ELECTRICITY AUTHORITY
TE MANA HIKO

Market Development Advisory Group

Price discovery under 100% renewable electricity supply

Presentation to Council of Energy Regulators

11 May 2022

Outline

- Our brief and our approach
- What we have found so far – Stage 1 (Issues)
- What we are doing now – Stage 2 (Options)
- What happens next year – Stage 3 (Recommendations)

→ Aim for today – draw out key policy themes

Our brief

What changes should be made to the wholesale electricity market assuming 100% renewable supply?

- 100% – reflects government policy
- Effects and issues are similar whether 100% or 98-99% in CCC's 2021 report
- Key difference relates to economics of peaking supply

Our approach

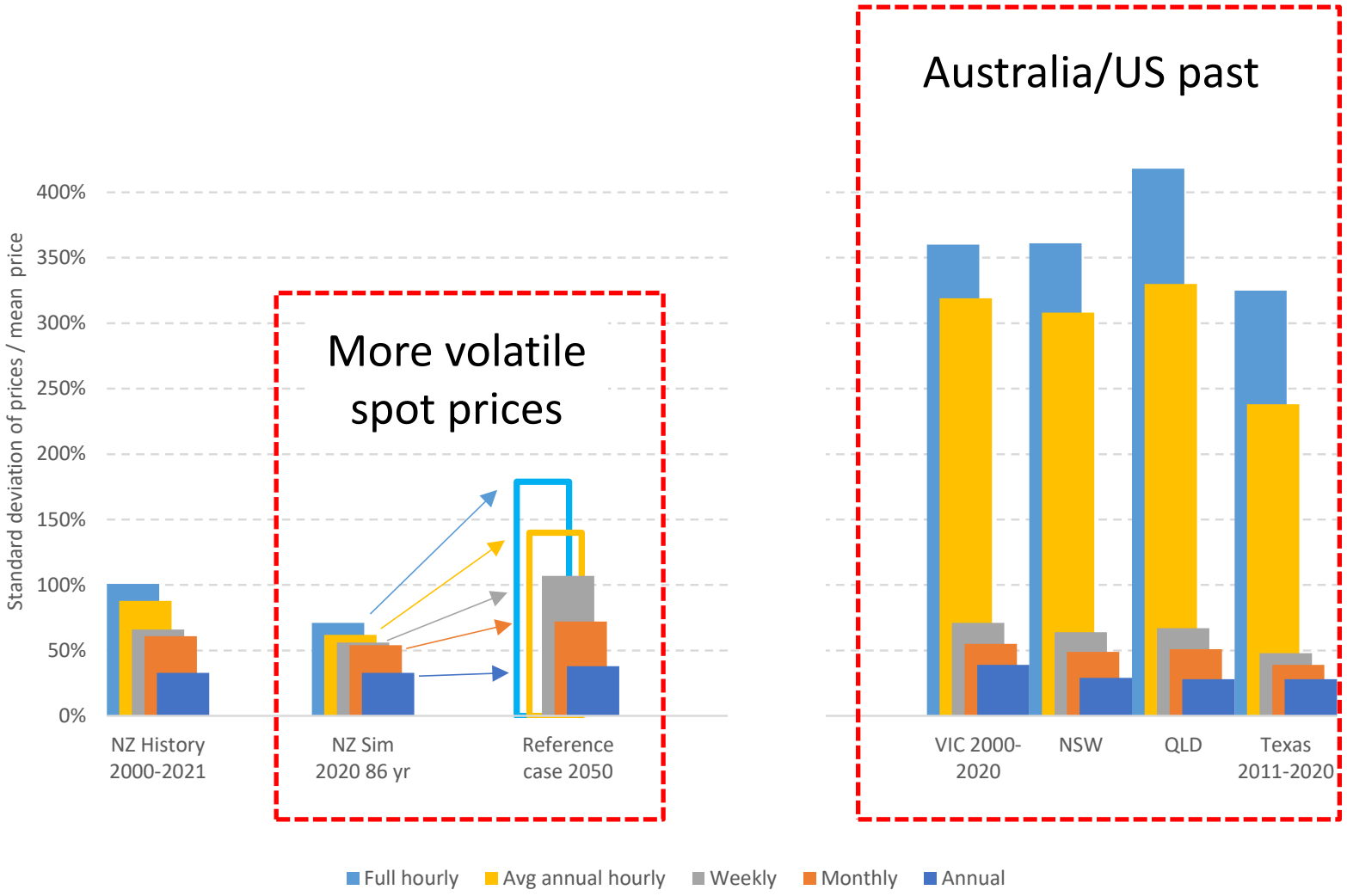
- Open-minded, rigorous, evidence-based – *Bayesian* (park 'priors')
- Empirical – use simulation tool to test assumptions and scenarios
- Close engagement with stakeholders along the way – shared journey
- NZ Battery observer

Findings to date

First, at a physical level, we see six key effects:

- **New investment** – 400-500 MW *per year* until 2050 (c.f. <100MW in the past)
- **Intermittency** – uncontrollable supply rises to ~50% (c.f. 6% today)
- **Disaggregation** – 'supply' becomes a lot more fragmented, inside and outside distribution networks
- **Hydro** – plays a different role ('shock absorber'), more conservative, weather-driven
- **Spill** – more spill of water, wind, solar and on networks – but economically efficient – change of mind-set
- **Volatility** – marked increase but less other countries *(see next chart)*

Volatility


Australia/US past
More volatile spot prices
Standard deviation of prices / mean price
400%
350%
300%
250%
200%
150%
100%
50%
0%
NZ History 2000-2021
NZ Sim 2020 86 yr
Reference case 2050
VIC 2000-2020
NSW
QLD
Texas 2011-2020
Full hourly
Avg annual hourly
Weekly
Monthly
Annual

Issues arising and work for Stage 2

- **Accurate price signals** *[Pivotal issue -- return to shortly]*

- **Demand side participation**
  - Much more important with 100%RE – significant potential as cheaper risk management tool
  - Case studies – gauge when DR becomes beneficial across a range of supply and demand conditions assuming 100%RE
  - Identify underlying barriers (i.e. any market failures)
  - Evaluate policy options, including Australian 'nega watt' scheme

- **Contract markets**
  - Much more important with 100%RE
  - Case studies – gauge benefits from different hedge instruments across a range of supply and demand conditions assuming 100%RE
  - Identify underlying barriers (i.e. any market failures)
  - Evaluate policy options, including capacity ticket mechanism (and variants like 'strategic reserve')

Issues arising and work for Stage 2 *(cont'd)*

- **Competition**
  - Under 100% RE, we see 'thinning' of competition in seasonal flexible supply, but strengthening in short term supply (e.g. batteries)
  - Seek guidance on analytical approach from overseas experts (Prof George Yarrow)
  - Simulations to test whether exercise of market power is profitable across a range of supply, demand, contract and DS assumptions under 100%RE
  - Evaluate policy options

- **Real time coordination**
  - Under 100%RE, this becomes a lot more challenging
  - Input into FSR project (Future Security and Resilience)
  - Recommend a set of broad market design principles that the Authority (and system operator) should apply to help guide the FSR project as it unfolds over future years

- **Transition**
  - Near-term design choices could impact on design options for 100%RE
  - In reverse, our work should inform some near-term choices (e.g. our evaluation of capacity and demand-side mechanisms)

Importance of accurate prices

- **Investment efficiency is the major prize over the coming 25 years**
  - Large amount of capital and resource use will be channelled into new sources of electricity supply to meet growing electricity demand (on steroids with decarbonisation)
  - We want new supply to come on stream at optimal time, place, size and type
  - This means new supply from sources that are least cost –
    - To the economy
    - To the environment, and therefore
    - For the long term benefit of consumers.

Importance of accurate prices *(cont'd)*

- **Any single decision-maker can't see or deploy the full range of optimal solutions**
  - We see a pressing focus around the world on developing ideas and technologies to meet electricity demand without fossil fuels
  - Supply and demand-side options will emerge that are currently not known or currently considered not viable
  - In short, innovation will continue to drive costs and technology is ways that we can't predict

    For example, few people predicted that the cost of solar PV would decrease by more than three orders of magnitude since its first commercial use, while prices for fossil fuels now (ex-carbon), after adjusting for inflation, are very similar to prices 140 years ago with no obvious long range trend

  - So, there is a very high value on a regulatory framework that fosters and enables better supply and demand options to come into the market, displacing less competitive alternatives

Importance of accurate prices *(cont'd)*

- **Why marginal cost pricing?**
  - We want our wholesale prices to reflect the cost of consuming/producing an extra unit of electricity in a given timeframe
  - This is the "price to beat" for parties looking to offer lower cost supply or demand-side solutions
  - At its core, the purpose of the wholesale market to enable lots of different parties to put in place more competitive ways of meeting electricity demand
  - Overtime, this diversity of action is more likely to produce lowest cost solutions

Importance of accurate prices *(cont'd)*

- **Volatility is not a 'bad'**
  - Rather, it is an inherent feature of our electricity system, and needs to be fully signalled without smearing or camouflage
  - This pricing information drives risk management by wholesale buyers and sellers, which feeds into longer term contracts, which in turn drives innovation and investment for the long term-benefit of consumers
  - In New Zealand, this was a foundational design idea was brought into focus by the Prime Ministerial Review into the 1992 electricity shortage, chaired by Rt Hon Sir Ronald Davidson*

Volatility is caused by several factors – relatively inelastic demand; our long, stringy transmission network; highly changeable weather; large variations in hydro inflows; and step-changes in the cost of supply (across hydro, wind, geothermal, gas, coal and diesel)

Those step changes in cost of supply are likely to become greater with 100%RE, resulting in greater volatility, as outlined earlier

* Then Chief Justice, with Ron Carter, Chair of Beca Carter, and Murray Gough, CEO of the NZ Dairy Board – see Electricity Shortage Review Committee, The Electricity Shortage 1992 (December 1992).

Importance of accurate prices *(cont'd)*

- **Bad effects of artificially raising or lowering marginal price**
  - If it is artificially lowered, consumption will rise (and visa versa).

> In 1994 study for the government, BERL found that "average pricing" would result in near double the level of demand –
> - so a massive increase in the capital required for power stations, and
> - a lot more harm to the environment –
> - which would be avoided if wholesale buyers faced the full cost of producing an extra unit of electricity

  - Further, artificially lowering real high prices encourages wholesale buyers not to properly hedge against high price risks –
    - which only makes the risk worse as back-up suppliers won't run when needed, and
    - Investors won't build new capacity when needed
  - Parties that don't hedge properly sometimes try to socialise their losses. If this is allowed, it also only makes the risk of shortage greater and more costly.

Importance of accurate prices *(cont'd)*

- **Political-economy is a key dimension**
  - In summary, efficient risk management and new investment across the system depends on real marginal pricing.
  - However, when marginal prices are under stress, acceptance at a political-economy level depends on two key elements:
    - Confidence among wholesale buyers and sellers that prices make sense (which means confidence in the structure and rules of the market, including sufficiency of competition); and
    - Availability of 'tools' for wholesale buyers and sellers to manage their exposure to those spot price risks
  - Also draws out the need for further measures to strengthen an energy-only market.
  - MDAG is looking closely at these elements in this Stage 2 of our project.

Q&A

Link to MDAG's Stage 1 report – https://www.ea.govt.nz/development/work-programme/pricing-cost-allocation/100/consultations/#c19134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