

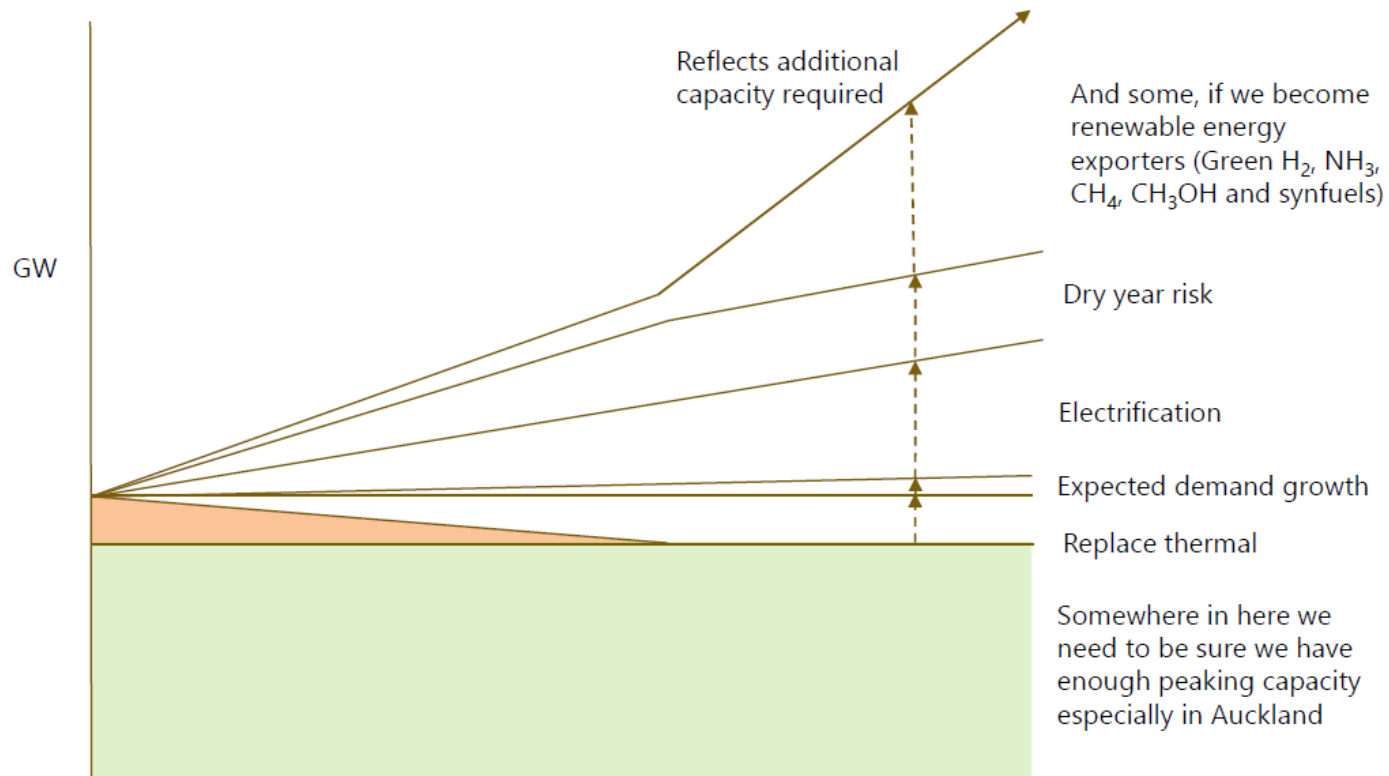
Pricing under 100% renewable supply: Key issues for problem definition – working draft

MARKET
DEVELOPMENT
ADVISORY GROUP

Supply-demand outlook

Investment in renewables required to:

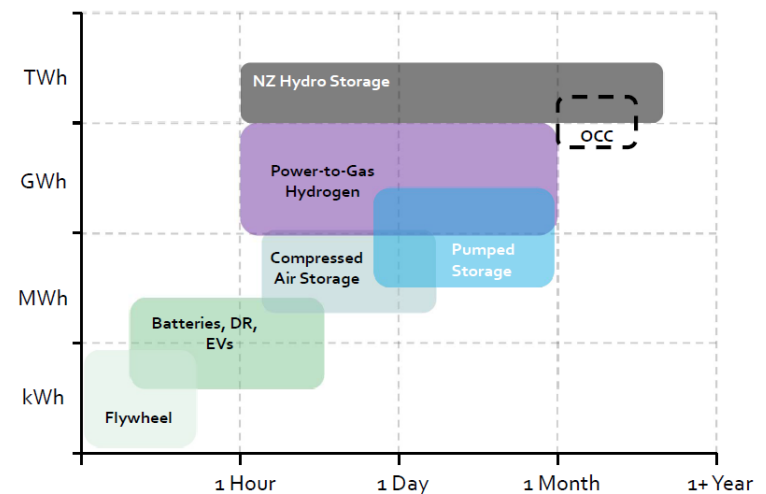
- replace thermal *and*
- support electrification *and*
- cover dry year risk *and*
- provide instantaneous security 24/7



Change in market characteristics

- Moving to 100% renewables will greatly increase the proportion of supply from intermittent sources
- Gives rise to substantial increases in short run variability in *net* demand
- Flexible energy resources are required to manage intermittency
- Mix of new intermittent generation and 'storage' resources to come onto the system – wind, solar, batteries, pump storage, demand response. Can't predict mix – opportunities will evolve over time
- Transition will involve lumpy decisions – Huntly, Tiwai, TCC, Methanex, large pumped storage
- However, NZ's proportion of intermittent renewables (25% by 2035 and 35% by 2050) likely to be less than other jurisdictions

2020 – MBIE (42.9 TWh)
2050 – TPNZ BAU (51 TWh)
2050 – MBIE EDGS (52 TWh)
2050 – CCC (59 TWh)



Source: Concept

Key (macro) question

Will the existing wholesale market design deliver this transition and then, assuming 100% renewables, deliver:

- Efficient investment – least cost additional supply delivered in timely manner
- Security of supply – supply meeting demand continuously without involuntary cutting of supply, or a heightened threat of cuts to supply
- Efficient wholesale market operation – dispatch
- Social licence – price and access to the community
- Environmental goals – avoiding unnecessary harm to NZ's environment (with climate change goals reflected in timely 100% renewable supply outcome)
- Technology neutrality

Will the market signals (spot and forward) and the degree of variability with 100% renewables deliver adequate investment the way the market has to date?

If not, why not? Distil clearly the root problems

Key uncertainties

- **Spot prices:** Two views –
 - **Dichotomous price behavior** – If economically-dominant technology has variable cost of circa \$0, then price will alternate between circa \$0 (including negative prices) and the value of demand response (DR) / value of lost load (VoLL). So there will be long periods of energy price equal to zero (or less) – missing scarcity payment; OR
 - **Price will continue to reflect opportunity cost of resources available** – particularly stored water (and other forms of energy storage), the opportunity cost of which does not rely on price of thermals

This is a foundational issue – drives choice of change options. Need to drill into it with modelling before considering options. Need to better understand how NZ price volatility will likely evolve, both timing and magnitude
- **Lumpiness issue** – risk analysis to analyse lumpiness issues (e.g. Tiwai retirement) and identify early warning signs to monitor
- **Contracts market:**
 - whether the evolution of exchange-traded and over-the-counter (OTC) financial instruments will be sufficient to deliver resource adequacy and the necessary investment in renewable solutions in a very low emissions sector
 - whether a mechanism accompanying the energy only market will be required as the sector moves to very low emissions supply side.
- **Ancillary services** – are other services required to enable technology neutral addition of renewable supply? More co-optimised inputs? E.g. frequency keeping, IR (short run capacity adequacy), voltage, intermittency, synchronous inertial response, fast post-fault active power recovery
- **Demand side flexibility** – Barriers to demand-side flexibility playing its full role in price discovery and system security, including new investment by the demand side in response to market conditions

Price formation: alternative expert view

- Prices, in workably competitive markets where additional unit cost approaches zero, are not linked to observable costs
- Efficient pricing delinks from observable cost because observable costs contain insufficient information for efficient pricing over time
- Information required for efficient pricing is opportunity cost (“economic costs”) of both demand and supply
- Hence, opportunity cost of any decision is the foregone value of the next best alternative that is not chosen
- In workably competitive markets, opportunity costs are continually updated. Continuous updating means efficient economic costs —e.g., return on investment, scarcity rents, allocation of fixed costs, premiums for risk, etc —are revealed in the process of price discovery
- Market definition in competition sense – energy, ancillary, derivatives, are elements of one product market (not separate markets); and national market (with nodal prices showing location difference from national price), not collection of regional markets

Workplan for problem definition

Issue/Task		Proposed adviser	Timing*
1 st draft of problem definition paper –	Framework with what we know, don't know, and what we expect to find out from our analysis	TBC	TBC
Spot price formation	Develop and test two competing views:		
<i>View 1:</i>	Prices mainly at zero except during scarcity	TBC	TBC
<i>View 2:</i>	Price will continue to reflect opportunity cost of resources available	TBC	TBC
Lumpiness	Inhibitor to efficient investment?	TBC	TBC
Contracts market	Will exchange traded and over the counter (OTC) financial instruments be sufficient to deliver resource adequacy and the necessary investment in renewable solutions? Case for integrated wholesale and contract market design?	TBC	TBC
Ancillary services	Addressed through Authority's Future security and resilience work (with system operator)	TBC	TBC
Demand-side flexibility	Barriers to demand-side flexibility playing its full role in price discovery and system security?	TBC	TBC
Literature review	Review international literature for relevance to New Zealand	TBC	TBC

*Plus prior commissioning meetings, which MDAG members could attend if they wish

Workplan problem definition

Issue/Task		
Take into account:		
Papers prepared for NZ Battery	Sapere report Concept report	Pending release from MBIE
Stakeholder views	Programme of meetings	Pending
Climate Change Commission	Final report	Published
Other		