



A Supercritical Geothermal Inventory for New Zealand ?



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Room 306B 10:30
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Paper 604



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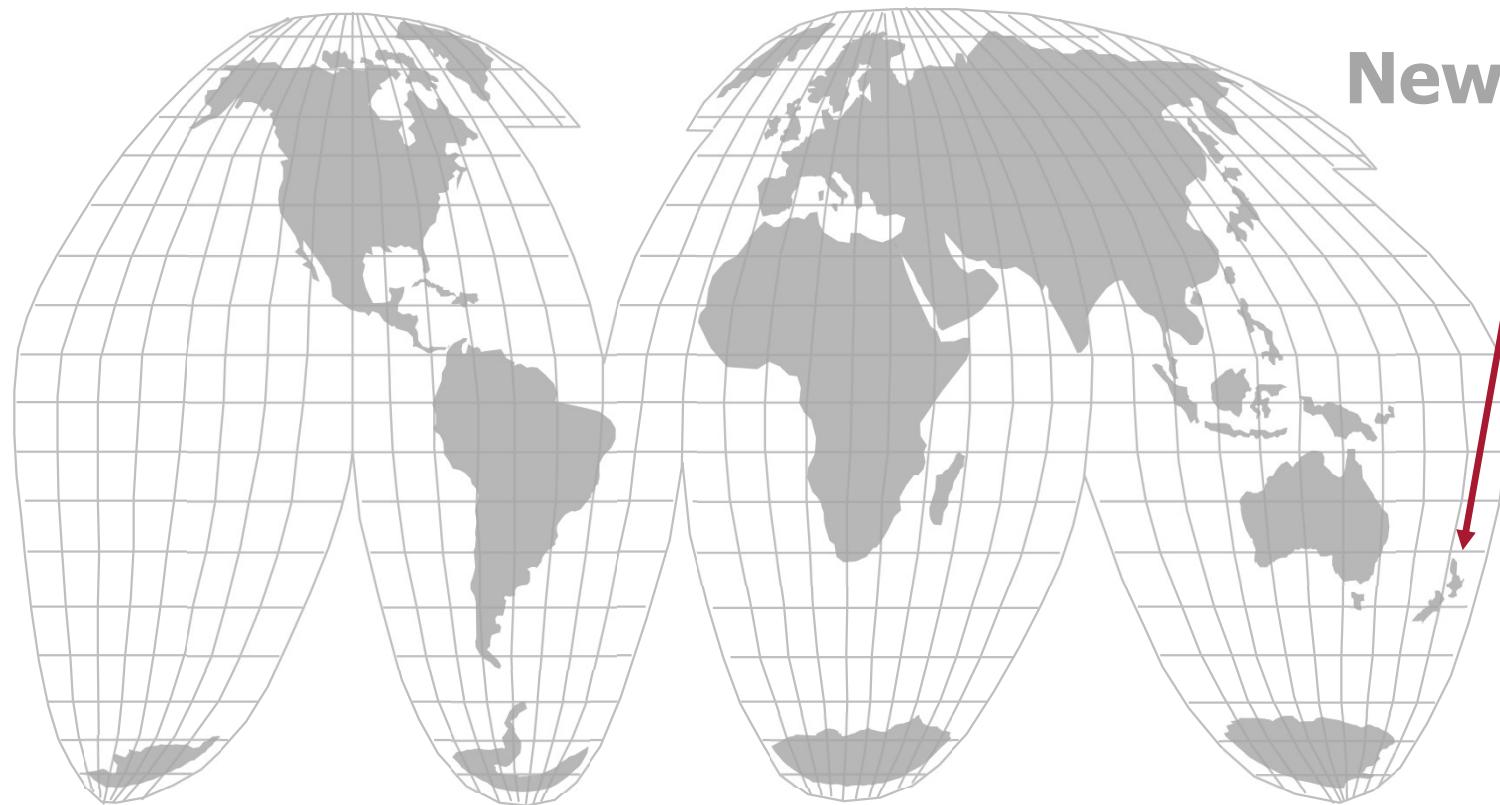
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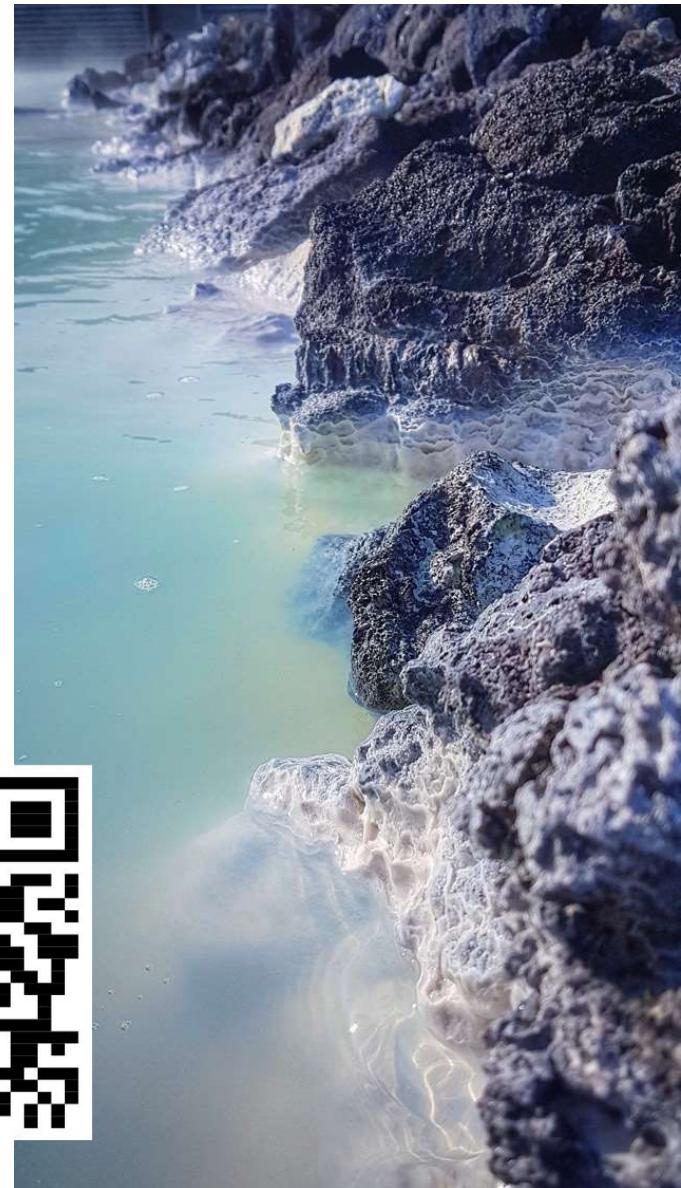
Where are we from ?



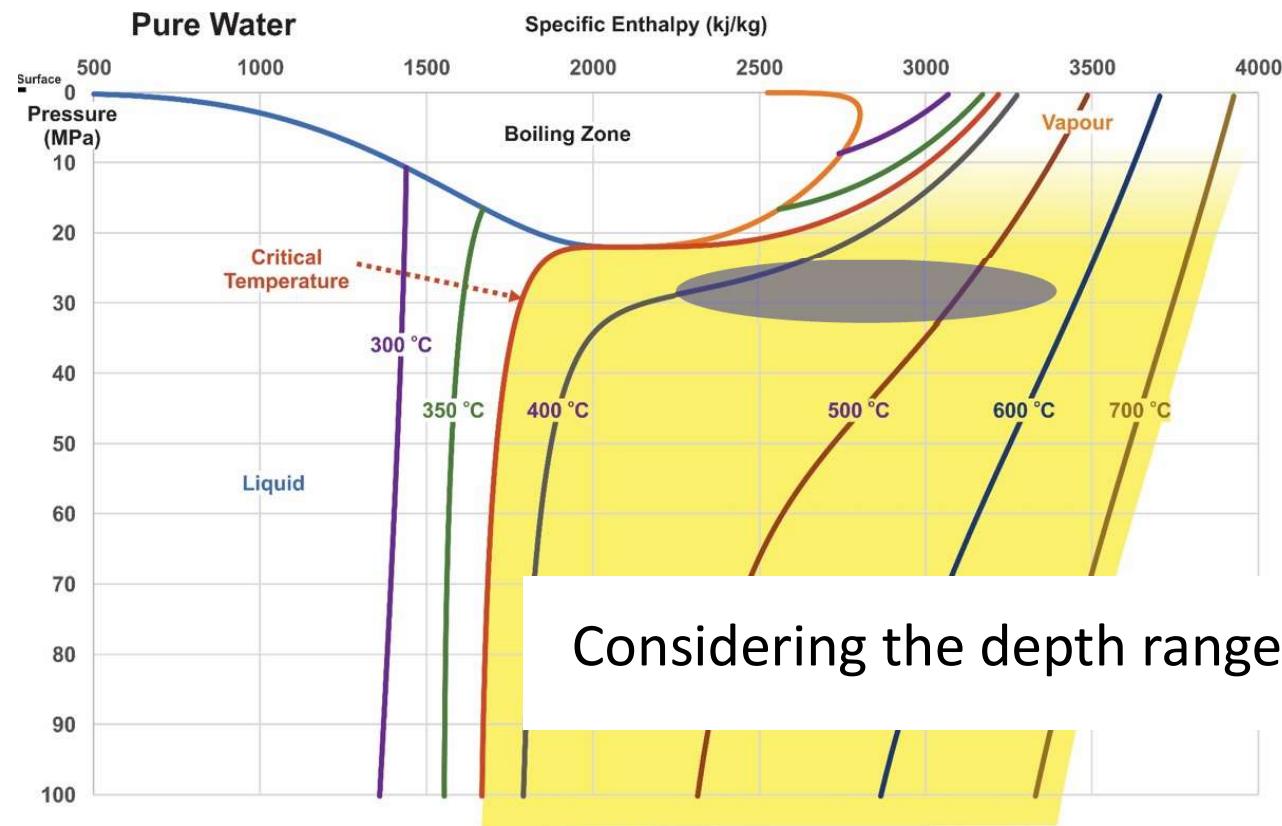
New Zealand



- Scientific Research
- MBIE Endeavour Funded research
 - Contract C05X1904
- 5 year Programme
 - To be Completed by March 2025
- Published outputs along the way
 - www.geothermalnextgeneration.com
 - Updates tab
 - Knowledge tab

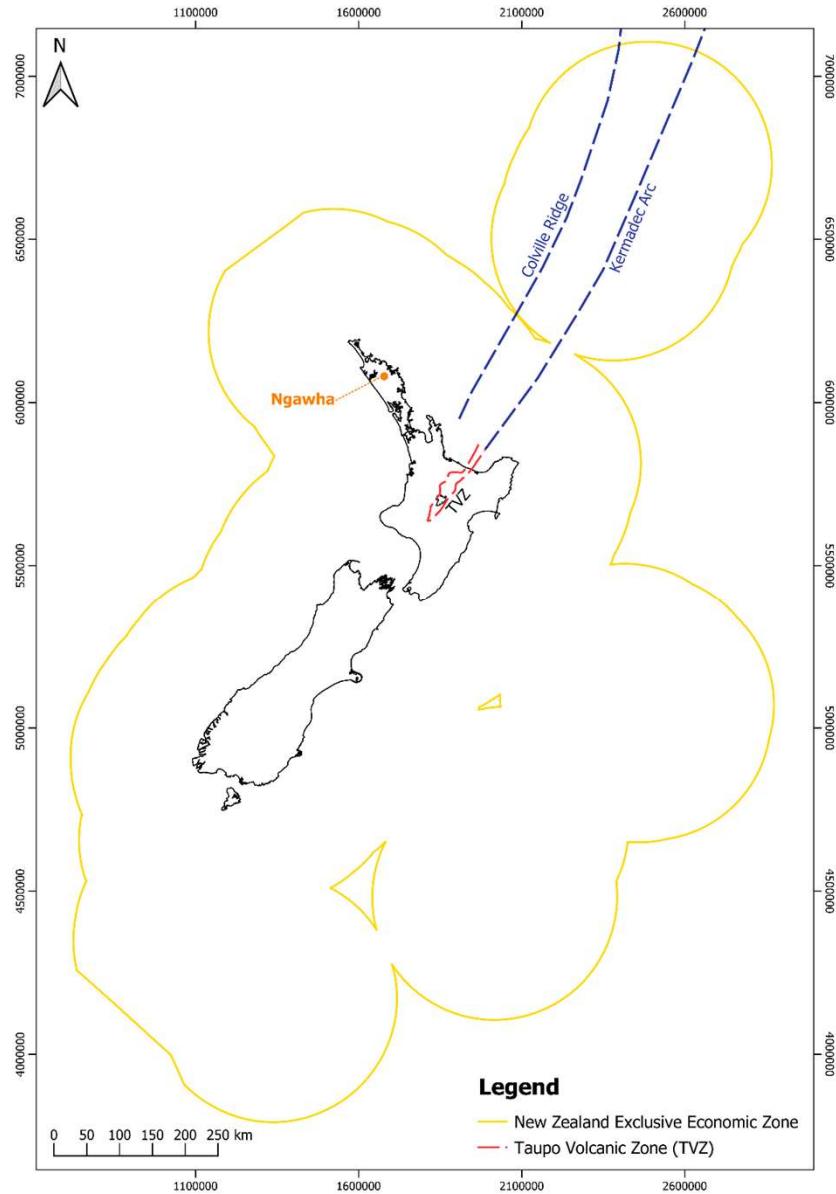


Focus on in-situ fluid in the supercritical / super hot state



And the locations

- New Zealand's Exclusive Economic Zone (yellow)
- Taupo Volcanic Zone (red)
- Ngawha (Orange)
- Also the 30 plus volcanoes on the Kermadec Arc (Blue)
- These will not included in the inventory for now



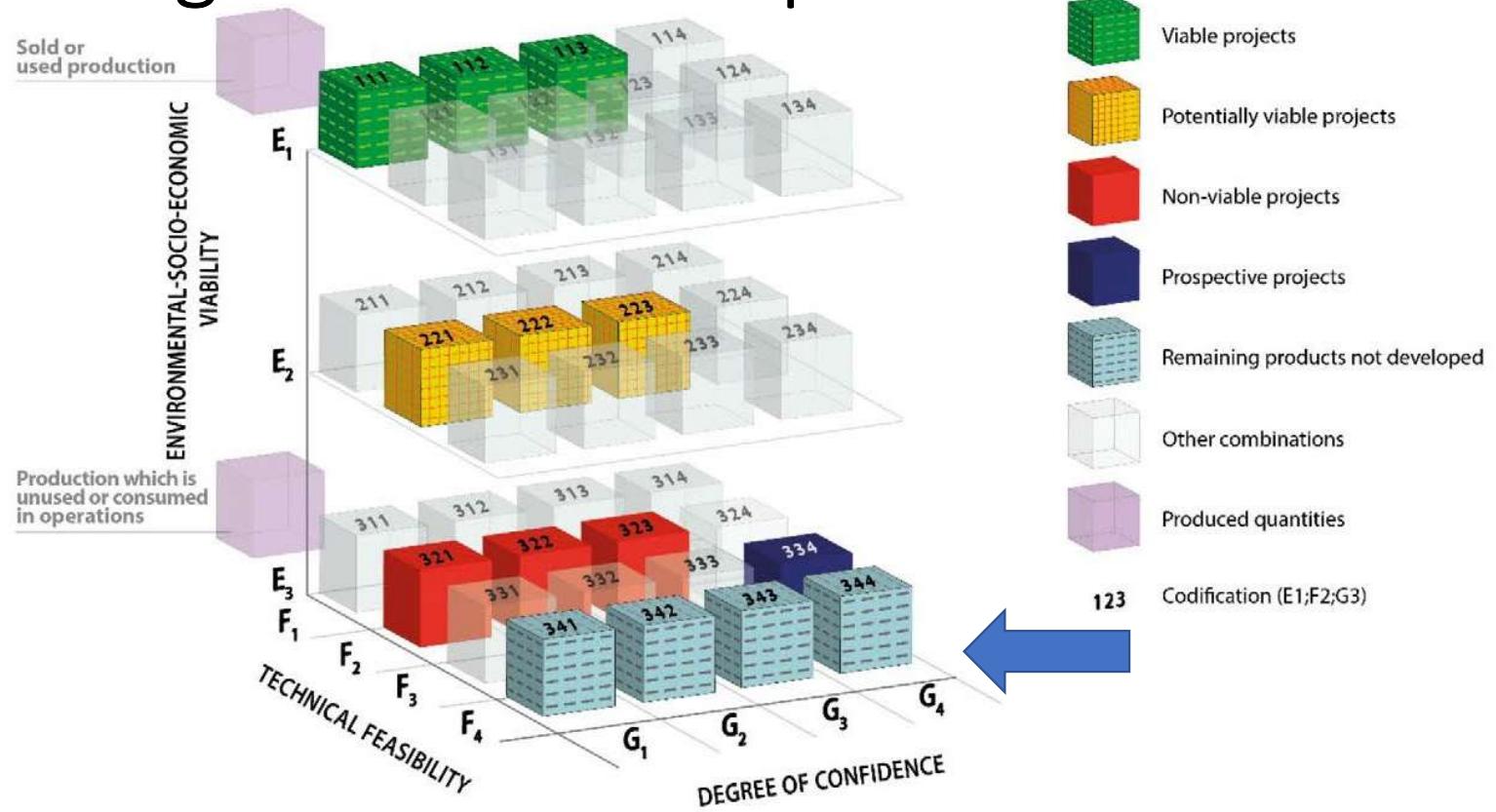
Developing the NZ inventory ..

Under the international geothermal framework developed by the UNFC / UNECE

- *UNFC 2019, United Nations Framework Classification for Resources Update 2019.*
- *UNECE 2022 United Nations Framework Classification for Resources Update 2019 (UNFC 2019) incorporating Supplementary Specifications for the Application of the classification framework to Geothermal Energy Resources*

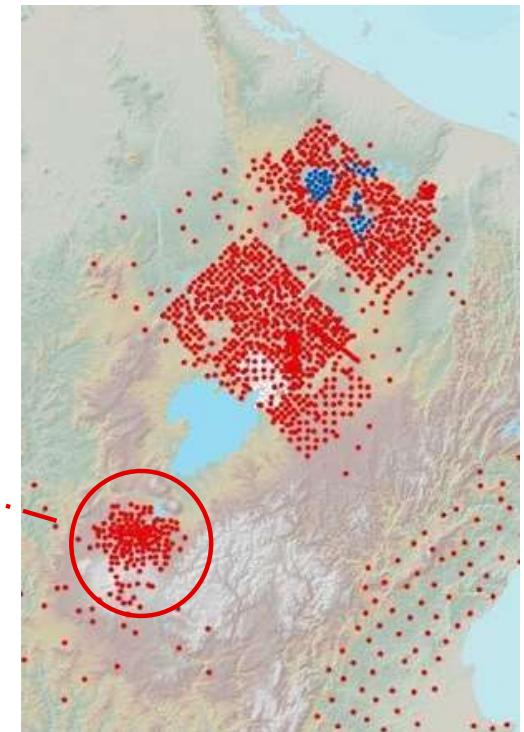
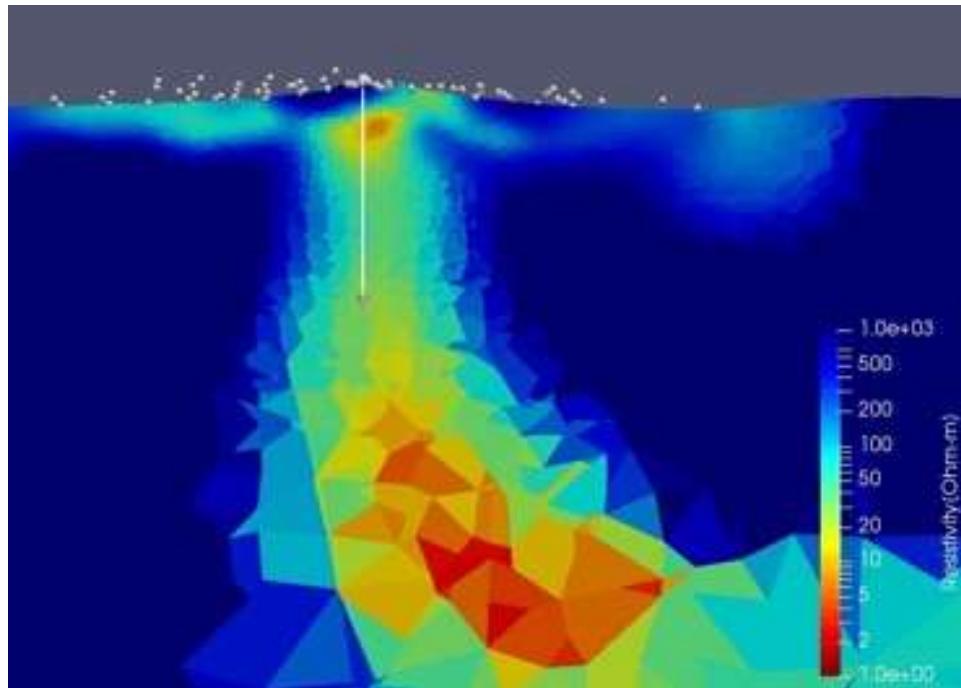


UNFC Categories and Examples of Classes

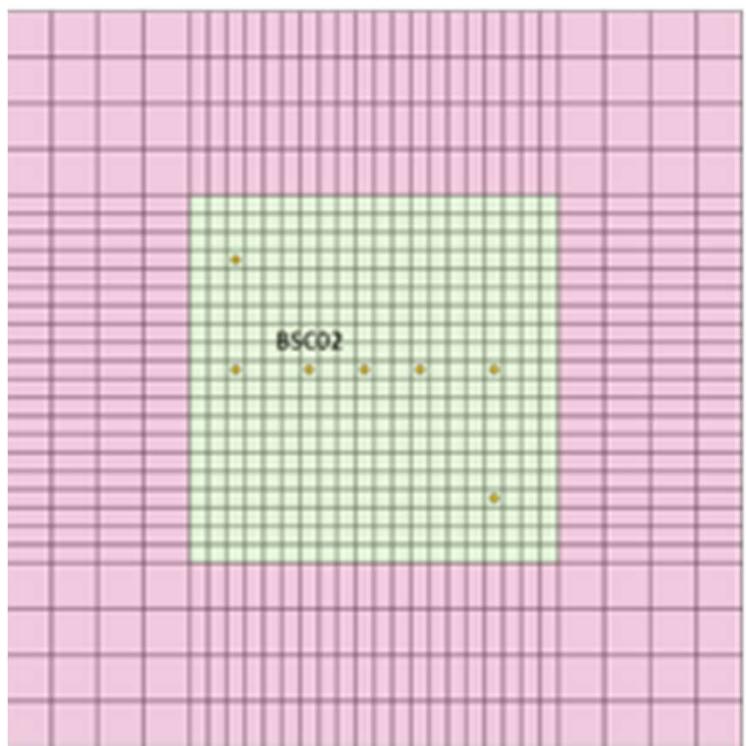


For a prospective but untested NZ super-hot project (at 3.5-7 km depth) UNFC grade will be **E3.2 : F4.2 : G4** (4.1 to 4.3 depending on confidence in assessment) which reflects the relatively high level of uncertainty of these novel unexplored prospects regarding their viability, feasibility and the degree of confidence in their energy potential.

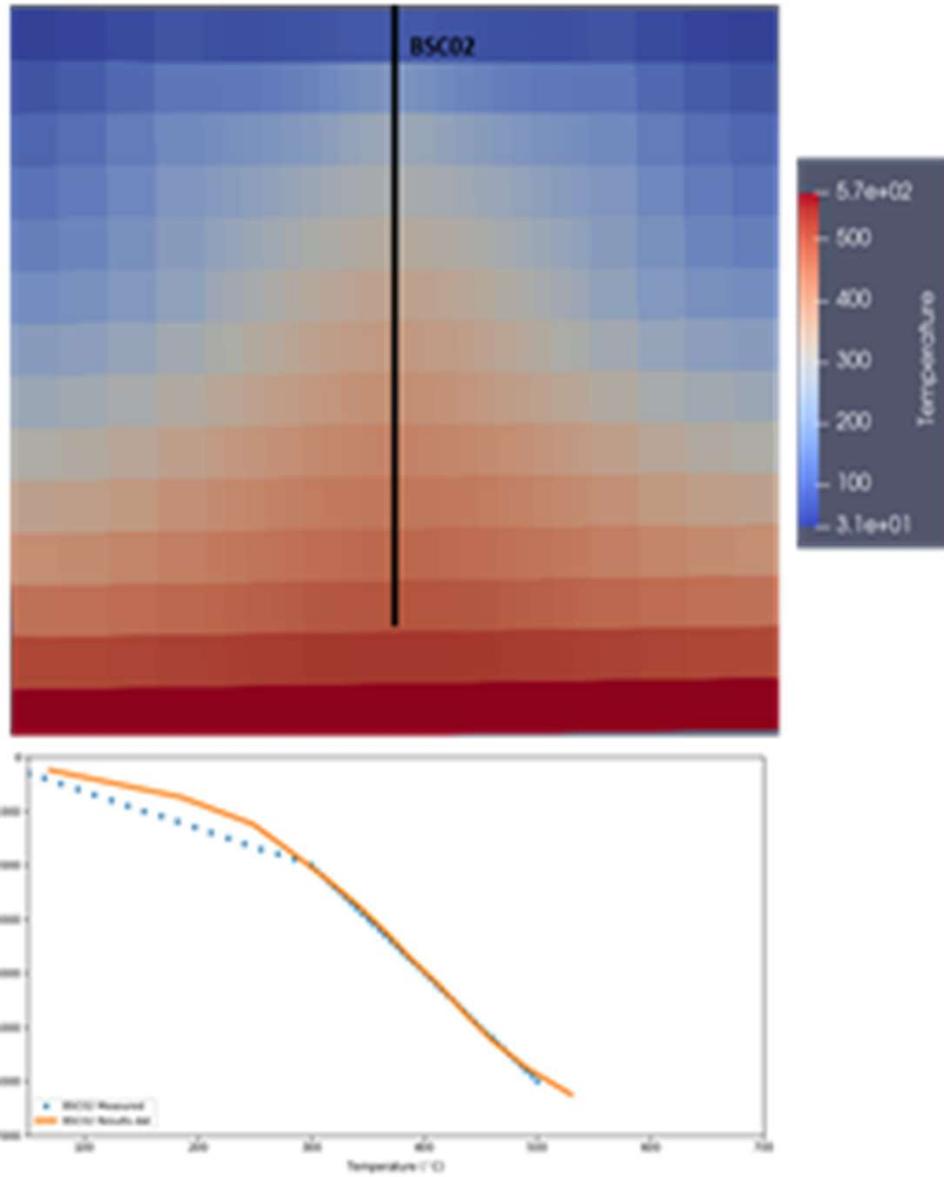
Resource Volume assessments using the Magneto-telluric Anomalies



Supercritical Process Model – TVZ example-



8km x 8km x
7km
500m thick
layers
4km x 4km
inner
5 rock types
300,000 yrs
Base 600 C,
370 bar
500 °C at 6km



Draft Table of stored heat calculations for NZ Super-critical resources

Table 2.2 : Inventory (excluding protected systems) of probable, 3.5-6 km deep, super-hot resources in New Zealand													
No.	Location	Top Depth	Bottom D	Area	Volume	Top T	Bottom T	StoredHeat*	Capacity	Generation			
TVZ		km (bsl)	km (bsl)	km^2	km^3	°C	°C	Exa-Joule	MWe	GWhr/yr			
1	Kawerau	3.5	6	15	37.5	375	500	58	412	3428			
2	S Tikitere	3.5	6		15.4	375	500	24	169	1408			
3	Haroharo	3.5	6		64.3	375	500	99	706	5877			
4	SW Reporoa	3.5	6		23.7	375	500	36	260	2166			
5	W Ohaaki	3.5	6		13	375	500	20	143	1188			
6	W Ngatamariki	3.5	6		13.6	375	500	21	149	1243			
7	Rotokawa	3.5	6		41.1	375	500	63	451	3757			
8	Mokai	3.5	6	5	12.5	375	500	19	137	1143			
9	Wairakei	3.5	6	5	12.5	375	500	19	137	1143			
10	Tauhara	3.5	6	15	37.5	375	500	58	412	3428			
11	Tokaanu	3.5	6	10	25	375	500	38	275	2285			
Northland													
12	Ngawha	3.5	6	10	25	375	500	38	275	2285			
Vers. CJB 14-7-23		TOTALS:			321			493	3527	29351			
assumes rock: 1.3 specific heat capacity, 2700 density													
assumes 2.5% heat recovery (4.6% of usable heat>200°C) over 35 yr life of consents for power plant													
95% capacity factor, 30% turbine conversion efficiency													
calculated values from deep Central TVZ geophysics data using leapfrog model of MT data, (<10 ohm-m)													
calculated values from deep Okataina geophysics data using leapfrog model of MT data, (<15 ohm-m)													
estimated values from geophysics, existing borehole data and modelling													
excludes resources underlying protected geothermal systems (Rotorua, Waimangu, Waiotapu, Te Kopia, Tongariro)													
default values													

**~3.5 GWe
~30 TWhr
35 years**

Comparison:

Existing conventional:

= **1 GW** (8000 GWhr /yr)

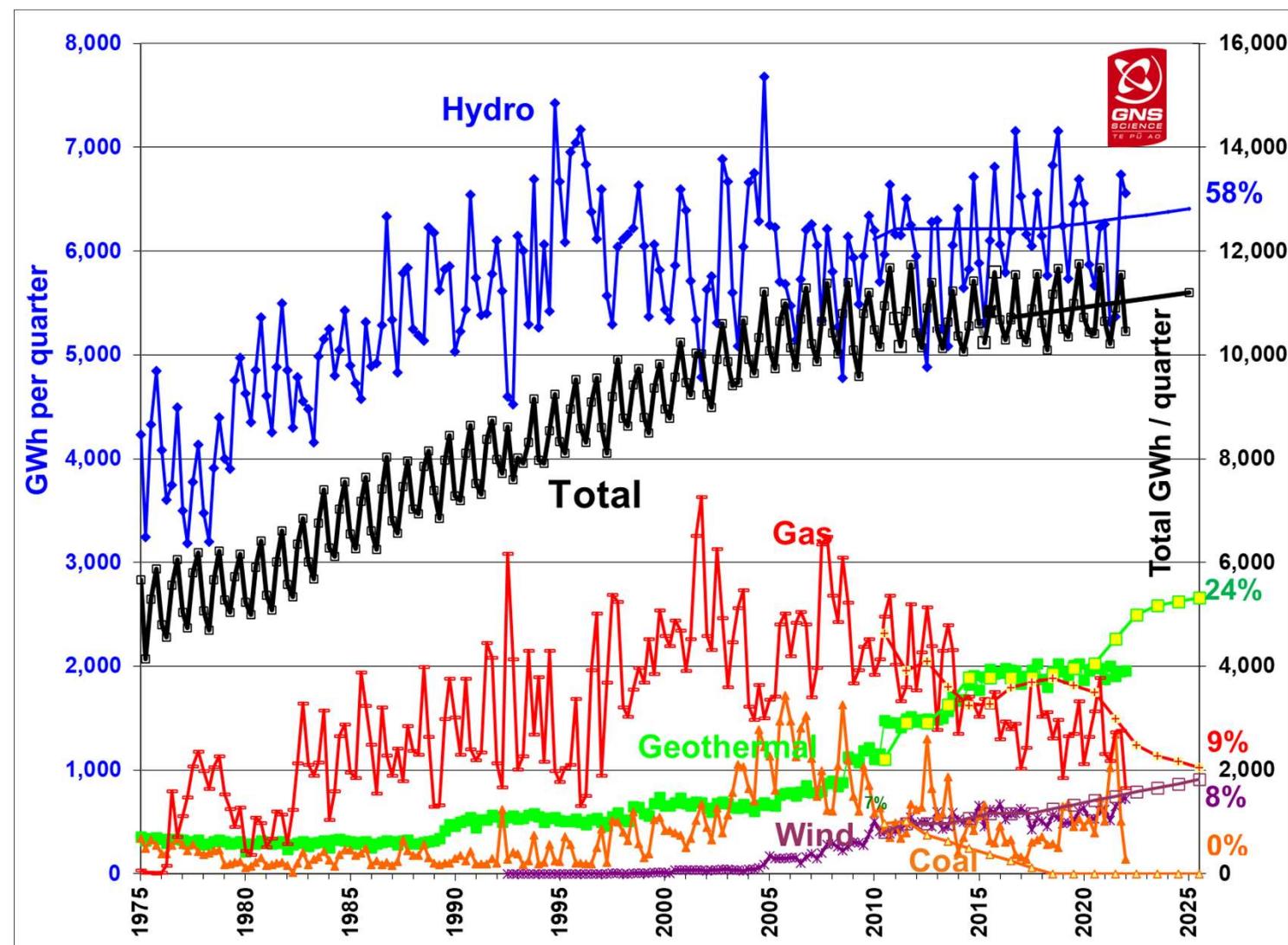
Planned conventional by 2030:

= **1.4 GW** (11,000 GWh/yr)

Future Supercritical addition :

= **3.5 GW** (30,000 GWhr/yr)

2050-2100 ?



Producing a New Zealand Super-Critical Inventory Report

- To be Published end of 2023
- Publicly available once completed
- Download from the GNG Website



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