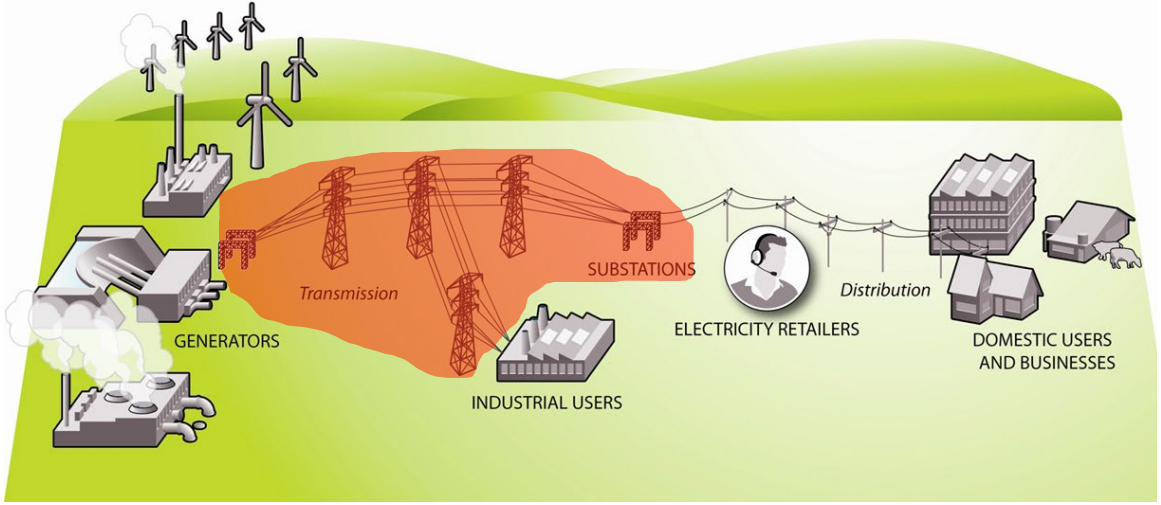
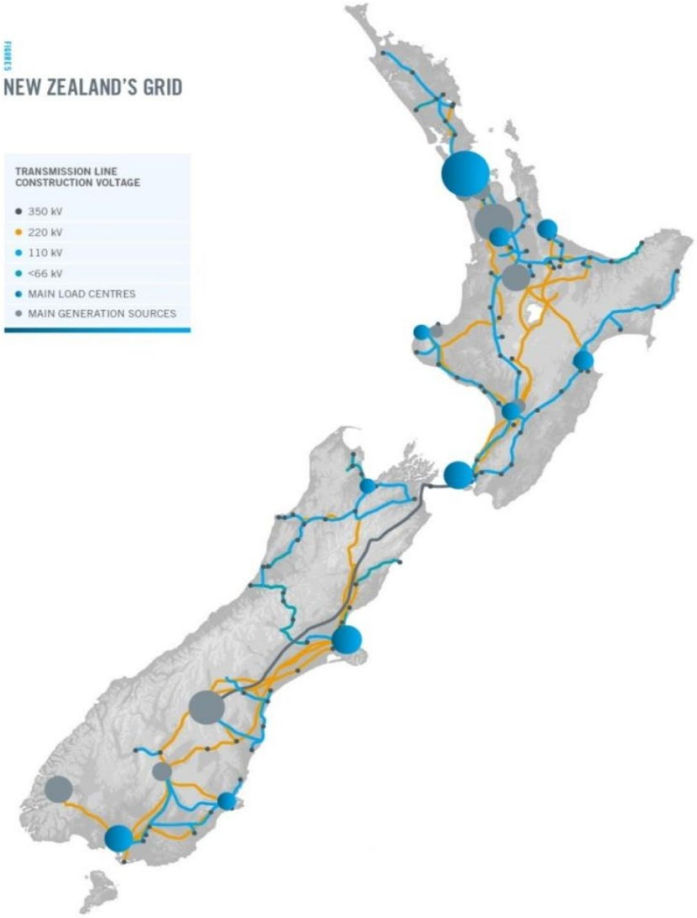
TRANSPOWER

Decarbonising transport

Andrew Renton Senior Principal Engineer, IRTENZ, Hamilton November 2022

Who is Transpower





Transpower
Transmission

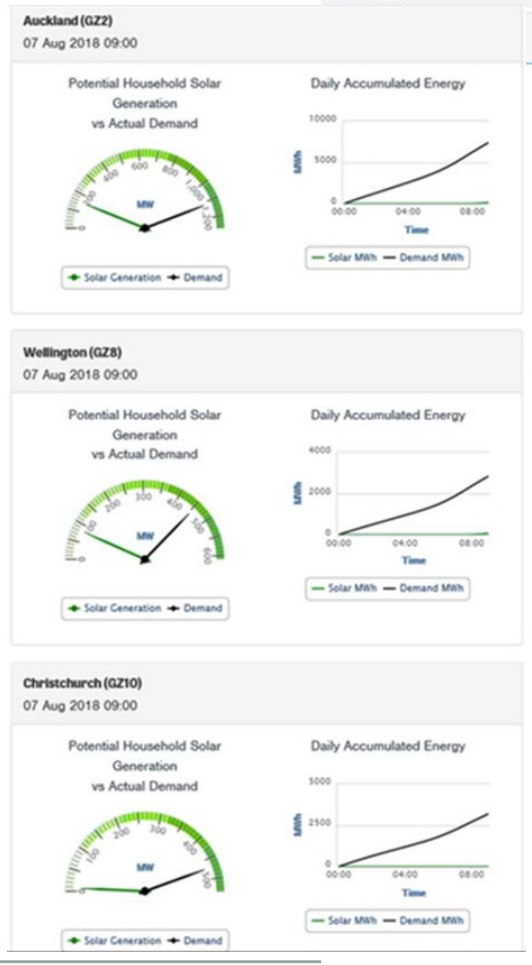
NZTA
State Highway

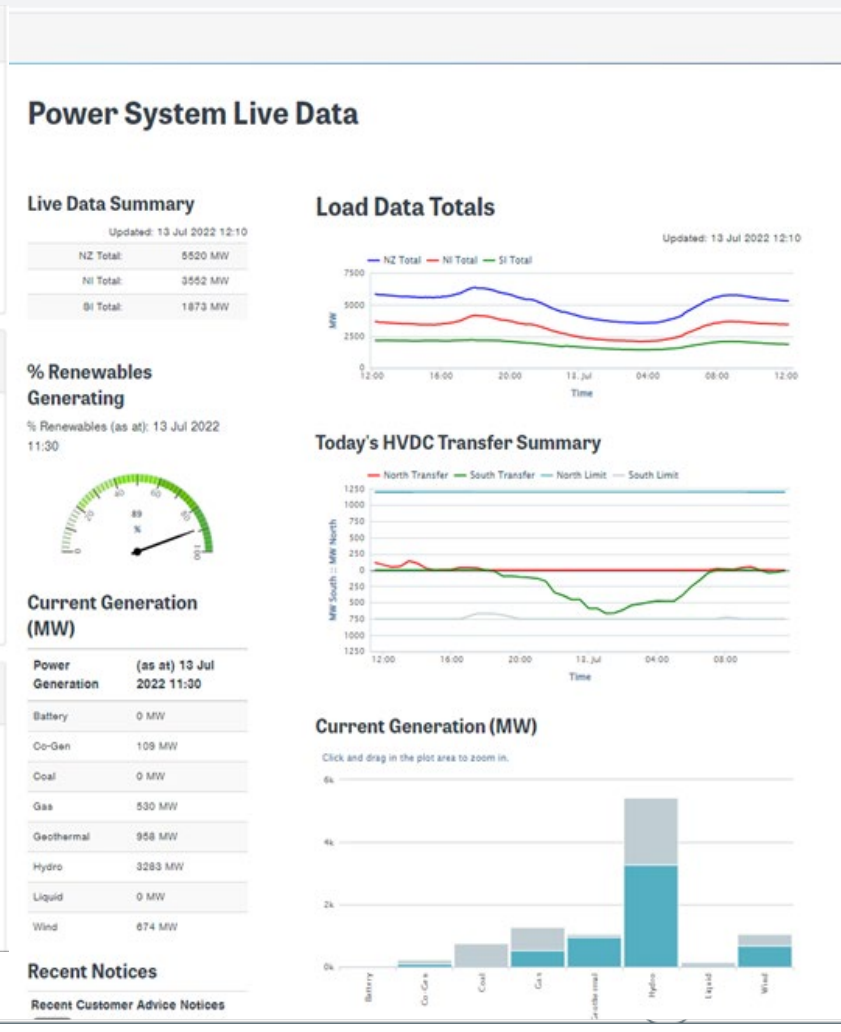
Vector/PowerCo/WE*
Distribution

Local Council
Local Roads

Our Grid

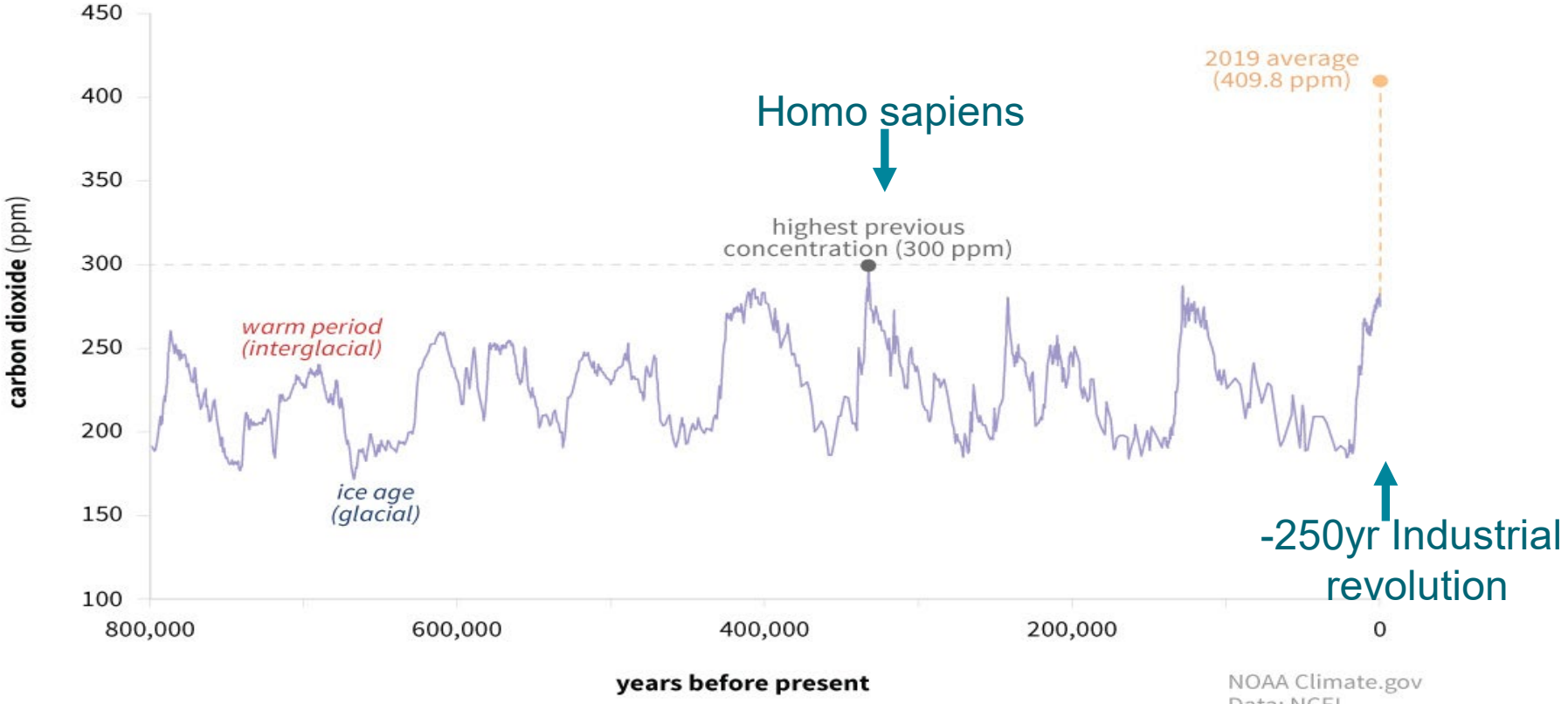
- 11,000km line
- 173 stations
- 66/110/220/400kV AC
- 1470MW HVDC link
- 7200MW Peak
- 9312MW Installed
- 78-90% renewable
- 42-44TWh pa
- 151-158PJ pa
- Winter peaking





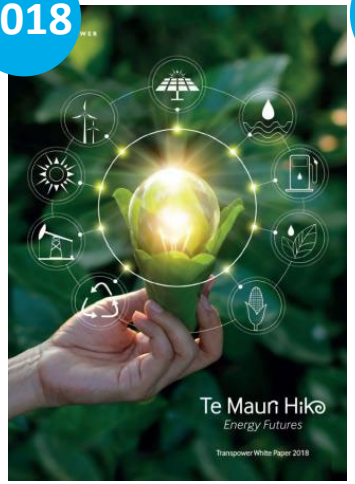
Market is real-time dynamic

The Why

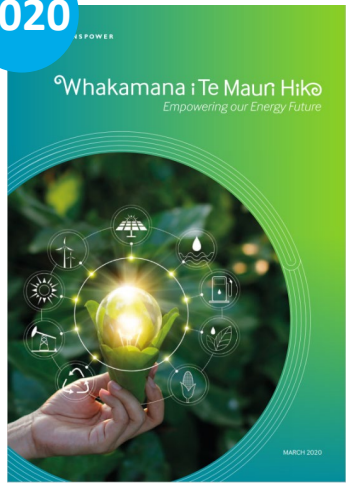

450
400
350
300
250
200
150
100
carbon dioxide (ppm)
2019 average
(409.8 ppm)
Homo sapiens
highest previous
concentration (300 ppm)
warm period
(interglacial)
ice age
(glacial)
-250yr Industrial
revolution
800,000
600,000
400,000
200,000
0
years before present
NOAA Climate.gov
Data: NCEI

Our Context: We are committed to developing our understanding of New Zealand's energy future needs

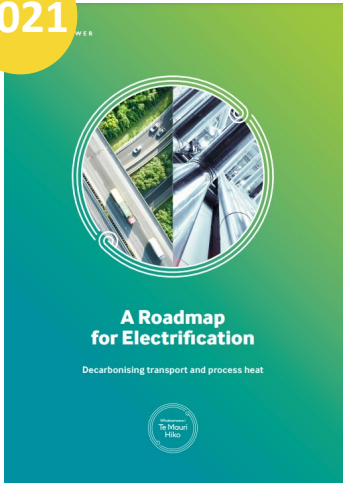
2018



2020



2021



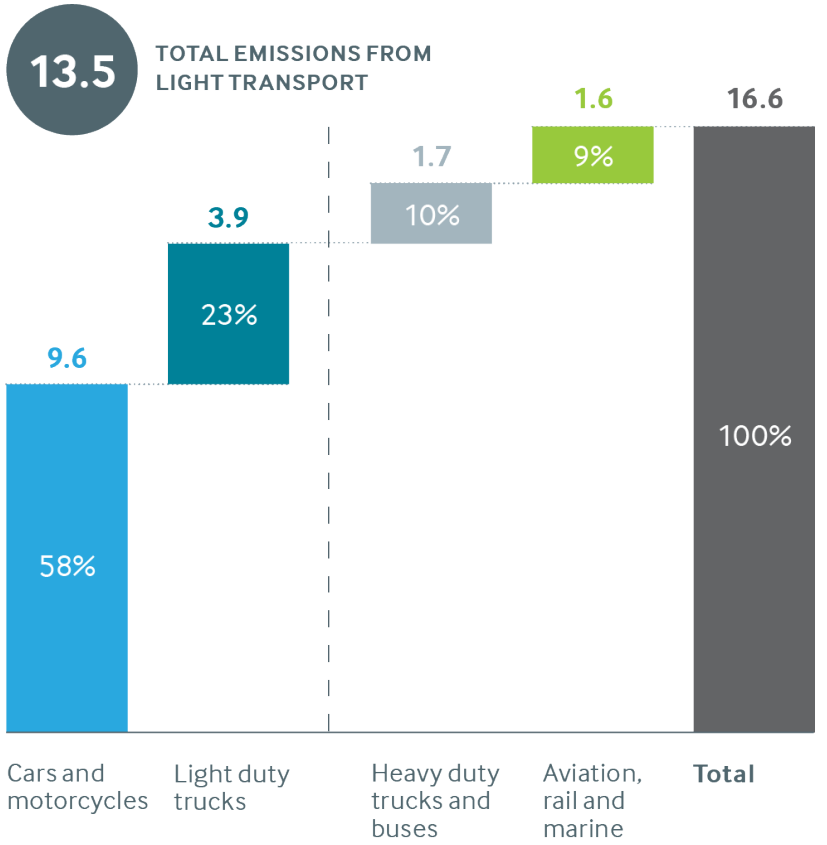
2021

2022

Light road transport represents 80% of transport emissions

Transport

Breakdown of New Zealand's transport emissions 2018
(Million tonnes of carbon dioxide equivalent)

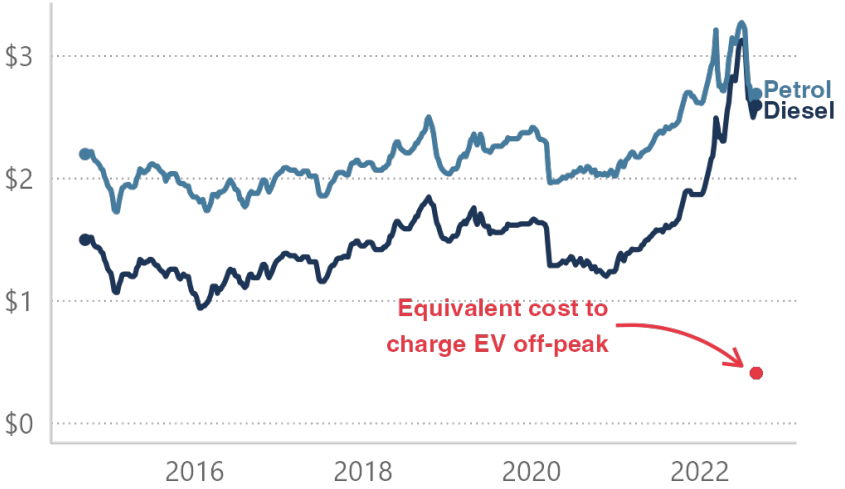


The Biggest Driver of Future Demand is Transport

- Petrol prices fell as the pandemic hit but now higher
- Causes include weaker NZD-USD exchange rate, higher import costs, supply chain issues due to COVID-19 and labour issues, and geopolitical instability from the Russia-Ukraine war.
- Petrol 6.5x times more expensive than (off-peak) electricity on a per litre equivalent basis.

Vehicle fuel prices

Dollars per litre (nominal). Petrol refers to regular.



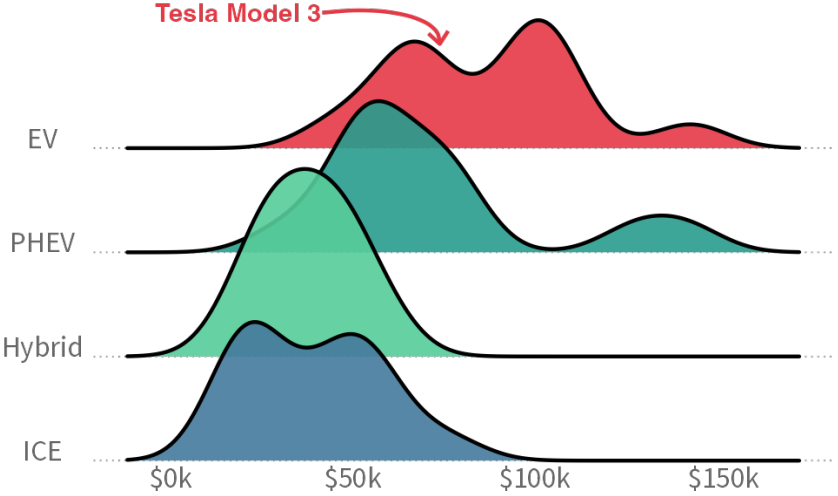
Source: MBIE. Last updated September 2022.

EVs have not yet reached price parity

- Upfront cost of EVS still higher than an ICE equivalent.
- However, hybrids are now broadly similar in price to ICE vehicles, helping drive their uptake.
- The all-time most popular EV in NZ is the Nissan Leaf with 17,225 currently registered.
- However, in the past 12 months, the Tesla Model 3 has overtaken the Leaf as the current best seller.

Distribution of vehicle prices

Top selling vehicle prices, including rebates



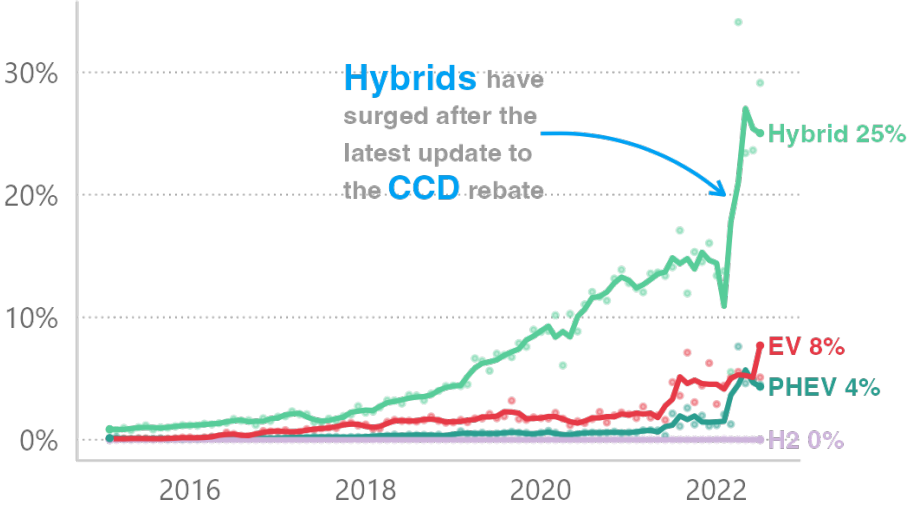
Source: NZTA for vehicle registrations. evdb, driven, turners, & toyota for price data.
Last updated September 2022.

Low emissions vehicles are on the rise

- This growth is supported by the Clean Car Discount.
- Around 1% of the total light vehicle fleet are EVs.
- Around 8% of new registrations are EVs each month.
- However, since the addition of Hybrids into the scheme, hybrids have surged ahead.
- This now averages almost 5,000 compared to 3,000 prior to the change (an increase of 70%).

Light low emission vehicle registrations

Percentage of registrations, rolling 3 month average



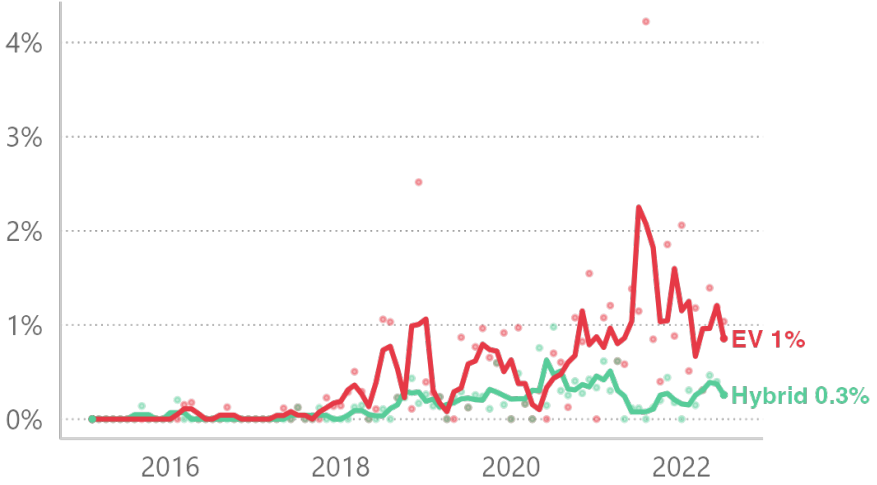
Source: NZTA. Last updated August 2022.

Low emissions heavy vehicles are also increasing, slowly

- Heavy trucks seeing much slower uptake than light vehicles
- 21 heavy electric trucks added to the fleet in 2022, 0.4% of trucks this year.
- Light trucks (<3,500t) are much easier to electrify
- 189 battery electric (BEV) light trucks added in 2022 + 31 plug-in electric trucks (PHEVs), together comprising 0.8% of trucks so far.

Heavy low emission vehicle registrations

Percentage of registrations, rolling 3 month average



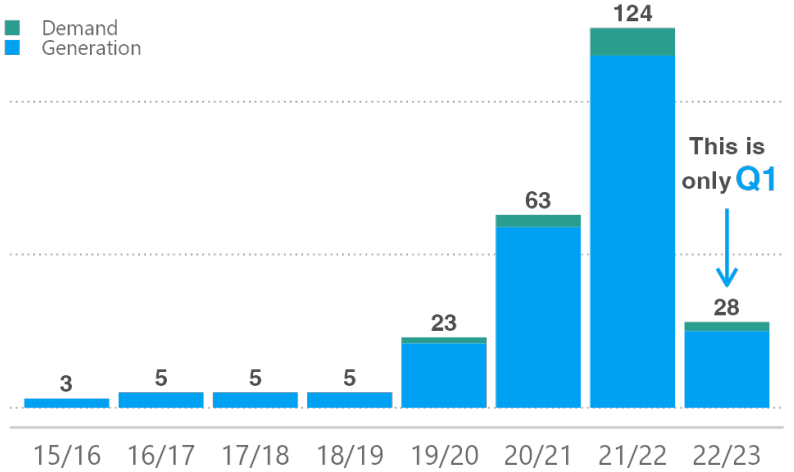
Source: NZTA. Last updated August 2022.

Renewable utility scale generation continues to see strong growth

- New generation enquiries have sharply increased in past 3 years
- The 21/22 financial year saw a total of 124 enquiries (9 demand / 115 generation) – around double the previous year.
- While not all enquiries eventuate in built projects, the volume of enquiries is a good indicator of developer appetite.
- 28 enquiries already in the first quarter of the current FY already.

Generation and demand customer enquiries

Count by financial year, excludes GXP enquiries from EDBs.



Source: Transpower. Last updated September 2022.

NZ has over 27 GW of potential generation interest in the pipeline

The total potential capacity of generation in the pipeline now is 27 GW including battery energy storage systems (BESS).

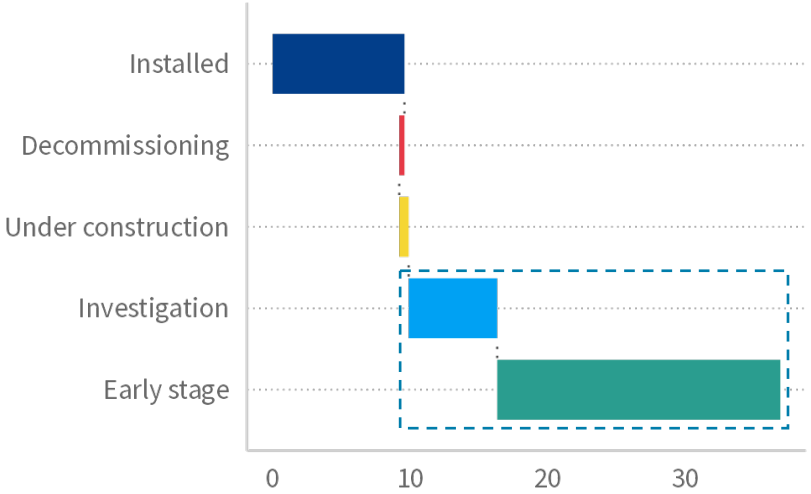
If two–thirds of this was installed by 2050, this would meet our *Accelerated Electrification* projection of 22 GW total installed capacity.

Generation in the pipeline includes:

- a 115 MW Solar farm in Edgecombe developed by new entrant Helios Energy,
- three new wind projects by Mercury: Kaiwakawe (72 MW), Hurunui (76 MW), and Kaiwera Downs (43 MW).
- Mainpower is developing a 93 MW wind farm at Mt Cass.
- Nova have announced a 400 MW solar farm near Taupō.
- A grid-connected battery and solar farm being planned by Meridian Energy.

Forecast utility scale generation pipeline

GW, includes generation decommissioning by the end of 2023.



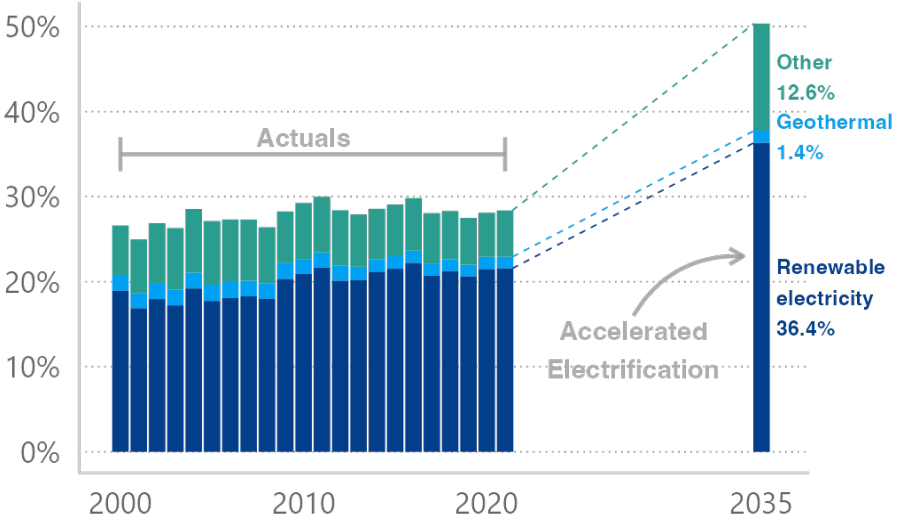
Source: Transpower. Last updated September 2022.

But… there's still a long way to go

- The NZ Energy Strategy is also aimed at understanding how NZ can achieve a target of 50% renewable energy consumption by 2035.
- This is inline with WiTMH's *Accelerated Electrification* pathway.
- However, despite all the recent progress highlighted in the monitoring report, there is a lot of action still needed.

Renewable share of energy consumption

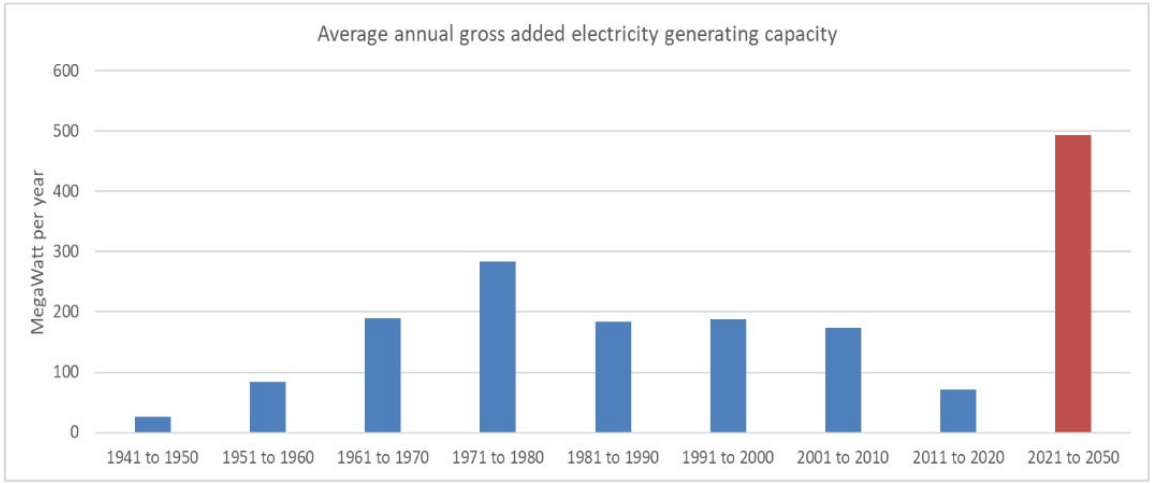
Annual, total final consumption vs Accelerated Electrification



Source: MBIE. Last updated September 2022.

Looking Back – what have we achieved
Looking Forward –what we need to achieve

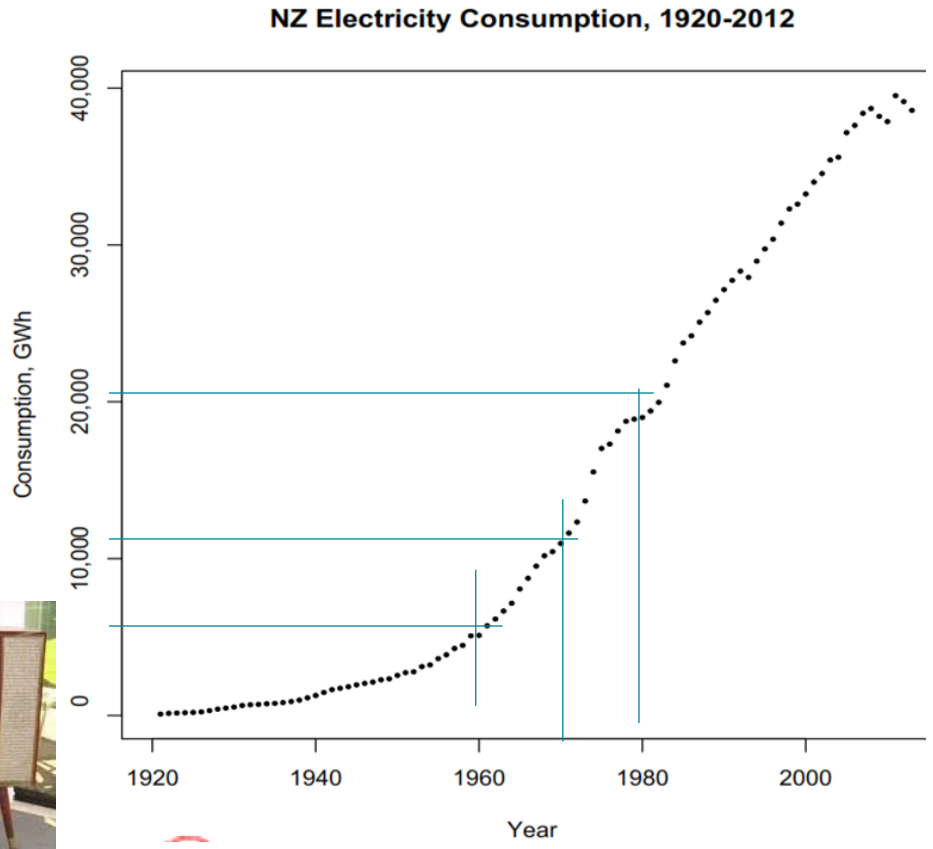
Figure 3: The generation build requirements for the next 30 years look very challenging



Source: Electricity Authority and Transpower

2021-2050 – 495 MW pa over 30 years

We have meet this challenge before

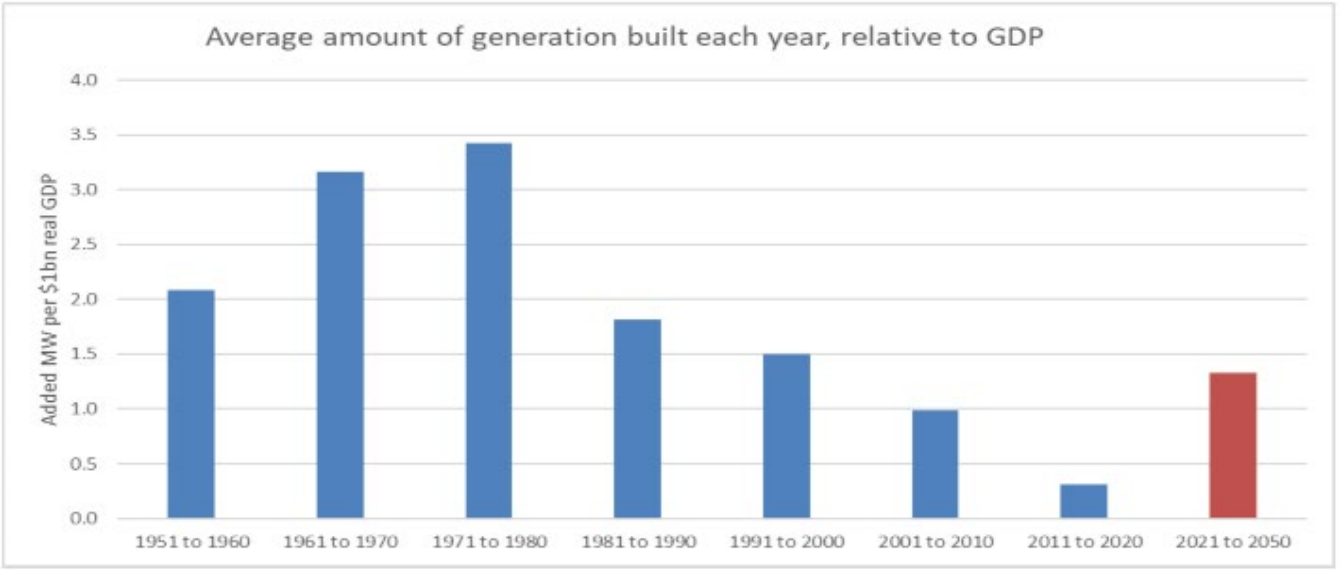


- 5,339MW = 213MWpa
- Wairakei A
- Aniwhenua
- Aratiratia
- Atiamuri
- Avimore
- Benmore
- Cobb
- Flaxy
- Kuratau
- Lloyd Mandeno
- Lower Mangapapa
- Manapouri
- Maraetai I & II
- Matahina
- Ohakuri
- Ohau A, B, C
- Paeru
- Patea
- Rangipo
- Roxburgh
- Ruahihi
- Tekapo B
- Teviot
- Tokaanu
- Waipapa
- Whakamaru
- Wheao
- Huntly
- Kawerau
- Marsden A
- Meremere
- New Plymouth
- Otahuhu A

Putting the challenge in context

Relative to the size of the NZ economy we built more capacity in ’50s, ’60s, ’70s than we need over next 30 years

We have experiences from the recent big build



Source: Te Waihanga

CUWLP -an accelerated delivery model

CUWLP consisted of three projects:

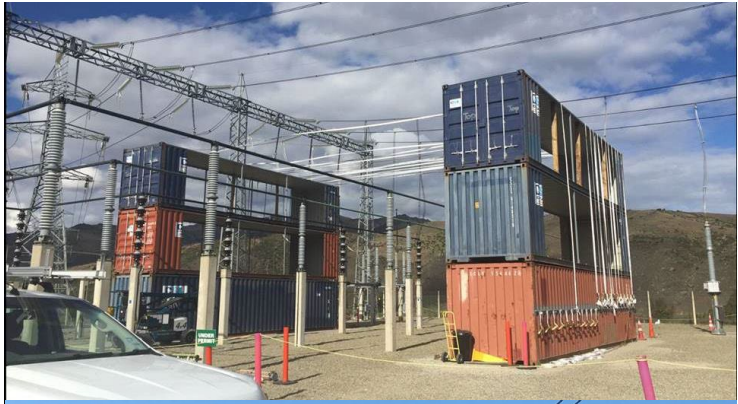
- Cromwell-Twizel TTU ($7m)
- ROX-LIV duplexing ($90m)
- AVI-BEN Special Protection Scheme ($0.5m)

A road to fast-tracking

- Pre-funding of enabling by Contact and Meridian
- June 2020, deliver a 3 year project in less than 2 years?
- August 2020 – approval to proceed with a completion by May 2022

CUWLP the final outcome:

- Cromwell-Twizel TTU ($5.5m)
- ROX-LIV duplexing ($78m) – 7 weeks early
- AVI-BEN Special Protection Scheme ($0.3m)



Questions

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Thank you for your attention

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