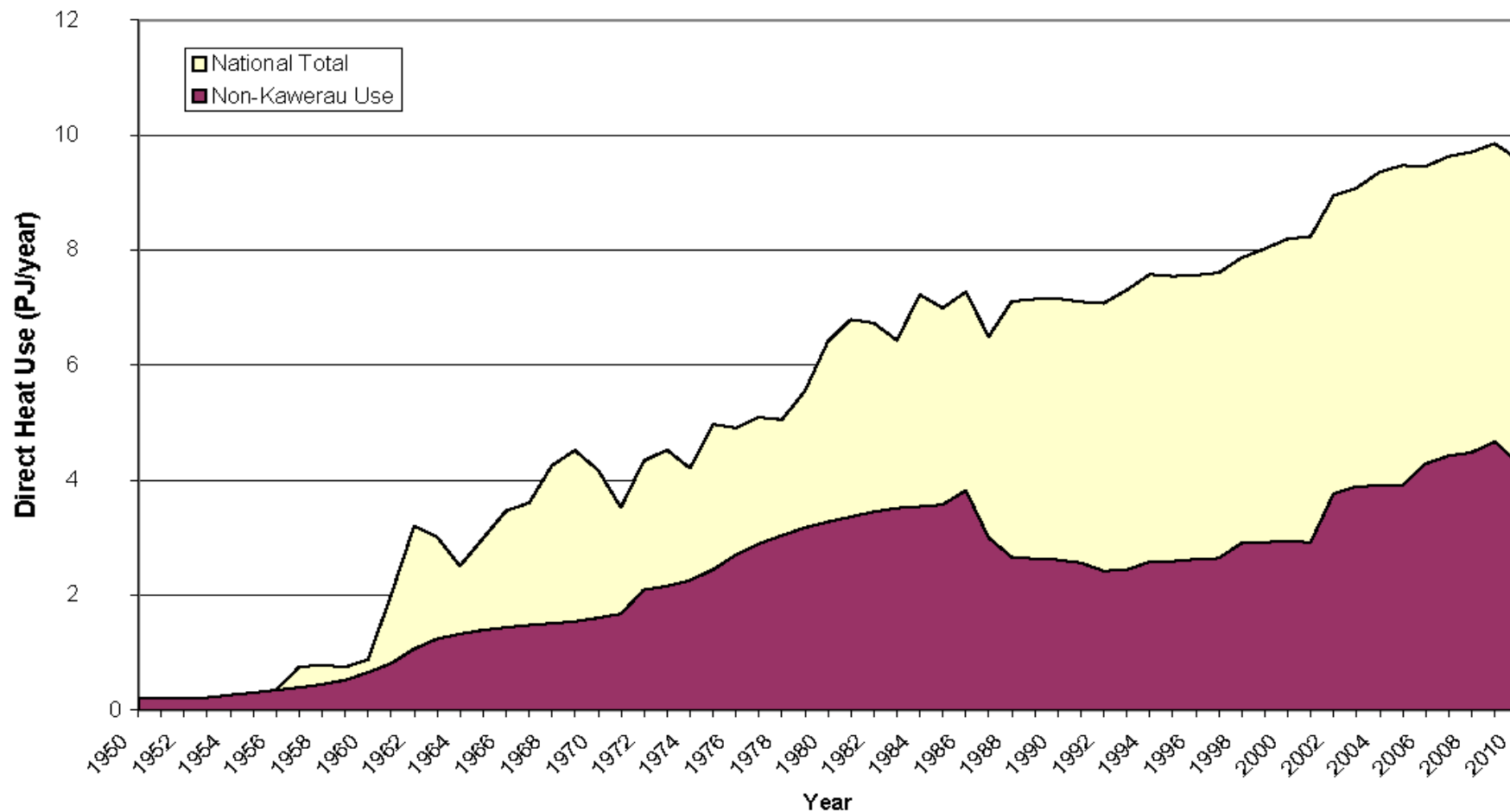


Bertani 2010 + updated NZ data June 2013

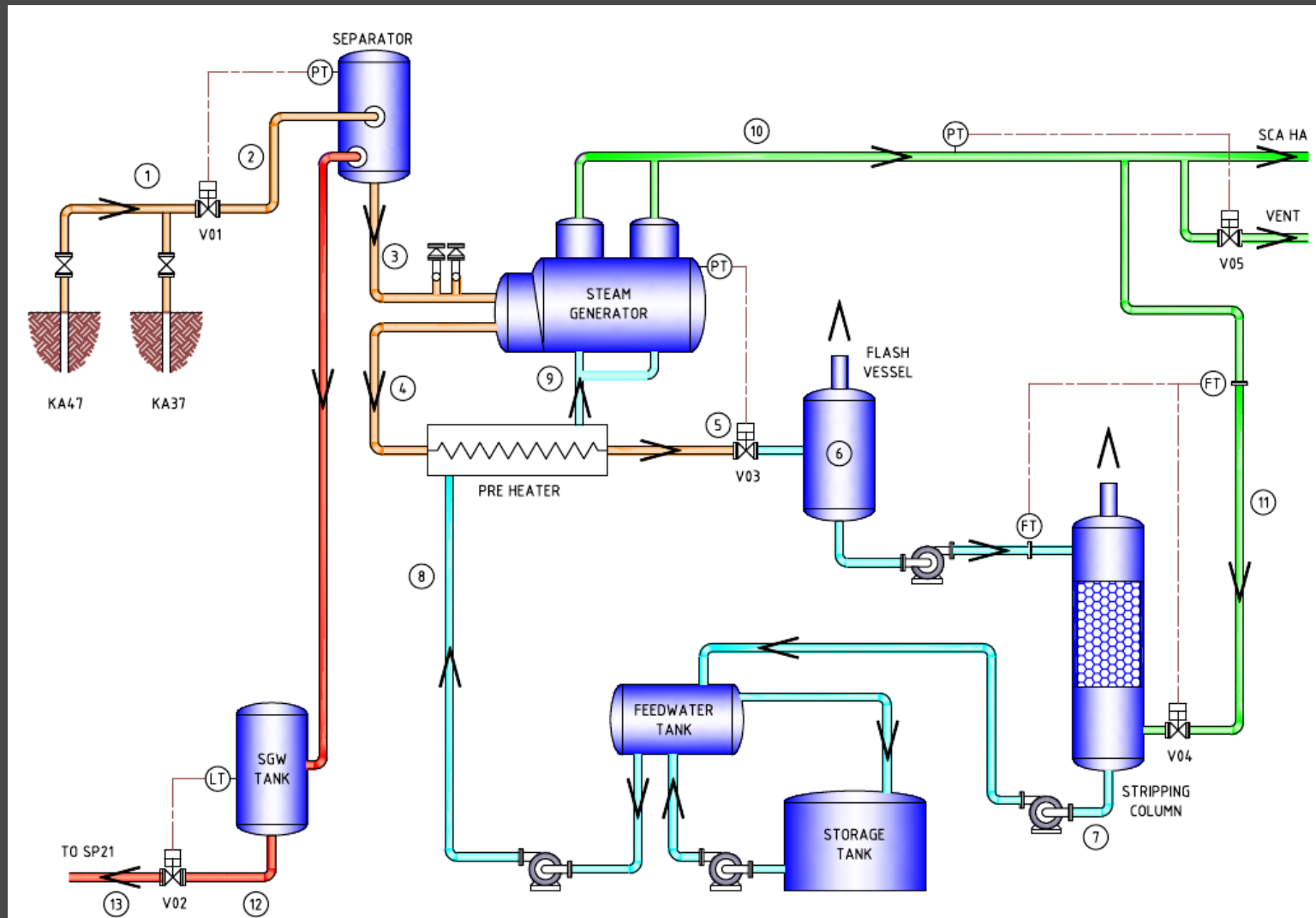
Direct Geothermal Use in NZ



Direct Geothermal



Direct Heat – Creating Clean Steam



Norske Skog Tasman Kawerau



Miraka – Mokai – Milk Powder



MB Century

SCA - Kawerau



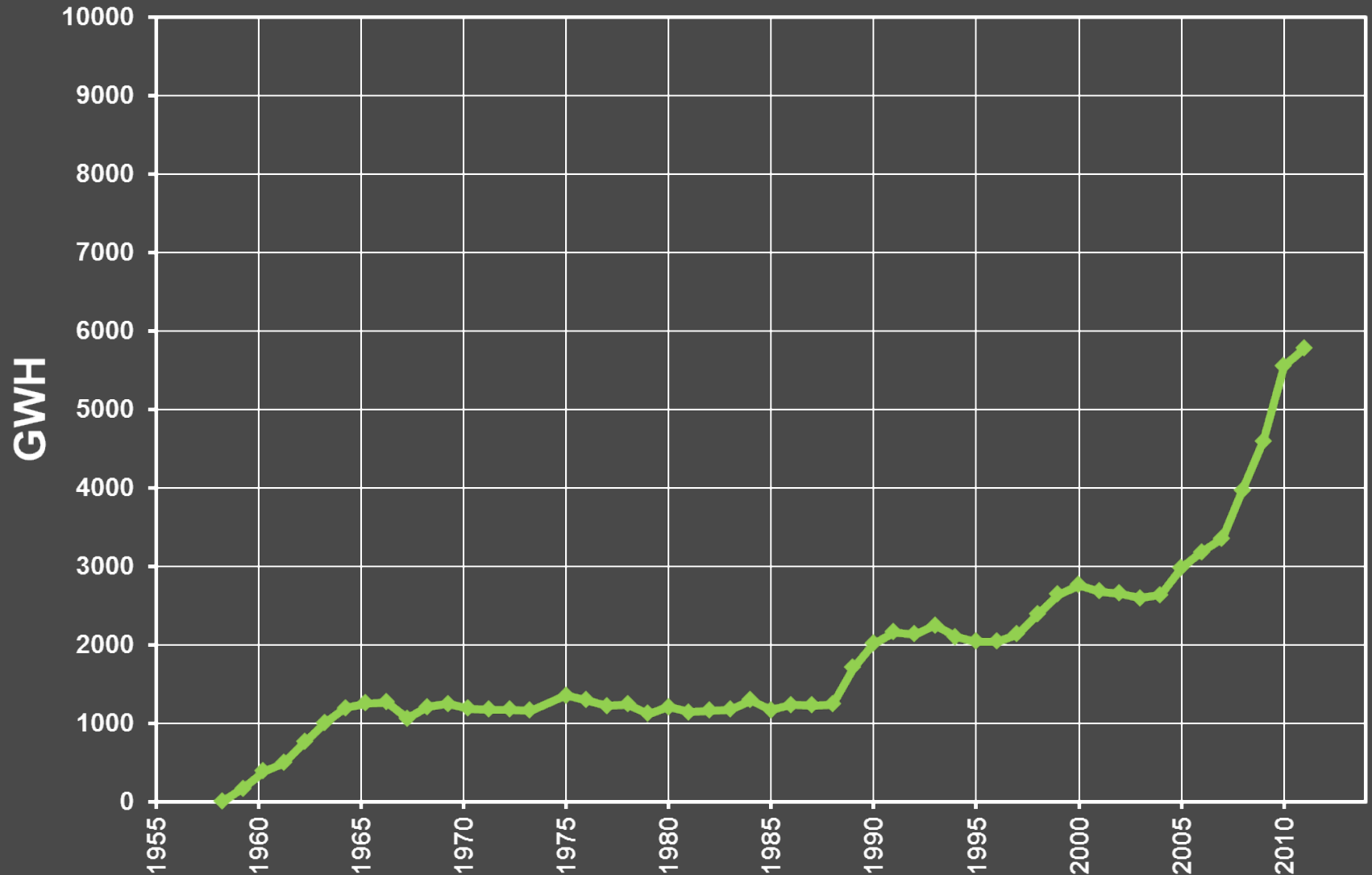
Dobbie Engineers



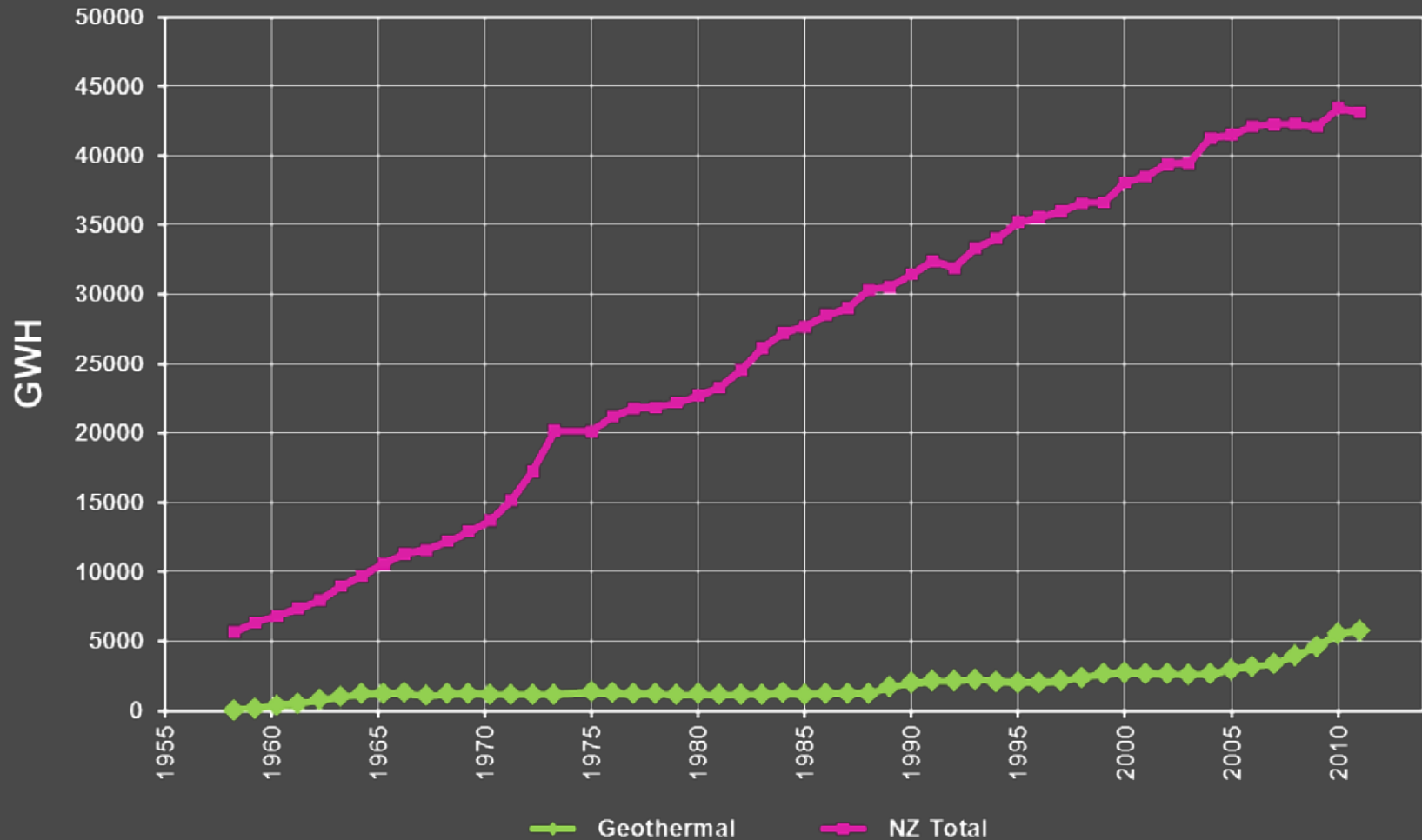
Geothermal Electricity Generation



Growth Geothermal Electrical GWH



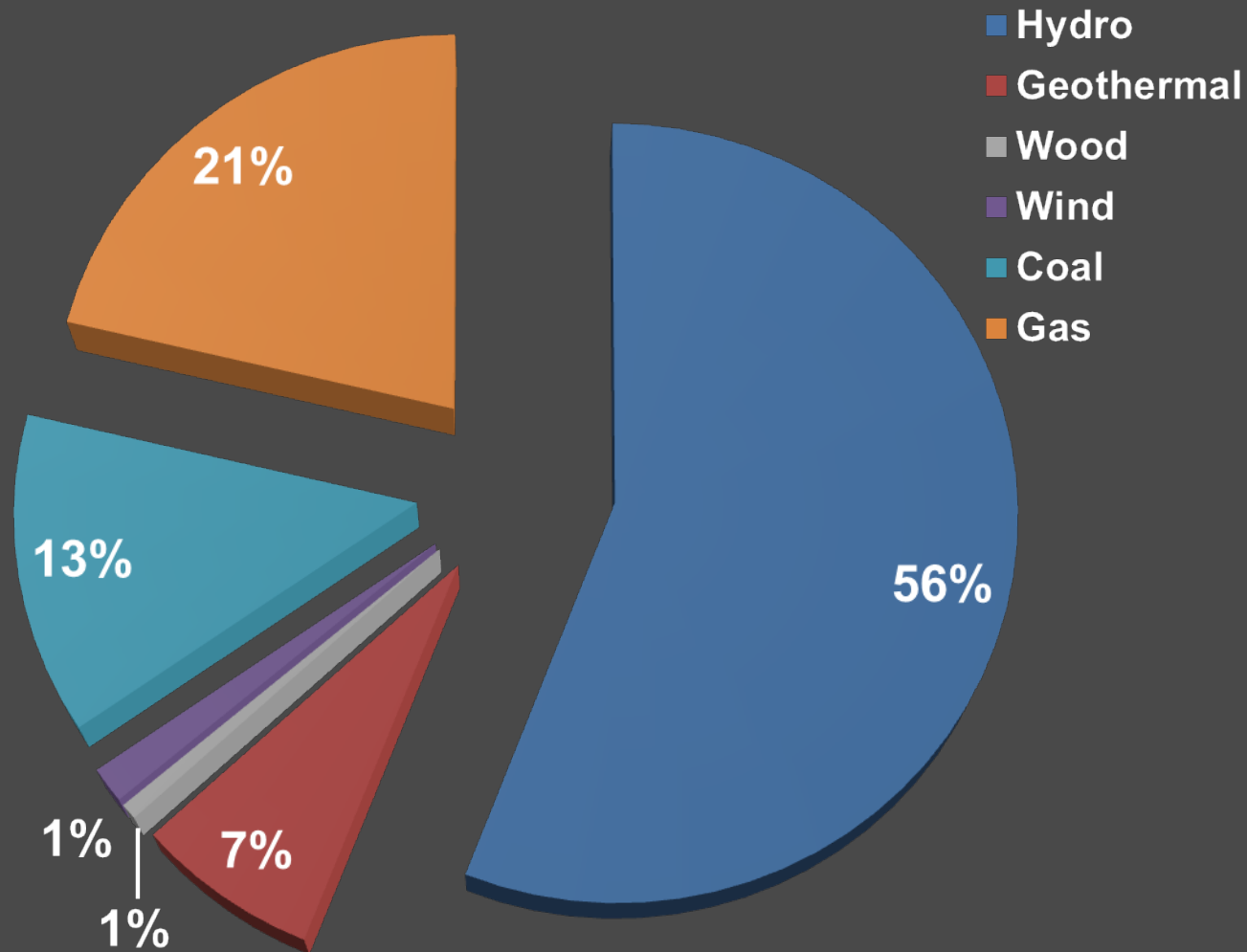
NZ Electrical Energy Net Generation GWH per year



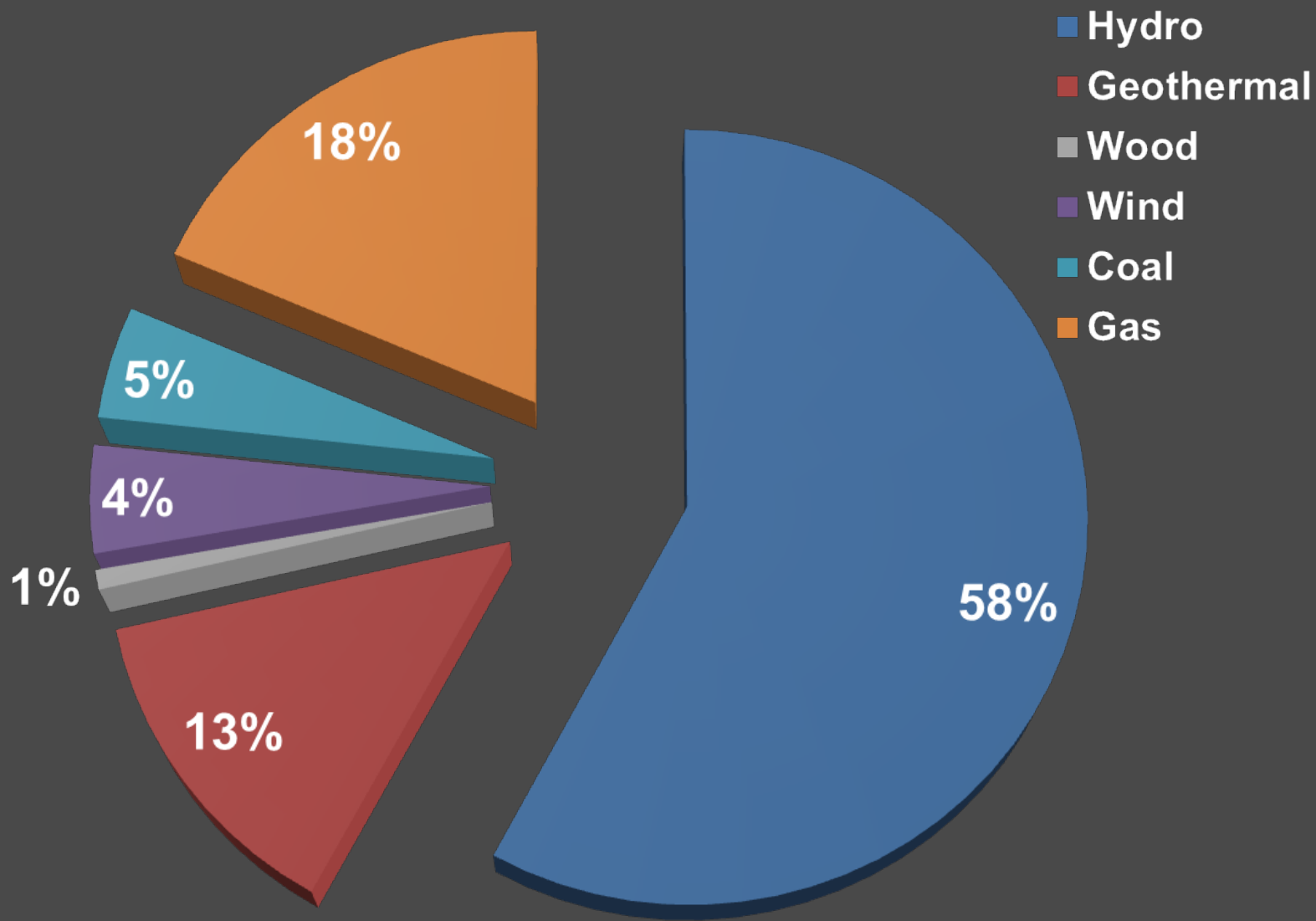
Geothermal – Percentage of Total



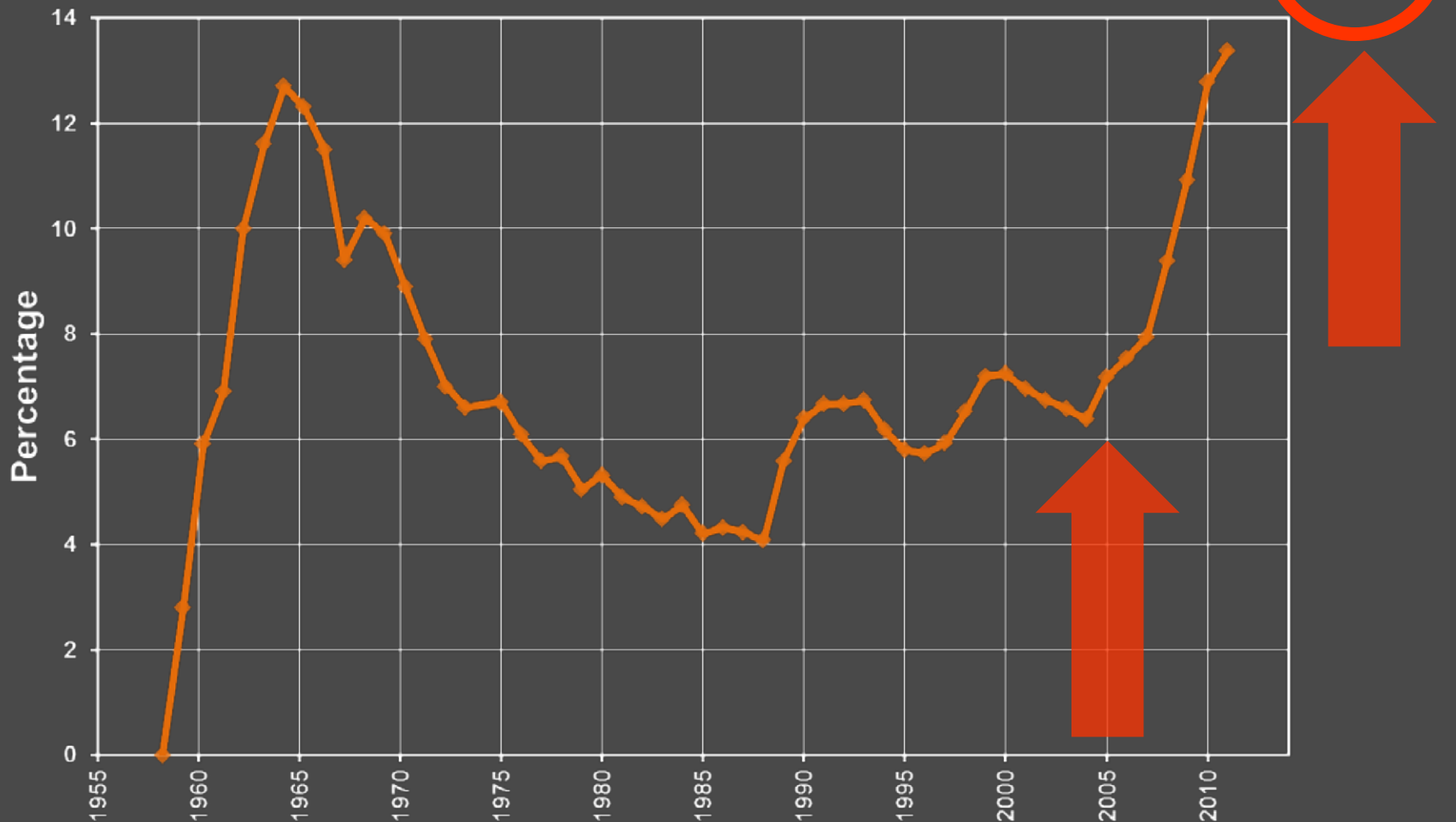
2005 Electricity Mix



2011 Electricity Mix



Doubling in Energy Produced in 8 years



And more commissioning now

- **Ngatamariki – 82 MWe**
 - Two Units on line now - Scheduled all on line by end June 2013
 - Organic Rankine Cycle
 - \$350 Million USD



Coming later in 2013

- **Te Mihi Uenukukopako - 160 MWe**
- **Two 80 MWe Toshiba Steam Turbine Machines**
 - Replaces some of Wairakei so ≈ 110 MWe Increment
 - Scheduled on line later 2013
 - USD \$500 Million



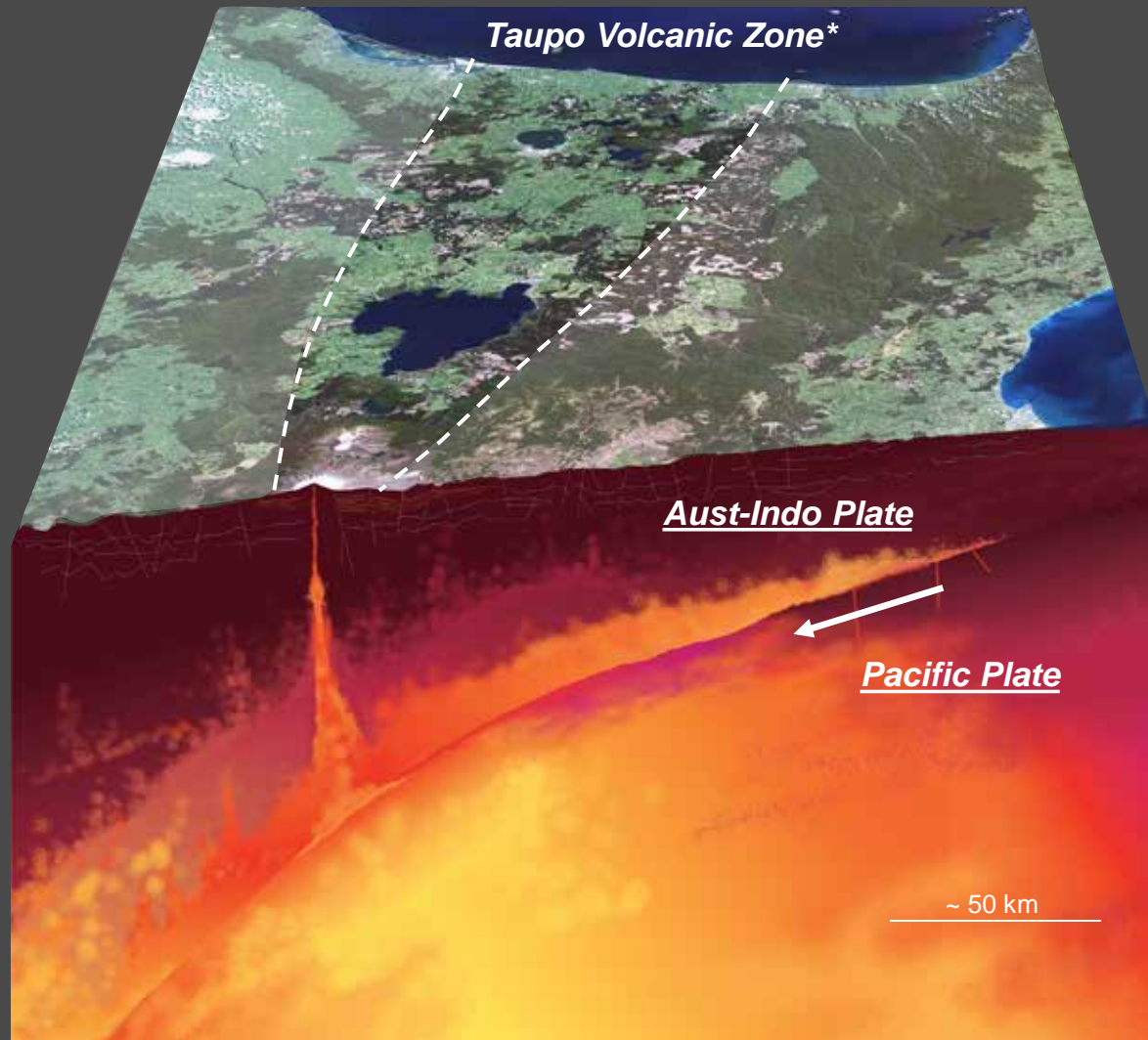
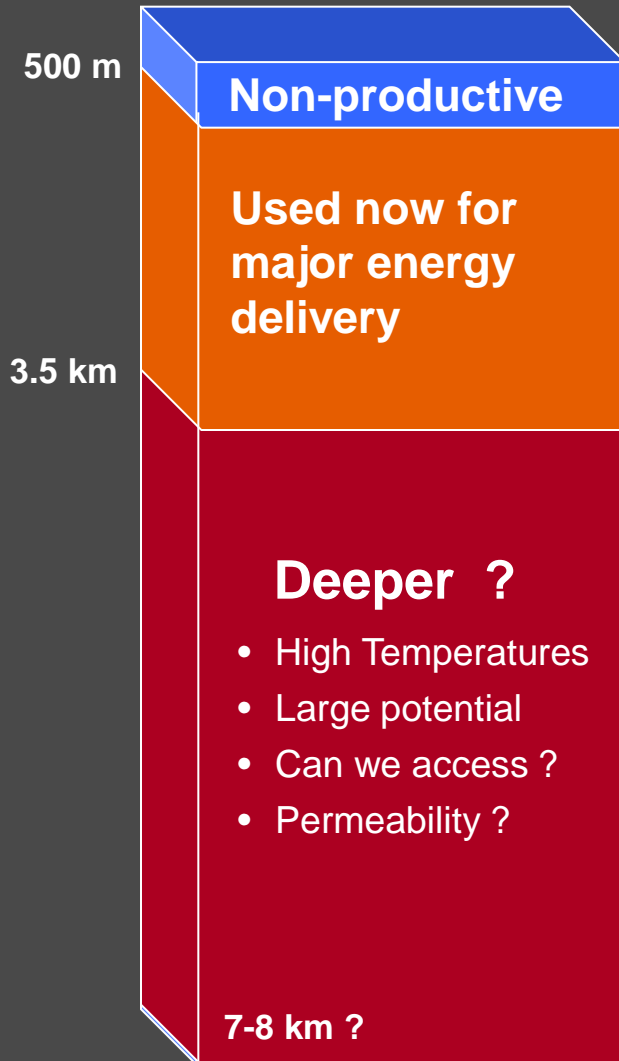
May be more to come

- **What if we are able to develop deep resources**

> 30 %



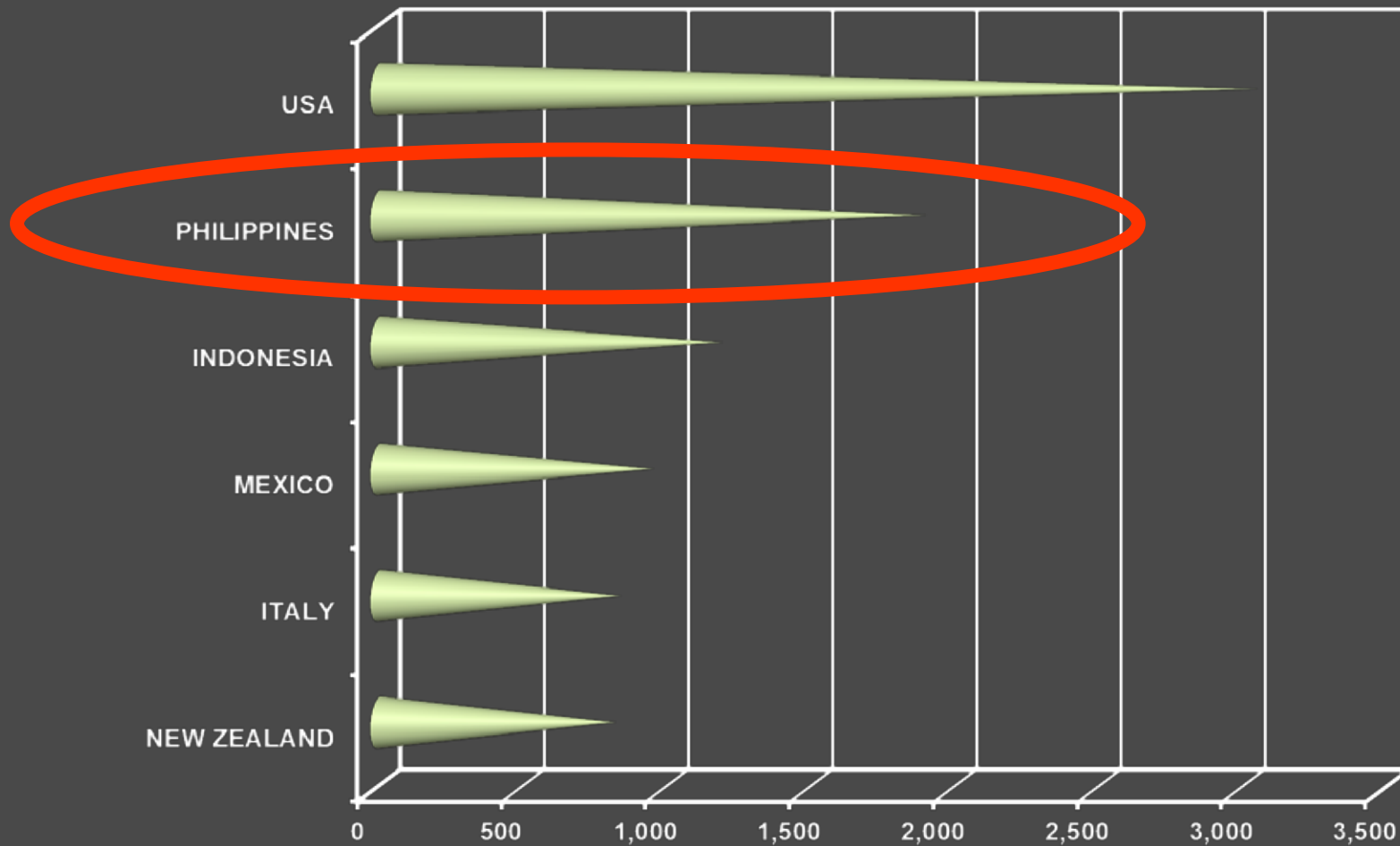
Hotter and Deeper



Other Nations Joined



NZ Support for Other Nations

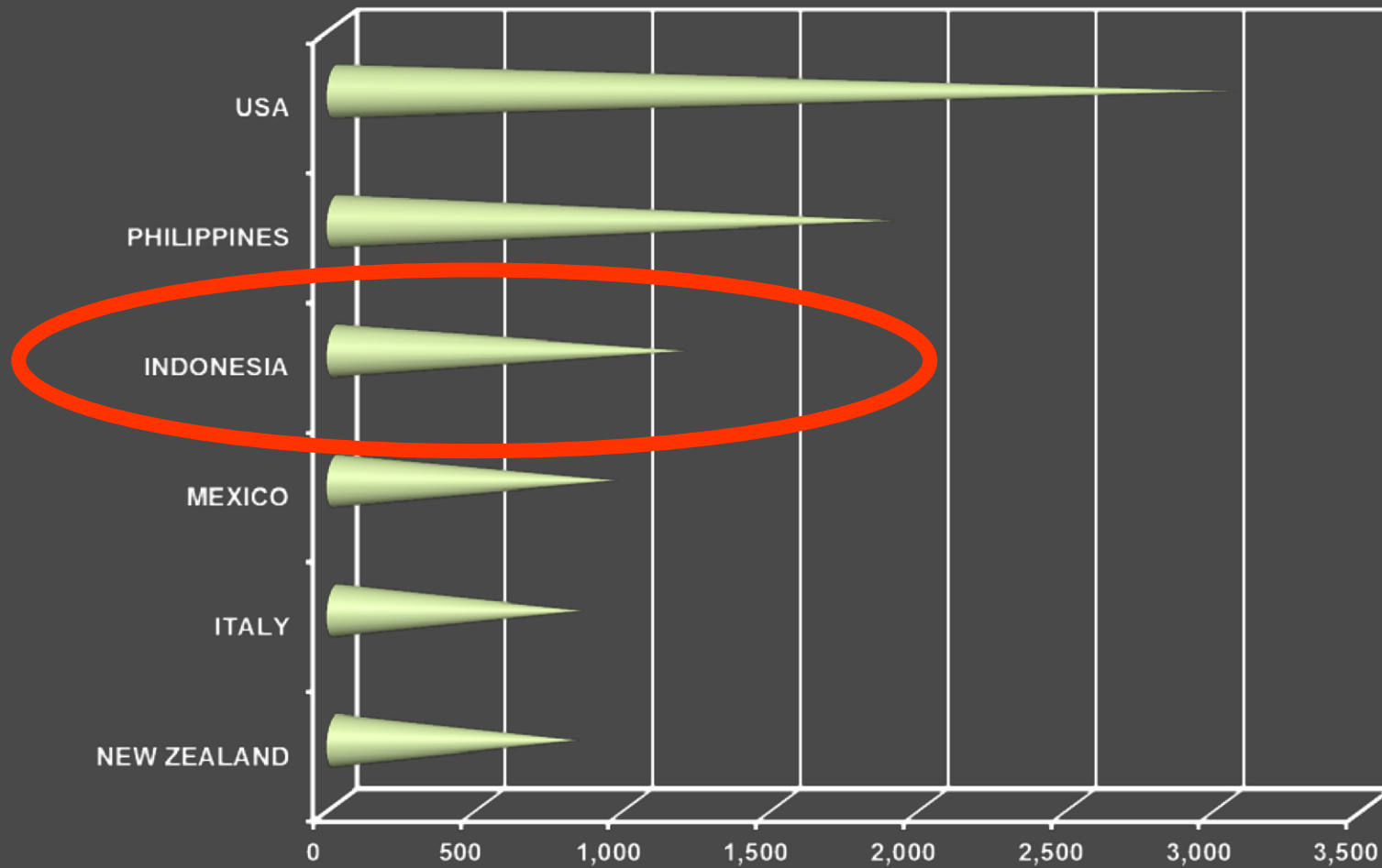


Philippines - Over four decades

- 1976 – bilateral government agreement
- Early exploration at Leyte and Palinpinon
- New Zealand supplied a rig
- Undertook early drilling work

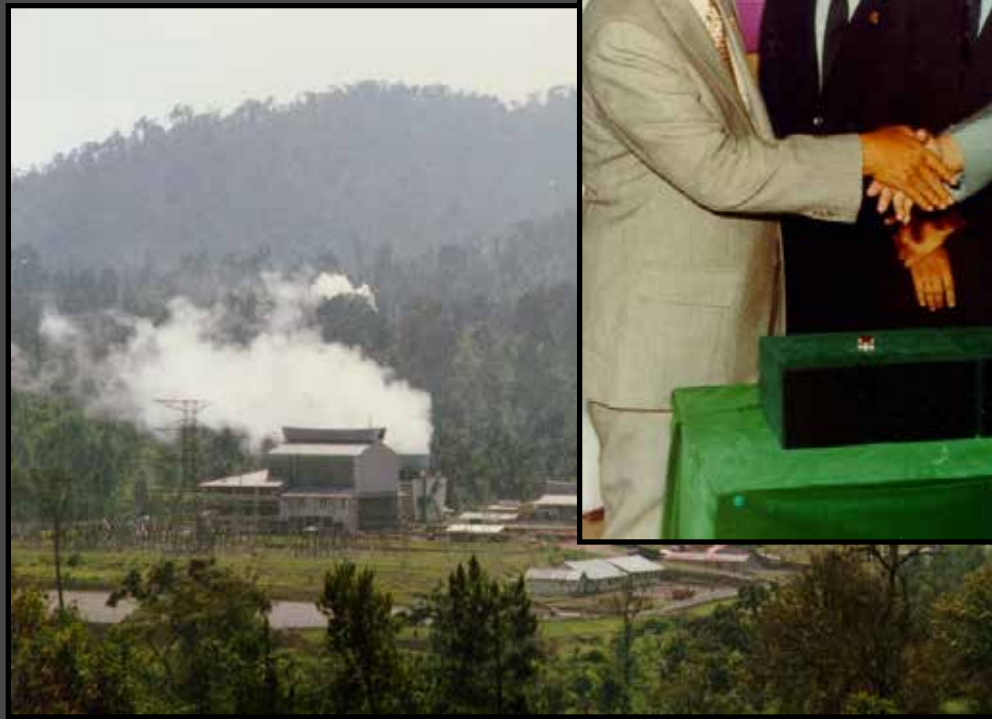


Indonesia



Working with Indonesia for over four decades

NZ PM at Kamojang 1 Commissioning 1982



Geothermal Training - All Nations

New Zealand Geothermal Institute 1978

> 850 trained

Class of 1990



THE UNIVERSITY OF AUCKLAND
NEW ZEALAND

Post Graduate Certificate – Geothermal

- Geothermal Institute
- Auckland University
- Contact Sadiq Zarrouk

s.zarrouk@auckland.ac.nz



GNS Trains and Builds Geothermal Capacity

- Training for tomorrows needs
 - Such as at Gadjah Mada University



- Introduction to Geothermal Geo-scientific Techniques
- Monitoring the developed geothermal field
- 3D Geological Modelling

GNS will Train and Build Capacity

Recent Training Courses

- From Start to Steam
 - From exploration to sustainable development
- 3D Geological Modelling
 - Leapfrog 3D
 - Indonesia, Philippines, Chile, Australia, New Zealand
- Geochemical sampling techniques
 - Papua New Guinea
- Geophysical techniques for geothermal exploration
 - Papua New Guinea
- Acoustic image log Interpretation and processing
 - Australia, Indonesia, New Zealand



New Zealand Geothermal Association



www.nzgeothermal.org.nz

Geothermal Heat Pump Association of NZ



www.ghanz.org.nz

International Partnership for Geothermal Technologies



- **New Zealand Participation**
- **Lead by Dr Bignall**

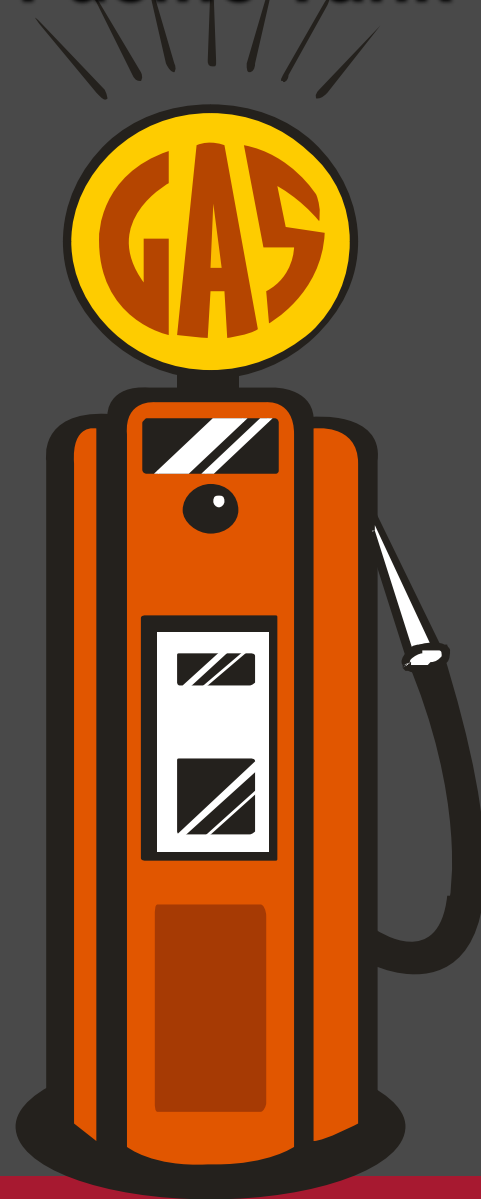


Your turn



Lots more geothermal in the Pacific Tank

Get Into it



To connect - GNS Geothermal geothermal@gns.cri.nz



Greg Bignall

Head of Department
Geothermal Manager



Stuart Sanderson

Manager New Zealand Geothermal Analytical Laboratory

NZ Geothermal Analytical Laboratory



Rob Johnston

Andrea Blair

Business Development

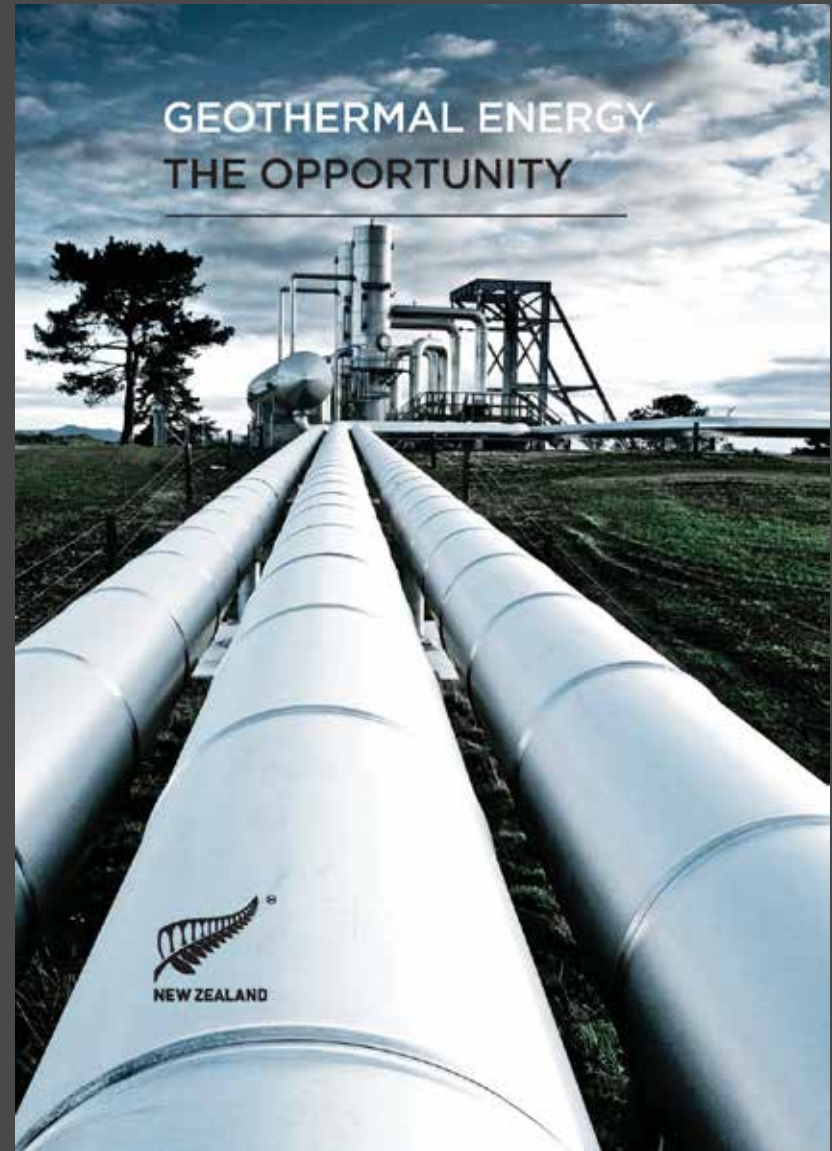
To Connect to Geothermal New Zealand

- Looking for industrial support
- NZ Industry and expertise
 - Pacific market
 - Indonesia
 - Chile
 - Japan

www.geothermalnewzealand.com

- Dr Mike Allen

mike.allen@xtra.co.nz



Today's picnic is just about over



The background of the slide features a warm sunset scene. In the foreground, the silhouettes of several people are visible as they sit on a dark ledge, looking out towards the horizon. Above them, the dark silhouettes of tree branches hang down from the top edge of the frame. The sky is a gradient of orange and yellow, with the sun's glow visible on the left side.

Kia Ora

Thank You