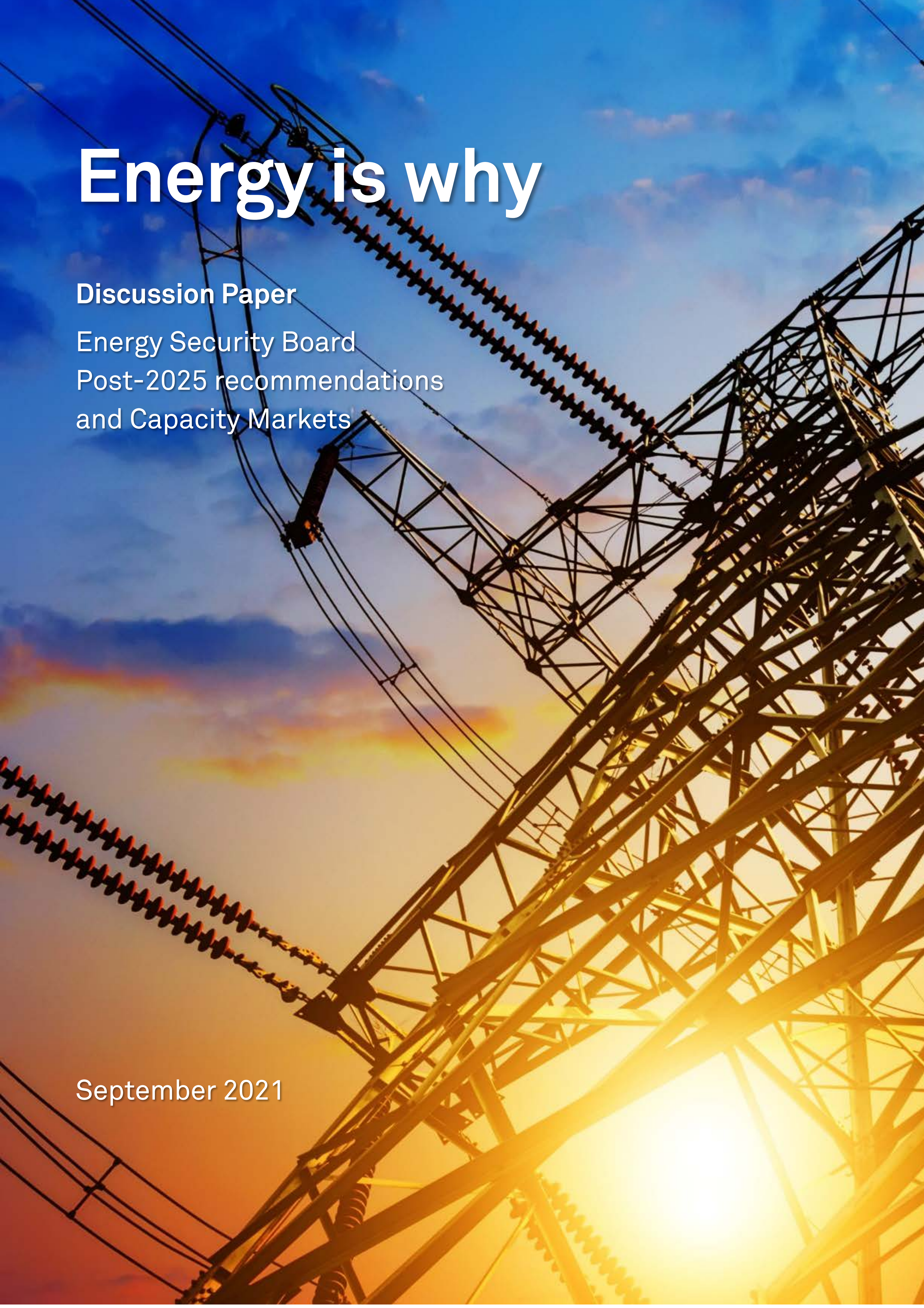
Energy is why

Discussion Paper

Energy Security Board
Post-2025 recommendations
and Capacity Markets

September 2021



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1 Executive summary

1.1 We care about this as a customer and for customers

Telstra has a direct and growing interest in the future direction of Australia's energy policy. We are a major user and generator of electricity and will soon establish ourselves as an energy retailer. This Discussion Paper in response to the Energy Security Board's "Post-2025 Market Design | Final advice to Energy Ministers" report (**ESB Report**) reflects this.

Australia's demand for data and energy is evolving, and decisions made now need to accommodate and support the benefits this could bring in the near future.

Technology, particularly the increasing use of connected devices in and around the home, is creating opportunities for new solutions to old problems associated with generation, transmission and storage. Empowered by the data they have access to, consumers will continue to demand simpler, more flexible and more transparent retail options.

In this environment, energy market policy settings that can continue to provide consumers affordability, reliability and fairness must remain paramount.

Affordability matters to us and to our customers. Telstra is one of the largest consumers of power in Australia (1.6TWh p.a.) and our consumption will grow as demand for connectivity grows. Upon becoming licensed by the Australian Energy Regulator and the Essential Services Commission (Victoria), we will also immediately become the energy retailer with the largest number of customer relationships (albeit not for energy at that stage) and household connectivity services in Australia.

Reliability matters to us because our telecommunications services depend heavily on continuity of energy supply (from the grid or otherwise). As well as taking energy from the national grid, we have 300MW of standby generators and 1GW(1GWh) of battery storage assets that we have been progressively activating to support the security of the energy system (see section 3.3). And we are the Market Generator in respect of 0.6TWh of renewable generation assets.[1]

As a generator, user and soon-to-be retailer of energy, fairness matters to us. We believe we have a constructive role to play in ongoing policy debates, especially to ensure that proposed policies do not create unnecessary risk or harm to customers.

1.2 Supporting the process with constructive debate

We support the Energy Security Board's:

- (i) objective to promote "a secure, reliable, and efficient energy transition while maintaining affordability for customers";[2]
- (ii) intent to evolve data availability, appliance standards, tariff structures and operating envelopes to enhance the visibility and flexibility (and diminish the negative impacts of) Distributed Energy Resources;
- (iii) recognition that any changes to market mechanisms must be carefully considered to avoid negative impacts on retail competition, transaction costs and overall affordability; and
- (iv) desire to encourage the Effective Integration of Distributed Energy Resources (**DER**) and flexible demand.

However, we have concerns about some aspects of the ESB Report.

This **Discussion Paper** focuses on the *Resource adequacy mechanisms and ageing thermal retirement* pathway (**Capacity Market**) and its pre-cursor, the Physical Retailer Reliability Obligation (**PRRO**). We are concerned that the "Straw Proposal" for a Capacity Market (**Capacity Market Straw Proposal**) may lead to unintended consequences and significant risks, including those raised in the table below.

[1] Telstra has completed three power purchase agreements: solar farm in Emerald (QLD); a wind farm in Murra Warra (VIC) and a wind farm in Crookwell (near Goulbourn in NSW). When Crookwell comes online in 2023, the output from these investments will be the equivalent of displacing the fossil-fuelled electricity used by more than 150,000 homes.

[2] ESB Report – Part A, p.7.

Higher prices	The (current) energy spot market has "**high fidelity**" – price signals change rapidly to reflect the real-time demand, and generators respond accordingly. By contrast, the Capacity Market Straw Proposal involves a low fidelity price signal, with participants paid on a "just in case" basis a long time ahead of any (potential) shortage. This "smears" the price signal, reducing the fidelity of generator bidding behaviour, and potentially resulting in higher energy prices.[3] See sections 3.1, 3.4, 3.5 and 5**.**
Reduced reliability	If the Capacity Market Straw Proposal makes payments broadly available to plant formats that don't improve flexibility and reliability (e.g. Open Cycle Gas Turbines, which are not flexible), the price signal available for investments in the right forms of capacity (and demand flexibility) will be dampened. This may diminish (rather than enhance) reliability. See section 3.6.
Reduced competition	Intertwined with retailer obligations, the Capacity Market Straw Proposal may risk exacerbating the concentration of market power in energy markets, which could have material adverse impacts for customers and the economy. See section 3.12.
Missed opportunity for Demand Side Management	Much of the shortage of "firm capacity" identified in the ESB Report can be met by Demand Side Management, enhanced by the vehicle-to-grid potential of electric vehicles and the ultra-responsiveness of new industrial processes (e.g. electrolysis). If the Capacity Market Straw Proposal is based on existing processes for large generators, it may be less accessible by "owners" of latent assets & flexible demand (residential & business customers). See sections 3.2, 3.6-3.9 and 3.11**.**
The fact base is changing rapidly	Recent regulatory changes have not yet commenced – e.g. 5-minute settlement, and the implementation of the Wholesale Demand Response initiative (both starting in Oct-2021). These changes are more conducive to load control and use of batteries, which provide a faster response than other energy sources (e.g. gas plant) which may be favoured by the Capacity Market Straw Proposal. There is also the potential missed opportunity for policy co-optimisation (network tariffs, appliance standards etc). See section 6.

Given these concerns, and at a time of unprecedented energy market uncertainty and speed of change,[4] we would welcome more opportunities to engage with other stakeholders on these issues.

Getting Australia's energy market policy settings right is incredibly important, and we hope that this Discussion Paper aids the development of better solutions.

1.3 Restoring confidence while minimising distortion

Fundamentally, the current market design works to deliver reliable, affordable energy. However, we have not seen support for a coordinated approach to policy settings or support to leave the policy settings to operate as intended. This has eroded community and stakeholder confidence in policy settings (**Policy Confidence**).

In part, this may be driven by differences of opinion on the speed at which thermal assets will (or should) exit the market and replacement technologies will be commercially available. In the absence of coordinated national policy changes, there is the risk of continued intervention from governments at all levels distorting the signals needed for private investment in energy assets and capabilities that are needed to maintain reliability and affordability.

We question whether the Capacity Market Straw Proposal is **tangible enough** to create and sustain Policy Confidence, thereby reducing the pressure for future uncoordinated government interventions. We also

[3] This is consistent with our experience in the Western Australian markets.

[4] This uncertainty is reflected in the 300%+ spread (6-19GW) in the ESB Report's estimated shortage of "firm capacity". We note that the ESB Report is released just weeks prior to the introduction of a number of regulatory changes that have been enacted but not yet implemented; including transition to 5-minute settlement, and the implementation of the Wholesale Demand Response initiative. These changes will undoubtedly evolve the market to be more flexible.

question whether such a policy change can be achieved without unnecessarily distorting what already works.

The spot energy price (and other existing mechanisms) currently addresses energy imbalances in the short and medium term (e.g. minutes or hours) and keeps prices down. In contrast, the Capacity Market Straw Proposal is mostly focused on solving issues that emerge on a longer timescale – particularly the prospect of prolonged periods (days or weeks) of energy shortage (the ***dunkelflaute*** problem). However, rather than solving this issue it may actually deter investment signals that already exist for highly-responsive assets and capabilities (e.g. demand response and batteries).

If governments are to build Policy Confidence by introducing a new mechanism to address this potential problem, it should focus specifically and explicitly on the ***dunkelflaute*** problem, especially if thermal assets exit before replacement technologies are commercially available. The mechanism should be narrow and direct in its impact and minimise the distortion of existing **effective** market mechanisms that already address the clear and present demand / supply imbalances that threaten affordability and reliability.

Clear guiding principles for the design of such a mechanism could reduce the risk of extinguishing the prospect of better policy outcomes (enhanced by new technologies) in the long term.

Some initial thoughts on such principles are set out below.

Principle	Description
Isolate the specific problem	The mechanism should isolate the **specific** problem sought to be solved by the policy; in particular to the extent that it lies beyond the reach of the energy-only price signal (**Specific Problem**). See section 2.
Define the physical characteristics	Recognising that the Policy Confidence issue arises from concerns about long duration but infrequent shortages (see section 2), the characteristics of the policy mechanism should be targeted to this issue. The mechanism should also minimise distortions relating to the high-fidelity responsiveness needed to address constraints that occur (more frequently) on shorter timescales (see sections 3.2, and 3.5-3.6).
Expressly target Policy Confidence	Rather than designing a permanent, market-wide signal whose efficacy will not be known for many years, **crystallise early** those investment decisions and tangible commitments needed to address Policy Confidence.
Expressly target "Investor Uncertainty"	Explicitly "design out" the investment uncertainty which the policy seeks to address. Use price certainty and duration to augment investor appetite to provide the specific tangible capabilities that address the Specific Problem (**Uncertainty Suppression**). This should minimise distortion of rights and obligations in the broader market.
Efficiency in suppression, not core price signals	Knowing that Uncertainty Suppression will still result in **some** distortion, use market mechanisms (e.g. forced scarcity, reverse auctions, rights transferability) in the Uncertainty Suppression process.
Viability of beneficiaries	Include mechanisms to ensure appropriate performance assurance (e.g. credit support) for beneficiaries of Uncertainty Suppression.
Reduce permanent distortions	Design Uncertainty Suppression to narrow the sweep of operational and investment decisions that it could adversely affect. A staggered approach with increments (similar to spectrum auctions) may be helpful.
Address the root cause of Jurisdictional Schemes	The proliferation of Jurisdictional Schemes[5] has been caused not only by the need to address Policy Confidence, but by a desire from State Governments to build their climate considerations into the energy policy landscape. Jurisdictional Schemes are likely to become more pervasive and intrusive unless emissions are incorporated in the valuation & allocation of Uncertainty Suppression.

[5] State governments developing energy policy or investments in a way that is not coordinated for NEM-wide optimisation. See ESB Report – Part A, p.23.

Sections 2 and 3 of this Position Paper focus on the *Resource Adequacy Mechanisms and Ageing Thermal Retirement* pathway (**Capacity Market**).

Our initial comments on the other recommendations in the ESB Report are summarised in Appendix 1.

1.4 Shining a light on immediate opportunities

Telstra also notes some key dynamics and the opportunities they create were not emphasised in the ESB Report:

(a) In many instances, market evolution has been held back not by the efficacy of the market rules but by the culture, mindset and behaviour of incumbent participants (see section 6.2).

(b) Policy development should take into account other profound transformative transitions in technology, such as artificial intelligence and connected devices (see section 3.10).

(c) The velocity and quantum of change in the energy landscape mean energy policy development must be co-optimised with multiple intersecting policy domains (e.g. roads, vehicle emissions standards, appliance standards) and not developed in isolation (see section 6).

1.5 Driving for more ambition

If Australia is to commit to a material change to energy market mechanisms, we believe it should do so with a more expansive view of the future, and a stronger focus on consumers. In addition to asking:

> ***"How can the domestic energy grid and energy market be technically adapted to cope with higher penetration of VRE and the withdrawal of (stranded) thermal assets?",***

would it be possible to also ask (see section 5):

> ***"How can a new energy system based on evolving technologies minimise costs and maximise benefits at every level of society and the economy?"***

We hope that our perspective as a large customer and market participant with a focus on data and technology can assist the next phase of the ESB's work. Our experience in addressing similar complex and challenging issues in the other industries in which we operate (e.g. through auctions in respect of radio spectrum) may also be of value.

Telstra looks forward to continuing to engage with the Energy Security Board, the AEMC and other stakeholders in the next phase of this work.

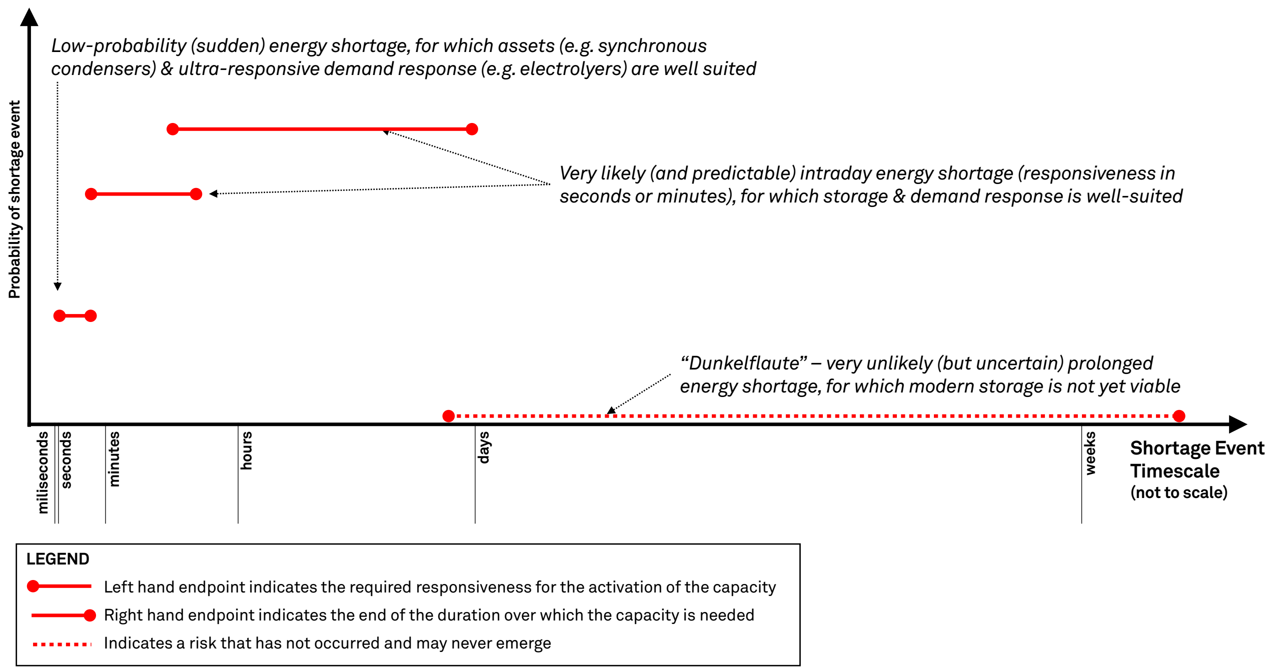
2 What problem are we solving?

Apprehensions regarding "early closure" of coal assets, the inability of VRE to manage long periods of low resource, and the perception that this challenge lies beyond the reach of the energy-only price signal are key reasons cited for the need to introduce a Capacity Market. Unless the mechanism is highly targeted to assuage this apprehension, the result may be unnecessarily higher power bills and an e

xacerbation of reliability risks in the short-medium term.

The scenario contemplated by this apprehension is characterised by a prolonged period (days or weeks) of energy shortage, to which modern technologies are not (yet) well suited. This is described as the ***dunkelflaute*** (renewable energy drought) problem, illustrated in the probability diagram below.

> ***Dunkelflaute: risk or fear?***
>
> *Although it has an outsized influence on the Policy Confidence issue, the prospect of infrequent but longer duration episodes of energy shortage (the "dunkelflaute" problem) is not yet clearly a credible threat. It may also be rendered irrelevant by the advancement of technology on the timescales over which it could emerge.*



If the community and governments lack confidence that the current market design "will work", they will not sit back and "let it work".

As we understand it, the policy question is not simply whether the Capacity Market Straw Proposal is sensible in an efficient market sense (we understand doubts remain), but whether it is possible to develop a policy change that is **tangible enough** to create and sustain community and government confidence (**Policy Confidence**), without causing unnecessary and significant adverse impacts for market participants and consumers.[6]

If the policy question is defined in this way, it helps to clarify the risk of distorting the efficient market signals needed to address the energy sector's challenges. Whether a policy is a "tax" levied on consumers in order to pay for insurance against the *dunkelflaute* apprehension can be better understood to help guide policy decisions.

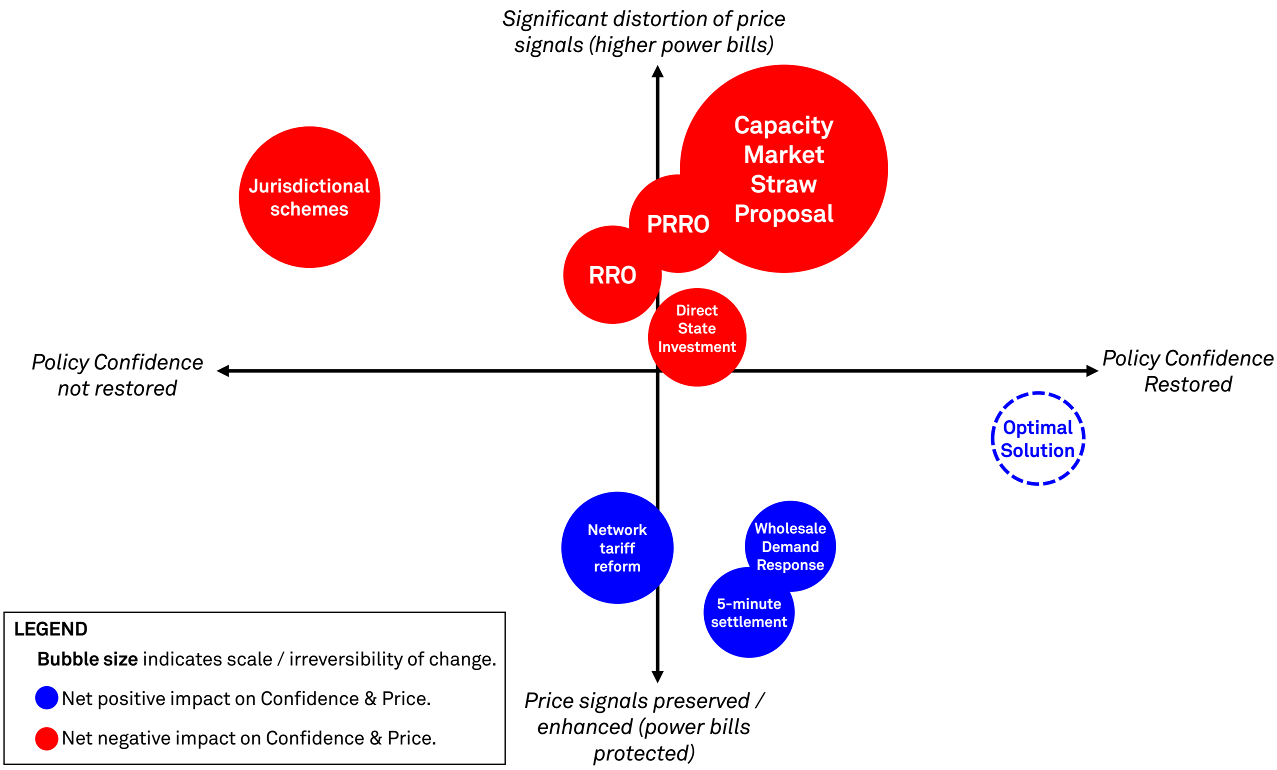
Current technologies that are capable of addressing the *dunkelflaute* apprehension are typically not suited to the clear & present risks that manifest on the shorter timescales shown in the probability diagram (above). Many of those technologies have the potential to exacerbate such risks, adding further cost (and reliability) pressures to the system. If the Capacity Market Straw Proposal were to subsidise such technologies, this could exacerbate reliability risks and cause power bills to be more expensive.

If lack of Policy Confidence continues to be an issue, further Jurisdictional Schemes[7] may be implemented without NEM-wide coordination, further contributing to inefficiency. However, a policy to address this risk of fragmented Jurisdictional Schemes is only likely to be sensible if:

- it **succeeds** in addressing the lack of Policy Confidence; **and**
- it causes **less damage** (e.g. distortion of price signals) than ongoing Jurisdictional Interventions.

In the grid set out in the diagram below, such a policy be best located in the **bottom right** quadrant.

[6] It is apparent that the financially based Retailer Reliability Obligation (**RRO**) introduced in 2019 did not represent enough tangible change to alter the trajectory of community concern and Government intervention (and the fragmentation of Jurisdictional Schemes), as noted in the ESB Report.
[7] State Governments developing energy policy or investments in a way that is not coordinated for NEM-wide optimisation. See ESB Report – Part A, p.23.



3 Potential risks associated with a Capacity Market

3.1 Understanding the economic benefits of a Capacity Market

While the ESB Report did not emphasise the economic modelling of the Capacity Market Straw Proposal, proponents of the Capacity Market report this as justification for change.

Over the 20 year forecast horizon, the modelled $1.3 billion NPV benefit represents less than 1% of the Present Value of total energy cost.[8] This benefit is likely to be within the margin of modelling error, especially given that the modelling assumes “a (perfectly-functioning) and appropriately designed” capacity mechanism.[9] Given the desire to influence Policy Confidence (see section 2), it unclear whether the problem even lies within the realms of conventional economic modelling.

By contrast, we are very supportive of the Energy Security Board’s identification of “Effective integration of Distributed Energy Resources (**DER**) and flexible demand” (**Flexible Demand & DER**). We see this could address the affordability & reliability challenge, delivering benefits 3-5X greater than the Capacity Market Straw Proposal.

Reform pathway	Value (NPV)
Resource Adequacy Mechanisms and Ageing Thermal Retirement (**Capacity Market**)	$1.3B
Essential System Services and Scheduling and Ahead Mechanisms	$1.2B
Effective Integration of Distributed Energy Resources (DER) and Flexible Demand (**Flexible Demand & DER**)	$3.6-6.3B[10]
Transmission and Access Reform Pathway	$1.0 billion

We would welcome the opportunity to discuss the potential risk that the Capacity Market Straw Proposal would impede Flexible Demand & DER rather than support it (see section 3.6).

[8] Assuming 200TWh of energy consumption p.a., and an average energy cost (whether via spot energy or spot energy plus the proposed capacity payments) of $60/MWh.
[9] ESB Report – Part B, p.130.
[10] It is not clear from the ESB Report whether the “potential benefits of harnessing flexible demand and the successful integration of DER” of “around $6.3 billion over the next 20 years” (ESB Report – Part A, p.39) reflected NPV or undiscounted cumulative benefits. Accordingly, a discounted figure of $3.6 billion was derived by applying a 6% discount rate (unlevered, real) to these benefits, assuming they are derived at a constant rate over the 20-year period.

Even if the modelled benefits of the Capacity Market Straw Proposal are accepted, they may be dwarfed by the economic value eroded by that proposal if:

- it results in the persistence (or introduction) of generation formats that are less flexible for what is needed in peak demand (see section 3.5) and low demand (see section 3.7) scenarios;
- the signals for Flexible Demand & DER are dampened (see section 3.6.3);
- the investment risk premium increases due to uncertainty about how the market will re-settle for both spot energy and capacity revenues (see section 3.8);
- the impact of emissions is not taken into account (see section 3.11); or
- market power among incumbent retailers & generators is concentrated further (see section 3.12).

3.2 Adequacy of Flexible Demand & DER

We agree with the ESB that the energy transition is underway at pace. This creates a market (and system) environment in which energy is abundant (and cheap) most of the time, punctuated by short (intraday) episodes of pronounced undersupply (extreme high prices) or pronounced oversupply (zero or negative prices).

This creates a new equation for supply continuity, creating challenges and opportunities for the national electricity system, energy companies and customers alike. As the ESB notes, “Over the next two decades 26-50 gigawatts (GW) of new large scale variable renewable energy and 13-24 GW of distributed PV – in addition to existing and committed projects – are forecast to come online. This means there is a need for **6-19 GW** of new utility scale, flexible and firm resources, as up to 63% of the current coal and gas fleet in the NEM retires by 2040.” (emphasis added).[11]

In this new world, flexibility is critical for both load (consumption) and capacity (supply). Participants & consumers who can throttle, defer and accelerate their assets & activities are best placed to take advantage of market conditions for both commercial benefit and improved resilience.

The good news is that the capacity to achieve this does not have to rely heavily on new utility-scale dedicated generation assets, or the subsidisation of old formats that are not suited to the conditions of the new market. Subtly shifting the energy usage patterns of both households and industrial users dramatically expands flexibility. Devices and appliance whose primary purpose is **not** energy management are **latent** assets, already paid for by businesses and households. In the **residential market alone**, several GW of demand is available to address peak and low demand events and system security (see below).[12]

Households with electric powered device type			Power per device (kW)	Probability of device use in Peaks (%)	Load available for Demand Response	Load (GW) available (curtail or surge) in …	
Device type	(%)	(M)				low demand	peak event
Air Conditioner	74%	5.99	2.30	80%	16%	13.79	1.76
Hot Water	56%	4.54	1.30	40%	100%	5.90	2.36
Pool Pumps	12%	0.97	1.00	40%	100%	0.97	0.39
Dishwasher	55%	4.46	2.40	10%	100%	10.69	1.07
Wash Machine	97%	7.86	0.90	10%	100%	7.07	0.71
Tumble Dryer	55%	4.46	2.40	10%	100%	10.69	1.07
Total (GW)						**49.11**	**7.36**

The thoughts of the ESB and other stakeholders on what it would take to unlock the barriers to the control (or influence) of the use of such assets will be valuable. This could unlock significant potential available from capacity that **is already paid for** and is set to become almost **universally connected** over time (see section 3.10).

The potential of the industrial user market for Demand Response is even larger than the residential opportunity. The flexibility of millisecond-response electrolysis assets will enhance this further (see section 5.2).

[11] ESB Report – Part B, p.35.
[12] In fact the ESB Report refers to 50GW of latent capacity in homes (Part B, p.71), but does not specify its configuration.

The potential for a further step-change may come from electric vehicles.[13] In the passenger market alone, Australia is expected to have approximately **four million** EVs by 2040. EVs are widely distributed and portable. They can instantly soak up energy from the grid during oversupply, or discharge into the grid during undersupply, exactly where it is needed.

Australian families' typical driving distances are much shorter than the average range of EVs. EVs' capacity to support the grid during constrained periods will be limited by their discharge rate (kW) rather than their stored energy (kWh).[14]

Passenger vehicles spend 95% of their time in a parked state,[15] while less than one-third of passenger vehicles are on the road at any one time (even during peak traffic periods).[16] Electric vehicles are therefore the classic "latent asset". This is illustrated in the table below.

This illustrates the value of co-optimising policy domains (see section 6). If appliance standards, vehicle emissions and road infrastructure policies are conducive to two-way charging, EVs could make a dramatic contribution to the energy capacity challenge.[17]

The views of the ESB and other stakeholders on how policy can be co-optimised to achieve this will also be valuable.

Passenger vehicles – potential capacity available

% of ESB Shortage (6-19GW) addressed		Average discharge rate			
		2kW	5kW	10kW	20kW
% of fleet available	*2%*	1-3%	2-7%	4-13%	8-27%
	5%	2-7%	5-17%	11-33%	21-67%
	10%	4-13%	11-33%	21-67%	42-133%
	20%	8-27%	21-67%	42-133%	84-267%

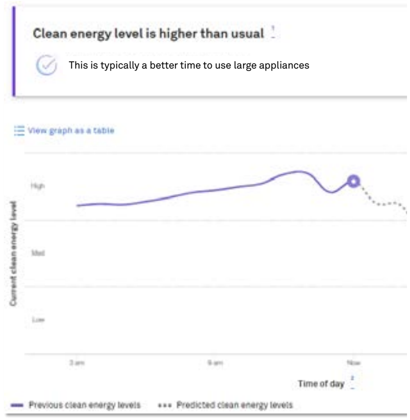
3.3 Investment is critical and is gaining momentum

While the Federal Energy Minister has noted that "… investment in new dispatchable generation has been almost non-existent" and "no new dispatchable generator has been built in NSW in the last 12 years or Victoria in the last eight,"[18] the story is different for non-generation energy capacity. There are already two grid-scale battery investments in Victoria, and another three in South Australia. More than 85 grid-scale batteries with a total capacity of 18,660 MW are in planning, as detailed in AEMO's latest Generation Information report.[19] Investment in sub-grid-scale capacity is accelerating, and industrial load flexibility is growing.[20] All of these investments are expected to be further stimulated by the transition to the higher fidelity price signal enabled by 5-minute settlements later this year.[21]

Telstra intends to invest in utility scale energy storage in the next 12 months. This adds to our programme of progressively activating 300MW of standby generators and 1GW of on-site battery systems, so that these assets can assist in addressing market constraints.

During the recent blackouts in Queensland (May 2021), Telstra' standby energy assets (across more than 60 sites) and renewable generation contributed to provide that flexibility. We kept the lights on for the equivalent of 50,000 families, so that customers stayed connected. This also reduced pool prices for the whole market.

[13] Source: Marchment Hill analysis from 2017.
[14] Assume a typical household that uses approximately 5,000 kWh of electricity per annum and owns an electric vehicle with a 75kWh battery. This vehicle has a range of 300km, but generally the family travels less than 100km per day. The vehicle can therefore be stored in a half-charged state (so that there isn't a preference between charging v. discharging) at work or home. A vehicle in this state would have the capacity (with the right charging point) to provide for all of the household's energy needs for many hours.
[15] David Z Morris, 'Today's Cars Are Parked 95% of the Time (March 2016), Fortune.
[16] 'Greater Melbourne | Number of cars per household' (2016) ID Community.
and 'Transport Planning for the Australian Infrastructure Audit | Transport Modelling Report for Melbourne' (June 2019), Veitch Lister Consulting prepared for Infrastructure Australia.
[17] Manufacturer momentum is gathering for this, as illustrated in the release of the Ford eF150.
[18] 'Energy market reforms will create the grid we need for the future' (August 2021), Herald-Sun.
[19] 'Energy Explained: Big Batteries' (May 2021), Australian Energy Market Operator.
[20] New technologies can transform this – e.g. rapid response electrolysis (see section 5.2).
[21] The importance of price signal fidelity is discussed in section 2.7.



Telstra is also making the technology that it uses to manage its own energy position freely available to all Australian families. In September 2021, we will release a the "Clean Energy Tracker" application (right). This enables customers to understand how they can shift their consumption from periods when regional system demand is high and/or renewable output is low, to periods when the system is facing low demand challenges, renewable energy is abundant and prices are low. This is the first step in a long-term program to assist customers (with or without DER) to improve their impacts on the grid, the market and the climate.

These assets and capabilities do not meet the criteria by which capacity is recognised in AEMO's NEM Electricity Statement of Opportunities (**ESOO**) publications. They are not in published plans, and are unlikely to have impacted the assessments in the ESB Report.

Appetite for these types of investments is significantly higher than it has been over the last decade, or even the last five years. This is apparent to us from recent evidence from capital markets and energy market participants.

The value of (even recent) historical observations is limited in a market characterised by a high degree of uncertainty and pace of change (see section 3.4). Comparisons to "what other jurisdictions **have implemented**" (emphasis added)[22] should also be considered with caution. This is especially true given that "Australia stands out for the rapid pace of its change and for its adoption of distributed (rooftop) solar photovoltaic (PV) systems – the highest in the world".[23]

3.4 Unprecedented uncertainty

3.4.1 Timing and scope

The ESB has correctly identified that the market is characterised by unprecedented uncertainty. This is reflected in their **300%+** spread (6-19GW) of the estimated shortage of "firm capacity". This uncertainty gives rise to questions as to whether fundamental changes to the energy market are required at this time, or whether they are required at all. It is possible that more simple and incremental changes may be capable of bridging the medium-term challenge.

If the objective is to address Policy Confidence associated with the *dunkelflaute* apprehension (see section 2), is it possible to ensure that mechanism to address that **specific apprehension** can be very targeted? Appropriately targeted measures have less adverse impact on affordability & reliability, involve less reliance on forecasting accuracy (see section 3.4), are more reversible (see section 3.9) and do not extinguish the option to achieve better policy outcomes in the long term.

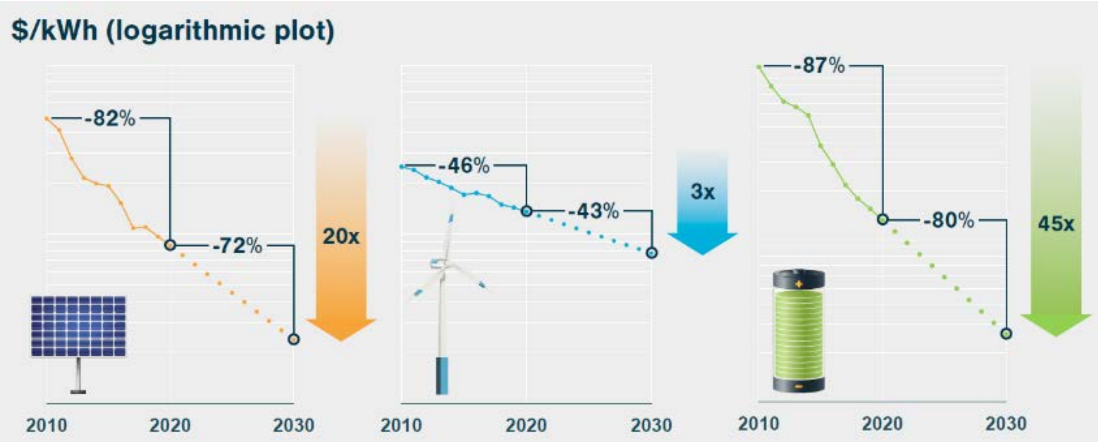
3.4.2 Non-linear drivers of change

The ESB identifies technology advancement, government intervention and rapid change in demand profile as causes of uncertainty.[24] Falling technology costs are driving technology disruptions that are **not linear**. Like most disruptions, the energy disruption "is being driven by the convergence of several technologies whose costs and capabilities have been consistently and predictably improving."[25] Those technologies include solar photovoltaic power, wind power, and lithium-ion battery energy storage.

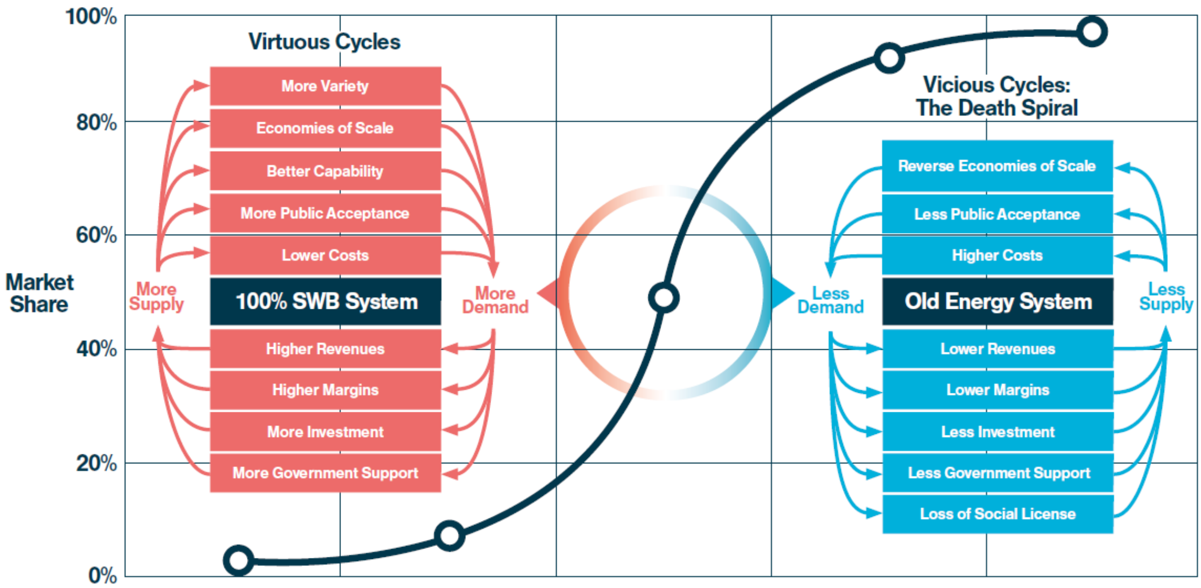
Solar and wind are already the cheapest new generation options. They cost less than existing coal, gas, and nuclear power plants in most areas globally. The cost of solar-wind-battery systems will fall another 70% over 2020-2030. This means that disruption is inevitable (overleaf). [25]

Even without a formal price on carbon, coal has become a stranded asset class. Globally, gas & nuclear power assets are expected to become stranded during the 2020s or shortly thereafter.[25]

[22] A key focus in Part C of the ESB Report.
[23] ESB Report – Part A, p.13.
[24] See Appendix 2.
[25] "Disruption, Implications, and Choices | Rethinking Energy 2020-2030: 100% Solar, Wind, and Batteries is Just the Beginning" (October 2020), RethinkX.



It is fraught to assume that disruptive technologies will simply replace old ones on a 1-to-1 basis. Disruptions tend to disproportionately replace the old system with a new system that has dramatically different architecture, boundaries, and capabilities. History shows that in most instances the new system is much "larger" than the one it displaces. The disruption of the energy sector will be no exception.



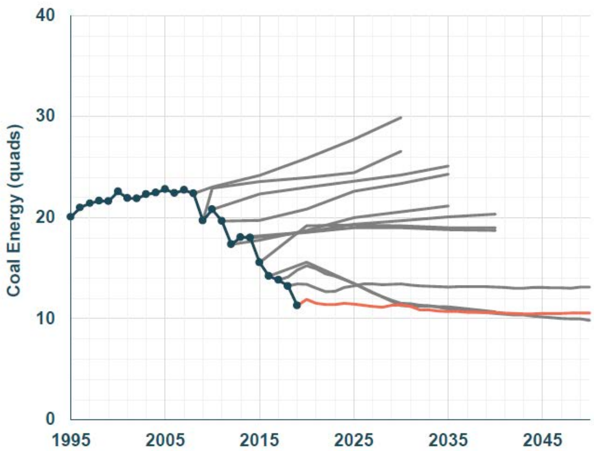
The speed of disruptions is nonlinear; driven by reinforcing, causal feedback loops (above).

"These loops interact with and amplify one another, accelerating the adoption of new technology in a virtuous cycle while at the same time accelerating the abandonment of old technology in a vicious cycle".[25]

3.4.3 The challenge for forecasting

Forecasts tend to underestimate the speed of disruption. As an example, coal in the United States was initially disrupted by unconventional well-stimulation technologies ("fracking"). It continues to collapse under pressure from VRE.

The U.S. Energy Information Administration have wrongly made linear projections for the recovery or stabilisation of coal power each year for over a decade (right).[26]



Source: US EIA Annual Energy Outlook series, 1996-2020.

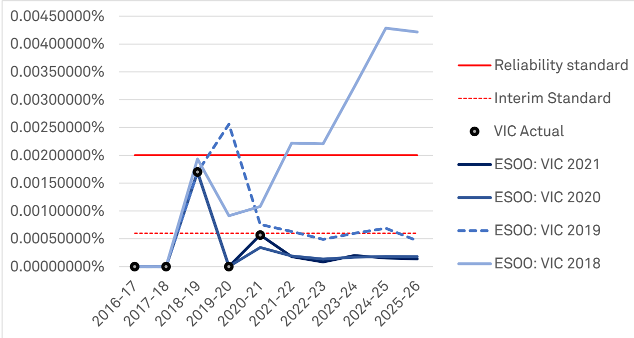
[26] "Disruption, Implications, and Choices | Rethinking Energy 2020-2030: 100% Solar, Wind, and Batteries is Just the Beginning" (October 2020), RethinkX.

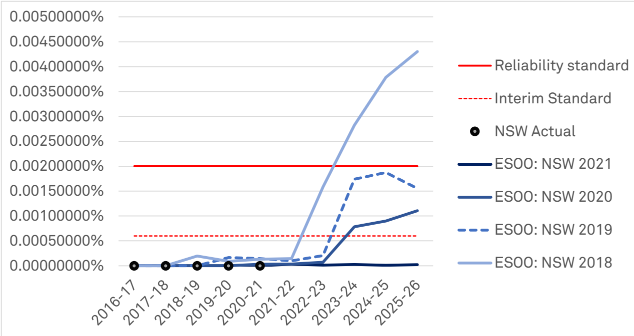
This is consistent with AEMO's estimates of unserved energy (**U.S.E.**) in their Electricity Statement of Opportunities (**ESOO**) studies. Over just four years, the forecasts of U.S.E. have dramatically collapsed in most states compared to prior forecasts.

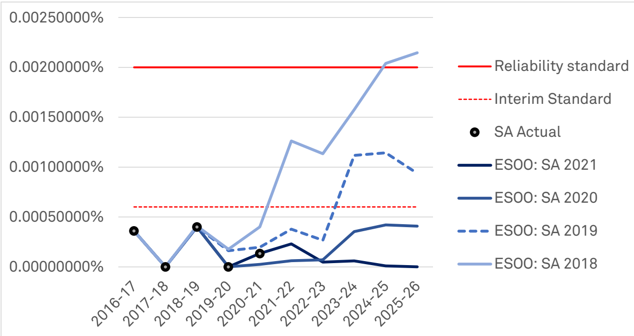
A forecast breach of the Reliability Standard (0.002% U.S.E.) has **never** come to pass. Most such forecasts are made several years before the year in which the breach is forecast to occur. Those forecasts rarely survive one year without being revised substantially downwards.

This is because the AEMO forecasting methodology is understandably naturally conservative[27] and the market **operates as expected** to develop new resources as required in response to market signals. In other words, projections tend to "inspire responses" to fill the gaps.

The diagrams at right show the forecasting history for Victoria, New South Wales and South Australia.[28]







Source: Telstra analysis based on ESOO data.

At the time of writing this report, a number of regulatory changes have been enacted but are not yet implemented. These include the transition from a 30-minute to a 5-minute market, and the implementation of the Wholesale Demand Response mechanism. Both changes will increase the market's flexibility.

Although the ESOO forecasts do include expected Integrated System Plan (**ISP**) transmission investments, their full positive impact on system flexibility and new generation investment is unlikely to be reflected.

The genesis of the ESB Report was a failure of the regulatory framework to forecast the complexion of generation mix we have today. Yet the success of a broad-based Capacity Market proposal depends heavily on high confidence in forecasting the next few decades.

3.5 How extreme do spot prices need to be?

The ESB Report questions whether the energy price (under the current market system) is "sufficiently high" during periods of undersupply:

> *"... investment uncertainty and the increasing volatility of high price events suggest that under the current market design, investors will discount the contribution of these events to revenue streams in their business case analysis for new firm and flexible resources ...*

Forecasts versus fear

Headline reliability projections from AEMO are based on announced coal retirement dates. However, government intervention in the issue suggests that they expect faster exits. Governments understandably want to prepare for this without being seen to accelerate it (the Policy Confidence issue – see section 2).

Because the Capacity Market Straw Proposal is based on a price-based mechanism which is itself inherently uncertain, it is unlikely to stimulate the types of investments (based on current technologies) that would be needed to address Policy Confidence.

*Can a more targeted and contained mechanism to address this **specific** forecasting concern be designed to prevent "preparation for the worst cases" driving further apprehension and distortion of perceptions of likelihood?*

[27] For example, excluding all but the most certain of future asset developments.
[28] Given that the AEMC Reliability Panel's Annual Market Performance Review is not published until several months after the completion of the year on which it reports, the actual figure for 2020-2021 is derived as an average of the prior three years.

... revenue potentially earned during high price events ... would need to increase significantly to facilitate investment to deliver the reliability standard. Increasing the MPC could provide a solution ... analysis suggests that if this discounting by investors amounts to 50-75% of prospective over cap revenue streams, the MPC may need to increase to between $35,000 to $60,000 to support resources expecting 5.5 hours of revenue at price cap (from its current level of approximately $15,000)." [29]

Being clear about which problem to solve (see section 2) is critical. The degree to which different technologies can participate in price surges is a function of their physical performance characteristics. Most gas and coal plants have prolonged "ramp-up" periods, making them less suited to the short-lived character of price spikes that the market will regularly encounter in future. For example, the contribution of an OCGT may only be 8% (of its rated capacity) for a sudden spike lasting only 5 minutes. This is illustrated in the table below.

Capacity type	Ramp UP profile (time to capacity)[30]		Participation in a high-priced episode lasting ...				
			5 mins	10 mins	30 mins	2 hours	4 hours
OCGT	30	mins	8%	17%	50%	75%	94%
Aero derivative gas units	10	mins	25%	50%	83%	92%	98%
Marine gas engine	1	mins	90%	95%	98%	99%	100%
Battery (2 hours storage)	-	secs	100%	100%	100%	100%	100%
Standby generator	30	secs	95%	98%	99%	100%	100%
Coal (already operating)	3	hours	1%	3%	8%	17%	63%
Coal (cold start)	4	days	0%	0%	0%	1%	2%
Air-conditioner (turn off)	15	secs	98%	99%	100%	100%	100%

Investors in coal and gas plant definitely need to heavily discount the revenues available to them from extreme price peaks in the spot market. This is especially true in a 5-minute settlement market.[31] But this is less the case for hydro, modern storage technology (including EVs), flexible industrial load (e.g. electrolysers) or flexible elements of residential load (e.g. pool pumps). Such technologies can (almost) fully capture these spot revenues.

The degree to which the MPC would need to be lifted (if at all) to encourage investment in new flexible assets is likely to be less than the levels suggested in the ESB Report. This means the benefits of the Capacity Market Straw Proposal (compared to the status quo) are probably overstated. Further and more diverse approaches to this analysis would be of value.

The market signal needed to activate "latent assets"[32] is much lower than the signal needed for new assets to be built.[33] Harnessing such assets reduces overall system cost because the investment needed to create them is already sunk, or is funded outside the energy system for other purposes. The opportunity for such assets to be activated with shorter investment timeframes is also an advantage in avoiding "overbuilding" of capacity. Such assets also tend to benefit from A.I. and probabilistic portfolio solutions (see section 3.9).

3.6 Reduced signal fidelity

3.6.1 Macro Decisions versus Micro Decisions

If funding is a constraint, solving for **security alone** is easy. Simply over invest in the mix of specific generation and storage types to meet all known (and some unknown) stress scenarios, and force the jettisoning of inevitable oversupply (i.e. waste the excess or store it). Market operators than have confidence in supply continuity through the operation of "**Macro Decisions**". For simplicity, assume that an over-investment of 30% is needed to achieve this.

[29] ESB Report – Part B, p.37.
[30] For simplicity, all plant types are assumed to ramp up in a straight line from 0% at the **beginning** of the interval to 100% **at the end** of the interval. In other words, during the ramp-up period for a specific plant type, the output for that plant type over the ramp-up period is 50%.
[31] "For the purposes of this analysis an Open Cycle Gas Turbine (OCGT) has been used as the marginal capacity resource ...", from the ESB Report – Part B, p.130.
[32] Assets and capabilities that already exist but whose primary purpose is not power management.
[33] In the diagram above, these are marked with the **dotted red** outline.

But system security is a function of massive volumes of events and conditions occurring at an incredibly granular timescale, characterised by high volatility, and with patterns that are hyper-local.

Policy can enable security **and affordability** by permitting a large volume of "**Micro Decisions**" that target 2-3% improvements acting on specific events & conditions. Relying on **Macro Decisions** is inefficient, because each Macro Decision is like making thousands (even millions) of Micro Decisions all at once on a homogeneous basis. This ignores the differences needed at the Micro scale to optimise the impact. Designing a system for Macro Decisions is likely to be (in this hypothetical) 30% higher than a more efficient approach enabling Micro Decisions at scale.

Price signals are more effective if they have a high degree of **fidelity** to the complex and fast-moving physical conditions that give rise to system constraints. In particular, they are optimal if they appropriately:

- reward rapid and specific response (whether from generation, storage or load curtailment) to conditions of constraint or imbalance; and
- discourage behaviours (of assets, users etc) that contribute or do not respond adequately to constraint or imbalance.

By way of illustration, AEMO indicated that in the South Australian outages that occurred in March 2017 (which could have resulted in a system black were it not for the fortuitous and contemporaneous loss of 400MW of load): *"The total loss of generation for this event was 610 MW, however 410 MW was lost within 1.5 seconds of … The remaining 200 MW was lost over a period of between one to five minutes after the initial fault."*[34] 350MW of generation was lost within **0.1 seconds**.

Smearing exacerbates the problem

Albeit on a smaller scale, the transition from 30-minute to 5-minute settlement illustrates the effects of smearing. Consider a scenario in which significant shortages drive the dispatch signal to $15,000/MWh in the first 5 minutes of a 30-minute Trading Interval, followed by oversupply (negative $1,000/MWh prices) in the last 25 minutes of the Trading Interval. This was not an uncommon occurrence under the 30-minute settlement system, as generators rushed in to capture the high price.

Under the 30-minute settlement construct, the OCGT owner ramps their plant as fast as possible to capture the high price, and the OCGT owner earns $1,667/MWh (well above its short run marginal cost). Yet the OCGT made only a negligible contribution to the solution, and a significant contribution to the problem, as indicated below.

Minutes elapsed since event	***Grid Condition***	***Output (% of rated capacity)***	***Impact of Energy Output***
0-5	*Under-supply*	*8%*	*Alleviates the problem*
5-30	*Over-supply*	*58%*	*Exacerbates the problem*
25-30		*98%*	

*In the same scenario but using a 5-minute settlement construct, the OCGT owner would earn **negative $625/MWh** for their output. In practice, they would simply **not run** during the period of over-supply.*

Given the distortions that arise from smearing the price signal over 30-minutes instead of 5-minutes, it is necessary to explore how the smearing effects of long term ex ante reward systems can be contained so as to reduce broader distortions.

For this reason, the 5-minute settlement market (due to commence October 2021) is expected to be a dramatic improvement on the 30-minute settlement system (see section 3.6.2).

3.6.2 The coexistence of complementary capacity and spot markets

The ESB Report states that *"Under current arrangements electricity generators are paid for the energy they produce **but not the capacity they make available**"*.[35] But the Australian energy system **does** have a **financial** capacity market, based on traded financial derivatives that exist alongside the spot energy market. These two markets are correlated and complementary.

The derivatives market provides longer-term signals of the likelihood and quantum of extreme pricing in the spot market. Those participants exposed to the spot price (large customers and retailers) purchase these derivatives to insure against extreme events. By entering into these arrangements, participants are able to create investment certainty to the volatile exposures that the energy only market **appears** to create. This is precisely how Telstra understands and manages exposure to energy costs.

The payout curve on these derivatives is a function of the real-time relative demand conditions (reflected in spot price) in the real world. This means that the incentives for generator bidding behaviour and

[34] "Fault at Torrens Island Switchyard and loss of multiple generating units on 3 March 2017." AEMO 10 March 2017.
[35] ESB Report – Part A, p.23.

demand response activities in the physical world during extreme price episodes are **not** dampened by the operation of the derivative market.

Ex ante payments under the Capacity Market Straw Proposal may risk diluting the real-time signal (spot energy) and "smearing" bidding behaviour. This may favour Macro Decisions that crowd out the opportunity for Micro Decisions to optimise efficient outcomes. It may also have the effect of reducing the need for the development of an efficient derivative market which may be necessary to actually provide the investment certainty sought. The smearing effect is illustrated at the 5-minute versus 30-minute scale (see inset, section 3.6.1).

Under the current energy-only market, higher spot prices are only experienced by those retailers and (large) market customers who are inadequately prepared for increased volatility. By contrast, the Capacity Market Straw Proposal will tend to spread **higher costs** across **all** retail customers.

This is especially so if there needs to be a *"compulsory accreditation and allocation of certificates to all resources, rather than a voluntary participation model"* to address concentration of market power risk.[36]

Higher cost is borne out in our direct experience as a major customer in the Western Australia electricity market. In that jurisdiction, the capacity component of our energy bill is estimated to be 50% higher than the case in a gross pool situation.

There is a risk that the smearing effects of the Capacity Market Straw Proposal:

- discourages investment and/or innovation generally; or
- rewards assets that respond in minutes or hours (see section 3.5), crowding out investments & other mechanisms that can **actually** respond within the timeframes required for system security.

The result may be a material reduction (not an enhancement) in system security.

3.6.3 Demand response is dampened

The effects of reduced fidelity are especially pronounced for demand response. If the Capacity Market Straw Proposal strengthens signals for large generation assets, and dampens the signal for demand and small-scale supply, the lag effects of a supply-biased system (see section 3.9) are reinforced.

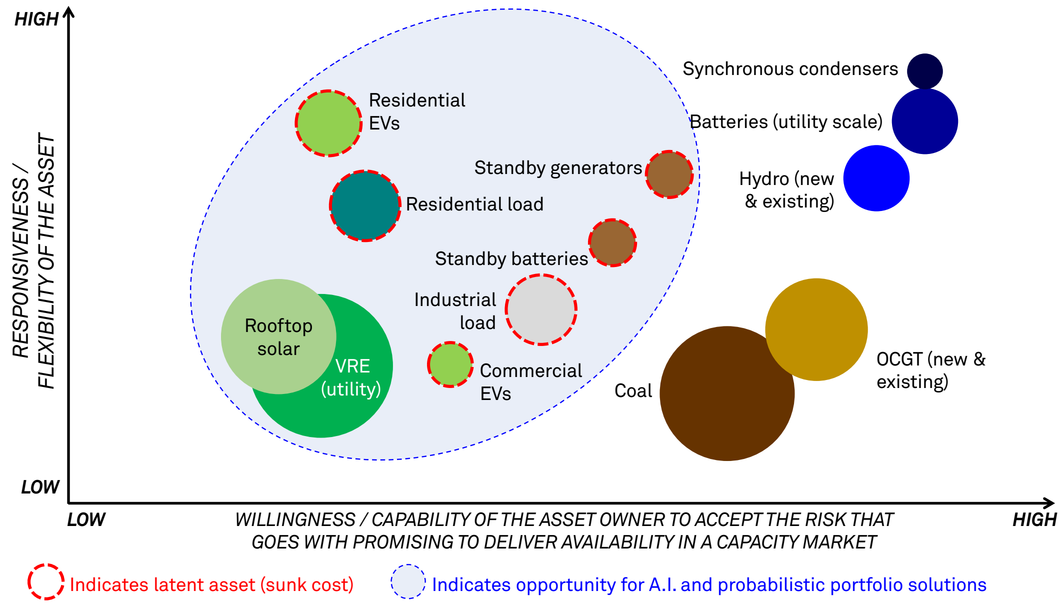
A better understanding of how perspectives on this issue contributed to the development of the Capacity Market Straw Proposal would be valuable, given that:

- the ESB estimates that the positive impact of Flexible Demand & DER outstrip the benefits of the Capacity Market proposal by 3-5X;
- demand response is enhanced by a probabilistic portfolio approach with A.I. (see section 3.10); and
- demand response will be naturally stimulated by several policies that have been (or are being) enacted, including 5-minute settlements & tariff reform (see section 6).

> ***Don't bother locking up your car***
>
> *Poorly designed, a Capacity Market can be likened to nationalising car insurance, with a uniform premium regardless of risk profile, and then not caring whether people park their vehicles unlocked on the street, leaving their keys in the ignition.*

Assets and capabilities available for demand response (flexible load, behind-the-meter appliances and generation) tend to be highly distributed among many assets owners (households and businesses). Energy risk management and demand response tend not to be core business for these owners. The Capacity Market Straw Proposal's system of ex ante pricing (with penalties and consequences for performance failure) may not be well matched to such owners (see below).

[36] ESB Report – Part C, p.17.



Past efforts to drive demand response relied almost exclusively on monetary-based signals. The assumption of rational decision-making limits the potential of desired behavioural change. Especially in a post-COVID landscape with rising concerns about climate change, consumers and businesses are taking action for reasons other than immediate financial rewards.

Optimisation of non-price factors is beyond the reach of centrally administered market systems but can be harnessed with portfolio approaches and M.L.-A.I. (see section 3.10).

3.7 Asymmetry and minimum demand

The Capacity Market Straw Proposal asymmetrically targets the challenge of energy **undersupply**. However, the market of the future is equally challenged by conditions of **oversupply**:

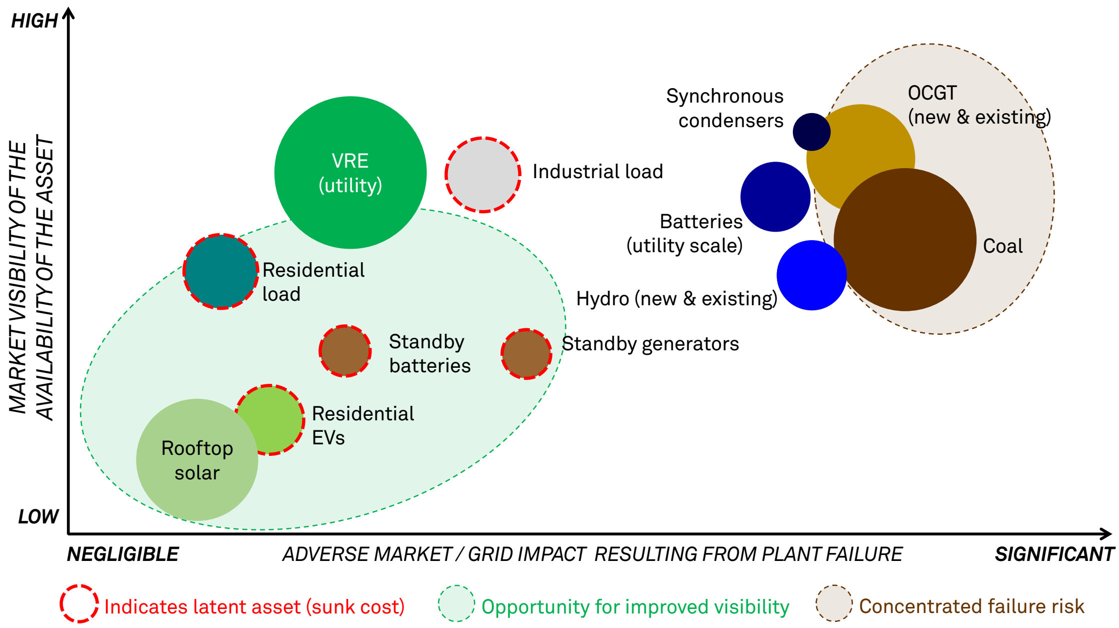
> "[minimum system load conditions] *… are already being observed in South Australia, and AEMO has forecast the occurrence in other regions (i.e., Victoria, Queensland …*[37] *it is critical that work continues to progress towards two-sided market measures to encourage shifting of flexible demand to times of the day where it would be most valued".*[38]

The table below indicates how different generation formats are able to respond to periods of oversupply, and how some formats **exacerbate** the problem (as indicated in section 3.6.2).

Capacity type	Ramp DOWN profile[39]		Participation in a high-priced episode lasting …				
			5 mins	10 mins	30 mins	2 hours	4 hours
OCGT	30	mins	8%	17%	50%	75%	94%
Aero derivative gas units	10	mins	25%	50%	83%	92%	98%
Marine gas engine	1	mins	90%	95%	98%	99%	100%
Battery (2 hours storage)	-	secs	100%	100%	100%	100%	100%
Standby generator	30	secs	95%	98%	99%	100%	100%
Coal (de-rate to min gen)	3	hours	2%	4%	13%	25%	75%
Coal (shut down)	4	days	1%	1%	3%	6%	25%
Air-conditioner (turn off)	15	Secs	98%	99%	100%	100%	100%

The failure modes of coal and OCGT generation formats tend to be sudden, unforecasted, and concentrated in large single units. This results in a concentration of failure risk, diminishing system security (see diagram below).

[37] ESB Report – Part B, p.77.
[38] ESB Report – Part B, p.65.
[39] For simplicity, all plant types are assumed to ramp up in a straight line from 0% at the **beginning** to 100% **at the end** of an interval – i.e. during ramp-up for a specific plant type, the output for that plant type over the ramp-up period is 50%.



3.8 Will a Capacity Market overcome investment uncertainty?

The success of the Capacity Market Straw Proposal depends on the elimination (or at least significant reduction in) of the uncertainty that prevents investment in firm generation capacity.

While media headlines tend to be captured by short-lived spikes in the spot price (up to $15,000 per MWh), consumers actually experience the quarterly / annual movement in prices. The annualised volatility of 12-month baseload swaps is 12-16%, while the annualised volatility of 12-month baseload caps is 26-30% (and has been as a high as 45%).[40]

The market for these derivatives acts as a **financially settled** capacity market. As a reasonable proxy for the likely annualised volatility of ex ante capacity payments, it is not clear why price volatility under the Capacity Market Straw Proposal would be any lower. Given its dramatic & fundamental impact on the workings of the energy market, the Capacity Market Straw Proposal's ex ante payments are likely to be more volatile than those derivatives.

The Capacity Market Straw Proposal would replace a market mechanism for which there is three decades of spot price and derivative pricing data, and create an entirely new physical market for which there will be **zero years** of data on day-one of its operation. The Capacity Market Straw Proposal will also reduce the depth of existing spot & derivative markets, rendering their historical data less useful.

Volatility will be exacerbated by (as noted in section 3.9) the extended period needed to design and implement the Capacity Market Straw Proposal, and "the ongoing need to regularly review and adjust aspects of the mechanism".[41]

The ESB notes that the market-based signal may fail altogether, requiring a price-fixing intervention that would result in additional cost (**Intervention Premium**):

> *"Targets for jurisdictional schemes could also be integrated in a new capacity mechanism … in the context of a certificate scheme, this could be done through a centrally administered scheme that guarantees, in the case of the straw proposal, a **minimum certificate price** for new entrants based on pre-determined … This could involve AEMO running an annual process that would provide a **minimum price** on certificates for new projects from year 4 onwards for a period of 5-7 years."*[42]

A system of ex ante payments for declared availability, combined with long range retailer commitments,[43] may bias eligibility to incumbent participants (see section 3.12). If so, a few incumbent participants may

[40] Bloomberg, 4 September 2021.
[41] ESB Report – Part C, p.18.
[42] ESB Report – Part B, p.39.
[43] The ex ante nature of the Physical Retailer Reliability Option (precursor to the Capacity Market Straw Proposal), requires retailers to commit to volumes years in advance. That involves new risks associated with forecasting customer

have enough power to trigger the application (or withdrawal) of Intervention Premiums. This would further compound the risk of market concentration and the need for intervention.

Given these considerations, Telstra would welcome the opportunity to discuss ways to drive a net reduction in investment uncertainty.[44]

3.9 Supply-focused, with low reversibility

In contrast to the Flexible Demand & DER pathway, the Capacity Market Straw Proposal assumes that fundamental changes to the energy market pricing mechanism will reduce the uncertainty faced by investors in (primarily) **long term generation** assets.[46] If the introduction (or extension) of long-term assets distorts the market signals for more appropriate investments, the consequences are long-lived and not easily reversed.

> ***5+ years for a simple & obvious change***
>
> *The transition from 30-minute settlement to 5-minute settlement in the National Electricity Market took **5.4 years** to implement, measured from the publication of the Consultation Paper by the Australian Energy Market Commission.[45] In contrast to the 5-minute settlement proposal, the Capacity Market proposal is not simple, represents a radical departure from the current market model and has only been conceptualised at a very high level, leaving a large volume of design questions to be debated among large groups of stakeholders whose views are diametrically opposed.*
>
> *Some Australian energy market enthusiasts would argue that this proposal has in fact been debated for decades.*

As noted by the Pacific Energy Institute, energy policy structures that focus on the (capital intensive) supply side tend to push "grid and electricity ecosystem constraints onto the consumers at the innermost loop in the form of limited product and service choices as well as limiting potential product and service providers".[47] They rely on the much longer cycles of measurement and decision in regulation and capital-intensive industry. As a result, they impede the shorter cycles available in business services and customer decisions.

In this model, "the customers (who generally have the fastest loop dynamics) are limited by the outer loops [capital intensive business and regulation] that always lag the customer in decision making ... The lag effect is most noticeable when disruptive step changes occur in the inner loops." [48] This is illustrated in the diagram **overleaf**.

The comparison to capacity mechanisms in international jurisdictions in Part C of the ESB Report is relevant to the "irreversibility" concern. These jurisdictions took 3-5 years to implement a capacity market.[49] Lead times were further compounded by "the ongoing need to regularly review and adjust aspects of the mechanism".[50]

The long implementation period (and prolonged period of review and modification) means that **any** policy premised on fundamental and sweeping changes to the energy market may be rendered redundant, ineffective or counterproductive by the time it works its way into active investment decision-making in the energy market.

A better understanding of the types of changes in markets and technology that could cause this would be valuable. What should be assumed about Australia in a Post-2025 world, given that the pace of technology change has been non-linear since those international schemes were implemented, and "Australia stands out for the rapid pace of its change"?[51]

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volumes, and makes it especially difficult for new entrants to enter the market. This further diminishes competition (see section 3.12).

[44] ESB Report – Part B, p.130.

[45] "CONSULTATION PAPER: National Electricity Amendment (Five Minute Settlement) Rule 2016" (19 May 2016), Australian Energy Market Commission.

[46] ESB Report – Part B, p.34.

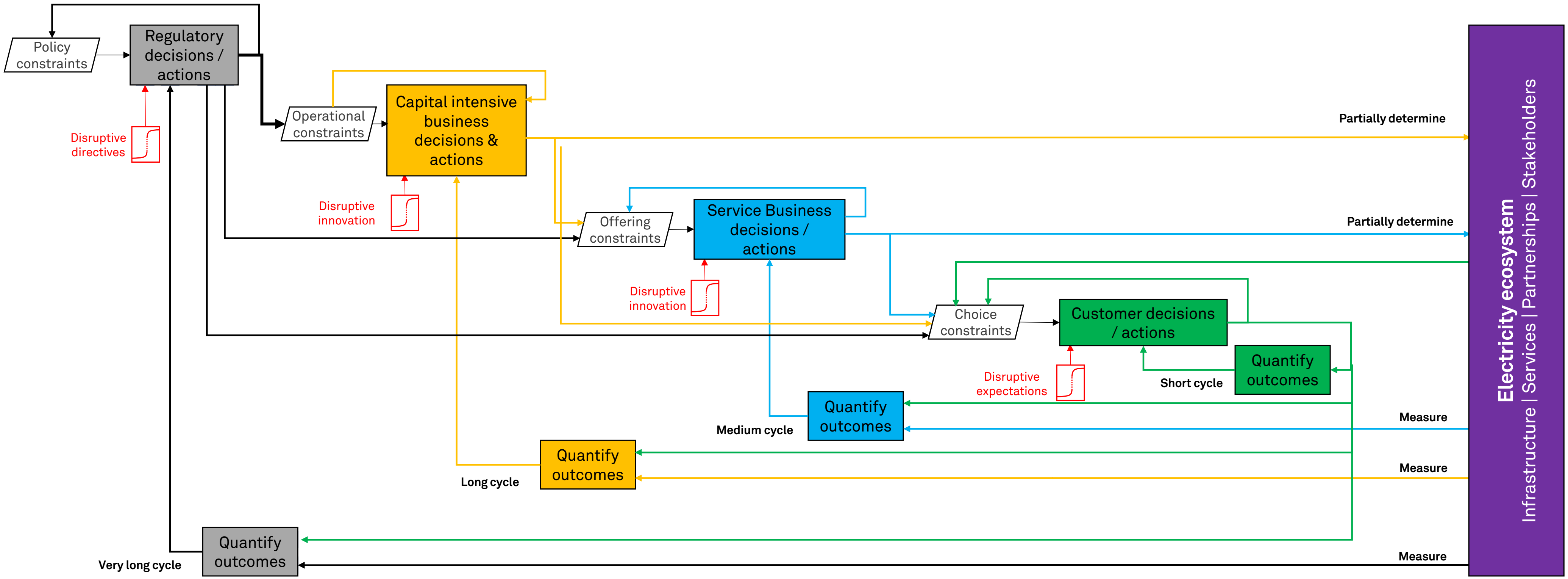
[47] "A Gambit for Grid 2035 | A Systemic Look into the Disruptive Dynamics Underway" (April 2021) Pacific Energy Institute.

[48] "A Gambit for Grid 2035 | A Systemic Look into the Disruptive Dynamics Underway" (April 2021) Pacific Energy Institute.

[49] ESB Report – Part C, p.18.

[50] ESB Report – Part C, p.18.

[51] ESB Report – Part A, p.13.



Source: Pacific Energy Institute.[52]

Conversely, a decision to **not** implement a Capacity Market preserves the option to consider a Capacity Market at some time in the future when conditions might be less uncertain and if the case for change is apparent. The "option to defer" is especially valuable given AEMO's current observation that the energy market (as currently designed) will the meet reliability standard for at least the next five years.

The risk of summer blackouts has been reduced by 2.25GW of new generation capacity, while peak demand is likely to be lower than forecast amid the pandemic: *"No reliability gaps are forecast for the next five years, primarily due to more than 4.4 GW of new generation and storage capacity, as well as transmission investment and reduced peak-demand forecasts."*[53]

Scarcity versus Abundance

A source of increasing tension is the difference in mindset between traditional industry entities with a scarcity mindset versus customers and new business entities with an abundance mindset.[48]

[52] "A Gambit for Grid 2035 | A Systemic Look into the Disruptive Dynamics Underway" (April 2021) Pacific Energy Institute.
[53] AEMO Chief Executive Daniel Westerman, quoted in "Power grid faces fresh test from solar boom" (31 August 2021), Angela MacDonald-Smith, Australian Financial Review.

Conversely, AEMO sees the "greater near-term risk to supply security over the next few years was from **minimum demand** rather than **insufficient supply**, making it 'a different story' from past years."[53] As indicated in section 3.7, the Capacity Market Straw Proposal is less well suited to addressing minimum demand challenges, and may diminish the market flexibility needed to address this.

The real objective of the Capacity Market Straw Proposal may be to address Policy Confidence arising from the ***dunkelflaute*** fear associated with faster coal closures, rather than to address the medium-term issues identified by AEMO (see section 2).

If governments are compelled to act on the Policy Confidence issue, a more targeted, less sweeping and less irreversible policy is likely to be more effective and less distortionary.

Given that the reliability standard will be met in the medium term in the absence of a capacity market, the value of policy deferral is significant. We assess the value of a one-year policy deferral would deliver NPV equivalent to half of the modelled benefits of the Capacity Market Straw Proposal.[54]

In such an uncertain environment, the fact base for any policy change is enriched through another year of data on the effects of: non-linear technology change; the operation of 5-minute settlements, Wholesale Demand Response Mechanism and other policy adjustments.

This would help to determine whether a system change (or other policy) is needed, or would do more harm to the positive trends that are emerging. If it becomes apparent that a Capacity Market is **not** needed, this would avoid unnecessary investments (funded by consumers) valued at **3-10 times** the modelled benefits of the Capacity Market Straw Proposal.[55]

3.10 Probabilistic portfolio approach and the role of new technology

We support the ESB's recommendation for a Data Strategy for the NEM.[57] Working in in conjunction with other policies like the Consumer Data Right, this has the potential to improve real-time access to meaningful data within and outside of the energy sector.

However, while the ESB Report emphasises the importance of data to the energy transition,[58] there remains a significant opportunity to explore the profound advantages from the convergence of three rapidly evolving technologies; namely the Internet of Things (**IoT**), Machine Learning (**M.L.**) and Artificial Intelligence (**A.I.**) (together, ***IoT-M.L.-A.I.***).

Historically, orderly management of the Australian energy market has been premised on highly visible, directly controllable, large units of generation, to serve the prevailing demand conditions, using deterministic algorithms and rule sets. Each unit was massive, and unit performance could have significant implications for the whole system. Precisely connecting, metering and dispatching each unit was important.

> ***Rise of the machines***
>
> *The realisation that conventional models are not equipped for high velocity, high complexity markets is all but universal in financial markets.*
>
> *High frequency trading (**HFT**) has turned into an arms race of acquiring data and executing on it on nanosecond timescales.*
>
> *Using M.L., A.I. to optimise for latency in both links and processing, firms profit by exploiting market conditions indiscernible to humans and in a very small time duration that would otherwise be physically impossible to execute.*[56]

This is no longer the case. The energy market transition is amplifying the potential of *IoT-M.L.-A.I.* in a few ways:

- More of the "generation fleet" is fragmented, dispersed, and invisible;[59]
- Massive data sets that exist "outside the energy system" (e.g. behavioural propensity) can inform an understanding of the behaviour of the energy system;
- The "connectedness of everything", combined with M.L. means that load profiles can be estimated and predicted without precise (or any) metering;

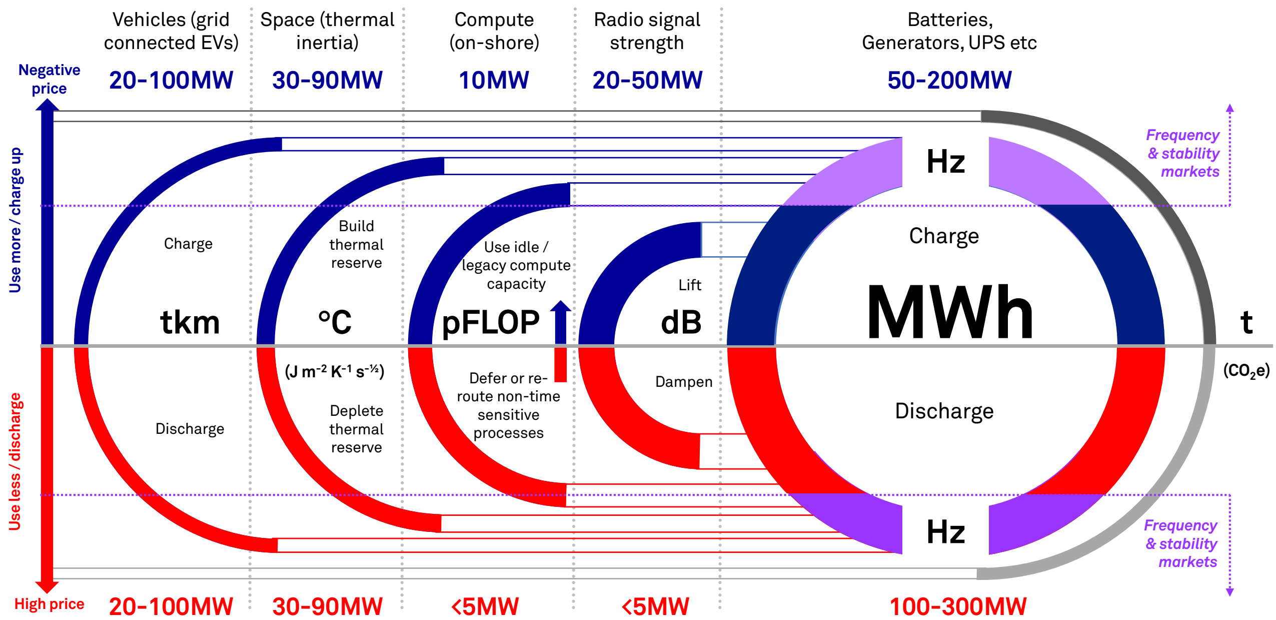
[54] See Appendix 4
[55] ESB Report – Part A, p.35.
[56] 'Improving High-Frequency Trading' (August 2021), Traders Magazine.
[57] ESB Report – Part A, p.16.
[58] ESB Report – Part A, p.49-51.
[59] ESB Report – Part A, p.38-39.

- The relationship between demand and supply appears to be more chaotic,[60] but can be discerned at high resolution in terms of both geography (hyper-localised) and timescale (real-time); and
- Volatility enhances (rather than impedes) models for the optimisation of assets, appliances and devices by targeting large volumes of Micro Decisions (see section 3.6.1). This happens in ways that lie beyond what can be achieved with conventional deterministic modelling and scheduling approaches.

In a federated environment focused on Micro Decisions, countless decisions need to occur over short periods. It is not practical nor possible to achieve this in manually or with deterministic algorithms. *IoT-M.L.-A.I.* is better suited to the velocity, veracity and volume of data produced by the system. It makes sense of data within the vanishingly short "shelf-life" of the Micro Decisions.

With the application of these capabilities, the required level of confidence in the behaviour and performance of a "single element" is much lower. Confidence is measured at a portfolio level, based on access to a large number of elements. A single household might not have "firm" capacity to address a constraint, but a portfolio of households within an *IoT-M.L.-A.I.* portfolio can be firm at high levels of confidence.

At Telstra we recognise that the days of treating energy as a separate business decision are over. Telstra is taking an integrated energy perspective in relation to is internal portfolio of loads and assets, as illustrated in the figure below.



Within this framework, algorithms seek opportunities to transition any **state** of energy (electrons, radio signals, compute workloads, thermal inertia) to maximise value and improve resilience. We want to use every form of energy to respond to the characteristics of the grid and the conditions of the market.

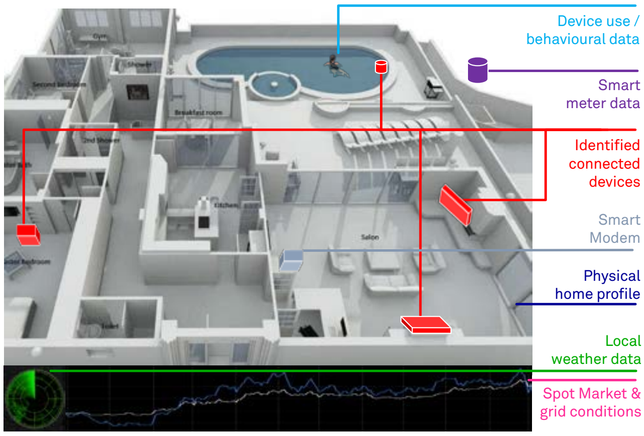
Because the **actual underlying value** of behaviour in the market is volatile, efficiently operating markets need to reflect this:

- Energy market pricing mechanisms are dynamic, fluctuating on granular timescales that reflect the actual conditions of constraint in real-time.
- Volatility is preserved and encouraged, rather than "smeared out" by the simplification of constraint signalling (see section 3.6). The existence of volatility and arbitrage (extreme high or low/negative pricing) helps to highlight the shifts in behaviour and performance which are needed.
- Incentives and obligations are based (encouraged and discouraged) on a portfolio view, rather than an individual asset or system element. This enables algorithms to learn and improve in the early deployment of the capability.

[60] ESB Report – Part B, p.50.

The Capacity Market Straw Proposal involves a material reduction in the fidelity of the price signal (see section 3.6). Its intention is to reduce short term volatility, by focusing on certainty in isolated system elements (rather than clustered portfolios). In particular, *ex ante* pricing models are not conducive to the application of *IoT-M.L-A.I.*

Married with real-time and forecast data relating to weather, grid conditions and household behaviour, it is possible to (imperceptibly) change the performance and behaviour of major appliances in the home (pool pumps, air conditioning, hot water). These changes can be mapped to grid and market conditions. The incremental investment to achieve this is negligible, and largely exists in hardware that is already on the market.



The potential of demand response also emphasises the need for data to be available to and discoverable by users, market participants and service providers who can act upon it in shorter cycles than are possible under a supply-side biased centrally administered approach to market operation (see section 3.9).

As is the case for EVs (see section 3.2), appliance standards need to be evolved to unlock the true potential of demand response (see section 6).

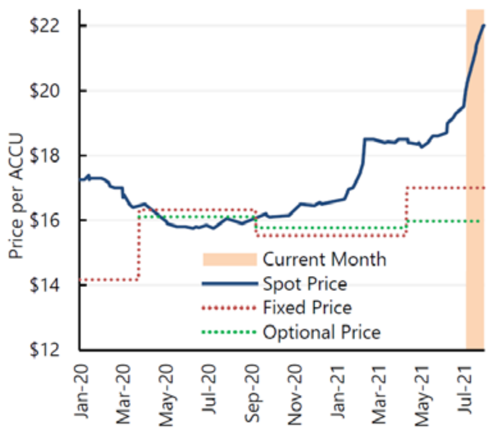
3.11 Carbon intensity

The ESB's mandate did not extend to a consideration of the role of emissions in energy policy design. The implications of the Capacity Market Straw Proposal does not include implications for grid carbon intensity or the costs thereof.

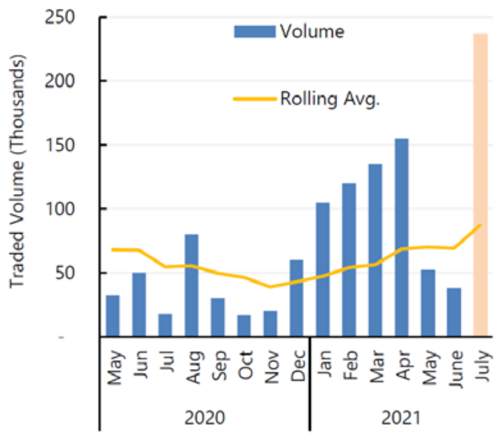
While Australia has not formally adopted a carbon price, the Australian economy is nonetheless exposed to the implications of the cost and carbon intensity of its energy supply. Most Australian corporations are exposed to global markets at some level, whether that is directly through exports, via import substitution, or as a consequence of capital flows (**Trade Exposed Businesses**).

Climate impact is becoming an increasing consideration in customer preferences, capital flows, and international regulation. The domestic Australian voluntary carbon price (below left) is already responding to rising demand for abatement (below right).[61] Macquarie now estimates that 54% of companies on the S&P/ASX 100 and 38% of those on the S&P/ASX 200 have committed to a net zero emissions target.[62]

ACCU price (spot)



ACCU volume



Australian Trade Exposed Businesses compete among international businesses that benefit from regulatory and market conditions that are more conducive to cheap energy and efficient carbon avoidance & abatement. Businesses can more easily seek competitive advantage when supported by: a low carbon energy grid; direct incentives to decarbonise their value chain; broad-based climate policies that ensures the burden of decarbonisation is widely shared and not concentrated among a small subset of businesses

[61] Charts from Market Advisory Group (July 2021), TFS Green and Jarden.
[62] Alex Gluyas, 'Climate Change "biggest opportunity since the internet" (September 2021) Australian Financial Review.

who make voluntary commitments; and access to the most efficient markets (globally) for carbon abatement.

To the extent that the Capacity Market proposal results in extension of existing thermal plant or investment in new gas-powered assets (such as OCGT), there will be an additional burden on Australia's economy. This manifests in the form of:

- higher energy prices;
- higher emissions volumes (and abatement costs) among those Australian businesses that have committed to climate targets;[63] and
- higher potential border adjustment taxes imposed by lower carbon intensity jurisdictions on the products of Australian Trade Exposed Businesses.

The proliferation of Jurisdictional Schemes has been compounded by a desire from State Governments to build climate considerations into the energy policy landscape. Jurisdictional Schemes are likely to persist unless emissions feature in any policy designed to address the Policy Confidence issue.

We would welcome the opportunity to discuss the interactions between emissions and energy policy, and how this can be explicitly managed to avoid further policy fragmentation.

3.12 Concentration and shallowing of markets

If the Capacity Market Straw Proposal rewards existing large format generation assets, they will compete on the basis of their short run marginal cost (**SRMC**). Conversely, new investments will have to compete on their long run marginal cost (**LRMC**). This results in the risk of either:

- failure to deliver the necessary investment, because the LRMC of new assets cannot be recovered; or
- higher overall system cost to compensate both existing and new assets using equivalent pricing (e.g. via the Intervention Premium).[64]

If the reduced fidelity of the price signal also impedes innovation (see section 3.6), this may be an impediment to new entrants for whom innovation is a focus.

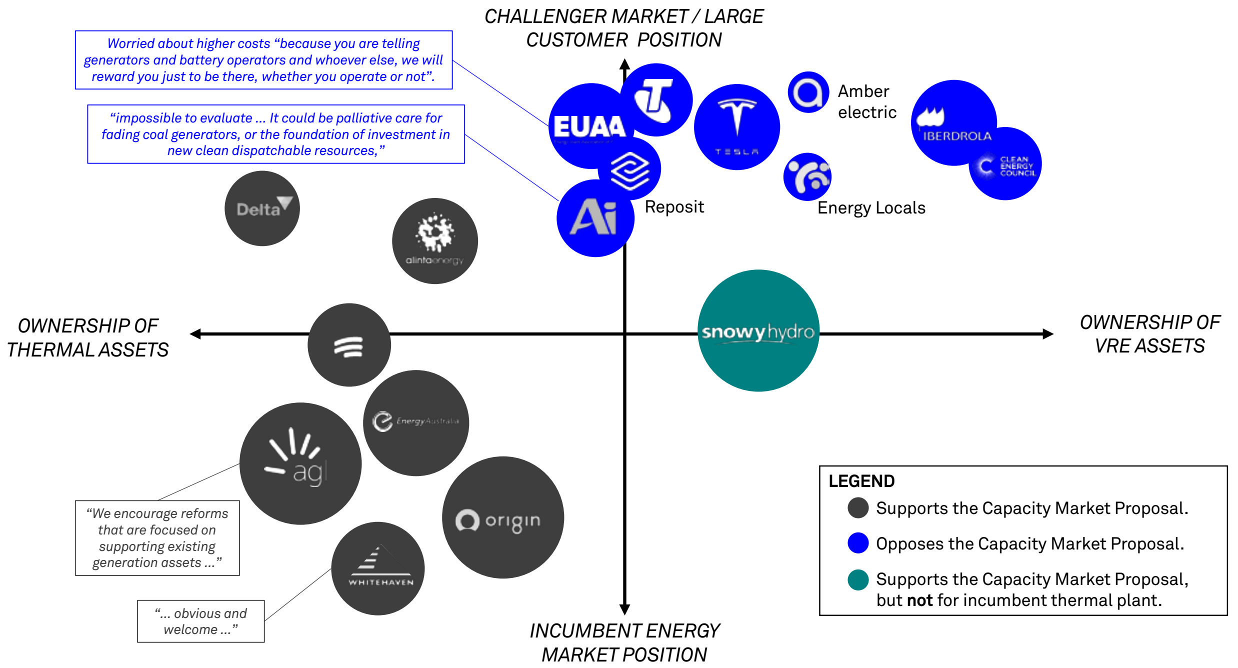
Fragmentation of the spot energy, derivative and (proposed) physical Capacity Market mechanisms will result in a shallowing of each pricing market. This is shallowed further if additional markets are created for *Essential system services and scheduling and ahead mechanisms*.[65] It would be valuable to explore further the "inter-market distortions" associated with a combination of markets including: gross pool spot energy; ex ante capacity; frequency services; inertia; operating reserve; system strength; scheduling and ahead market; and emissions.

Concentration of market power (particularly in the peaking segment) is further complicated by Government ownership of key assets (e.g. Snowy Hydro, Hydro Tasmania, Stanwell). There has been a demonstrated historical tendency for Government-owned entities to depart from rational bidding and investment behaviours to address the objectives of their owners.

Further concentrating their market power would exacerbate the difficulty already faced by market participants in accessing appropriate long term hedging positions and contractual instruments.

Whether the Capacity Market Straw Proposal will result in a further concentration of market power is suggested by the reaction of different energy markets participants. This is shown in the diagram below.

[63] The challenge posed by increased demand for abatement is even more pronounced, given that the current supply of available ACCUs is so dramatically outstripped by the emissions of NGER Scheme reporting entities (167x), the market distortion introduced by a de facto preference for "local" certificates is significant (see Appendix 3).
[64] See section 3.8.
[65] ESB Report – Part A, Page 33.



Telstra has 0.6TWh of renewable generation, which would face downside risk from the Capacity Market Straw Proposal. Conversely, our 300MW of standby generators and 1GW(1GWh) of battery storage means that we stand to gain even more from higher generation revenues associated with the Capacity Market Straw Proposal (see section 3.3).

Telstra's view on the Capacity Market Straw proposal ignores these portfolio benefits, because we are concerned about:

- higher energy prices (see sections 3.1-3.2, 3.4-3.8, 3.11 and 5); and
- the concentration of market power in energy markets (see section 3.12).

These are significant issues for Telstra's own energy bill (as a user of 1.6TWh of electricity p.a.), for consumer affordability and for economic growth.

4 An alternative approach to mitigate risk

As noted in section 2, if the community and governments lack confidence that the current market design "will work", they will not sit back and "let it work".

If governments feel compelled to act on the issue of Policy Confidence, it should be with the objective of explicitly bridging real gaps for the **specific** medium-term apprehensions not addressed by the current market. It should do so in a way that doesn't distort the market mechanisms that **are effective** in addressing the clear and present threats to affordability & reliability.

Clear guiding principles for the design of such a mechanism could reduce the risk of extinguishing the prospect of better policy outcomes (enhanced by new technologies) in the long term.

Some initial thoughts on such principles are set out below.

Principle	Description
Isolate the specific problem	The policy mechanism should isolate the **specific** problem sought to be solved by the policy; in particular to the extent that it lies beyond the reach of the energy-only price signal (**Specific Problem**). See section 2.
Define the physical characteristics	Recognising that the Policy Confidence issue arises from apprehension relating to long duration but infrequent shortages (see section 2), the characteristics of the policy mechanism should target this issue. The mechanism should also minimise distortions relating to the high-fidelity responsiveness needed to address constraints that occur (more frequently) on shorter timescales (see sections 3.2, and 3.5-3.6).

Expressly target Policy Confidence	Rather than designing a permanent, market-wide signal whose efficacy will not be known for many years, **crystallise early** those investment decisions and tangible commitments needed to address Policy Confidence.
Expressly target "Investor Uncertainty"	Explicitly "design out" the investment uncertainty which the policy seeks to address. Use price certainty and duration to augment investor appetite to provide the specific tangible capabilities that address the Specific Problem (**Uncertainty Suppression**). This should minimise distortion of rights & obligations in the broader market.
Efficiency in suppression, not core price signals	Knowing that Uncertainty Suppression will still result in **some** distortion, use market mechanisms (e.g. forced scarcity, reverse auctions, rights transferability) in the Uncertainty Suppression process.
Viability of beneficiaries	Include mechanisms to ensure appropriate performance assurance (e.g. credit support) for beneficiaries of Uncertainty Suppression.
Reduce permanent distortions	Design Uncertainty Suppression to narrow the sweep of operational and investment decisions that it could adversely affect. A staggered approach with increments (similar to spectrum auctions) may be helpful.
Address the root cause of Jurisdictional Schemes	The proliferation of Jurisdictional Schemes[66] has been caused not only by the need to address Policy Confidence, but by a desire from State Governments to build their climate considerations into the energy policy landscape. Jurisdictional Schemes are likely to become more pervasive unless emissions are incorporated in the valuation & allocation of Uncertainty Suppression.

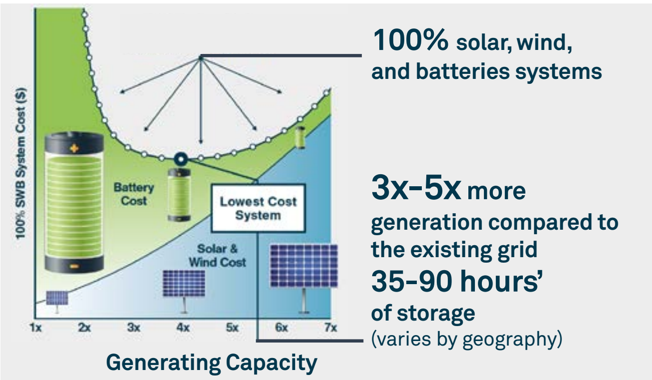
5 Global ambition

5.1 The non-linear nature of disruption

As the Federal Minister for Energy has indicated, the ESB Report represents a "once-in-a-generation opportunity to get Australia's electricity system ready for the future". At a time when Australia's natural resources in renewable energy and carbon sequestration are emerging as strategic advantages that can underpin its position as an energy superpower of the 21st century, is it possible to frame a more global perspective?

The replacement of conventional energy technology with solar-wind-batteries (referred to in section 3.4.2) is set to transform the energy system in ways that go far beyond the displacement of fossil-fuelled generation.

A valuable (but counterintuitive) property of such a system is the capacity to produce **much more energy overall**.[67] This is because the cost trade-off between generation and storage is non-linear, as reflected in the "**Clean Energy U-Curve**" (right).[68]



5.2 Transformative nature of *super power*

The "superabundance of clean energy output" or "super power"[69] that results from this enlarged system will be available at near-zero marginal cost throughout much of the year. This has profound implications more generally:

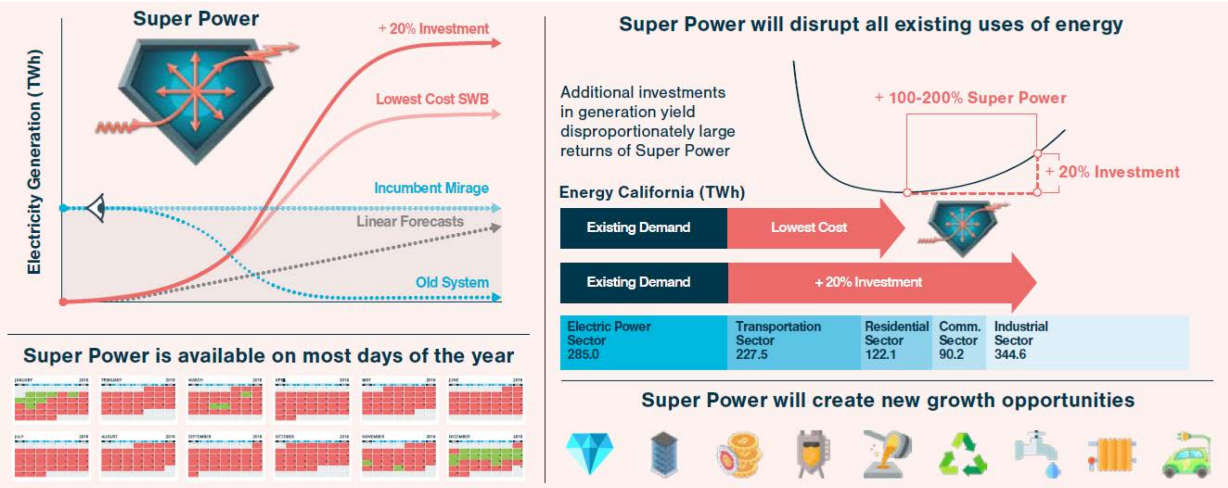
[66] State governments developing energy policy or investments in a way that is not coordinated for NEM-wide optimisation. See ESB Report – Part A, p.23.
[67] This is because the total system capacity must be designed to meet maximum electricity demand in low output periods (e.g. at night or during winter when irradiance is lower), and so they produce power beyond maximum conventional demand throughout the rest of the year.
[68] "Disruption, Implications, and Choices | Rethinking Energy 2020-2030: 100% Solar, Wind, and Batteries is Just the Beginning" (October 2020), RethinkX.
[69] A term coined by Tony Seba , Co-founder of RethinkX.

> *"The [solar-wind-battery] disruption of energy will closely parallel … digital disruption of information technology. Just as computers and the Internet slashed the marginal cost of information and opened the door to hundreds of new business models that collectively have had a transformative impact upon the global economy, so too will [solar-wind-batteries] slash … marginal cost of electricity and create a plethora of opportunities for innovation and entrepreneurship. What happened in the world of bits is now poised to happen in the world of electrons."*[68]

In the last two decades, information-based industries have been disrupted by the Internet, digital media, smartphones, and cloud computing. This has delivered products and services at near-zero marginal cost:

> *"The resulting superabundance of information and communication has created trillions of dollars of new value, dozens of new industries, and tens of millions of new jobs, which together have had a dramatic impact on the economy and society at large. These information technologies transformed the world of bits, and [solar-wind-batteries] will transform the world of electrons in a similar way."*[70]

Darren Miller (Chief Executive of ARENA) recognises this potential, giving Australia the capacity to generate 700% renewables.[71] This is illustrated in the diagram below.



Disruptive technologies wipe out their incumbent predecessors within just a few years of becoming cost competitive. The new industries and markets are much larger than the ones they replaced (see below).

New Technology	Old technology (wiped out)	New applications that emerged or were accelerated as a result
Refrigeration	ice boxes	air conditioning | dehumidification | cryogenic industrial processing | ice skating
Smartphones	flip phones	video calling | social media | digital payments & banking | QR codes | streaming | location services | augmented reality | proliferation of apps generally
Bi-directional GPS tracking	street directories	Google maps | in-car navigation | Uber | real-time delivery booking & tracking | vehicle automation
Broadband Internet	analogue modems, DSL	TV streaming, cloud storage, app stores, gaming, e-commerce, social media | remote working
Digital Imaging	film imaging / cameras, film chemicals, retail printing	photography integrated into devices (e.g. phones) | selfies | photo-sharing & real-time posting | user-generated content | 3D medical imaging | augmented reality | image & video recognition (M.L.) | context-aware robotics
E-payments	cheques / cash	credit/debit cards | digital wallets | ApplePay | e-commerce
Email & Social Media	letters, catalogue marketing, postal workers	user generated content | marketplaces | dynamic pricing | personalisation | contextual marketing

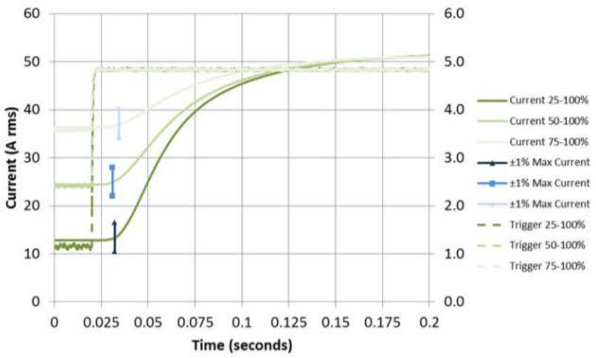
[70] "Disruption, Implications, and Choices | Rethinking Energy 2020-2030: 100% Solar, Wind, and Batteries is Just the Beginning" (October 2020), RethinkX.
[71] "Australia could aim for 700 per cent renewables, ARENA boss" (October 2019), Renew Economy.

Examples of economic possibilities enabled or accelerated by ***super power*** include:

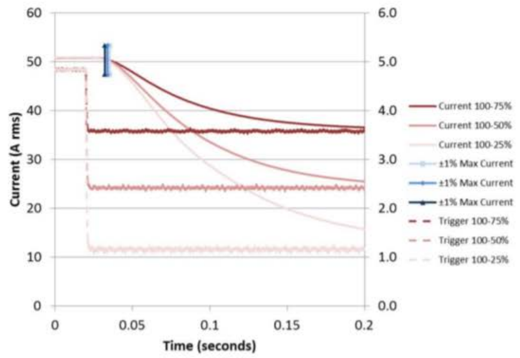
- road transport electrification;
- heating electrification;
- irrigation;
- electrolysis for hydrogen;
- waste processing & recycling;
- metal smelting & refining;
- residential appliance electrification;[73]
- water desalination & treatment;
- chemical processing & manufacturing;
- cryptocurrency mining;
- cloud computing;
- telecommunications;
- heavy manufacturing generally; and
- carbon removal.

> ***Exporting land based on a 200,000% commodity spread***
>
> *The super power opportunity is exemplified by Sun Cable's Australia-ASEAN Power Link (**AAPowerLink**). This will generate solar energy in the Northern Territory and transport it to Singapore via undersea cable. How is this viable? Australia and Singapore have very different energy demand per m^2 of land mass factors. That measure differs by a factor of **2,000x** between the two countries; even more when measured on the basis of long term energy cost per m^2.[72] In effect, AAPowerLink's core business is "land exportation".*
>
> *This 2,000X spread is enough to overcome electrical losses, technology risk and construction blowouts. Value is further enhanced by the broader opportunities catalysed, including: connection of multiple Asian energy markets; marginal transmission investment to connect to the NEM; hydrogen electrolysis potential; and connection to desalination.*

Ramp-up



Ramp-down



The load profile of many of these new economic activities are flexible by design. As an example, hydrogen electrolysers have ramp-up and ramp-down capabilities measured on the millisecond scale (see below).[74] The same capabilities from zinc smelting have been use in Tasmania to provide ultra-rapid response to BassLink trip events.

The job creation potential of these opportunities has not been considered explicitly in this Position Paper, but would likely swamp the number of jobs supported by thermal generation in Australia.

> ***Opportunity for industrial re-conception***
>
> *Energy intensive activities that may be designed (physically and financially) around the variable availability of cheap power seems to be an important area for visioning.*
>
> *Hydrogen electrolysis at the underlying capacity factor of associated generation without storage is an obvious version. How much VRE could be absorbed by a global-scale electrolysis sector? How much demand response could such a sector offer to the electricity grid? How much dedicated flex resources would be obviated as a result?*
>
> ***Could other energy intense activities be reconceived as seasonal or variable?***
>
> *Telstra would welcome the opportunity to explore this with stakeholders and the ESB, with a consideration of automatability, cost of capital, technology cost trends in various industry sectors.*

An expansive view of *super power* not only eliminates virtually all greenhouse gas emissions from the existing electric power sector but also reduces emissions by displacing fossil fuel energy use in other sectors – residential, commercial, industrial, transportation, and agriculture.

This requires a shift in regulatory mindset. "As seen in the telecom industry responding to similar structural changes in the 1990s and 2000s, regulatory frameworks that enable entities to pursue business

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[72] Imported LNG is the dominant competing energy source in Singapore, and the outlook for local renewables in that region is constrained.
[73] Gas-to-electric conversion.
[74] 'Role of Electrolyzers in Grid Services' (2017) U.S. Department of Energy.

models that traverse traditional boundaries have proven to be more successful when the industry is transforming from supply orientation to demand orientation. The anticipated growth of electrification and abundant, low/no marginal cost renewable energy and storage by 2035 will accelerate this shift to customer-centric economics already well underway." [75]

Telstra would welcome an opportunity to explore the conditions that would be needed to achieve such a shift in mindset.

6 Policy co-optimisation and market cooperation

6.1 Policy co-optimisation

One of the more difficult aspects of energy policy is that energy market signals can be diluted or nullified by signals in other policy domain areas. We support the ESB Report's call to address a number of these counter-productive dynamics. We have identified others in the table below.

Policy area	Risk of siloed policy development	Opportunities for co-optimisation
Vehicle emissions standards	Australia's vehicle emissions standards lag the developed world, impeding the uptake of EVs and risk Australia becoming a "dumping ground" for less desirable models[76]	Aligning emissions standards to global markets enables Australia to benefit from innovation, and reduces barriers to adoption of EVs, which should be seen as "portable energy storage" (see section 3.2).
Road Infrastructure	Charging networks are an important condition for EVs, particularly in terms of addressing "range anxiety". Several $ billions of road projects have been announced in the last year. While some significant "after-the-fact" charging initiatives have been announced, none involved explicitly "designing the new infrastructure" with EV charging in mind.	Baking charging infrastructure into construction is far more efficient than a retrofit programme. By way of illustration, just $150 million could deliver 500 stations with 5,000 charging points and a flexible energy capacity of 2.5GW.
Standards for rooftop solar	Even if solar cannot be "firmly dispatched", it can be monitored and dynamically constrained to reduce grid instability. Yet most of the 3 million rooftop PV installations across Australia are not visible to energy market operators. Standards relating to performance & interaction with grid stability were not contemplated at the time that most of this fleet was installed.	We support the objectives of the DER Implementation Plan referred to in the ESB Report relating to data and visibility,[77] and inverter that assist with voltage and frequency disturbances, consistent with international standards.[78] We also support the concept of developing Dynamic Operating Envelopes for DER.[79]
Standards for EVs	Even more than rooftop PV, EVs can be a tool for grid stability and market support if the rights standards for visibility and modes of operation are developed. Conversely, they will have their own adverse impacts if appropriate standards are not developed.	Technical standards for EVs can help to deliver the greatest value to customers and the grid system, based on greater visibility of EVs and appropriate dynamic operating envelopes.[80] Standards and envelopes should be developed in a way that does not diminish the fidelity of price signals (see section 3.6).
Network Tariffs	The persistence of network tariff structures that reflect **outdated** net system demand profiles (e.g. 7a.m.-11p.m. "Peak") issue signals to energy users that tend to **amplify** those profiles.	We support the development of tariffs that protect & enhance the fidelity of price signals (see section 3.6), incentivise and reward customer actions that improve the operation of the grid, and discourage actions that adversely impact the operation of the grid. [82]

[75] "A Gambit for Grid 2035 | A Systemic Look into the Disruptive Dynamics Underway" (April 2021) Pacific Energy Institute.
[76] Angela McDonald-Smith, "Australia to lag on electric vehicle sales until 2030s" (May 2020), Australian Financial Review.
[77] ESB Report – Part A, p.38-39.
[78] ESB Report – Part B, p.74.
[79] ESB Report – Part B, p.76.
[80] ESB Report – Part B, p.86.
[82] ESB Report – Part B, p.77.

	Cost reflective network tariffs can deliver cost savings "as large as $9.9 billion over 20 years …".[81]	However, we also recognise the criticality of protecting customers in remote areas where "the cost to serve customers is high compared to customers in denser parts of the network".[81]
Default Market Offer (**DMO**)	The Default Market Offer (**DMO**) – and its Victorian equivalent[83] - have been effective mechanisms for reducing confusion in energy retail plans, and reducing the capacity for incumbent retailers to charge a rapacious loyalty tax to those customers who don't "shop around". However, the rigidity of the DMO construct impedes the ability of retailers to incentivise and reward customer behaviour that supports grid stability.	We support the evolution of the DMO to protect & enhance the fidelity of price signals (see section 3.6), incentivise and reward customer actions that improve the operation of the grid, and discourage actions that adversely impact the operation of the grid.
Emissions Disclosures	Presently, businesses who seek carbon neutral certification via Climate Active[84] calculate their Scope 2 emissions based on average annualised carbon intensity factors for regions of the grid in which they operate. This eliminates carbon-related incentives for businesses to shift their usage from times of low renewable output (and higher prices) to times of higher renewable output (and higher prices). The effect of this distortion is likely to be exacerbated as the European Union considers how Scope 2 emissions should be incorporated into their Carbon Border Adjustment Mechanism (**CBAM**).[85] We expect similar developments in other international jurisdictions.	We support the adoption of entity-specific carbon intensity factors, based on time of use data for the business. Such an approach will incentivise businesses to change their load profile in a way that is conducive to grid support and a reduction in emissions. If Australia can develop robust reporting arrangements domestically for Scope 2 emissions,[86] it will be well placed when exporting to CBAM economies.
Ease of telemetry & access	As discussed in section 3.10, the degree of precision in telemetry originally contemplated for the National Electricity Market reflected the view that most energy would be supplied by large format generators, and demand would be an exogenous factor in the equation.	We support the ESB Report's recommendations (e.g. "Scheduled Lite") relating to reducing the barriers to telemetry and metering of small devices in support of Flexible demand and dispatchable DER.[87] We also support the expansion of automatic network access standards for embedded generation where plant can provide grid and market support.

6.2 Market cooperation

Aside from policy and market rules, the energy transition is often held back by the approach of regulators and participants like network service providers:

- The connection of capacity assets to distribution networks is difficult and cumbersome, even if those assets are positioned to solve for network constraints and challenges;
- It is often difficult to obtain operational and performance data from regulators and networks, even when that data is sought to be used on an anonymised basis to address market and network constraints.

[81] ESB Report – Part B, p.89.
[83] Victorian Default Offer.
[84] Climate Active is an ongoing partnership between the Australian Government and Australian businesses to drive voluntary climate action.
[85] The European Commission adopted a proposal for a Carbon Border Adjustment Mechanism (**CBAM**) in July 2021. This will put a carbon price on imports of a targeted selection of products so that ambitious climate action in Europe does not lead to 'carbon leakage'; European emission reductions contribute to global emissions decline, rather than shifting carbon-intensive production outside Europe.
[86] Similar to the applied by NGER for Scope 1 emissions.
[87] ESB Report – Part B, p. 88-89.

- Many of the timescales for regulatory reporting (e.g. AEMC reporting of U.S.E.) tend to lag the timescales on which it can be useful.

New rule changes are not needed (and would not be effective) to make the changes needed to address these barriers. An exploration of the other factors that contribute to these barriers to the evolution of the market would be valuable.

7 Conclusion: striving to ask the right questions

7.1 More targeted & contained …

Fundamentally, the current market design works to deliver reliable, affordable energy. However, governments seem to have found it difficult to support a coordinated approach to policy settings or leave them to operate as intended. This has eroded Policy Confidence.

We question whether the Capacity Market Straw Proposal is **tangible enough** to create and sustain Policy Confidence, thereby reducing the pressure for future uncoordinated government interventions. We also question whether such a policy change can be achieved without unnecessarily distorting what already works.

The spot energy price (and other existing mechanisms) currently addresses energy imbalances in the short and medium term (e.g. minutes or hours) and keeps prices down. In contrast, the Capacity Market Straw Proposal is mostly focused on solving issues that emerge on a longer timescale – particularly the prospect of prolonged periods (days or weeks) of energy shortage (the ***dunkelflaute*** problem). However, rather than solving this issue it may actually deter investment signals that already exist for highly-responsive assets and capabilities (e.g. demand response and batteries).

If governments are to build Policy Confidence by introducing a new mechanism to address this potential problem, they should focus specifically and explicitly on the ***dunkelflaute*** problem (see section 2), especially if thermal assets exit before replacement technologies are commercially available. The mechanism should be narrow and direct in its impact and minimise the distortion of existing **effective** market mechanisms that already address the clear and present demand / supply imbalances that threaten affordability and reliability.

Clear guiding principles for the design of such a mechanism could reduce the risk of extinguishing the prospect of better policy outcomes (enhanced by new technologies) in the long term (see section 4).

7.2 … or otherwise more expansive and ambitious

If Australia is to commit to a material change to energy market mechanisms, could it do so with a more expansive view of the future, and a stronger focus on consumers? In addition to asking:

> ***"How can the domestic energy grid and energy market be technically adapted to cope with higher penetration of VRE and the withdrawal of (stranded) thermal assets?",***

would it be possible to also ask (see section 5):

> ***"How can a new energy system based on evolving technologies minimise costs and maximise benefits at every level of society and the economy?"***

Telstra welcomes the opportunity to continue to engage with the Energy Security Board, the AEMC and other stakeholders in the next phase of this work.

Appendix 1. Mapping of ESB Report recommendations

Theme	ESB Recommendation	Telstra Position
	1. To support immediate resource adequacy in the NEM, the ESB recommends Energy Ministers agree a number of reforms:	
	(a) instruct the ESB to prepare rule changes for submission to the AEMC to implement: (i) a NEM wide jurisdictional strategic reserve for the procurement of any required reserves, that individual jurisdictions consider necessary beyond the market reliability standard; and (ii) enhancements to existing generator exit mechanisms to provide greater transparency of generator availability.	We support the availability of a JSR as an incremental modification to the RERT framework. We would encourage caution before implementing any additional reserves, as it could impose significant costs on consumers and the economy without delivering any actual benefit (see section 3.4). We support enhanced availability disclosures for all generation formats.
Resource adequacy mechanisms and ageing thermal retirement pathway	(b) adopt a set of principles to guide the development of any future jurisdictional schemes to ensure a common approach that is consistent with current market signals for investment. Jurisdictions are encouraged to use currently available information on market needs and seek additional information from the market bodies as necessary when considering jurisdictional schemes.	We recognise that incongruent jurisdictional schemes can be counterproductive. We support data driven schemes.
	(c) adopt a Ministerial lever to trigger the current Retailer Reliability Obligation as is currently in place in South Australia. This would give Ministers the ability to strengthen the Retailer Reliability Obligation if they wish while further detailed design work is undertaken on a capacity mechanism.	We consider the Retailer Reliability Obligation (**RRO**) based on financial instruments to be a better long-term solution (with less potential distortions than a Physical Retailer Reliability Obligation (**PRRO**). Changes to the current RRO would be better than imposing the PRRO.
	2. To support timely entry and orderly exit of resources in the NEM for 2025 and beyond, the ESB recommends Energy Ministers agree to a further initial reform: (a) provide in-principle support for a capacity mechanism for the NEM to ensure the competitive provision of the right mix of resources as the market transitions towards net zero emissions. This mechanism will ensure investment in an efficient mix of variable and firm/flexible capacity that meets reliability at lowest cost and increase government and community confidence that resource adequacy will be delivered by the market reducing the need for interventions.	We question the need for the Capacity Mechanism. As the ESB Report makes clear, designing and developing an effective capacity mechanism will be difficult, protracted and carries a high risk of failure. Public commitment to exploration of such a mechanism has the potential for adverse outcomes, and may exacerbate investor uncertainty.

	(b) In recognition of significant stakeholder concerns, instruct the ESB to work with stakeholders and jurisdictions over the next 12-18 months to develop the detailed design of the capacity mechanism for the agreement of Ministers in mid-2023. There are a number of policy choices in the design of a capacity mechanism, as set out in this advice, which need to be considered to ensure the recommended design is both effective and efficient. (c) a decentralised capacity mechanism (where the volume of required capacity is determined by liable entities, such as the Physical Retailer Reliability Obligation set out in this advice) should be the starting point for the design work. Further consideration should also be given to: (i) whether it would be preferable to centrally determine the volume of required capacity; (ii) whether using existing contracts between registered market participants would be preferable as the basis of the scheme (rather than creating a new certificate); (iii) how to best address the impacts of the proposed capacity mechanism on retail competition (including small retailers), commercial and industrial customers, market power concerns, transaction costs for market participants, and affordability; and (iv) integrating a NEM-wide, common approach to jurisdiction investment schemes to work alongside the new capacity mechanism.	The ESB highlights the difficulties associated with such a mechanism. Any design of a future scheme should address and seek to ameliorate adverse impacts. Our views on the Capacity Market proposal are covered extensively throughout this document.
Essential system services and scheduling and ahead mechanisms pathway	3. The ESB recommends Energy Ministers note that AEMC rule change requests are underway to progress the following immediate and initial reforms to support the availability, investment in and scheduling of the resources capable of delivering essential system services: (a) frequency control, including a new fast frequency response service and enduring primary frequency response arrangements; (b) operating reserves services, to explicitly value reserve services separately to energy; (c) unit commitment for security and system security mechanism. These are operational and short-term procurement mechanisms allowing AEMO to value, procure and schedule specific services and resources to help keep the system secure; (d) enhanced system strength frameworks, to make it simpler, faster, and more predictable for new generation to connect to the grid and keep supply as secure as possible.	We support the AEMC advancing these essential service system rule changes within the existing rule change process, provided the potential unnecessary negative impacts are not also introduced.

	4. The ESB recommends Energy Ministers instruct the ESB to monitor and provide advice about market conditions and the need for, longer term reforms for essential system services, including the need for further unbundling of essential system services, an integrated ahead market or development of inertia spot market.	We are not convinced of the need for an integrated ahead market, for reasons similar to our concerns about the Capacity market proposal, especially in relation to the fidelity of price signals (see section 3.6) and investor uncertainty.
Transmission and access reform pathway	5. To support the integration of renewable energy zones (REZs), the ESB recommends Energy Ministers agree a number of immediate and initial reforms: (a) to adopt the REZ Planning Rules and the Principles for an Interim REZ framework to address the urgent planning implications for REZs. (b) instruct the ESB to prepare a rule change for submission to the AEMC to progress the congestion management model, adapted for integration with REZs. This model complements the Interim REZ framework and will address the emerging congestion management needs of the system. Comprehensive consultation, with a wide range of industry, consumer and government stakeholders on the detailed design of the model will be undertaken as part of the rule change process.	We support clearer and more consistent integration of REZ processes into the Rules. We would like to know if the congestion management model as proposed will deliver the benefits claimed, as it has the potential to significantly undermine signal fidelity and investor certainty. The benefits of additional transmission are likely to far exceed the benefits of a capacity mechanism, by unlocking otherwise "constrained-off" generation in the system (thereby reducing requirement for additional energy capacity).
	6. To support timely and efficient transmission investment, the ESB recommends Energy Ministers seek advice from the AEMC on what initial reforms are necessary to current regulatory frameworks to improve the timely and efficient delivery of major transmission projects (including ISP projects). This advice will be prepared as part of the AEMC's current Transmission Investment and Planning Review.	We support this recommendation.
Enabling the integration of Distributed Energy Resources (DER) and flexible demand pathway	7. To enable the effective integration of high volumes of DER and flexible demand into the NEM the ESB recommends Energy Ministers support the DER Implementation Plan (see Section 5). The Plan sequences immediate and initial regulatory, technical and market reforms that address emerging risks and builds capability to deliver benefits to all consumers from high levels of distributed energy resources and new energy services. The ESB will provide Energy Ministers with advice on additional reforms that will be developed in customer focussed stakeholder co-design and consultation processes as part of the Plan. The Plan will deliver the following outcomes: (a) Consumers are rewarded for their flexible demand and generation, have options for how they want to engage (including being able to switch between DER service providers), and are protected by a fit-for-purpose consumer protections framework.	While supportive of the initiatives proposed under the DER Implementation Plan, Telstra believes that there remained too much focus on complex, structured approached to introducing demand response, without consideration for the steps that could be taken to encourage greater responsiveness of demand without such measures. This includes information & data about current and forecast system conditions being made readily available and easily accessible by all energy users. In addition, mechanisms for greater communication to a wider audience of the system needs and what households & businesses can do to address these needs in timely manner would assist

	(b) The wholesale market supports innovation, the integration of new business models and has a more efficient supply and demand balance. (c) Networks are able to accommodate the continued uptake of DER and two-way flows and are able to manage the security of the network in a cost-effective way. (d) AEMO has the visibility and tools it needs to continue to operate a safe, secure and reliable system, including maintaining system security associated with minimum load conditions.	increasing responsiveness. The transition to 5-minute settlement will help in this regard.
	8. To support system security and improved transparency at times of minimum system load, the ESB recommends Energy Ministers adopt a jurisdictional Ministerial lever for emergency backstop measures, as an immediate reform. Enduring measures to address system security challenges associated with low minimum system load are being prepared as part of the Plan.	We support the development of such these measures, provided they are truly a backstop and do not impede the development of enduring and more optimal mechanisms (including price fidelity, accessible data and clear signals for demand response) for addressing the issue.
	9. To support ongoing fit for purpose consumer protection, the ESB recommends Energy Ministers note the ESB has developed a Consumer Risk Assessment tool as an immediate reform. The tool will be used by the ESB and market bodies in work identified in the Plan.	We support placing the protection of consumers at the core of all decision making.
Implementation	10. The ESB recommends Energy Ministers instruct the ESB to monitor each of the reform pathways in light of changing market conditions and provide reports at least annually or more regularly if required.	Given the pace of change and unprecedented uncertainty, we believe that the Energy Security Board should continue to monitor the Reform Pathways and be ready to improve, adapt or abandon any of them if warranted by new data or insights.
	11. To enable the Post-2025 reform pathways, the NEM of 2025 and beyond requires modernisation of critical market systems and business processes (see Section 8) and adequately resourced market bodies. These are costs and risks associated with the scale and nature of the energy transition rather than costs of the Post-2025 reforms. The ESB recommends Energy Ministers: (a) instruct AEMO to provide more detail of its required funding on a year-by-year basis (to 2025) by end August for the longer-term upgrade that is necessary for AEMO's existing systems and business processes to enable these reforms. (b) instruct the AER and the AEMC to provide proposals on a year-by-year basis (to 2025) by end August about additional resources they need to implement the Post-2025 reform pathways.	We believe it is important that each of the market bodies has available to them the necessary resources to operate the market and to identify and implement the necessary changes. It is critical that these resources are applied efficiently to the key task at hand to maximise consumer outcomes.

Appendix 2. Energy Security Board comments on uncertainty

<table>
<tr><th>Risk</th><th>ESB Report comments</th><th>Telstra comments</th></tr>
<tr><td>Technology advancement</td><td>“The costs of variable renewable technology and batteries are changing … The capital costs of battery technology has been falling significantly. While existing plant equipped to provide similar services may become uncompetitive against new battery entrants, new entrants however may decide to delay their investment until their initial capital cost declines further…”[88]</td><td>We are at an inflection point in respect of the intersection of storage technology and EVs, Internet of Things (IoT), robotics, accelerated bandwidth (e.g. via 5G), machine learning (M.L.), artificial intelligence (A.I.). If implemented, we would want to see a Capacity Market proposal adequately account for this (see section 3.9).</td></tr>
<tr><td>DER and flexible demand</td><td>“… demand risk in the market is changing rapidly … DER and demand response will have a key role in maintaining reliability and minimising both system and consumer costs … Demand profiles are changing as residential customers support the growth in solar PV and battery installation, along with engaging with smart appliances and other DER.”[88]</td><td rowspan="2">We would like to see any policy changes take into account that Flexible Demand & DER is set to deliver 3-5X the benefits of the Capacity Market proposal (see section 3.1), and address concerns that a Capacity Market will discourage Flexible Demand & DER (see section 3.6.3). We are concerned that the Capacity Market proposal may impede a more ambitious approach to long term energy policy (see section 5).</td></tr>
<tr><td>Industrial demand flexibility</td><td>“In the commercial and industrial sector, a similar trend is occurring. Large users are examining ways to modify their production processes to become more flexible as they strive to produce ‘green’ steel, aluminium and even ’green’ cement. Energy intensive commercial and industrial demand has also been falling, and there is uncertainty over future energy intensive industries …”[88]</td></tr>
<tr><td>New sources of demand</td><td>“At a broader level it is also argued that demand may increase substantially after years of decline with the entry of EVs, larger demand from energy intensive data centres, from hydrogen electrolysis production and increasing electrification in other sectors as they seek to decarbonise.” [88]</td><td>New sources of energy consumption (EVs, data centres, hydrogen electrolysis can be configured for flexibility, so that the application of standards can minimise the risk of capacity shortage (see section 6).</td></tr>
<tr><td>Government intervention</td><td>“… the risks of investing is exacerbated by government intervention … Such interventions in the market do not encourage independent private sector entrants or upgrades and maintenance to existing firm generation plant. The uncoordinated nature of these interventions also dampens price volatility in the market and lessens the high price events needed to encourage investment in the right mix of resources.”</td><td>It is not clear that a Capacity Market will reduce the prospect of intervention (see section 3.8). This is especially so if the Capacity Market results in extending the life of (or stimulating the construction of new) carbon intensive plants. States with climate-related policy ambitions may feel compelled to compensate accordingly.</td></tr>
</table>

[88] ESB Report – Part B, p.36.

Appendix 3. Value of deferral

1. One year deferral value

Key assumptions underpinning the assessment that "deferring a decision to commence a Capacity Market by **just one year** would deliver NPV equivalent to half of the purported benefits of the Capacity Market itself" (see section 3.9):

- A real post-tax unlevered weighted average cost of capital (**WACC**) of 6% p.a.
- $1.2 million in capex per MW required to meet the purported 6-19GW shortage of large-scale firm capacity, using flexible marine derivative gas plant as a proxy.
- The 6-19GW of new investment is built progressively on a straight-line basis over the 20 year horizon (to reach 6-19GW at the end of the 20 years) for the NPV calculation in the ESB Report.
- Adjusting the capital expenditure profile to either (i) compress the same cumulative value of capital into the 19 years ending in the 20th year, or (ii) spreading the capital expenditure over 20 years, so that the horizon for the NPV is 21 years.

2. Avoided investment value

Key assumptions underpinning the assessment that a "... delay to making the decision may confirm that a Capacity Market is **not** needed, thereby avoiding unnecessary investments (funded by consumers) valued at **3-10 times** the purported benefits of the Capacity Market proposal (see section 3.9):

- A real post-tax unlevered weighted average cost of capital (**WACC**) of 6% p.a.
- $1.2 million in capex per MW required to meet the purported 6-19GW shortage of large-scale firm capacity, using flexible marine derivative gas plant as a proxy.
- Present value of the 6-19GW of new investment, built progressively on a straight-line basis over the 20 year horizon (to reach 6-19GW at the end of the 20 years), which is avoided.

Appendix 4. Availability of ACCUs

Based on Telstra's analysis, of the ~91M ACCUs issued since 2012[89] , the accumulated surplus of credits is currently ~8M[90] at Q4 2020, with the remainder largely being acquired by the Federal Government under Carbon Abatement Contracts. In Q4 2019 the surplus of ACCUs was ~6M[91] representing an addition of 2M ACCUs added over the previous calendar year. Conversely, the total Scope 1 greenhouse gas emissions of the 415 organisations reporting under the NGER Scheme are ~328Mt CO2e.[92]

Current ACCU issuance volume therefore has the capacity to meet just 0.6% of scope 1 emissions of NGER Scheme reporting entities in Australia. The shortage is even more pronounced if it is recognised that – as with international credits such as CERs and VERs – not all ACCUs will satisfy the strict criteria that Telstra has set.

Telstra and other corporations apply additional criteria (relating to factors affecting investors' and consumers' understanding and perception of abatement markets) that are not captured in the ACCU certification process. Telstra supports all policy measures that ensure that the reputation of the Australian carbon is enhanced on the world stage, while expanding supply to meet growing demand.

[89] 90,770,846 ACCUs issued as listed in the Emissions Reduction Fund Project Register, accessed 15th March 2021.
[90] 7,882,500 ACCUs in surplus as listed in the Clean Energy Regulator Quarterly Carbon Market Report December 2020, Table 2: Balance of Supply and Demand at Quarter 4 2020 Close.
[91] 6,078,172 ACCUs in surplus as listed in the Clean Energy Regulator Quarterly Carbon Market Report December 2019, Table 2: Balance of Supply and Demand at Quarter 4 2019 Close.
[92] Clean Energy Regulator Corporate Emissions and Energy Data 2019-2020.