The Big Picture of Geothermal in New Zealand

Exploring our current generation and direct uses, and where major players see the industry heading in the next five to ten years

Andy Bloomer

Introduction

My talk will be in two parts:

1. An update on the current state of the NZ geothermal industry, with a look back to look forward.
2. A brief review of recent activities within the NZ Geothermal Association

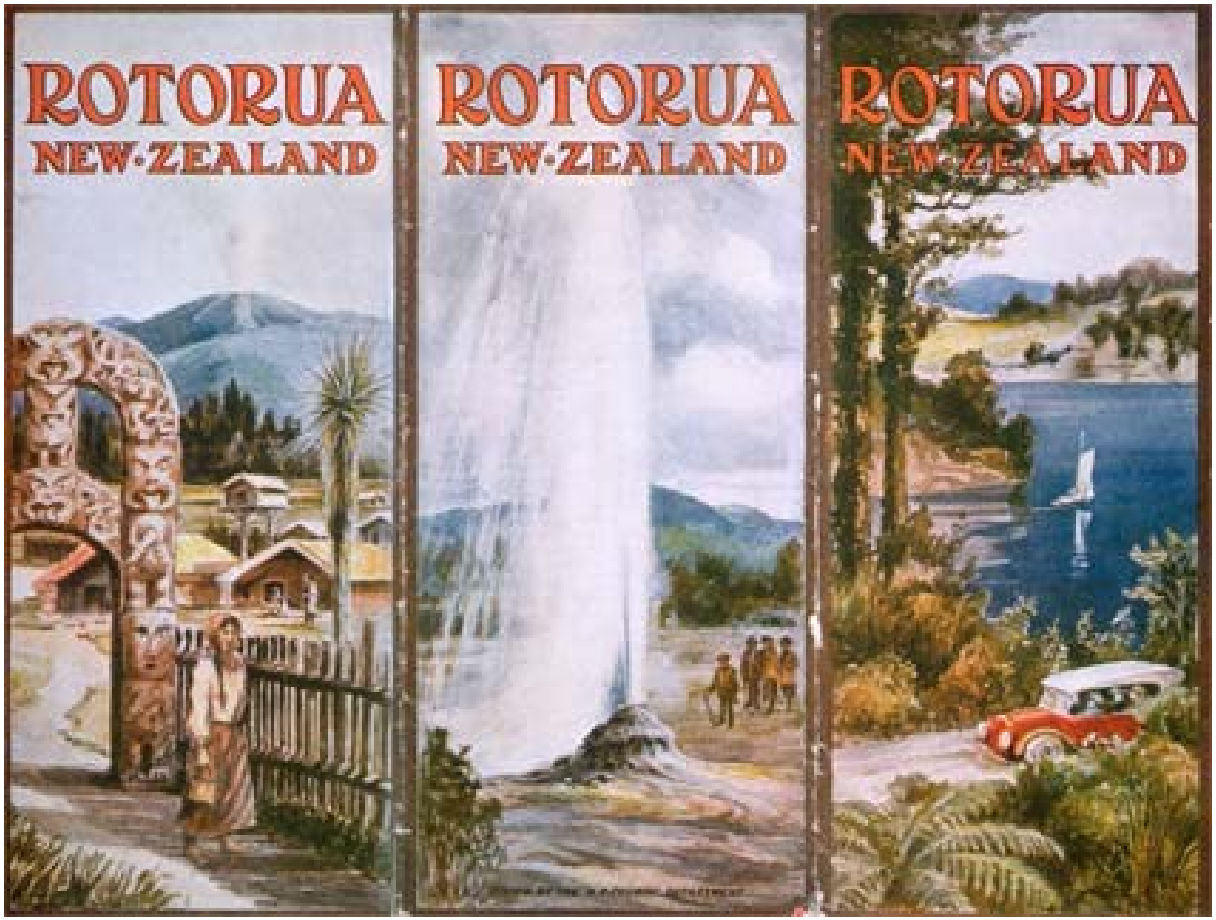
The New Zealand geothermal industry works in cycles rather than following a smooth trajectory.

We have just seen a the high activity cycle and are now looking at a quieter period for the immediate future.

A Look Back

Direct Use Including Tourism

Commercial direct use dominated by tourism - energy used is relatively modest.
Oldest use is domestic: bathing, heating, cooking.



A Look Back

Tourism and Commercial

Wairakei Terraces

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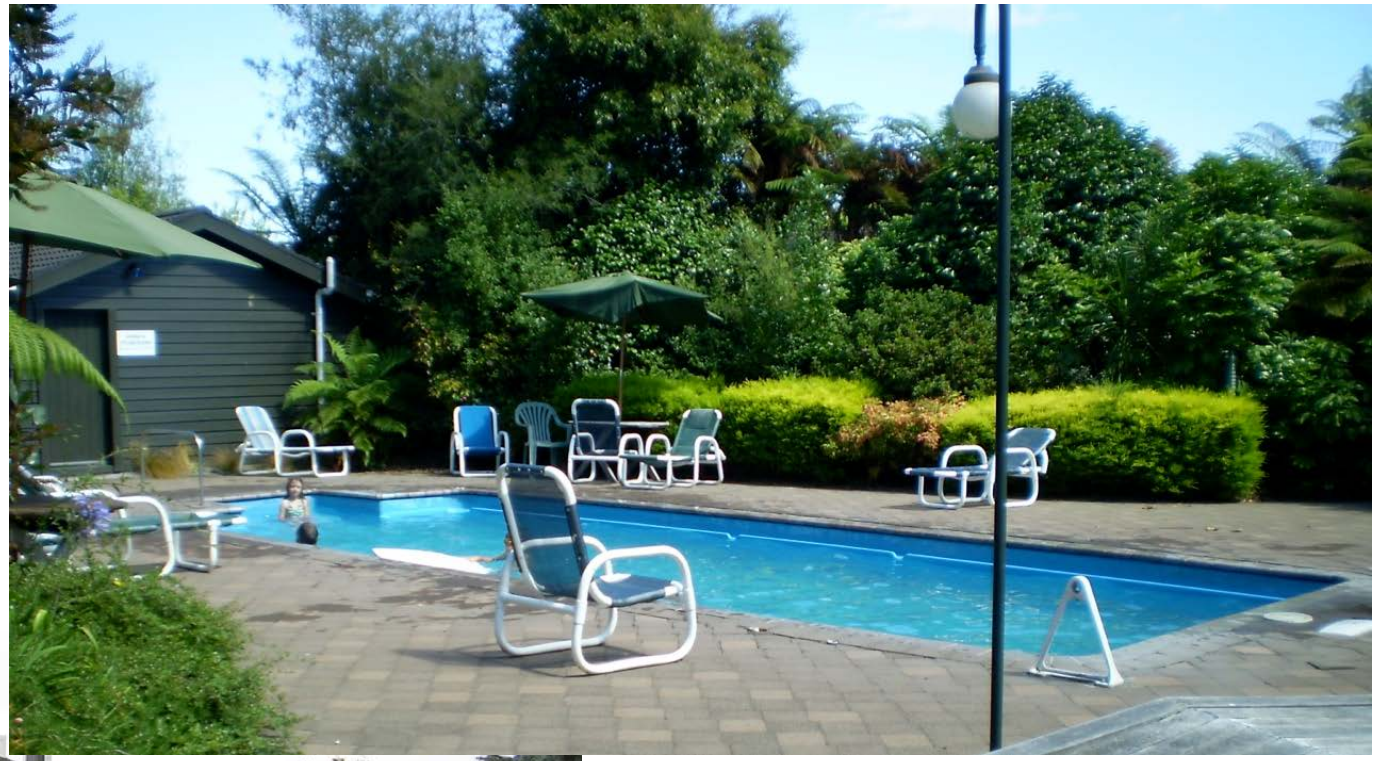
A Look Back

Tourism and Commercial



Alpin Motel, Rotorua

A Look Back

Tourism and Commercial

Ngawha Springs:
old mercury mine,
geothermal features
and bush walk

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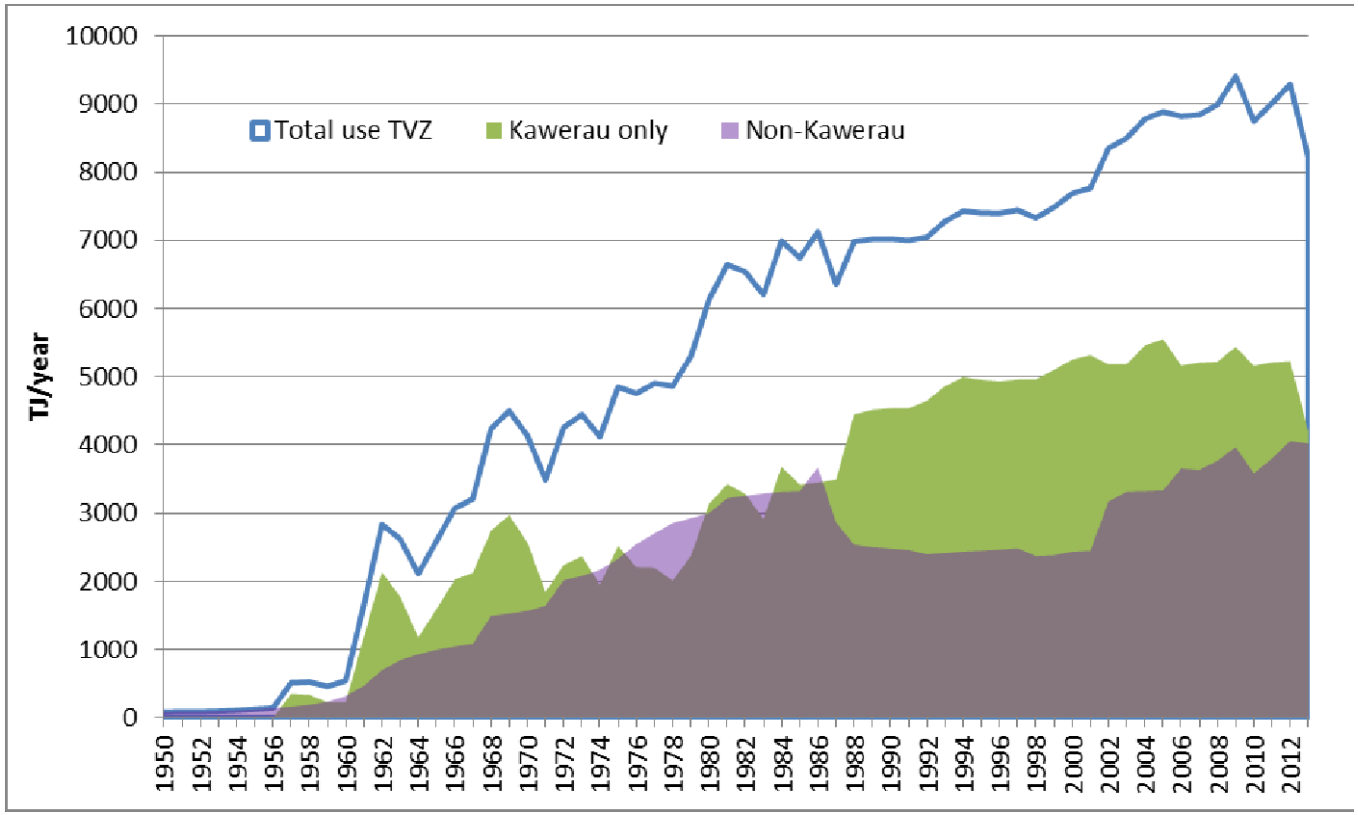
A Look Back

Direct Use - Breakdown

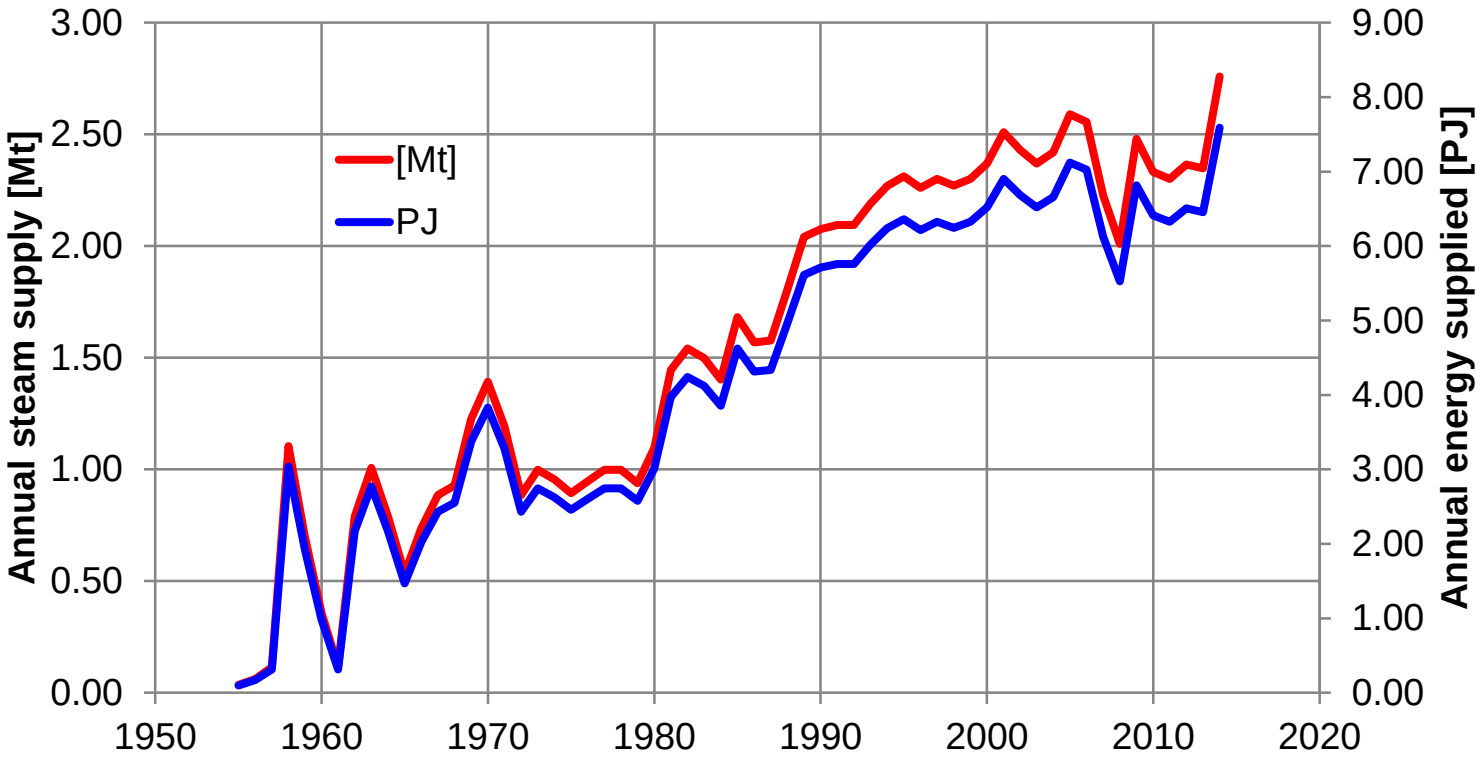
Estimated annual energy use (TJ) since the 1950s in New Zealand (blue), Kawerau (green) and the Taupo Volcanic Zone outside of Kawerau (purple).



From Geothermics Special Edition 2015: Climo, Milicich, White

A Look Back

Direct heat use increased significantly with supply to the Kawerau pulp and paper mills in 1957.



Total steam supply at Kawerau from the NTGAL steamfield.

Increasing use for electricity from 2012

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A Look Back

The largest geothermal direct heat use internationally.
But the trend is to use the steam for electricity generation rather than paper making.

Paper drying at Kawerau using geothermal steam.

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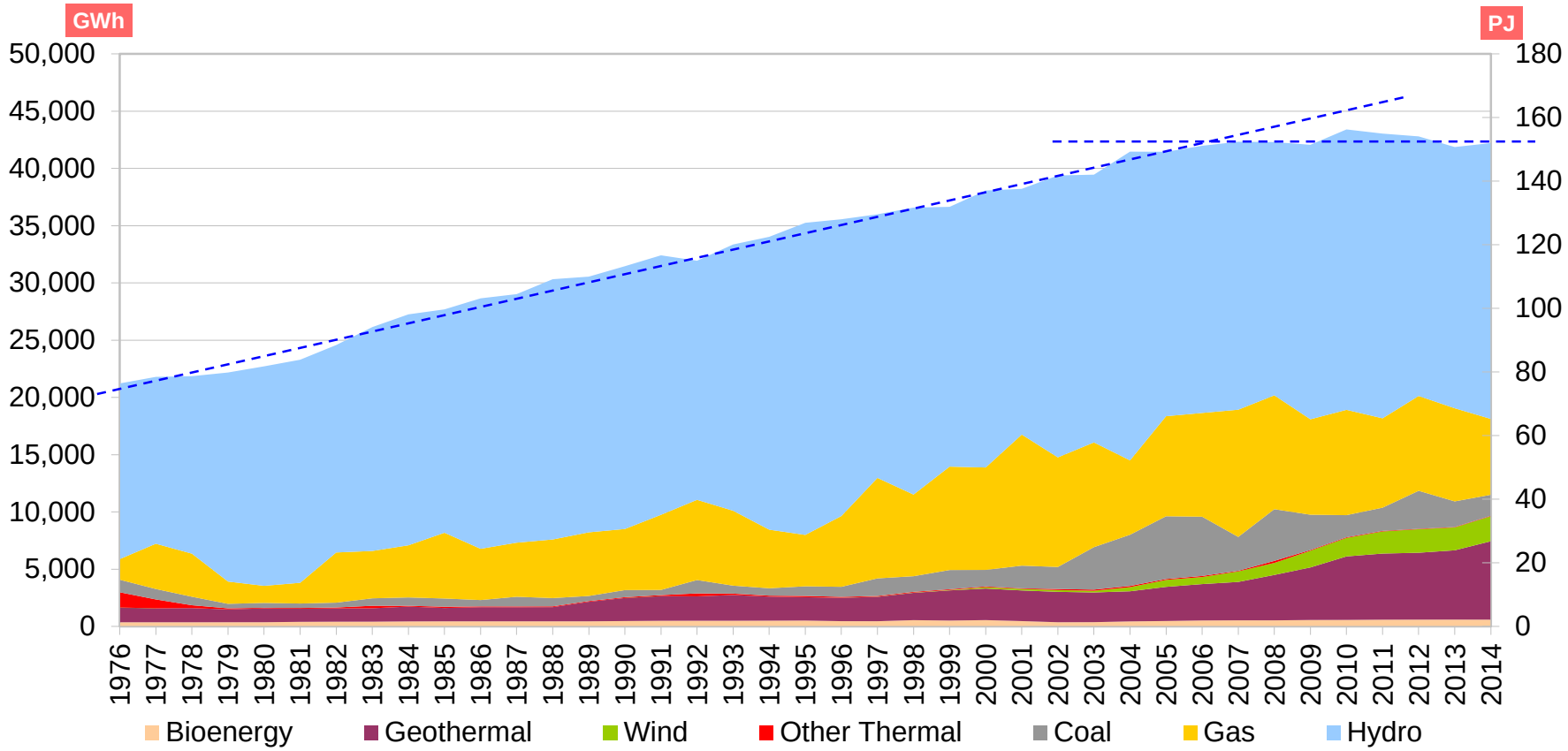
A Look Back

Electricity

Generally steady increase in overall demand – shift in the sources – flat since 2006 – dropping from 2010



MBIE data

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A Look Back

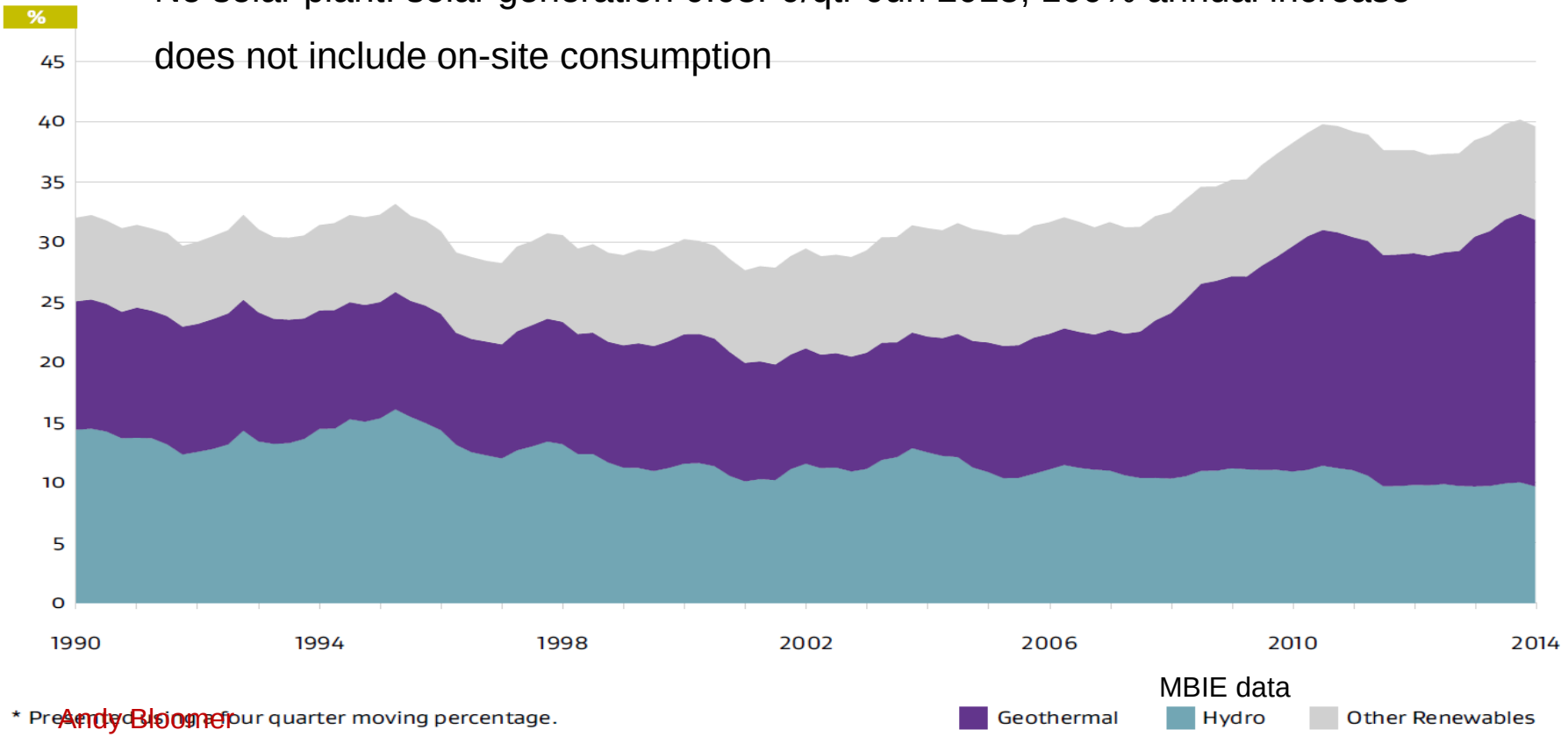
Renewable energy

Total primary energy supply contribution from renewable

NZ at 38% is 3rd in OECD (after Iceland and Norway)

75% of electricity from renewables in 2013, 4th in OECD: rising - 86% Mar 2017

No solar plant: solar generation 0.03PJ/qtr Jun 2015; 100% annual increase – does not include on-site consumption



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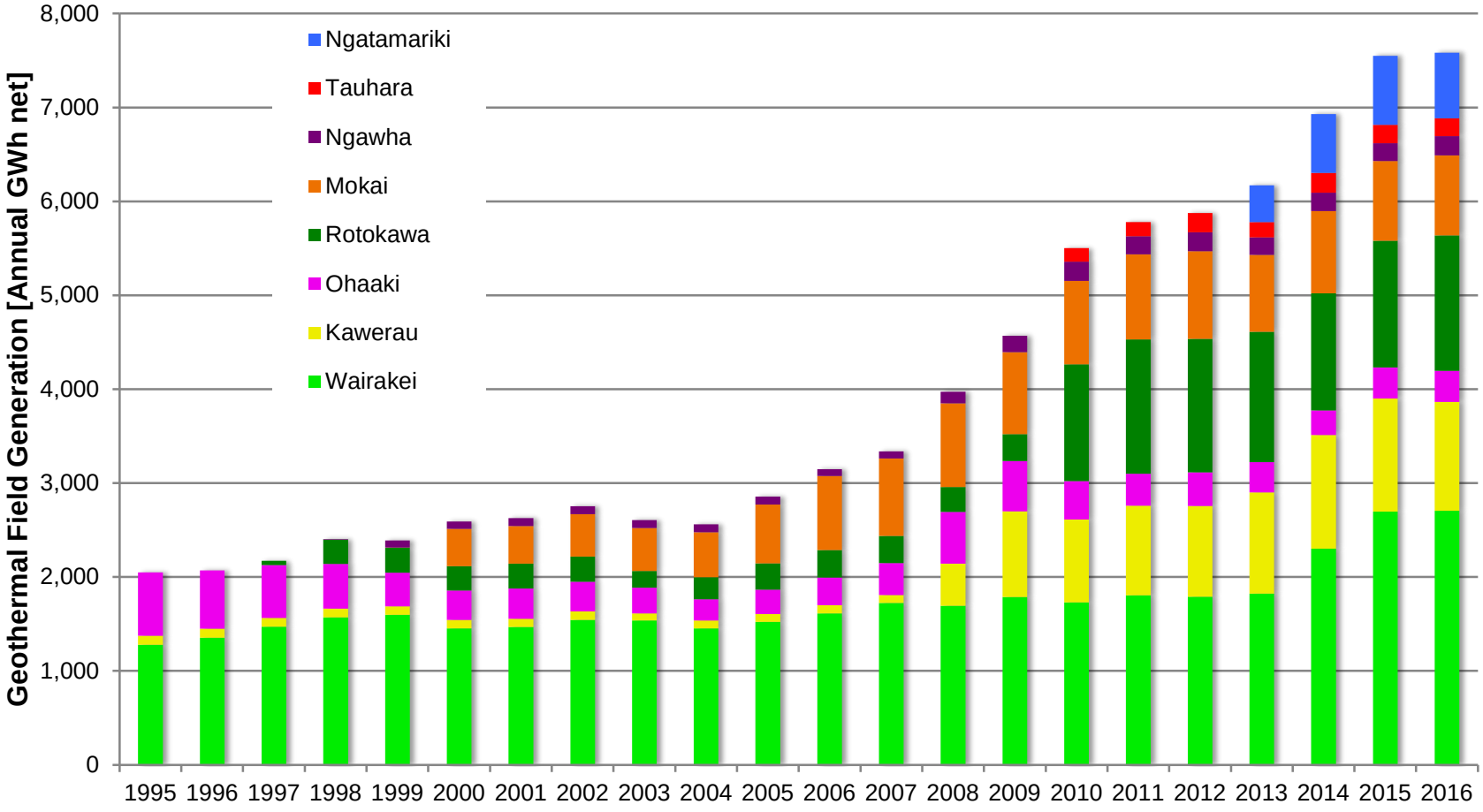
A Look Back

Geothermal Generation by Field since 1995

Marked increase since 2008, but smaller projects since 1998



Contact Energy graphic

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A Look Ahead

Summary

Flat electricity demand growth – from successful conservation methods – large generation projects on hold. Smaller companies/plants are continuing:

- Top Energy at Ngawha in Northland
- Te Ahi O Maui at Kawerau.

Mercury and Contact are promoting electric vehicles (EVs)
– use renewable electricity instead of transport fuels
– reduce greenhouse gas emissions
– increase electricity demand
– make use of new geothermal generating plant.

Continuing interest for direct industrial use:

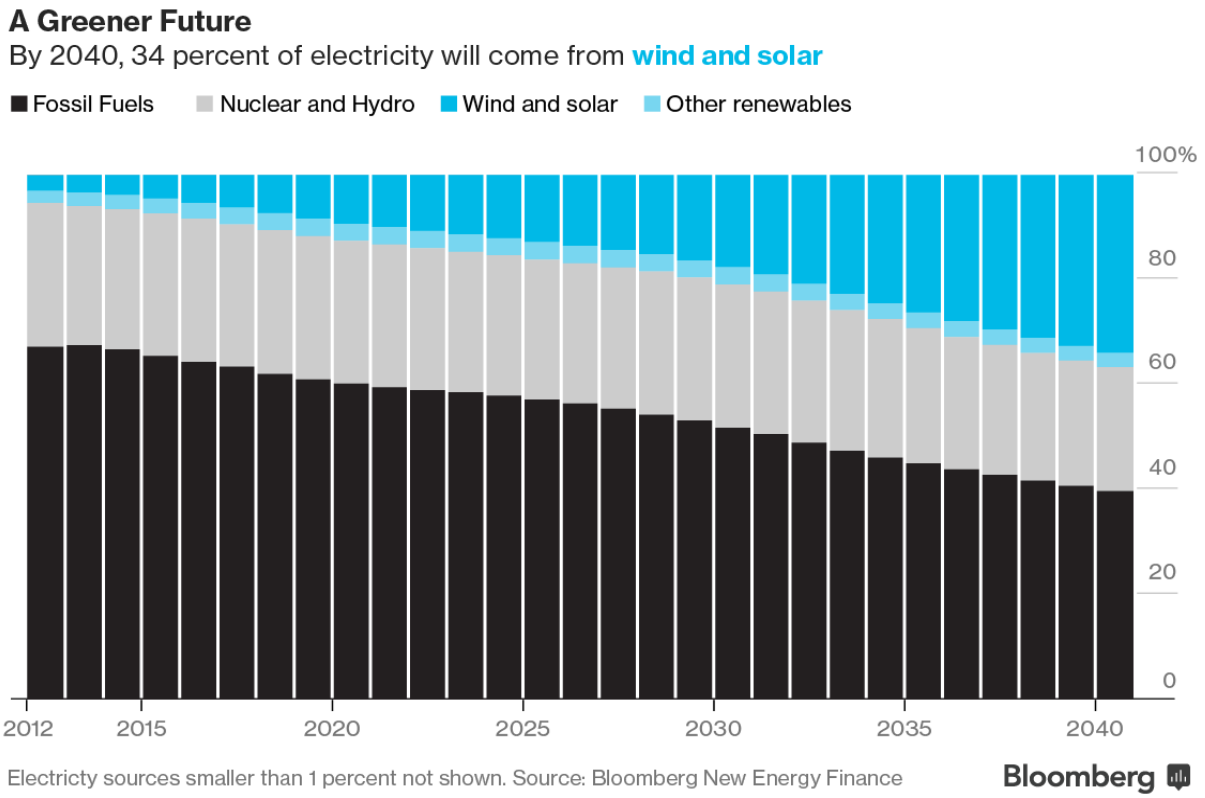
- Contact Energy in Tauhara
- Tauhara North No.2
- NTGAL and Putauaki Trust in Kawerau

A Look Ahead

International Forecast for Renewables

Renewables for electricity production to overtake fossil fuels by 2040. Bloomberg's *Renewable Energy Future Report* predicts the following mix.

Change driven by cost (including emission charges).



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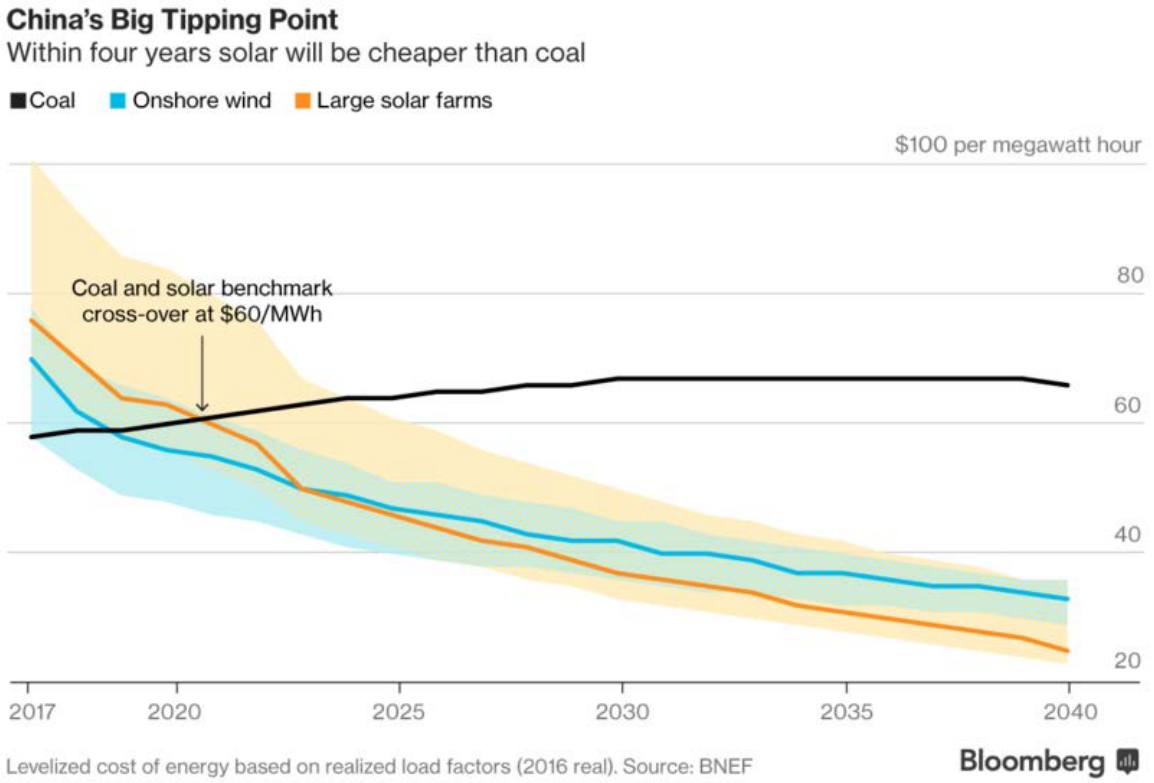
A Look Ahead

International Forecast for Renewables

Photovoltaic panels (PV) cost in 2016 ≈ 25% of 2009 cost;
likely to fall another 66% by 2040.

Onshore wind cost in 2016 ≈ 70% of 2009 cost;
likely to fall another 47% by 2040.

Battery costs are falling rapidly - will advantage both EVs and PV systems.



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A Look Ahead

How do International Forecasts Relate to NZ

Bloomberg has natural gas continuing – 16% more generation capacity – to balance a grid increasingly dependent on intermittent sources: wind and solar.

Comparison to New Zealand is unclear:

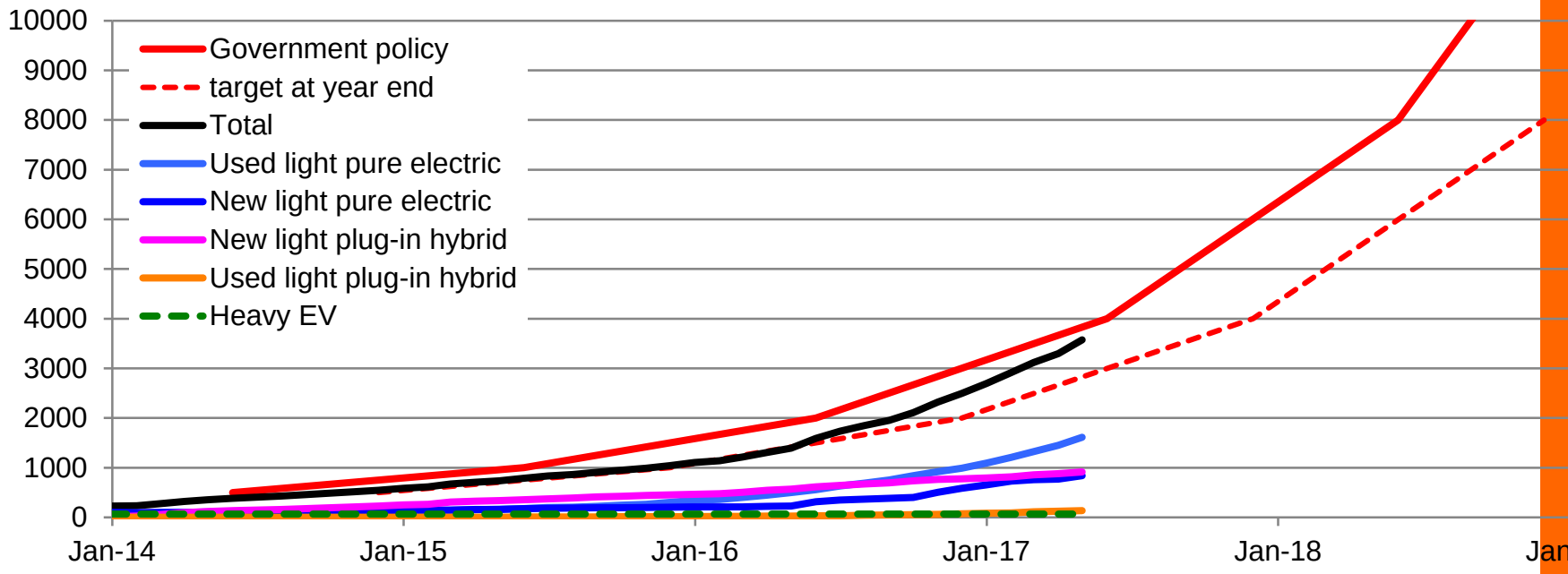
- NZ electricity generation mix already predominantly from renewable resources.
- Costs structures are different – currently no subsidies to reduce GHG emissions
- Flatter demand growth

A Look Ahead

Electric vehicle (EV) uptake in NZ

Energy News, *Annual New Zealand Electricity Survey 2017*

- 50% of respondents expect 10,000 vehicles within two years; two years sooner than in the previous survey. (Govt. goal of 64,000 by 2021)
- "Respondents also believe EVs will have the biggest impact of any technology on the electricity sector during the next year, followed by battery storage and increasing solar-plus storage".



A Look Ahead

Industry Views

Major industry players update the state of the industry as seen by their company at the NZGA sponsored “Industry Session” at the Geothermal Workshop.

I have summarised some of those points of view in the following slides

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A Look Ahead

Contact Energy

Ted Montague

- Total generation > 9,000 GWh
- % renewables up to 82%
- Cost of electricity down to $32/MWh
- Geothermal generation a record high ≈ 3,200 GWh.
- Plant availability returns to norms ≈ 95%
- Electricity conversion efficiency improving

Geothermal increasingly important part of earnings: 22% in 2012 – 33% in 2016

Contact plans to expand geothermal energy to large-scale direct use. To:

- Expand local employment;
- Strengthen grid based power demand
- Increase NZ exports.

Contact recognises the problem associated with cycles: skills learnt during the up cycle easily lost in the down cycle; people move into other areas.

Contact is making a deliberate move to retain skilled staff, including looking for offshore opportunities to provide expert advice in geothermal operations.

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A Look Ahead

Mercury Energy

Nick Clarke

Geothermal ≈ 16% of NZs total electricity supply

Second behind hydro

Output doubled over the past decade

Three major projects by Mercury

- Kawerau 100 MW (completed 2008)
- Nga Awa Purua 138 MW (completed 2010)
- Ngatamariki 82 MW (completed 2013)

“Premium renewable”

- Small physical footprint
- Sustainable heat reservoirs 2-3km underground (closed cycle, re-injection)
- Base-load, normally runs 24/7; the only renewable not weather-dependent
  2x output of hydro; 3x wind; 6x solar

Geothermal displacement of gas/coal generation is the single-biggest reduction to date in NZ’s emissions: 2 million tonnes CO_2-e per year

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A Look Ahead

Top Energy

Ray Robinson

Ngawha Expansion

- Consent for 50MWe expansion, 2 x 25MWe stages, granted February 2016.
- The design work to establish costs for the first 25MWe station under way.
- Business case to the Board and Trust in September 2017.
- Assuming approval is granted:
  enabling works November 2017
  production well drilling in March 2018.
- Commercial operation is scheduled for June 2020.

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A Look Ahead

Tauhara North No2 Trust

Kevin McLoughlin

The Trust has land at Rotokawa and investment in the Rotokawa steamfield.

It has access to steam from wells that are not suitable for commercial production but have temperatures of up to 220 degrees C: these can be made available for small to large projects.

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A Look Ahead

Ministry of Foreign Affairs & Trade

Tiffany Babington

New Zealand's aid is to develop shared prosperity and stability in our region and beyond, drawing on the best of New Zealand's knowledge and skills

12 investment priorities; 4 in the global reach programmes including flagships of **renewable energy** and agriculture.

Africa:
The NZ Drilling Code of Practice
Comoros: partnership
NZ Africa Geothermal Facility

Indonesia:
World Bank technical assistance
Geothermal training
Scholarships

Latin America and Caribbean
Geothermal energy is the cornerstone of the NZ partnership

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A Look Ahead

Conclusion

Future geothermal energy use growth is likely to come from:

- Increased demand from new uses, in particular electric vehicles
- Increased direct heat use:
  larger industrial commercial use, but also smaller domestic

Both will help reduce New Zealand's CO_2 emissions.
There may be limited subsidies or assistance available.

Smaller, niche, electricity generation opportunities are progressing anyway

- Top Energy at Ngawha in Northland
- Te Ahi O Maui at Kawerau.

Geothermal tourism is another potential growth area, with opportunities for employment and regional development:

- Scenic
- Bathing
- Spas

Competition in the electricity generation area will come from solar and wind.

Hybrid plants may be an option – using the advantages of each, combined with batteries, to move to a more renewable New Zealand.

What's happening in the NZGA

Web site development

- Process to make it the prime source of information and detailed communication.
- Incremental changes will be made as we go

Member Survey Summary

Thanks very much to all those who responded

- 67 respondents (≈ 20%).
- Our primary function is on-target; some feedback for more 'active' engagement
- Most respondents were unaware of website changes
- E-mail is still preferred method of communication
- Average, or a little above, satisfaction with membership benefits
- People belong to be identified with a professional body, for information and to network
- Lots of feedback on improving member value

Communication

- We plan to produce more frequent newsletters; in a different format: a brief item description with a website link for those who want more detailed information.

The survey results will be posted to the website, for those interested in more detail

What's happening in the NZGA

Member Survey

Q 1. What do you think should be the primary purpose of the NZGA?

To serve as an impartial body between industry and government in geothermal matters

Be the source of knowledge for events, seminars and conferences in the geothermal industry

Information sharing through industry, academic and regulatory changes to the NZ geothermal landscape

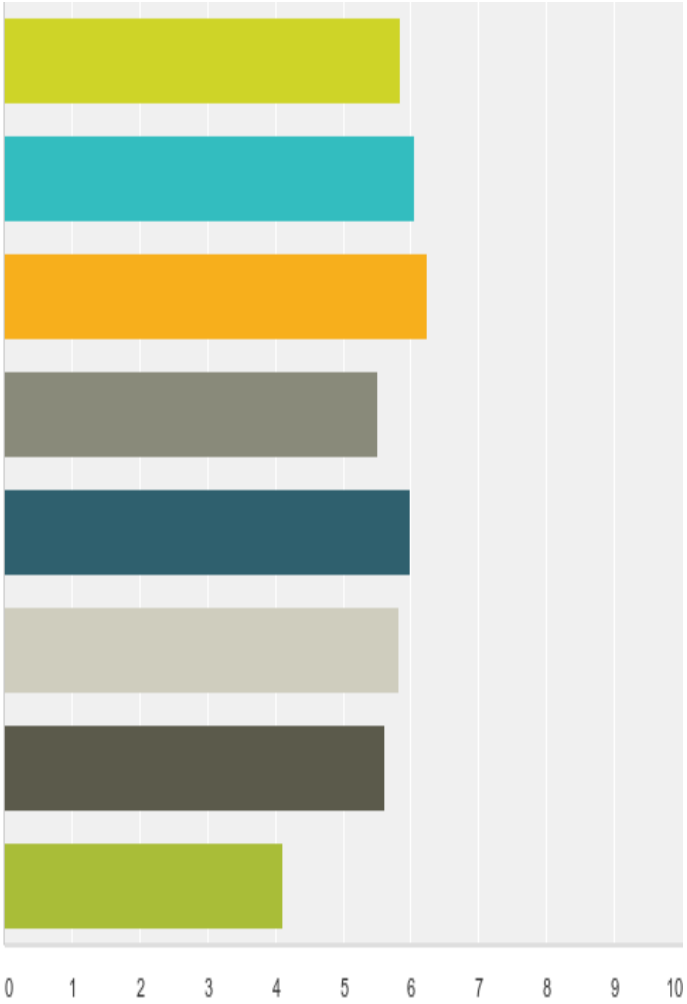
Be the superior means of communication for our membership community

Promoting geothermal capability and sector growth

Be an informed and impartial advocate of New Zealand geothermal legislation, policy and regulation

Promote collaboration with international governments, institutions and private agencies for the sustainable development of geothermal resources

Promote sustainable geothermal tourism in New Zealand



What's happening in the NZGA

Member Survey

Q 2. Were you aware that the NZGA website is in the process of being redesigned?

Yes = 25%, No = 75%

Q 3. What communication method would you prefer from the NZGA?

Email updates = 91%, Website updates = 26%, Social media = 15%

Q4. How would you rate the value you receive from being a member of the NZGA?

1	2	3	4	5	6	7	8	9	10
1.5%	9%	6%	8%	14%	17%	20%	23%	1.5%	1.5%

Q 5. What is your primary reason for being an NZGA member?

Identification with a professional body	91%
Education and information exchange	51%
Networking	51%
My company pays my membership	31%
Membership benefits	12%
Other	6%

(multiple choices possible)

What's happening in the NZGA

Member Survey

Q 6. What can we as an organisation to do improve member engagement/value?

(Rate on a scale from 1 to 5)	Average rating
Provide more regular updates on NZ geothermal activities	3.7
Publish more regular newsletters on NZ & international geothermal activities	3.4
Host more seminars	3.2
Engage members to actively participate in delivering on the NZGA's 5-year vision	3.2
Other	3.1

Q 7. Tell us about yourself

Professional area, etc.

Q 8. Age

<18	18 - 29	30 - 44	45 - 59	60+
0%	0%	29%	42%	29%

Q 9. Would you participate in a focus group

Yes = 27%, No = 73% (Most "yes" replies did not give contact details).

Q 10. Other comments

A number of useful suggestions

What's happening in the NZGA

Member Survey Response

What are we doing in response to the survey comments:

- Pleased to see that the responding members generally think that the NZGA is on the right track, however we can do better in most areas.
- Although the average response to Sustainable Tourism was lower than other areas, this is an area where we can do more to promote it.
- We are upgrading the website and will use it as our primary source of information
- We are running this seminar, which was one of the items seen as important. It was notified via a number of emails
- We will be putting out newsletters on a more regular basis. The first was supposed to go out last week but has been delayed.
- We will continue to make submissions on Government policy, eg., draft replacement NZNEECS (national energy efficiency & conservation strategy).