A Short History – 60 Years

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

Chief Executive

- Finance
- Strategy
- Maori Strategy
- Human Resources
- Business Development
- Research

Information Services

Geological Resources

Natural Hazards

National Isotope Centre

Geological Time
Hydrocarbons
Geothermal
Minerals
Geomicrobiology
Ocean Exploration

Kevin Faure
Group Manager Geological Resources

Mike McWilliams
Chief Executive

Greg Bignall
Head of Department
Geothermal Manager

geothermal@gns.cri.nz
Trust you enjoy today's presentation.
Where shall we go

Taipei – Chinese Taipei

New Zealand
What shall we talk about

STAFF PICNIC
Sailing
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

Taupo Volcanic Zone

North Island

South Island
An Amazing Heat Engine

Taupo Volcanic Zone*

Aust-Indo Plate

Pacific Plate

~ 50 km
Current New Zealand Scene
Locations for Power and Large industrial

- Ngawha
- Kawerau
- Ohaaki
- Rotokawa
- Tauhara
- Wairakei
- Mokai
- Ngatamariki
- Auckland
- Kawerau
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 – 6\textsuperscript{TH} now

- USA
- PHILIPPINES
- INDONESIA
- MEXICO
- ITALY
- NEW ZEALAND

Bertani 2010 + updated NZ data June 2013
Direct Geothermal Use in NZ
Direct Geothermal

![Graph showing the increase in Direct Heat Use (Pj/year) from 1960 to 2010. The graph is divided into two sections: National Total and Non-Kawerau Use. The data shows a steady increase in both categories over the years.](image-url)
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
Geothermal – Percentage of Total

![Graph showing percentage of total geothermal activity over time](image)
2005 Electricity Mix

- Gas: 21%
- Coal: 13%
- Wind: 7%
- Wood: 1%
- Geothermal: 1%
- Hydro: 56%
2011 Electricity Mix

- Hydro: 58%
- Geothermal: 18%
- Wood: 5%
- Wind: 4%
- Coal: 13%
- Gas: 1%
Doubling in Energy Produced in 8 years

Percentage


15%
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 \(\approx\) 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

- Used now for major energy delivery

Deeper?
- High Temperatures
- Large potential
- Can we access?
- Permeability?
Other Nations Joined

STAFF PICNIC
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
Post Graduate Certificate – Geothermal

• Geothermal Institute
• Auckland University
• Contact Sadiq Zarrouk
  s.zarrouk@auckland.ac.nz
GNS Trains and Builds Geothermal Capacity

• Training for tomorrow's 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
GNS can Train and Build Capacity

- Customise training for your needs
- Send staff / trainers to your location to train on the job
- Student Supervision
- Research ties with universities
  - New Zealand, Indonesia, Japan, Germany
Geothermal Heat Pump Association of NZ

www.ghanz.org.nz
International Partnership for Geothermal Technologies

- New Zealand Participation
- Lead by Dr Bignall
Your turn

STAFF PICNIC
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
Todays picnic is just about over
Kia Ora

Thank You