



MDAG price discovery and Future security and resilience

MDAG secretariat discussion with
Innovation and Participation Advisory Group

28 September 2021

Roles of the wholesale market

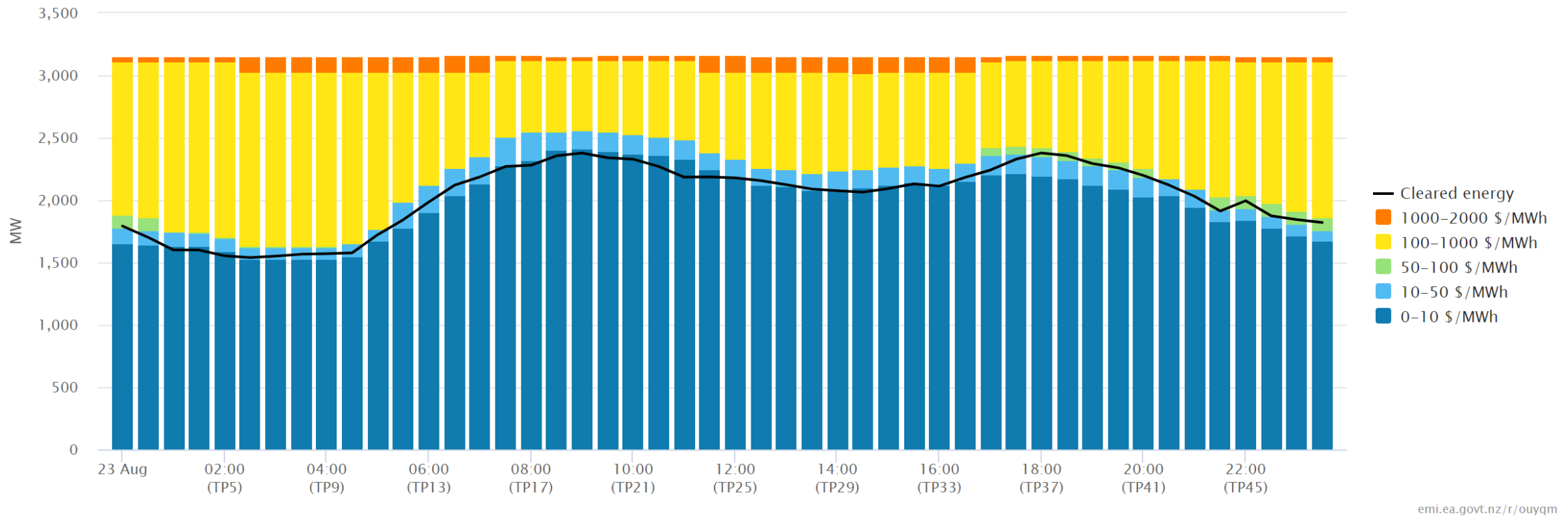
- The wholesale electricity market is a mechanism to:
 - Ensure the lights stay on:
 - match supply and demand every second, minute, hour, day, month and year
 - Determine efficient dispatch:
 - This includes allocation of stored water across the day/week/year
 - Discover prices and provide signals:
 - Signal the state of the demand-supply balance and what energy consumption/generation is worth
 - Promote efficient investment:
 - over the long-term, investors respond to signals to determine where, when and what to build
- The wholesale market includes spot, ancillary services and derivatives markets

*Slide presented to IPAG on 25
August 2021*



Market clearance

South Island offer stack, 23 Aug 2021



See <https://www.emi.ea.govt.nz/Wholesale/Dashboards/CWTFYE>

Two significant new projects commenced

- Future security and resilience (EPR G2 recommendation)
 - Examining how the New Zealand electricity system's stability and resilience requirements may change over time, given technology and other changes
 - Quick wins: ESS in reserves market
 - Next cabs off the rank could include small-scale ESS and other DER participating in ancillary service markets
- MDAG price discovery under 100% renewable electricity supply
 - Examining whether changes are required to wholesale market design under 100% renewable supply

Slide presented to IPAG on 25 August 2021



Price discovery under 100% renewable electricity



Price discovery under 100% renewables

Key questions

Electricity markets worldwide, like New Zealand's, have been designed on an assumption that at least a proportion of electricity demand is met by thermal generation.

- MDAG is asking:
 - How will the spot market promote efficient operation when a high proportion of generation capacity has low or zero short-run marginal costs of operation?
 - How will stored water be priced and allocated across time periods, without thermal plant in the market?
 - How will the wholesale market enable efficient investment when supply is dominated by generation with low short-run marginal costs?
 - How do we ensure efficient pricing in extended periods of supply scarcity, such as dry years?

*Slide presented to IPAG on 25
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MDAG price discovery

Process

- Process:
 - Phase 1: Problem definition (June – November 2021)
 - Met with local and international market design specialists
 - Undertaking targeted sector engagement
 - Developing deeper analysis of key issues
 - Phase 2: Options development and analysis (November – January 2022)
 - Phase 3: Recommendations (January – March 2022, submission to Board end April 2022)
- MDAG has met with New Zealand and international specialists in electricity market design
- NZ Battery Project staff member included as an observer

Slide presented to IPAG on 25 August 2021



MDAG price discovery

Initial insights

- New Zealand is unique in its circumstances – islanded power system, hydro dominated, prices already driven to large degree by storage
- A robust spot market is critical – the role of coordination will only become more difficult in future with millions of devices
- Large entry of intermittent generation expected to lead to more volatile prices BUT this provides an opportunity for significant response from the demand side, over the short and long terms – this is a significant paradigm shift
 - Barriers to demand-side flexibility playing its full role in price discovery and system security?
- Even at 100% renewables, NZ's proportion of intermittent will be less than other jurisdictions – perhaps ~30%
- System's requirements for flexibility and storage will change – including ancillary services
- Switch from thermal “overbuild” today to intermittent overbuild – more spilling, especially of hydro
- Evolution of contract market critical – emergence of renewable supporting contracts in NEM – shape and long-term PPAs

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Discussion points with IPAG – 28 September 2021

MDAG's interest in demand-side flexibility

Wholesale energy “flexibility market”

- The wholesale market is the most advanced and established flexibility market NZ has today.
- MDAG's project is considering wholesale price discovery in a 100% renewable world
- Wholesale pricing is a key part of efficient dispatch and signalling the value of wholesale energy (short, medium and long term; spot and contract, investment)
- A variety of views have been expressed about how wholesale prices will behave in the 100% scenario, with a key aspect of this being the extent to which wholesale price volatility will increase as thermal is removed and the supply curve is comprised of a combination of very low variable cost renewables, storable hydro, and scarcity values.
- This begs the question as to whether the shape of the wholesale demand curve will become a primary driver of price discovery

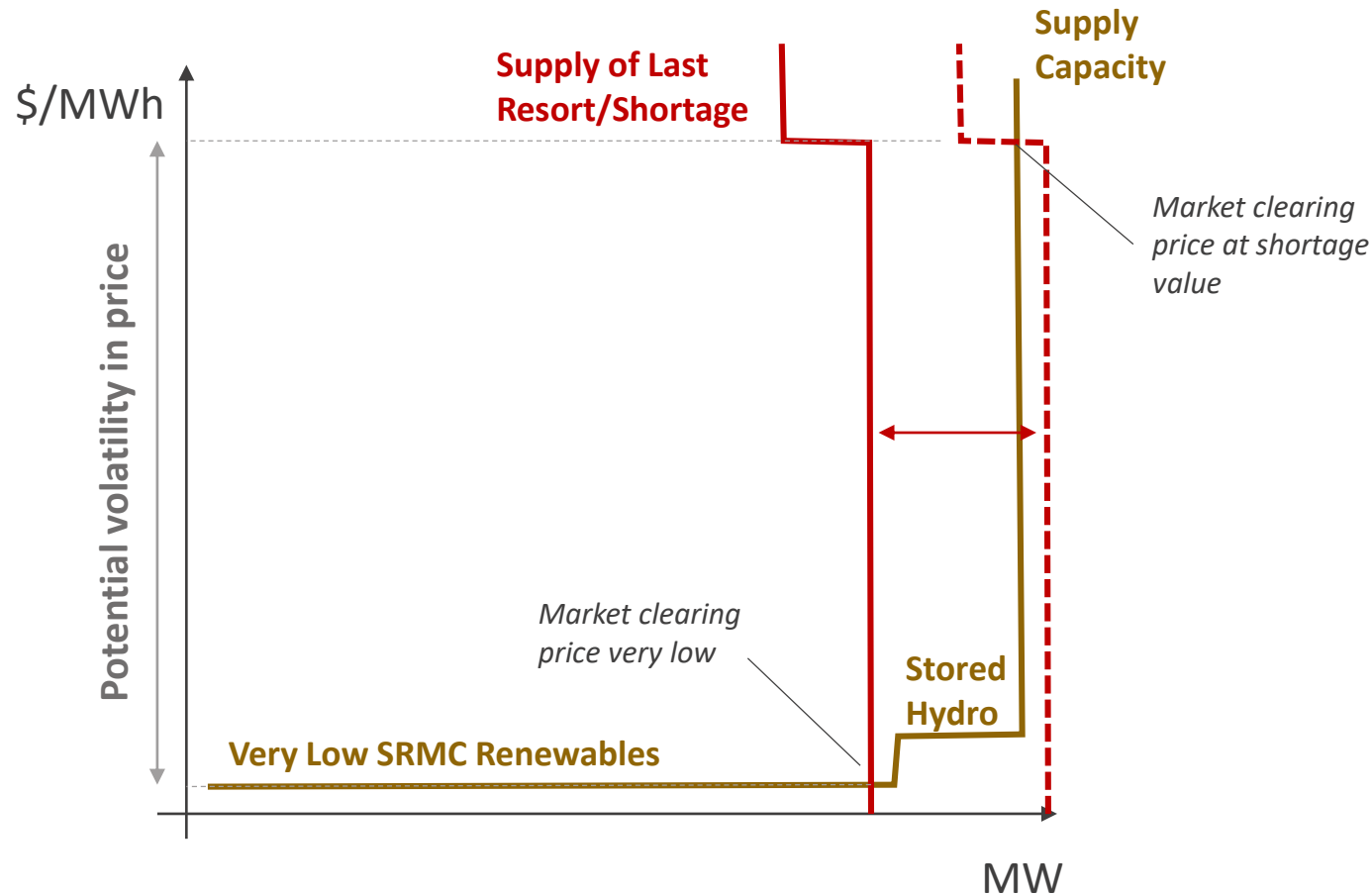


Questions for IPAG

1. To what extent does today's wholesale market not meet the IPAG's vision of healthy flexibility markets?
2. What does IPAG think about the prospects of DSR aggregation over time (AI/internet of things) – reaching into what levels of demand – C&I, SME, retail? With what degree of practicality (e.g. certainty of DSR 'dispatch')? In what volumes? Is there a useful taxonomy/ categorisation that would help us consider potential?
3. There has been a suggestion from some parties that DSR be **paid** for responding, much as generators get paid for generating – i.e. they don't just get the 'benefit' of not consuming when prices are high. What are IPAG's thoughts on this?
4. What are the barriers IPAG has identified to DSR playing its full role in wholesale price discovery, i.e. a symmetrical role to the supply side? (following slides)



Stylised example of 100% renewables



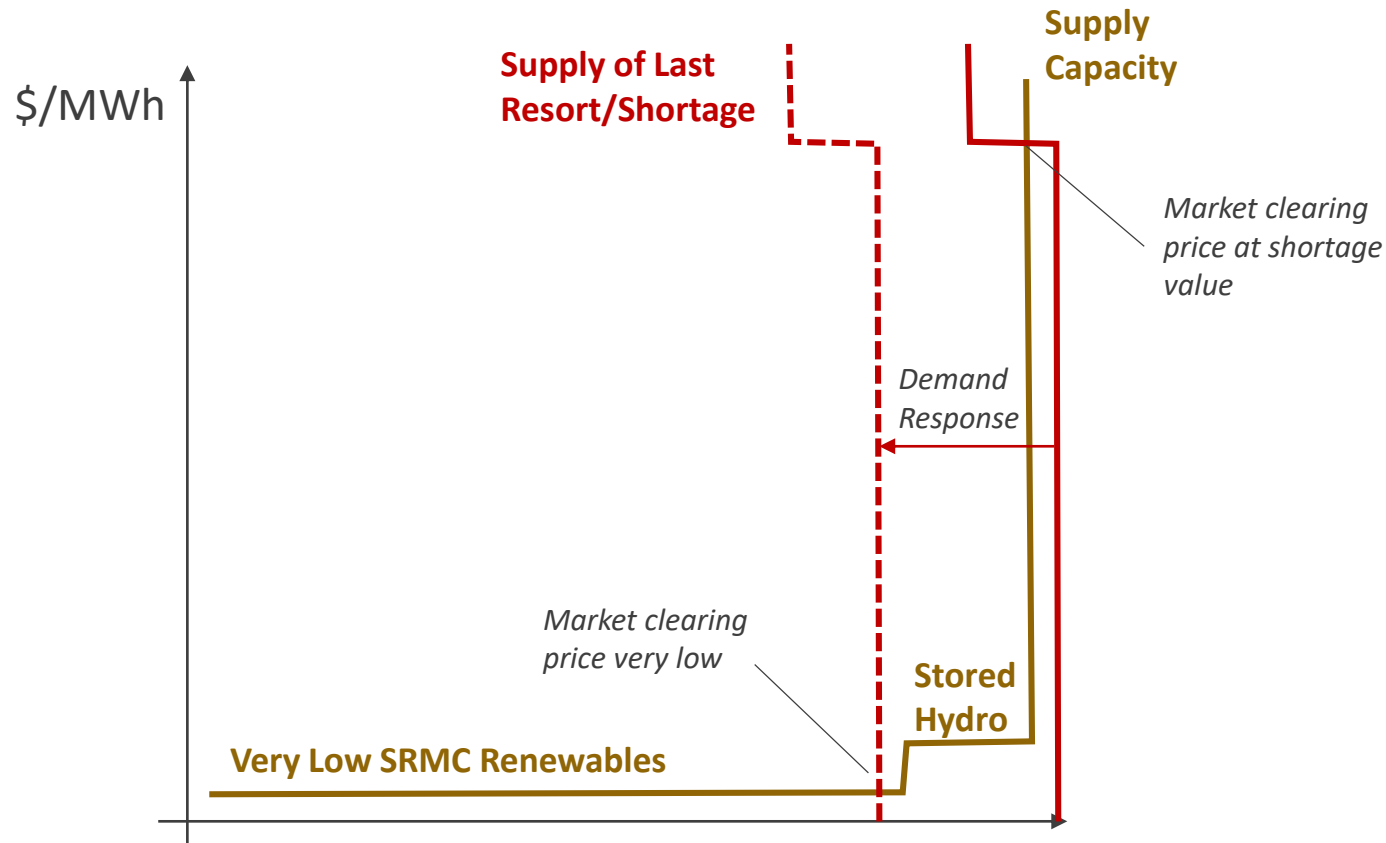
Plausible scenario proposed by some parties:

- Thermal offers removed as plant decommissioned
- Intermittent renewables added, offered at very low price levels
- Demand continues to vary with weather, seasons, events etc
- No material dispatchable demand...

...then prices may move between (potentially long) periods of very low levels, and periodic jumps to shortage levels.

This volatility poses a number of risks – how contracts are priced, retail products evolve, investment is signalled, and political intervention.

Scenario 1: Unoffered demand response

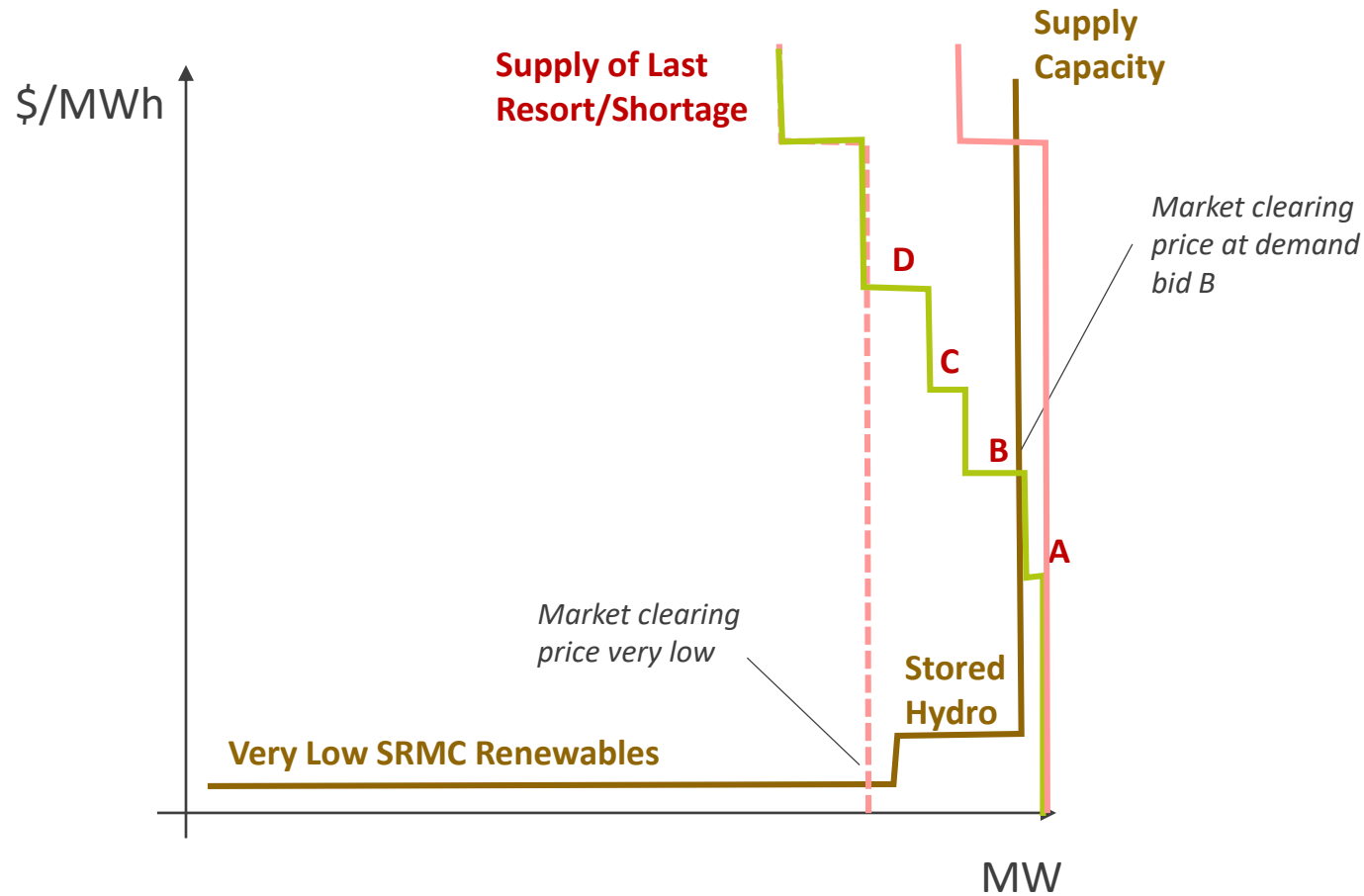


In situations where shortage is signalled by the wholesale price, demand response capability (coordinated by flexibility traders, but not formally offered into the wholesale market) may respond to the very high wholesale shortage price being signalled to them in advance, with the benefit that shortage is averted.

Presumably, the various forms of demand response have a spectrum of different valuations of energy, and would be willing to respond at different prices. But if a high enough scarcity price is signalled, all may choose to respond, which may not be the best outcome....



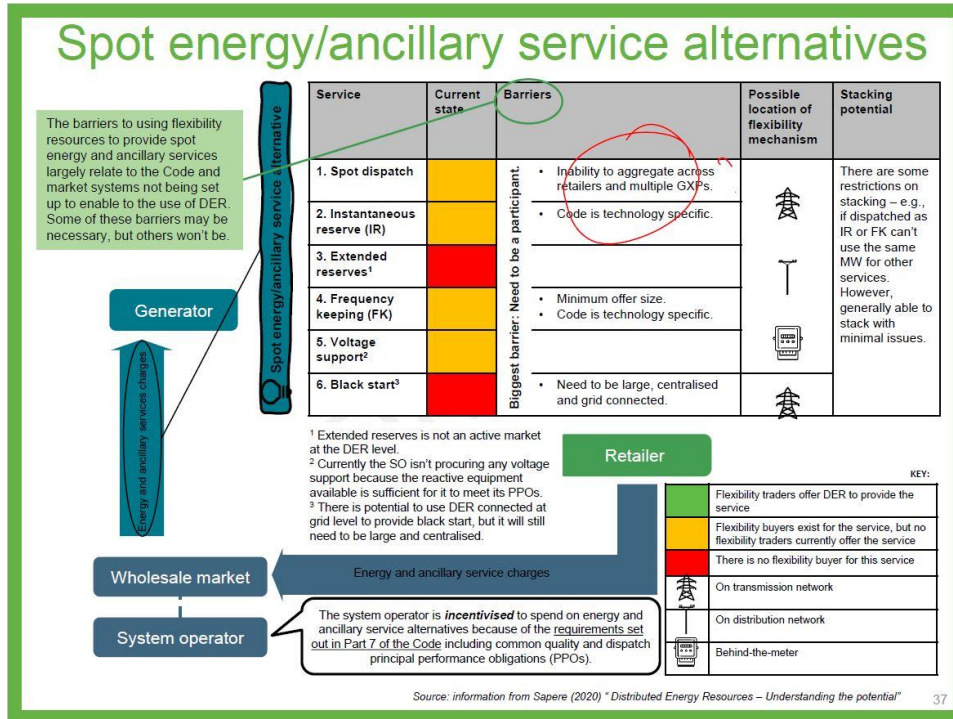
Scenario 2: Dispatchable demand flexibility



If that demand was bid into the wholesale market at their respective valuations (orange market demand curve):

- Only two would be “dispatched”, as that would be all that was necessary to avoid shortage (i.e., efficient dispatch), and
- Demand bid B would effectively create a marginal price signalling the “true” value of energy at that point – this would be a more efficient signal

Questions for IPAG



IPAG/Sapere's work identified some potential Code-related barriers to participation of demand flexibility in the wholesale market(s)

- How urgently should these barriers be addressed, and is there a priority order?
- Are there other technological, commercial, behavioural barriers or opportunities relating to the demand curve becoming an actual curve, and thus assisting efficient price formation in a 100% renewable world?