What we will cover

1. Background to market evolution
2. Wholesale and retail markets
3. Current and future challenges
4. Questions
History of electricity demand

**NZ Electricity Demand, 1920 - 2022**

- **Exponential demand growth**
  - Government investment in transmission and generation
  - Government only builds hydro until 1958
  - Predominantly hydro until 1992
  - Power boards set up to buy power from the government, reticulate and sell electricity to consumers

- **1970s energy crises switch demand to linear growth pattern**
  - Government still predicts exponential growth
  - Plus “Think Big” policy aims for industrialisation
  - Many thermal power stations built

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GWh per annum

<table>
<thead>
<tr>
<th>Year</th>
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<tbody>
<tr>
<td>1920</td>
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<tr>
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<td>2010</td>
<td>0</td>
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<td>2020</td>
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As part of the disastrous track record of government expenditure on power stations, the criticism of the Electricity Division of the Ministry of Energy in 1984 included non-commercial pricing.

The creation of ECNZ in 1987 had, at its core, an objective of acting commercially, bringing with it a focus on its bulk supply pricing (which now became “wholesale prices”). Counter to what many expected from a commercial monopoly, ECNZ allegedly* pursued entry-deterrence through its pricing, i.e., keeping prices low to deter the entry of competing generation, balanced against rate of return. It argued that, with surplus capacity, this was efficient.

By 1991, prices had declined 20% (real) and ECNZ began to consider the prospect for new capacity within 10 years and announced a 3% price rise.

All hell broke loose.

*Martin, John E (1998), People, Politics and Power Stations, p351
The New Zealand Market: Overview

- ‘Spot’ (physical) markets (energy + reserve) commenced in October 1996
- Full retail market competition from 1998
- Rules for managing hydro risk emerged over 2001-2011
- Contract markets have emerged over time, most significant since 2010:
  - Over-the-Counter,
  - Exchange traded Futures
  - Financial Transmission Rights
- No long-term capacity market.
- Real-Time Pricing 2022

Overriding reason for change was DYNAMIC efficiency – investment and innovation
An Electricity Market – what’s the point?

Investments and disinvestments in generation since demand went flat in 2007

- Kawerau (G)
- Te Rere Hau (W)
- West Wind
- Mahinerangi (W)
- Tahuara A (G)
- TOPP1 (G)
- Ngatamaniki (G)
- McKee Peaker (T)
- Mill Creek (W)
- Te Mihi (G, Net)
- Solar PV
- Solar PV
- Solar PV
- Solar PV
- Solar PV
- Junction Road (T)
- Waipipi (W)
- Te ahi O Maui (G)
- Otahuhu R (T)
- Southdown (T)

GWh per annum

Staying on top of demand growth
The New Zealand Market: Overview

NZ Generation Makeup

"Average" Year

- Hydro: 57%
- Gas: 15%
- Wind: 7%
- Coal/gas: 7%
- Gas: 15%
- Geothermal: 14%
- Diesel: 0%

NZ Generation Makeup

"Average" Year
Wholesale and retail markets
The New Zealand Market: Bids and Offers

- Demand is "bid", but close to real time is forecast
- No cap on offers
- Market clears every half hour
- Offers can be revised as half hour approaches
The New Zealand Market: Locational Marginal Pricing

Transmission Losses

Transmission Constraints
Pricing reflecting fuel, investment and network

Auckland daily average wholesale prices
2000-2022

‘DRY’ YEARS

HVDC RESTRICTION

GAS ISSUES

THERMAL RETIREMENT

GEN “OVERBUILD”
Contracts market

Contract prices and estimated costs for new baseload supply

SOURCE: Generation investment summary - 2023 update – prepared for Electricity Authority – Concept Consulting
Current and future challenges
Policy uncertainty and the new Government

- Uncertainty
- ETS pricing (ETS)
- When does decarbonisation and electrification really take off?
- Gas transition
- Market design
- Decarbonisation
- Government priorities
- And the trilemma...

The tradeoff between emissions and cost is that, some low-emission options are more expensive than fossil fuels (absent carbon price).

The tradeoff between cost and adequacy is driven by the level of adequacy required, and the cost of maintaining redundancy.

The tradeoff between emissions and adequacy is driven by the historical use of fossil fuels to provide discretionary generation.
ETS – politically set

Scarcity recommended by CCC led to significant price increase

Was supposed to go even higher $175/t.

Politicians tried to ease the price increase and the price dropped substantially

Current government remains committed to the ETS but no details on the auction settings
Potential demand growth

Annual Electricity Demand
Historical and Forecast, CCC and Transpower scenarios

- Historical
- CCC
- Transpower BAU
- Transpower High
- Tiwai Exit

Potential demand growth
What is the role of gas as we decarbonise?

Many commentators see some gas use as critical to affordable, reliable electricity as we decarbonise transport and process heat, including the current Government Coalition government policies:

• Assurances given that gas sector will get certainty
• Repeal of oil and gas ban
• Investigate production of hydrogen from natural gas with carbon capture
• Some potentially indirect support, e.g. investigate reopening Marsden Point
Wholesale market price structure with intermittent renewables

Price Curves - 2033 Normal

- Very high peak prices needed to get investment signals right?
- Intermittent renewables push prices low most of the time?

- Does the market work with high amounts of renewables?
- Does this encourage investment in renewables?
- Does this encourage investment in security and reliability?
- Is market power a problem?
- Dry years?

MDAG has made important recommendations on this

Government policy priority is on security of supply
Decarbonisation

- Government remains committed to zero carbon act but no detail on meeting Climate Change Commission’s carbon budget
- Security of supply highest priority through reinvigorating natural gas – although NZ First suggests that coal is also required post-2040
- Require Electricity Authority to make rules ensuring security
- Policy to double renewable energy supply
- ‘Examine’ transmission and connection pricing to facilitate cost effective connection of new renewable generation resources, both on-shore and off-shore
- Fast track resource consenting for new infrastructure including renewable energy
- 10,000 EV chargers, but needs robust business case
Government priorities

1. Stop Onslow (NZ Battery)
2. Security of supply – gas
3. Double renewable energy – RMA
4. Decarbonise transport – EV chargers
Questions
Additional information
The New Zealand Market: Importance of hydrology

![Bar chart showing energy generation by company]

- **Contact**
- **Meridian**
- **Mercury**
- **Genesis**
- **Manawa**

**Generation* by company**

- **Hydro**
- **Wind**
- **Geothermal**
- **Gas**
- **Coal/gas**
- **Diesel**

*Thermal generation based on capacity assuming fuel contracts, not actual/recent operating regime.
The New Zealand Market: Importance of hydrology

### Generation* by company

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<tr>
<th>Company</th>
<th>Hydro</th>
<th>Wind</th>
<th>Geothermal</th>
<th>Gas</th>
<th>Coal/gas</th>
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*Generation based on capacity assuming fuel contracts, not actual/recent operating regime.

Retail Sales

GWh per annum
The New Zealand Market: Importance of hydrology

Generation* by company

- Contact
- Meridian
- Mercury
- Genesis
- Manawa

- Retail Sales
- Total (Net) Sales

*Thermal generation based on capacity assuming fuel contracts, not actual/recent operating regime.
The New Zealand Market: Importance of hydrology

Year-on-year changes in hydro and thermal

GWh Change

-5,000
-4,000
-3,000
-2,000
-1,000
 0
 1,000
 2,000
 3,000
 4,000
 5,000


Hydro YoY Change
Thermal YoY Change
Hedge Market
The New Zealand Market: Market Makeup

**Generators**

- **Manawa**: 12%
- **Genesis**: 6%
- **Mercury**: 15%
- **Meridian**: 17%
- **Contact**: 31%
- **Other Gen**: 19%

**Generation FY22**

**Purchasers**

- **Industrial D/C**: 16%
- **Mercury Retail**: 15%
- **Genesis Retail**: 7%
- **Manawa Retail**: 15%
- **Meridian Retail**: 12%
- **Contact Retail**: 22%
- **Small Retail**: 12%

**Purchases FY22**

**Hedge Markets**
The New Zealand Market: Overview

2.1m Connections

- Residential: 1.8m, Avg Annual Consumption 7,300kWh (33%)
- Commercial: 190k, Avg Annual Consumption 49,000kWh (24%)
- Industrial & Agriculture: 135k, Avg Annual Consumption 122,000kWh (43%)

40,000 GWh

- Ag = 7%
- The Big 5 = 25%
The hydrology problem – low carbon solution

• We shift fuel around currently through:
  • Coal stockpiles (<2,000GWh)
  • Gas reservoirs (2,000GWh)
  • Flexible gas contracts
  • Batteries (short term only)
  • Hydro reservoirs (4,000GWh)

• Hydro is slightly problematic in that it provides some energy “shifting”, but its ability to do that over the medium term is limited by inflows and storage, which are not well correlated with demand. Over a long enough timeframe it is also “intermittent”.

• So we have a third requirement – the ability to meet demand during a (prolonged) period of low inflows
NZ Battery (Onslow)

- $15.7bn plus a couple billion in transmission upgrades
- Alternative is only slightly cheaper
- Fundamentally about 100% renewable electricity
- Also attractive because it gives the Government certainty (and potentially control)
- Cancelled by current Government