RENEWABLE ENERGY IN NEW ZEALAND

23rd February 2016

Dr Mike Allen
Geothermal New Zealand

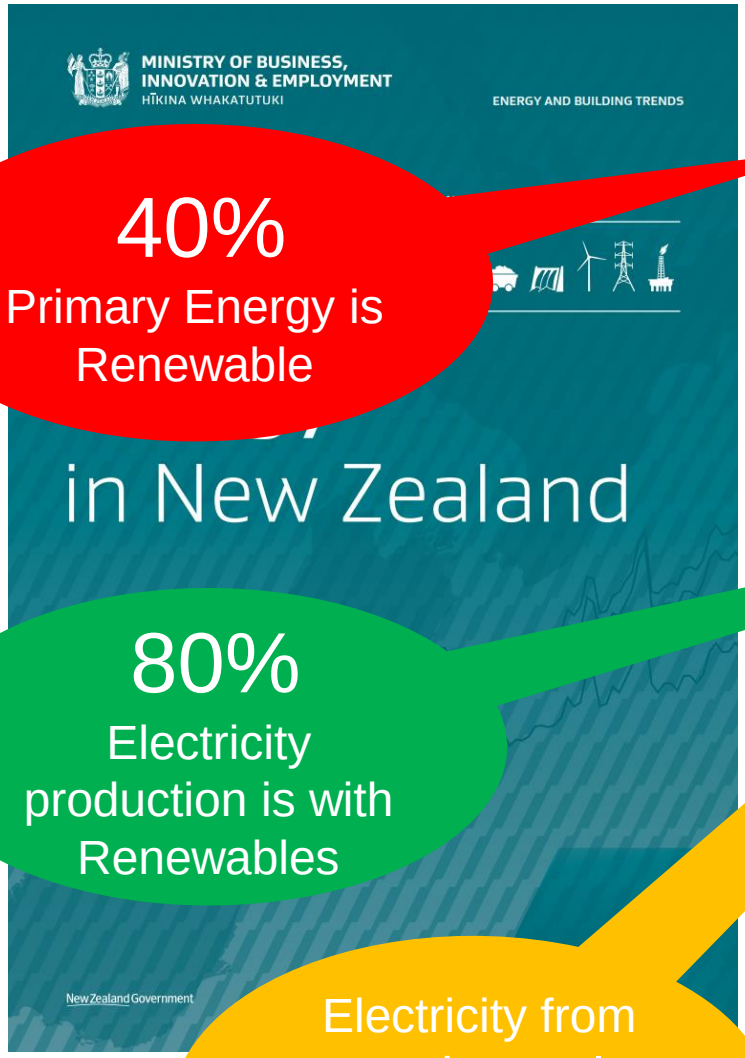
Summer School in Energy Economics

NEW ZEALAND

TOPICS

- An overview of New Zealand's energy sector and its development
- Energy Report 2014
- Electricity Sector
- Electricity Sources
- Geothermal Industry

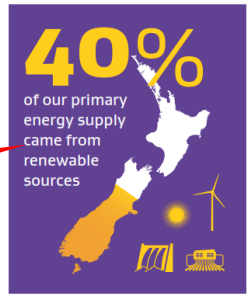
NEW ZEALAND'S ENERGY REPORT

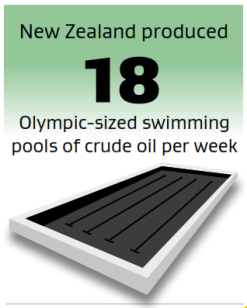


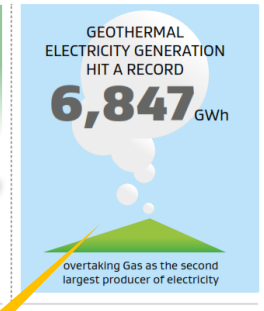
40%
Primary Energy is Renewable

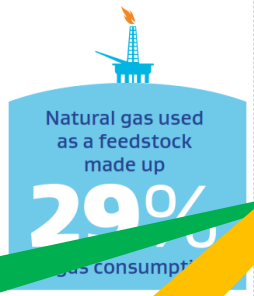
80%
Electricity production is with Renewables

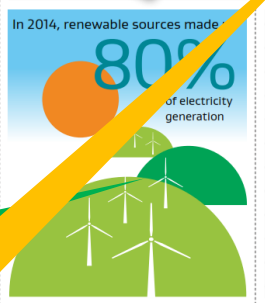
Electricity from geothermal exceeds that from gas

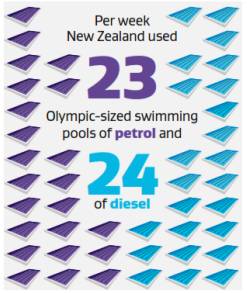


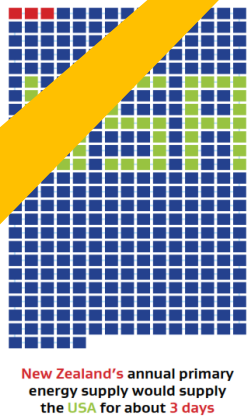


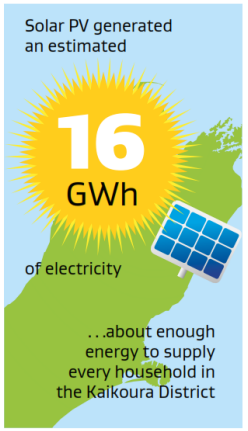








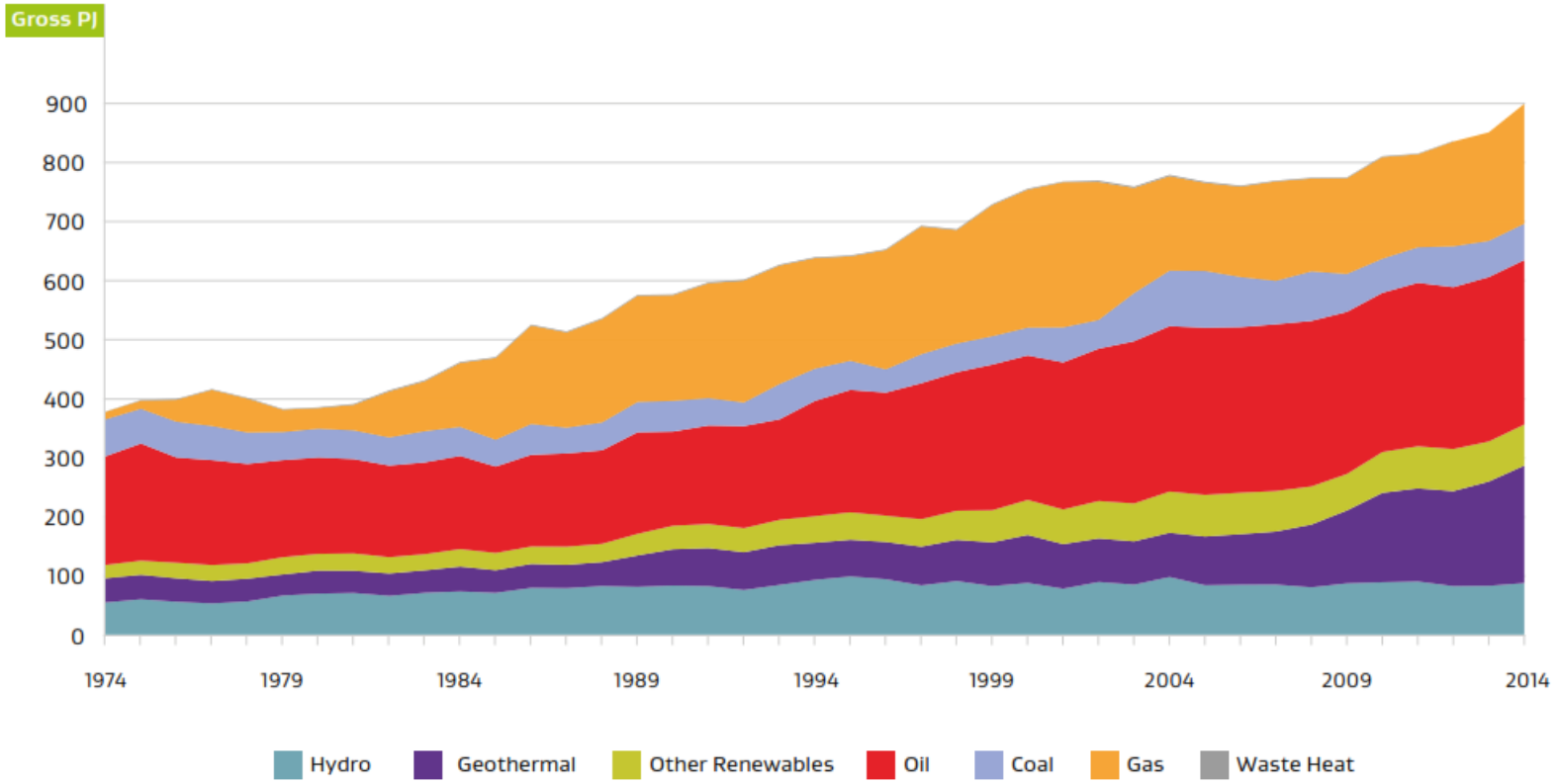




NEW ZEALAND

TOTAL PRIMARY ENERGY SUPPLY: BY FUEL

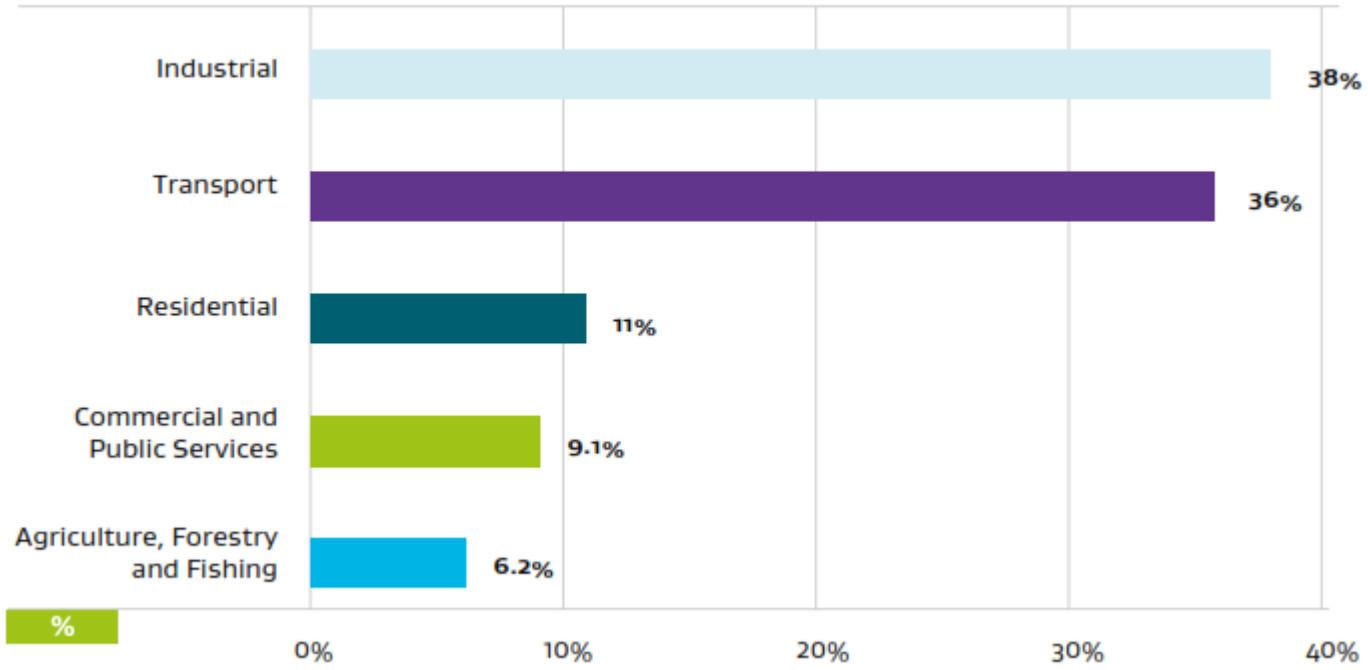
Figure A.1: Total Primary Energy Supply by Fuel



NEW ZEALAND

CONSUMER ENERGY DEMAND SHARE BY SECTOR

Figure A.3d: Consumer Energy Demand Share by Sector in 2014

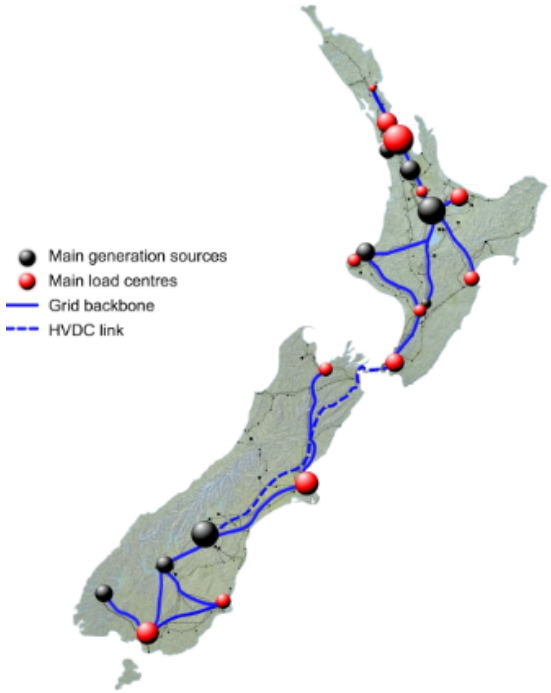


NEW ZEALAND

THE NEW ZEALAND ELECTRICITY SECTOR

NEW ZEALAND ELECTRICITY SYSTEM

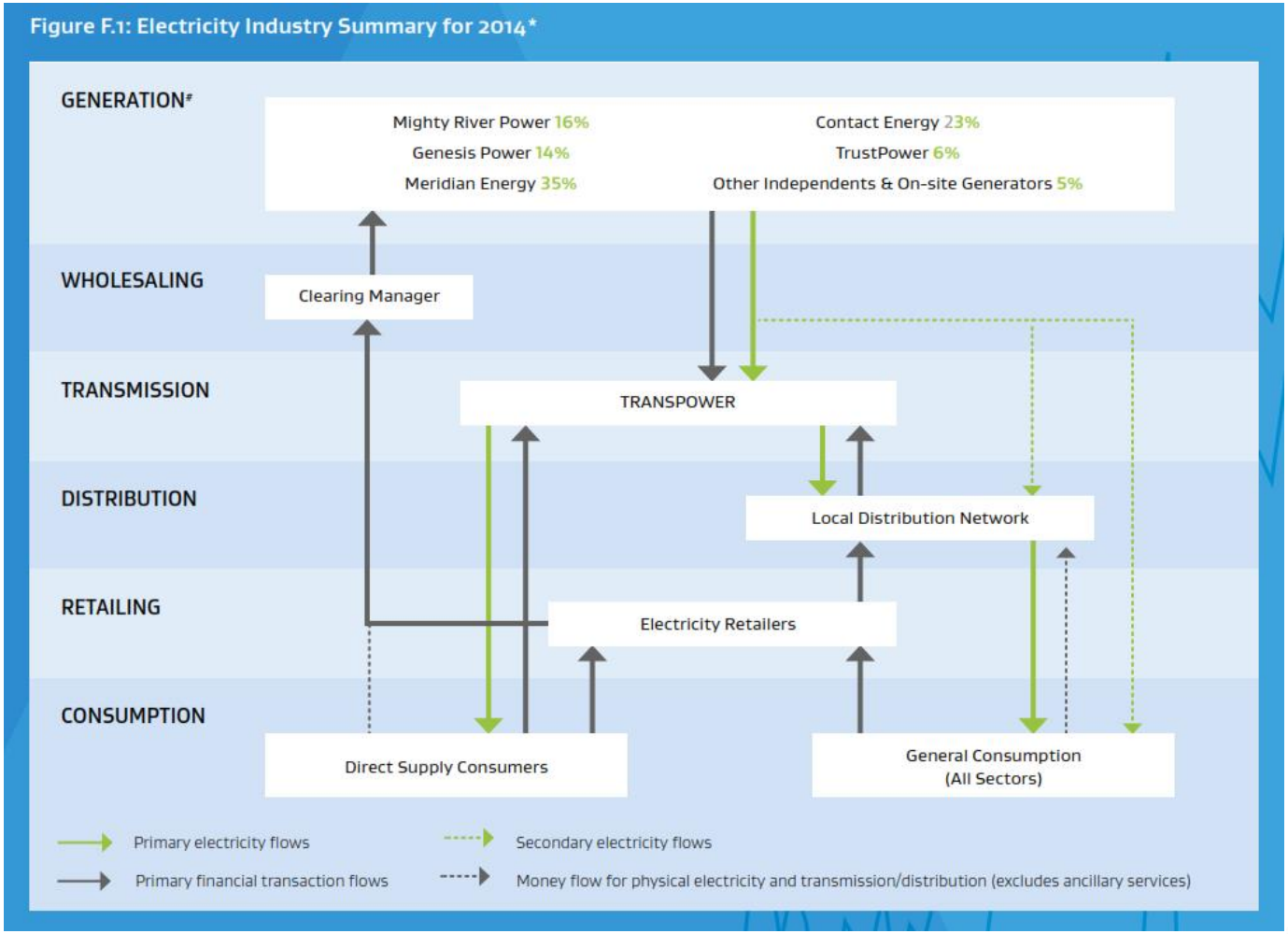
New Zealand's electricity system



- Installed generation 9,800 MW
- Peak demand 6,750 MW
- Total energy supply 43,000 GWh/yr
- Connected by 700 MW HVDC link
- Power mainly transferred northwards from southern hydro systems
- Large thermal plant in north island aids peak demand and dry years

NEW ZEALAND

ELECTRICITY INDUSTRY SUMMARY 2014

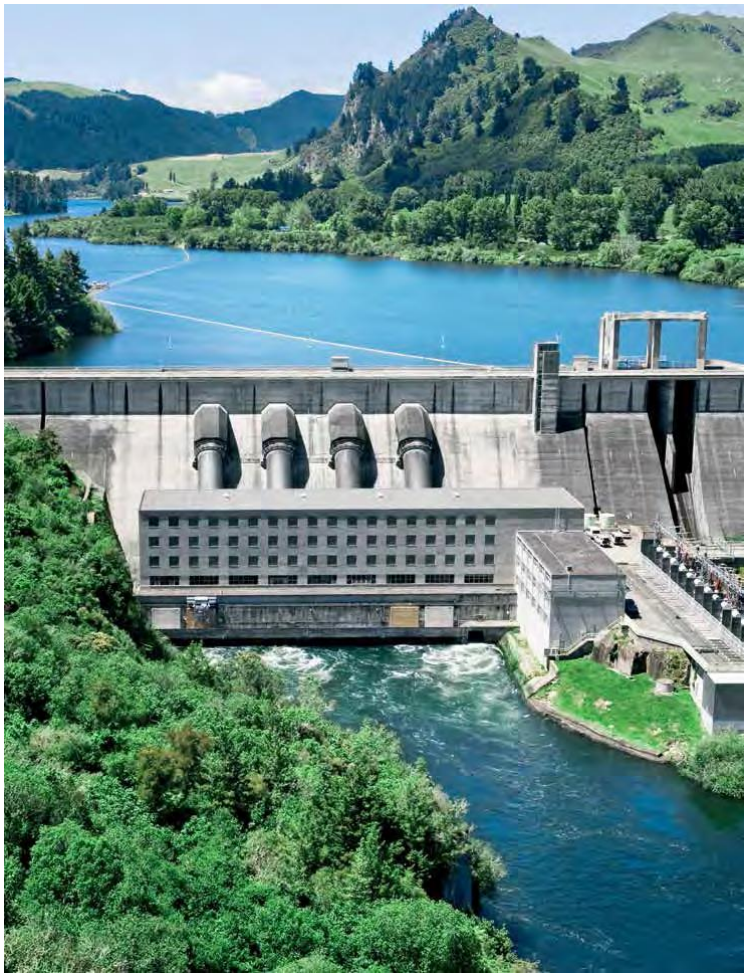


NEW ZEALAND

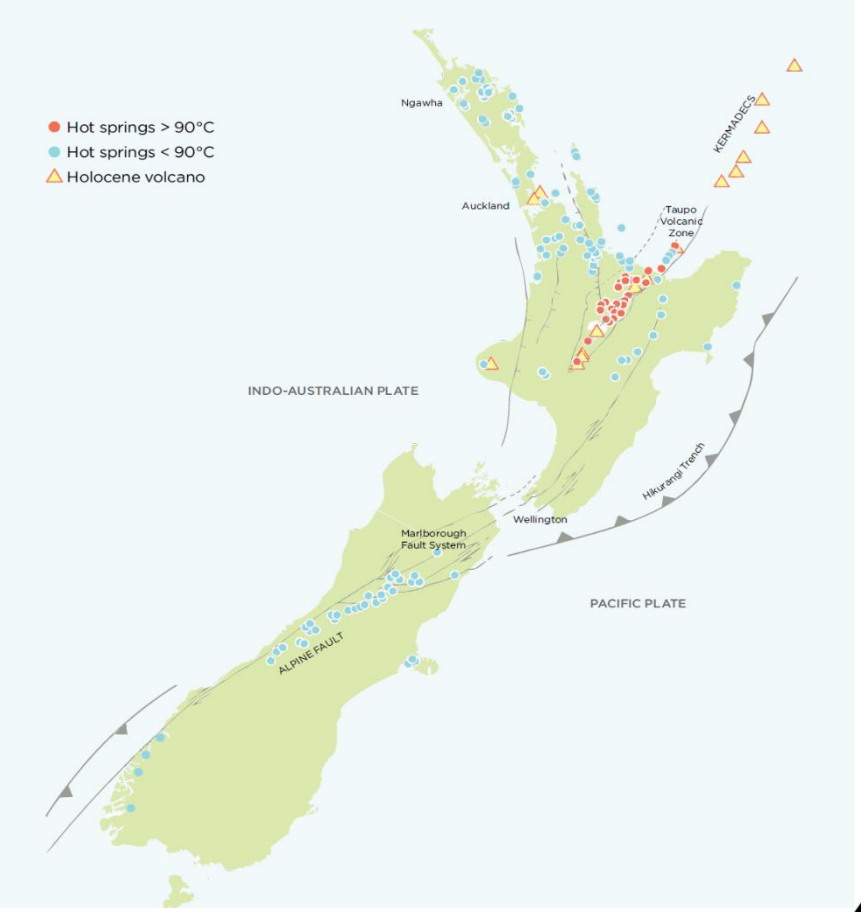
OUR ELECTRICITY SOURCES

HYDRO ELECTRICITY – 6000 MW

- Basis of system
- Main supply in South Island
- Considerable operational history
- Limited storage
- Limited future development



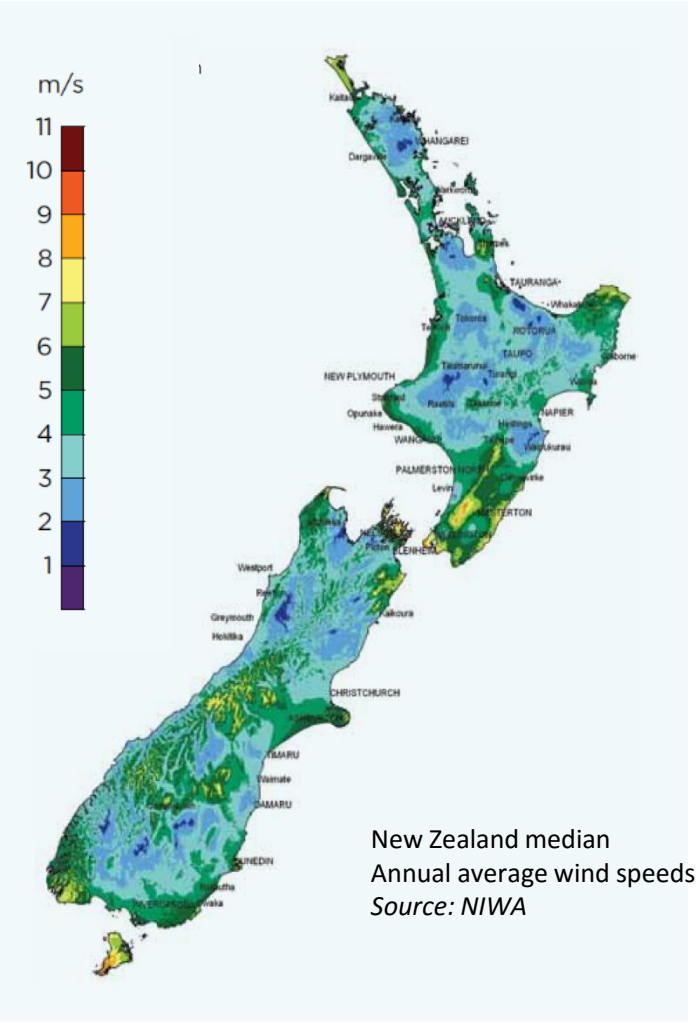
GEOTHERMAL – 1000 MW



New Zealand Geothermal Fields
Source: New Zealand Geothermal Association

NEW ZEALAND

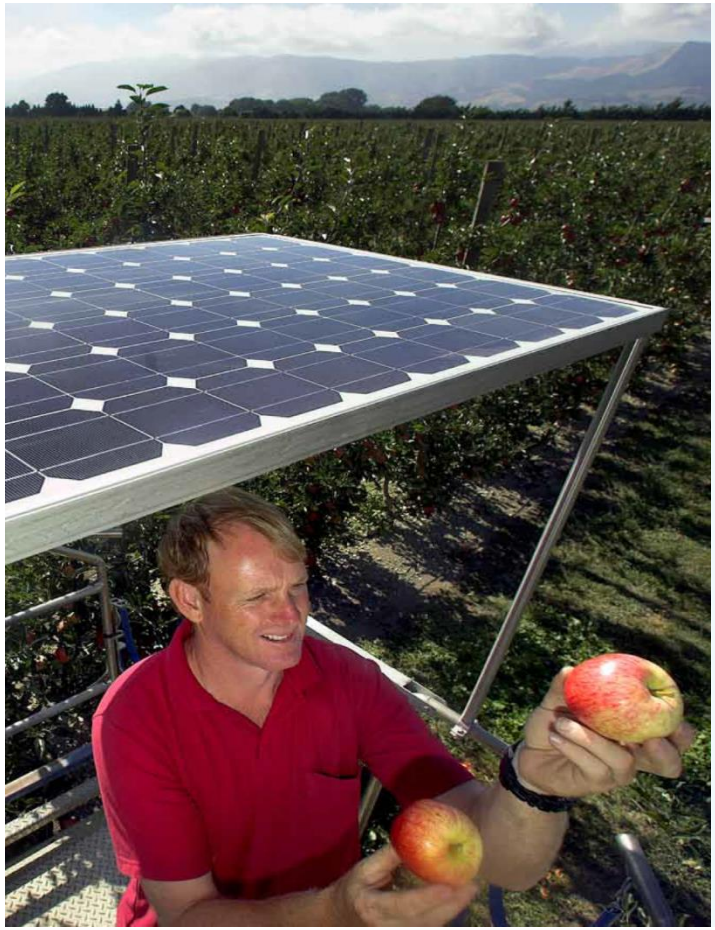
WIND – 620 MW



New Zealand median
Annual average wind speeds
Source: NIWA

NEW ZEALAND

SOLAR IN NEW ZEALAND



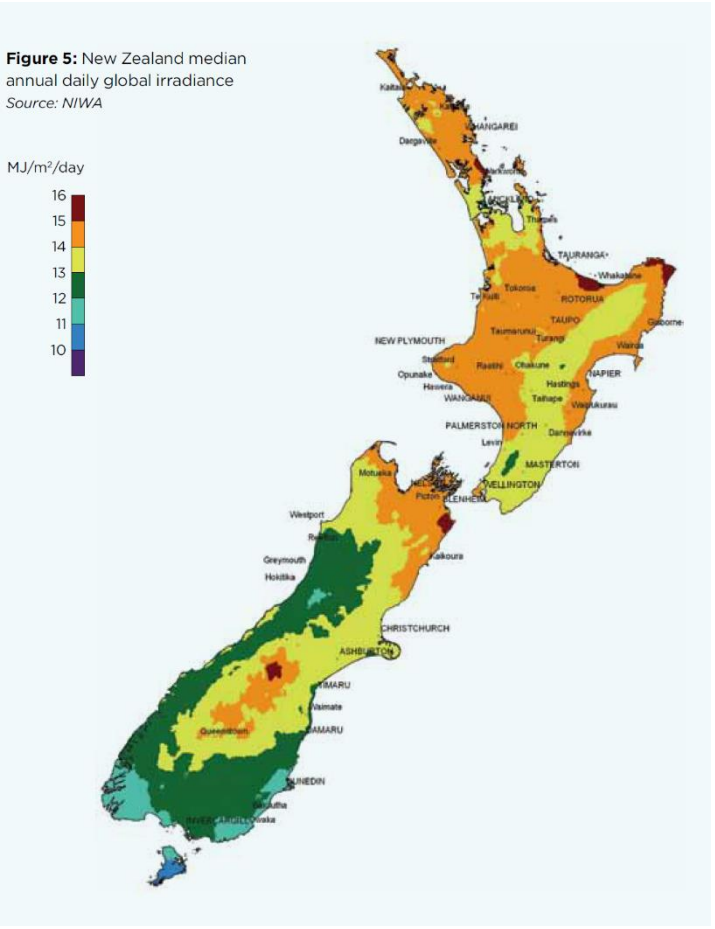
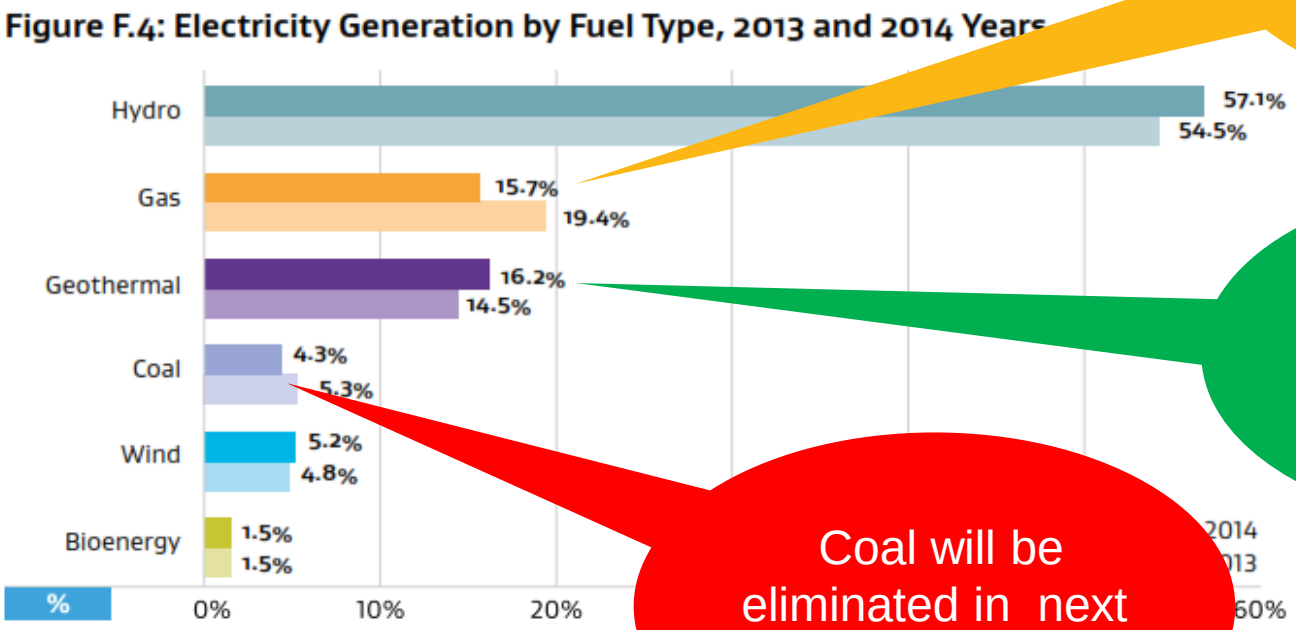


Figure 5: New Zealand median annual daily global irradiance
Source: NIWA

NEW ZEALAND

ELECTRICITY GENERATION BY FUEL TYPE: 2013/14



400MW of gas plant will be closed in Sept 2015

Electricity from geothermal exceeds that from gas

Coal will be eliminated in next two years

NEW ZEALAND

EXCITING FUTURE OPPORTUNITIES

The electricity that could be generated from already permitted (but un-developed) renewables sources ***could power our entire existing vehicle fleet*** *in New Zealand*

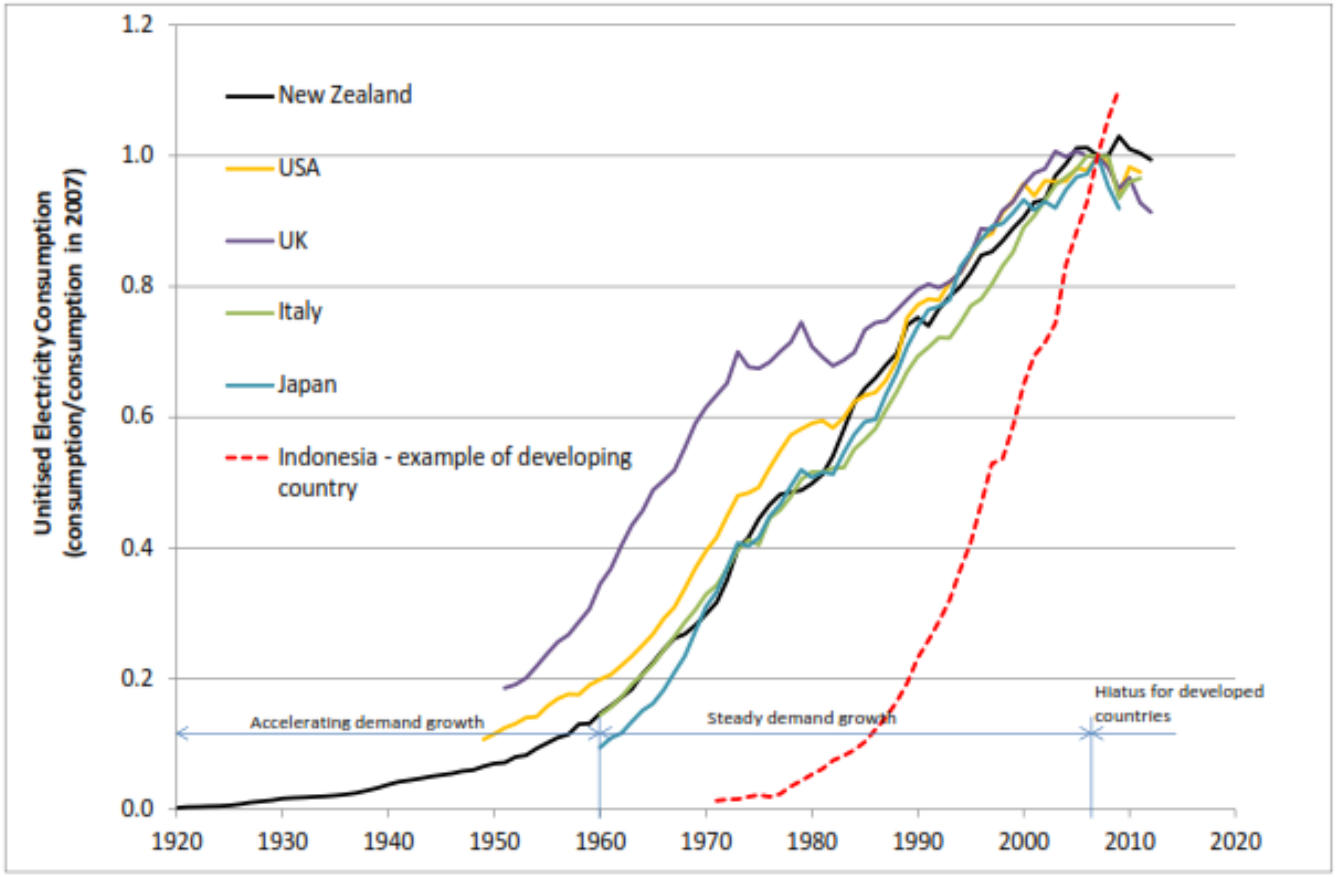
Take charge.
With home-grown energy.

NEW ZEALAND

BUILDING OUR GEOTHERMAL INDUSTRY

THE START OF THE JOURNEY

- Like many countries in the late 1940s New Zealand saw a steady growth in electricity demand
- Satisfied by hydro in pre war days, new and secure alternative sources were needed as concerns grew over the supply of fossil fuels



NEW ZEALAND

STRONG SCIENCE, A WILLINGNESS TO EXPERIMENT & EXPLORE - EARLY SUCCESS

Power from beneath the earth harnessed for electricity production

NEW ZEALAND

WAIRAKEI – A WORLD FIRST AND THE CORNERSTONE OF THE NEW ZEALAND GEOTHERMAL INDUSTRY

A reliable source of some 1200 GWh for more than 50 years and still delivering……

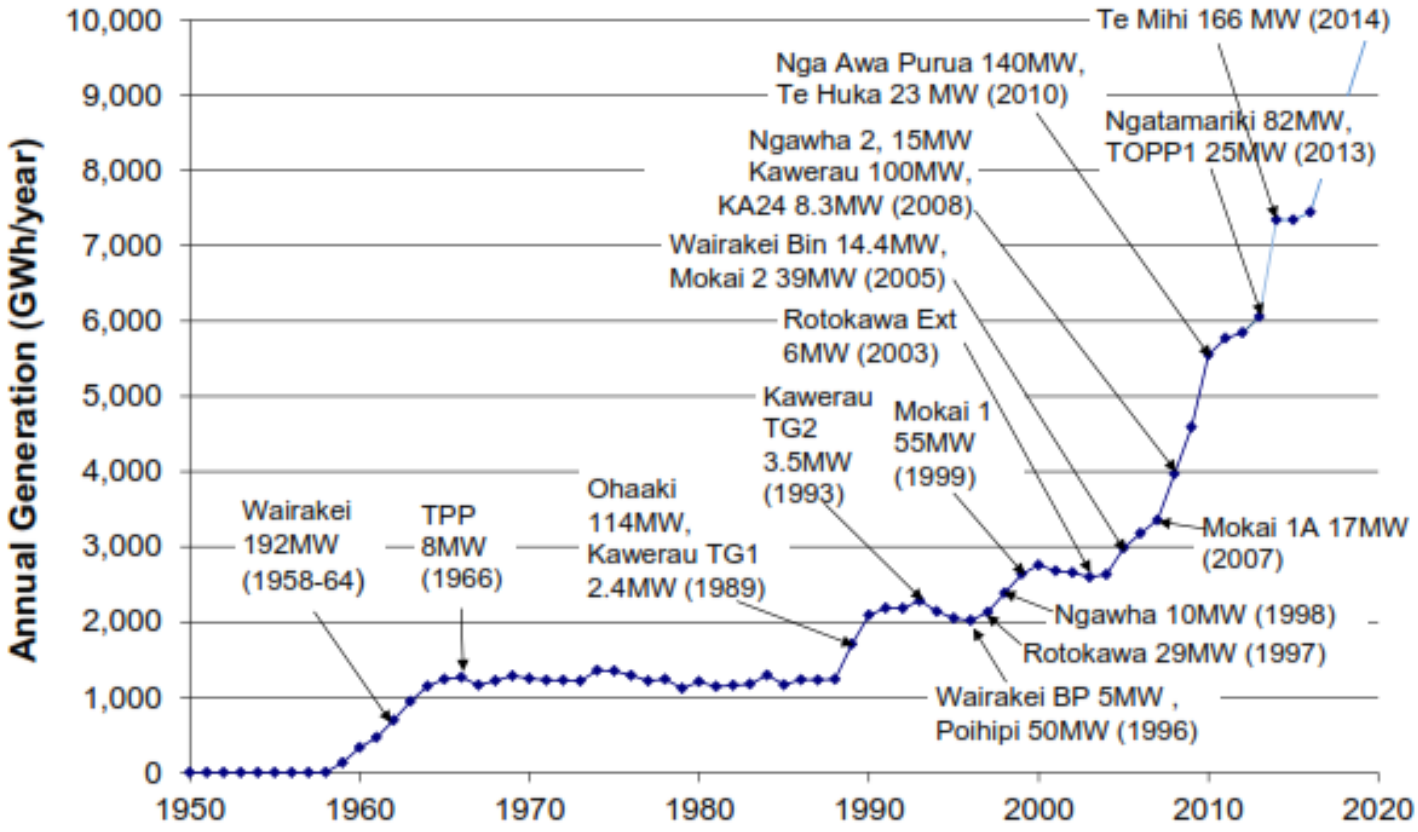
NEW ZEALAND

KAWERAU – LARGEST INDUSTRIAL USE OF GEOTHERMAL ENERGY

- Early commercial (private sector) opportunities identified for the use of geothermal for both process heat within the pulp and paper industry
- Progressively increasing level of captive power generation for paper and forestry processing;

A LONG TERM STRATEGY AND COMMITMENT

Over sixty years of development



NEW ZEALAND

KEY FEATURES OF SUCCESS

- Government funded early exploration including exploratory drilling
- Wairakei and a number of subsequent plants built by state electricity corporation
- More recent projects have been “brownfield” using existing information collected by government activities
- Geothermal is treated like water – rates of withdrawal and reinjection defined
- Development rights are controlled through land ownership
- Resource consent processes well established
- Geothermal commercially attractive within available energy mix

- Utilities have invested some $2 billion over last 8 years in new plant so that geothermal now supplies almost 20% of New Zealand’s electricity:

NEW ZEALAND

RECENT PLANT ADDITIONS

NEW ZEALAND

INTEGRATED USE OF GEOTHERMAL RESOURCES

"We will act as a beacon of hope and prosperity for our people"
Tuaropaki Trust, owners and developers of the Mokai resource

NEW ZEALAND

SUMMARY

- New Zealand is fortunate to have a good level of accessible renewable energy sources
- Our hydro resources are largely exploited; we have considerable additional geothermal and wind sources yet to be tapped
- The electricity market is deregulated and production costs and retail prices support a healthy market operation
- Development of renewables is determined by land owners
- Maori iwi, under whose land many of our geothermal resources are found, are active commercial partners in the newer developments
- Geothermal is a key primary energy source for industrial and agricultural processing and these integrated uses are being encouraged
- While we recognise that the approach we have used may not offer universal solutions, we welcome the ongoing opportunities that we have to share this experience with others as they build their geothermal and wider renewables markets.

NEW ZEALAND

SHARING OUR EXPERIENCE WORLDWIDE

- Early international engagement under UNDP programmes in 1960's
- DSIR & MWD took science & engineering to the world; household names; Healy, Mahon, Giggenbach, Glover, James, Hochstein, Bolton, Dench, Stillwell…
- Commercial consultancy focused on Indonesia, Philippines from early 1970's

NEW ZEALAND

CONTINUING INTERNATIONAL COLLABORATION

- Kenya
- Ethiopia
- Mexico
- Japan
- Azores
- Colombia
- Ecuador
- Kamchatka
- El Salvador
- Nicaragua
- Chile
- Caribbean
- Comoros
- And the list continues to grow……

NEW ZEALAND

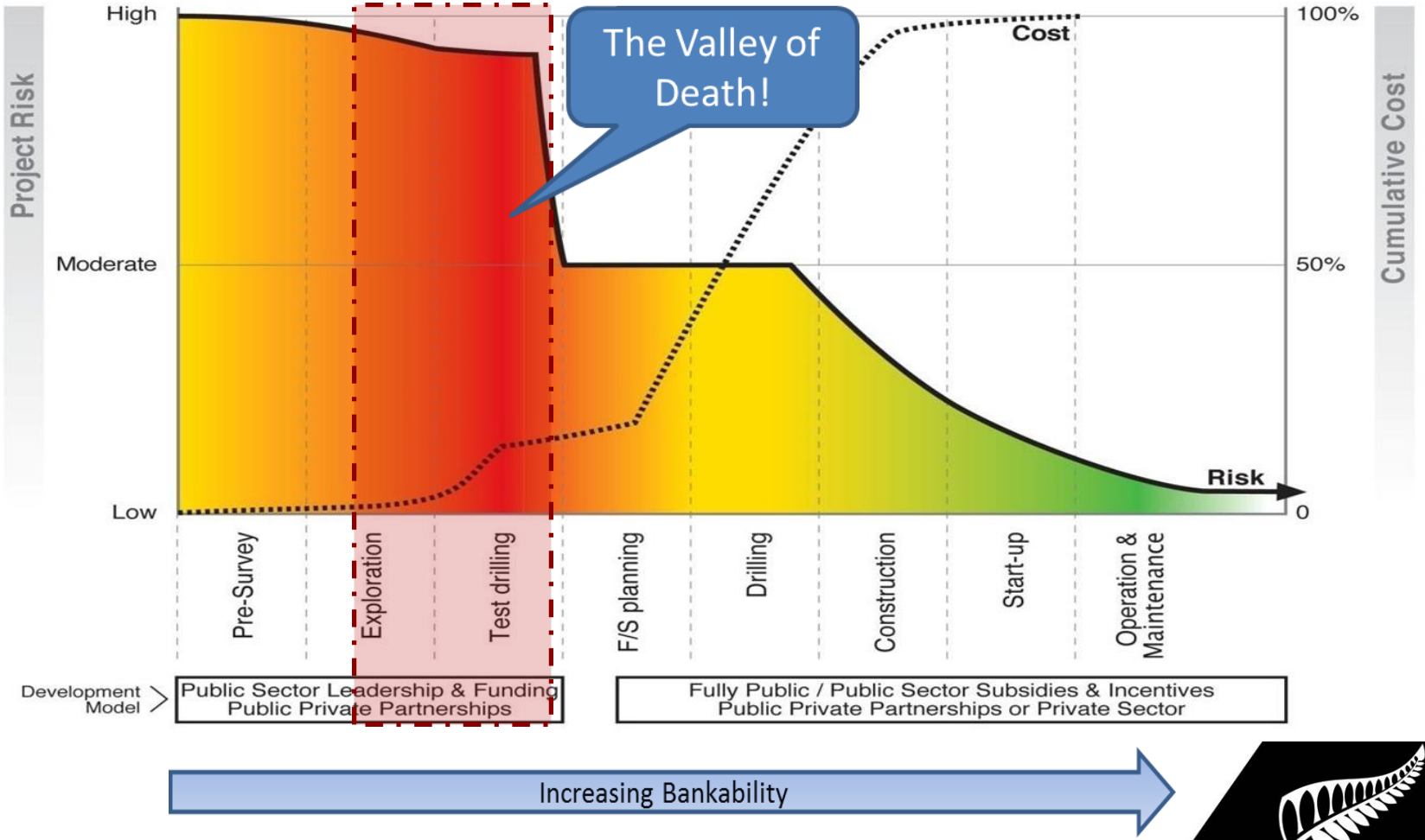
NEW CHALLENGES, DIFFERENT MODELS

Mighty River Power undertakes greenfield exploration in Tolhuaca, Chile

Mighty River Power invests in USA plant – 2011 commissioning of 49.9 MW John Featherston – Imperial Valley

NEW ZEALAND

MOVING INTO GREENFIELDS



NEW ZEALAND

RISKS

- Risks are not just those that are “geothermal”
  - Resource risk
  - Reinjection performance

  but equally important
- Those we can influence:
  - Construction Risks – an EPC approach
  - Financial risks – appropriate financial structuring
  - Market risks – security of off take agreement
  - Management risk – choose the very best
- Those we may have less control over
  - Country and political risk – some insurance possible

NEW ZEALAND

WHAT'S NEEDED FOR NEW PROJECTS

- Equity for the early phases
  - Need a strong corporate balance sheet or
  - Need investors who will take appropriate risks
  - Need project returns that meet these investors needs
  - Risks are economic, financial and political
  - *This balance is never easy*
- Debt for those stages once risk is reduced
  - Resource capacity and performance defined
  - PPA in place
  - EPC committed
  - *Likely that a syndication of banks may still be required*

NEW ZEALAND

MARKET RESPONSE

- There is a key challenge in all markets to finance the exploration / exploratory drilling phase
- Donor / grant funding has played a key role in opening opportunities in the past
- Emerging market support is attempting to address this financing
- Debt is available but banks still see geothermal as high risk influencing the cost / tenor of debt and a need for syndication
- Private sector interests exist but few specialised facilities have been established; corporates with strong balance sheet entering market
- To attract investment the risk reward profile must be appropriate; we compete with all other investment opportunities in the energy markets, many of which are much better understood and seen as less risky.

NEW ZEALAND

GEOTHERMAL NEW ZEALAND INC.

- A collaboration amongst leading consultants, service providers, contractors and construction companies
- Seeking international opportunities over and above our traditional consulting support; training growth
- Clearly Indonesia, Chile, Philippines and Kenya are key target markets
- Strong partnerships with international companies – manufacturers and EPC contractors
- Companies active in Indonesia and Kenya

GEOTHERMAL
New Zealand

NEW ZEALAND


GNS
SCIENCE
TE PŪ AO


MIGHTY RIVER POWER


Fitzroy
ENGINEERING


Hawkins
Infrastructure
A Division of Hawkins Construction Ltd


JACOBS


Eastland
Generation


Beca


Wintec
WAIKATO INSTITUTE OF TECHNOLOGY
Te Kuratini o Waikato


PROGEN
LTD


GEOTHERMAL
INSTITUTE


ReExCapitalAsia
connecting capital with clean energy


Geothermal Consultants
New Zealand Limited


mtl


GEOTHERMAL
New Zealand


NEW ZEALAND


NEW ZEALAND
A PIONEER
IN GEOTHERMAL
DEVELOPMENT
mike.allen@geothermalnewzealand.com