

**Network of
Illawarra
Consumers of
Energy**

**Network of Illawarra Consumers of Energy
Response to the ESB's Post 2025 Market
Design Consultation Paper
October 2020**

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Summary

This submission is made by the Network of Illawarra Consumers of Energy (NICE). This is a new project and the submission forms the basis on which NICE will engage with the community.

We find the entire Post 2025 Market Design project disappointing. The project started with no clear motivation, and the work since has failed to generate a consistent picture of what issue the project is attempting to address.

Ministers were seeking an approach that would focus on the long-term needs of the system and in response the ESB has delivered a suite of measures aimed at addressing near term issues. Furthermore, the ESB lacks evidence that these issues need to be addressed and the relationship between the solutions proposed isn't explored.

We propose an alternative approach that starts with a design of distribution markets and then determines how the bulk power system needs to adapt in response to these changes.

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Introduction

NICE and Consumer Advocacy

The Network of Illawarra Consumers of Energy is a newly formed informal network advocating for the energy transition to a net-zero carbon future to be managed with the interests of consumers at the heart. This necessary transition needs to occur at least cost to consumers while maintaining reliability and security of energy services, appropriate consumer protections for essential services and a just transition for affected workforces.

We believe there is a role for regionally based advocacy within the context of nationally consistent energy policy. The choice and options for energy supply do differ by geographic region having regard to different climatic conditions affecting demand and supply options, and different risk factors impacting on resilience planning. This submission has been prepared by David Havyatt who is the sole author.¹

Consumer advocacy tends to focus on a narrow range of issues, such as vulnerable customers, consumer control, and investment and utilisation of DER. In part this is influenced by the history of market reform and concern that 'benevolent' government ownership would be replaced by uncaring corporations motivated only by profit outcomes. It is also in part motivated by an 'energy democracy' agenda, that is 'an emergent social movement advancing renewable energy transitions by resisting the fossil-fuel-dominant energy agenda while reclaiming and democratically restructuring energy regimes.'²

This focus of consumer advocacy is valuable because the discussion of the future energy system is often too grounded in the engineering and economics alone. This weakness is in part addressed by the turn to 'behavioural insights' that seek to understand the decision making of real humans rather than the atomistic perfect self-optimisers of economic theory. Unfortunately, this recognition of the power of 'norms' is constrained to consumers and doesn't recognise that its twins – 'bounded rationality', 'paradigms' and 'regimes' – equally constrain the decision-making of policy makers and regulators.³

¹ Mr Havyatt was employed as Senior Economist at Energy Consumers Australia from October 2015 to August 2020 and is contracted till the end of 2020 to work on matters pertaining to the Consumer Data Right and the Electricity Sector Climate Information project. For the avoidance of doubt, nothing in this submission is the position of Energy Consumers Australia other than any references to previous ECA submissions or ECA's consumer research.

² Burke, MJ & Stephens, JC 2017, 'Energy democracy: Goals and policy instruments for sociotechnical transitions', *Energy Research & Social Science*, vol. 33, pp. 35-48. See also Ajaz, W 2019, 'Resilience, environmental concern, or energy democracy? A panel data analysis of microgrid adoption in the United States', *Energy Research & Social Science*, vol. 49, pp. 26-35. Thombs, RP 2019, 'When democracy meets energy transitions: A typology of social power and energy system scale', *Energy Research & Social Science*, vol. 52, pp. 159-68. van Veelen, B & van der Horst, D 2018, 'What is energy democracy? Connecting social science energy research and political theory', *Energy Research & Social Science*, vol. 46, pp. 19-28.

³ For a discussion on norms and the energy transition see Havyatt, D 2019, 'Planning the energy transition: A primer for policy makers Paper prepared for the ', paper presented to 'Energy and Society in Transition' 2nd International Conference on Energy Research and Social Science Arizona State University, Tempe, AZ, USA, 29 May 2019, https://www.researchgate.net/publication/333521248_Planning_the_energy_transition_A_primer_for_policy_makers_Paper_prepared_for_the_2nd_International_Conference_on_Energy_Research_and_Social_Science_%27Energy_and_Society_in_Transition%27.

However, the failure of consumer advocacy to equally concern itself with the detailed economic and engineering issues too often results in consumer issues being seen as the final layer of design – e.g. having designed the market how do we add consumer protections — rather than an essential component of design.

As Hugh Outhred observed in the introduction and conclusion of a conference paper extolling the success of the Australian reforms of the 1990⁴:

Electricity restructuring is a complex, never-ending process that has engineering, economic, commercial, legal and policy dimensions and takes place within a broad societal context that itself influences and is influenced by the outcome... Success depends on establishing and maintaining a consensus on the key objectives and principles... The dynamic and evolving nature of the broader social context means that there can be no guarantee of future stability and continuity in approach to electricity industry restructuring. For example [The AEMC's Comprehensive Reliability Review] opens up the possibility of a complete re-think of the current approach to addressing the perennial and irresolvable (in a deterministic sense) question of "resource adequacy."

While there is a general consensus that the key objective of energy policy is to navigate the transition to a zero carbon emissions future at least cost to consumers while maintaining reliability of supply at a level consumers are prepared to pay for, there is little consensus as to the required pace of the transition and the form of the transition. This is disappointing because the need to address green house emissions has always been part of the enunciated reform objectives beginning with the Special Premiers Conference in July 1991.

There will probably be participants who will advocate for the need for the policy objective in the Australian Energy Market Agreement (AEMA) and the objective of the law embodied in the National Energy Objective (NEO) to be broadened as part of the Post 2025 Project. We believe this is a distraction from the well understood policy objective of promoting the long-term interests of consumers. As the AEMC has already demonstrated it is possible to infer a climate obligation into the NEO⁵, while at the same time Ministers have been unable to act on the Finkel recommendation to agree to a new AEMA or to issue a Statement of Policy Principles.⁶

Background to the Post 2025 Project

We appreciate the opportunity to provide comment on the Energy Security Board's (ESB) *Post 2025 Market Design Consultation Paper* (the Paper) of September 2020. The context of the project that is referred to as the 'Post 2025 Market Design' is that an entity (the ESB) that was created as a consequence of a hurried reaction by the Australian Government to undertake a review (the Finkel review) in response to the South Australian system black event was similarly in a hurried

⁴ Outhred, H 2007, 'Electricity industry restructuring in Australia: underlying principles and experience to date', in *40th Hawaii International Conference on System Sciences*, Hawaii, p. 125. Outhred is credited in the acknowledgements of Schweppe et al's seminal *Spot Pricing of Electricity* as an important contributor to the development of the spot pricing and market design.

⁵ See the AEMC's *Applying the Energy Market Objectives* https://www.aemc.gov.au/sites/default/files/2019-07/Applying%20the%20energy%20market%20objectives_4.pdf Box 3.

⁶ See the ESB's *Health of the NEM Report 2019* <http://www.coagenergycouncil.gov.au/sites/prod.energycouncil/files/publications/documents/The%20Health%20of%20the%20National%20Electricity%20Market%20V01.pdf> Appendix B Recommendations 7.3 & 7.10.

moment asked to 'provide advice on a long-term, fit-for-purpose market framework to support reliability that could apply from the mid 2020's as the market transitions.'⁷

Ministers asked for the ESB to report back in December 'on a forward work program for endorsement.' The *Post 2025 Market Design - Scope and Forward Work Plan* approved by the Energy Council in December 2018 was released in March 2019.⁸ This outlined a timetable that aimed to deliver 'Recommend changes to existing market design or alternative market design to enable the provision of the full range of services required to deliver a secure, reliable and lower emissions electricity system at least-cost to customers' by Q4 2020. In September 2019 the ESB released an Issues Paper and received over 70 submissions.⁹

In April 2020 the ESB issued a Directions Paper that reflected the consequences of requests that had come from the Energy Council on immediate actions on reliability and security, which included the implementation of an alternative reliability standard for the purposes of the Retailer Reliability Obligation (RRO) and the Reliability and Emergency Reserve Trader (RERT) scheme. This broke the 'Post 2025' task into three phases:

- *Short term (12-18 month) deliverables: relating to the Renewable Energy Zones, and interim security measures and reliability framework measures,*
- *Intermediate deliverables: relating to development of Ahead Markets, Two-Sided Markets and Access Reform via CoGATI, to be developed for decision at the framework level by the end 2020 with implementation for some aspects likely ahead of 2025, and*
- *Longer term deliverables: relating to Investment programs, an aging thermal generator strategy and initiatives relating to development of DER markets with implementation after 2025.*

The seven Design Initiatives that constituted the second two categories have survived, with some change of emphasis, to the Paper, however, the sequencing arrangements offered as a representative example (in Figure 1 of the Paper) do not maintain this distinction between intermediate deliverables and longer term deliverables.

The ESB has been working on Post 2025 Market Design for just under two years now. It is our contention that the Consultation Paper represents little value for that effort and that the cause of that was the tasking of the ESB in the course of an Energy Council meeting without any prior analysis, and the ESB embracing the reference as a task on which to deliver an implementation plan rather than an opportunity to engage first on the deeper question of what the market will need in the long term.

Consequently, little in the proposals currently being considered by the ESB extends beyond a few years after 2025. This contrasts with the position put by Energy Consumers Australia in its submission on the earlier Issues Paper.¹⁰ In that submission they described the ongoing issues of the energy market as affordability and user control, they also identified the missing services

⁷ COAG Energy Council 20th Meeting Communique, 26 October, 2018, Sydney (<http://www.coagenergycouncil.gov.au/publications/20th-energy-council-ministerial-meeting-communicu%C3%A9>)

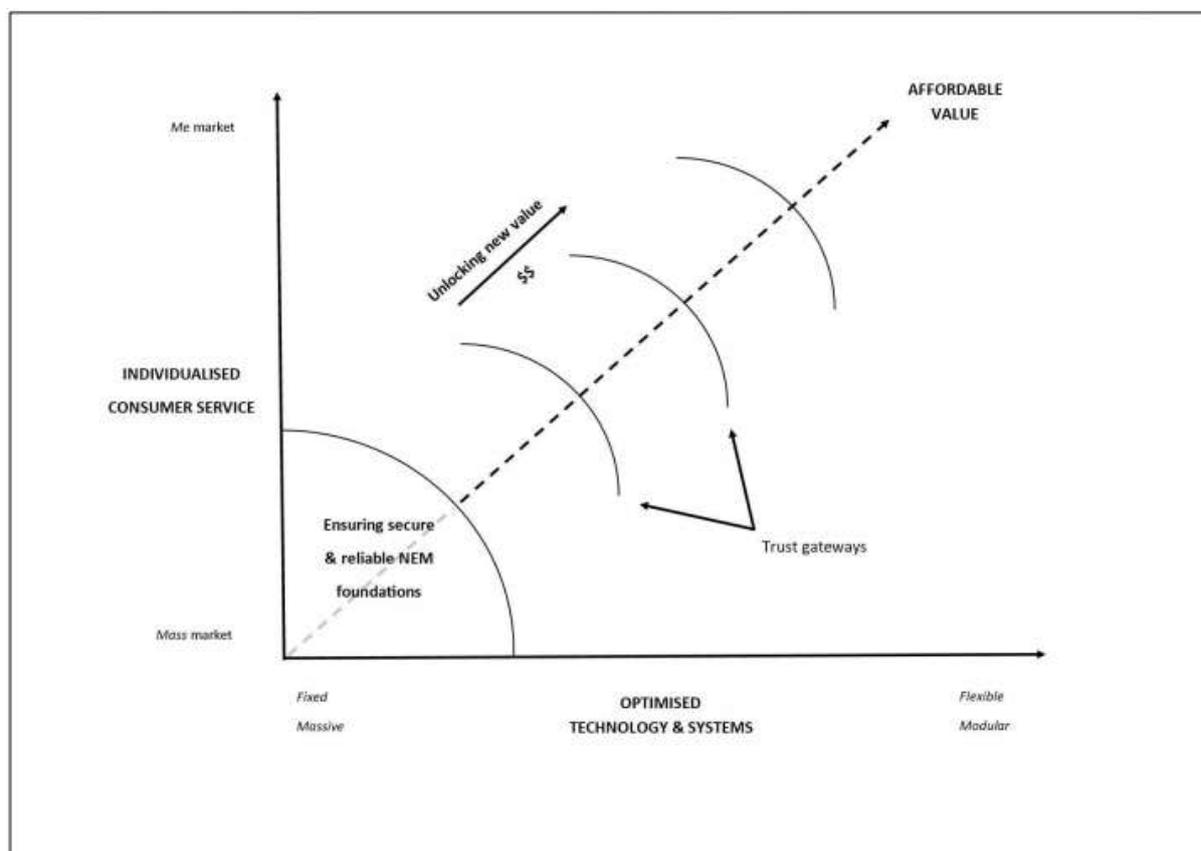
⁸ <http://www.coagenergycouncil.gov.au/publications/post-2025-market-design-national-electricity-market-nem>

⁹ <http://www.coagenergycouncil.gov.au/publications/post-2025-market-design-issues-paper-%E2%80%93-september-2019>

¹⁰ <https://energyconsumersaustralia.com.au/publications/post-2025-market-design-issues-paper-submission>

market that arises from the current retail model, and they proposed the use of a levels or stages approach to the development of both the services market and consumer trust and confidence.

This levels approach was then described in a model where two dimensions of optimisation and individualisation were seen to work in consort to deliver affordability, and these developments would pass through a series of 'trust gateways.' This is reproduced in Figure 1 below.



What is being presented by the ESB is not what Ministers asked for, rather than a 'long-term, fit-for-purpose market framework to support reliability that could apply from the mid 2020's as the market transitions' it is yet another collection of possible tweaks to the current market framework to limp a few years further forward.

In commenting on a LinkedIn post about Energy Queensland's nomination for an innovation award for its *Smart solar export in real-time via Dynamic Operating Envelopes* project, EQ Head of Corporate Strategy Peter Price observed¹¹;

What's disturbing is that at the national level the message that customers want simple solutions and they want them now has not sunk in. We are still confronted by a plethora of rule changes with ever increasing complexity and costs to develop new market based solutions. At Energy Queensland we will continue to evolve new solutions that enable customers to get the most from the solar, batteries and EV's!

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[https://www.linkedin.com/feed/update/urn:li:activity:6720530117942214656/?commentUrn=urn%3Ali%3Acomment%3A\(activity%3A6720410250618507264%2C6720530047012368384\)](https://www.linkedin.com/feed/update/urn:li:activity:6720530117942214656/?commentUrn=urn%3Ali%3Acomment%3A(activity%3A6720410250618507264%2C6720530047012368384))

Importantly, this innovation is in the distribution network. The ESB analysis fails in its approach because it continues the traditional focus on the bulk power system and an analysis that begins with generators (resource adequacy, generator retirement) and ends with consumer investments (DER) — noting that transmission and generation coordination actually comes last. The ESB has been persuaded to review proposals through the lens of ‘customer archetypes’ but once again this is applying the consumer perspective as a check-point rather than as a starting point.

Later in this submission we will discuss the role of distribution networks in a fundamentally different design.

Designing Power Markets

Principles of Market Design

It is appropriate at this point to talk briefly about the overall idea of 'the market.' The one ideal market as described by Marshall's scissors diagram of supply and demand is an abstraction from a complex variety of actual markets.¹² The core parts of the abstraction are well known, it assumes a sufficiently large number of buyers and sellers that their individual decisions have no impact, and that all buyers and sellers have perfect information about the other parties preferences.

This generalised form makes no distinction between a market where goods are acquired in retail stores from a market such as a produce market. Similarly, a produce market is different to an equities (stock) market. They have different design rules. A retail market is usually a posted price market, a produce market can either be an open outcry auction or posted prices plus haggling, a stock market is typically a variety of matching market where buyers and sellers each post prices.

The historical development of market towns describes the way the institutions (including laws) developed to support the markets including standard weights and measures, enforcement of agreements, and even early competition laws to limit monopolisation. Market towns were situated either on transport routes or near large population centres (manors or ecclesiastical properties). There was competition between market towns, both buyers and sellers could choose where to go. Importantly, they are two-sided because buyers and sellers get more value from there being more of the other.¹³

If we think of a stock exchange as primarily a place for capital formation, clearly people with money to invest benefit in a market with more initial offerings, and people with projects to fund (entrepreneurs) benefit from there being more people to invest. The subsequent liquidity in the stock is a benefit to the investors more than the entrepreneurs. In capital formation they have the characteristics of two-sided markets, but the daily trading is not.¹⁴ Stock exchanges similarly competed with each other and the development of their institutions (listing rules, bidding structures, settlement) were part of the basis for competition.

Both these examples of markets have a degree of evolution about them, but they are also clearly grounded in rules that are either laws or the basis of participation.

While both these kinds of markets evolved, the economic discipline of market design (or mechanism design) looks at how to design markets taking into account the deviations from the ideal. As one of the leaders of the field Alvin Roth puts it; 'traditional economics views markets as simply the confluence of supply and demand. A new field of economics, known as "market design," recognizes that well-functioning markets depend on detailed rules.'¹⁵

¹² Marshall, A 1920 (1890), *Principles of economics: eighth edition*, Palgrave MacMillan.

¹³ Casson, M & Lee, JS 2011, 'The origin and development of markets: A business history perspective', *Business History Review*, vol. 85, no. 1, pp. 9-37.

¹⁴ Cantillon, E & Yin, P-L 2011, 'Competition between exchanges: A research agenda', *International Journal of Industrial Organization*, vol. 29, no. 3, pp. 329-36.

¹⁵ Roth, AE 2007, 'The art of designing markets', *Harvard Business Review*, vol. 85, no. 10, p. 118.

Kominers et al. provide a more extensive view.¹⁶ 'Market design seeks to turn economic theory and analysis into practical solutions to real-world problems. Market designers iterate back and forth between theory and practice in order to improve the function of markets—settings in which economic incentives matter. The goal of the market design approach is to mitigate some of the frictions and externalities that prevent markets from reaching the first best, while at the same time aligning market outcomes with society's objectives beyond pure economic efficiency.'⁷ They note that in practice, market design is largely concerned with the rules that guide market transactions and the infrastructure that enables those transactions to take place—two ingredients that jointly constitute marketplaces.

Kominers et al also suggest that market design is a response to market failure. The market failure standard is a poor one as Kay has noted, because all markets deviate from the ideal and all fail.¹⁷ All markets have rules and infrastructure, they all have designs. The economic study of market design is to develop optimal rules and infrastructure for given circumstances (typically categorised as auctions or matching markets) that minimise the deviation from the outcomes of the ideal.

Typically, market design proceeds by finding a mechanism to deliver a Pareto optimal outcome (in equilibrium) given the incomplete information available to all the agents. It is the study of the incentives to the agents (market participants) and the objective is an incentive compatible outcome which is where every participant can achieve the best outcome to themselves just by acting according to their true preferences.

Electricity market design as we know it developed from the work of Fred Schweppe and his colleagues.¹⁸ Hugh Outhred from UNSW is one of the people recognised in the acknowledgements and he has detailed the work involved in establishing the initial market.¹⁹ That identifies the design work involved was the preparation of a physical model, a mathematical model and commercial models.

Despite the latter paper explicitly referring to 'market design' none of the characteristics of modern economic market design really exists. The Outhred paper observes 'spot price volatility should encourage fast-start generators and demand management activities.' That the former occurred and the latter largely didn't is a consequence of the inadequacy of the design, insufficient effort was put into understanding the incentives on both retailers and consumers and in particular how retailers use of forward contracts to manage their volatility risk would entrench a consumer preference for 'predictable' rates.²⁰

¹⁶ Kominers, SD, Teytelboym, A & Crawford, VP 2017, 'An invitation to market design', *Oxford Review of Economic Policy*, vol. 33, no. 4, pp. 541-71.

¹⁷ Kay, J 2007, 'The failure of market failure', *Prospect*, 1 August 2007 also at Kay, J 2007, *The failure of market failure*, John Kay, <<https://www.johnkay.com/2007/08/01/failure-market-failure/>>.

¹⁸ Schweppe, FC, Caramanis, ME, Tabors, R, D & Bohn, RE 1988, *Spot pricing of electricity*, Kluwer Academic.

¹⁹ Outhred, H 1998, 'A review of electricity industry restructuring in Australia', *Electric Power Systems Research*, vol. 44, no. 1, pp. 15-25. An earlier paper by Outhred and Kaye in 1996 incorporated 'network effects' but was only dealing with the constraints imposed by the network, and not economic network effects.

²⁰ A recent Oxford PhD Thesis (not yet online) has analysed the institutional constraints on retailers and concludes their focus on managing wholesale market risk means they are unable to develop demand management strategies—in effect their strategic focus is also the bulk power system not the consumer. Brinker, LC 2019, 'The politics of transitions in electricity: contested retail market designs and their significance for demand-side energy resources', Doctor of Philosophy thesis, University of Oxford.

Modern market design, just like contract theory, in dealing with hidden information is a derivative of the transaction economics developed by Coase and Williamson.²¹ In contrast Schweppe et al. (pp. 56-7) in discussing the sets of transactions to be chosen to structure the market say that the ideal criterion is 'choose those types of transactions that yield the best possible cost-benefit trade-offs for the particular utility and its customers.' They continue 'transaction costs can be quantified reasonably well by engineering analysis.'

Proponents of new designs for the electricity market(s) should at least have the depth of analysis of the original design, and ideally should utilise all the tools of modern market design.

Notes on the Current Design

Work on the current market design was formally initiated in 1991 with the formation of the National Grid Management Council (NGMC). The Commonwealth's intent in establishing the NGMC was to facilitate the interstate trade of electricity by separating generation and transmission and building a single east coast transmission network and hence reduce the over investment in capacity that had occurred under State governments.²²

The Commonwealth did not get its way. In a note from Peter Harris to Rod Sims a glimmer of the problems is provided.²³ Harris noted that the NGMC appeared to only be committed to ring-fencing generation from transmission and that the Chair of the NGMC had warned NSW and SA that their attitude risked destroying the NGMC. He added:

We believe the NGMC will be publicly criticized (as it is, now, privately by people such as Kerry Schott) as nothing more than a generators club.

The design of the market itself was built upon work already underway in NSW to build an efficient dispatch process for the Electricity Commission, but the NEM only went live in 1998. To put it in context, the design and implementation work, when all the assets were government owned, took seven years and the market they designed will have been operating by 2025 for 27 years. The ESB was given a similar time scale to undertake design and implementation work (2018-2025) and should have developed a design suitable for another 25 years, that is, to the end of the transition.

²¹ Coase, RH 1937, 'The nature of the firm', *Economica*, vol. 4, no. 16, pp. 386-405. Williamson, OE 1979, 'Transaction-cost economics: the governance of contractual relations', *The Journal of Law and Economics*, vol. 22, no. 2, pp. 233-61. Williamson, OE 1981, 'The economics of organization: The transaction cost approach', *American journal of sociology*, vol. 87, no. 3, pp. 548-77.

²² This section is based on Havyatt, D 2020, 'A History of Electricity Reform in Australia'. This has been drafted for a forthcoming book, a copy can be made available on request. https://www.researchgate.net/profile/David_Havyatt/publication/344803470_A_History_of_Electricity_Reform_in_Australia/links/5f90fe78458515b7cf937a8a/A-History-of-Electricity-Reform-in-Australia.pdf?origin=profileFeaturedResearchPublicationItem

²³ National Archives of Australia: Department of Prime Minister and Cabinet; A1209 1992, 1993/243 *Memo from Peter Harris; Electricity Reform - What May Need to be Done in Perth* Paper Files and Documents. At the time of the memo both Harris and Sims worked for the Department of Prime Minister and Cabinet. At the time of writing this submission Harris is the immediate past Chair of the Productivity Commission, Sims is the chair of the Australian Competition and Consumer Commission. Kerry Schott is the Chair of the Energy Security Board, a request to Dr Schott identifying what her role was at the time is awaiting a reply.

In work originally prepared as input to the market design process in Ontario, Robert Wilson (the 2020 co-winner of the Nobel Prize in Economics²⁴) observed²⁵:

The peculiar features of the electricity industry that must be considered include temporal and stochastic variability of demands and supplies, accentuated by the non-storability of power, multiple technologies with varying sensitivities to capital and fuel costs and environmental and siting restrictions, and dependence on a reliable and secure transmission system. The economic problems include substantial non-convexities (immobility of generation and transmission facilities, scale economies in generation, non-linearities in transmission), and externalities (mainly in transmission). As regards generation these problems have eased sufficiently in recent decades to enable competitive energy markets, but they remain important considerations in designing these markets.

Wilson also observes that ‘unlike the private-good character of generation, transmission has substantial public-good aspects, pervasive externalities, and highly non-linear behaviour described by Kirchoff’s Laws.’²⁶

At the highest architectural level markets can be designed as pools, exchanges or bilateral markets. In a bilateral market there is a continual process of trading, and are no less efficient in energy than pools or exchanges, but they have great difficulty maintaining efficiency in transmission, as transmission faces derived demand. Exchanges refer to simple processes for scheduling generation while transmission is then acquired in a second exchange. A pool is a tightly coupled arrangement that includes substantial intervention in scheduling. As Wilson notes, pools have been ‘carried over from the operational procedures of vertically integrated utilities who entirely managed their own generation and transmission systems.’

The NEM is a pool with an exchange in forward markets for energy. The transmission access and coordination of generation and transmission investment (COGATT) reforms included in the Paper are a proposal to de-average the price paid for dispatched generation and introduce an exchange for forward transmission contracts (which could be introduced separately).

However, another significant design feature is often left unstated, which is the question of how the buyer side of the market is organised. Biggar and Hesamzadeh identify three broad categories of approaches to this design issue, namely:²⁷

- The *single buyer* approach, under which a single entity has responsibility for purchasing wholesale electricity.
- *Wholesale competition*, under which entities (such as distribution businesses) have a local monopoly over customers and negotiate on their behalf to procure electricity.

²⁴ <https://www.nobelprize.org/prizes/economic-sciences/2020/summary/> Wilson and Milgrom won the prize for auction theory, which is simply a subset of the wider economic science of market design.

²⁵ Wilson, R 1998, ‘Design Principles’, in H-p Chao & HG Huntington (eds), *Designing Competitive Electricity Markets*, Kluwer Academic Publishers Boston.

²⁶ Kirchoff’s Laws were developed before Maxwell’s equations, and perfectly describe power flow in DC circuits. In AC circuits they work for ‘electrically small’ networks (where the wavelengths are large compared to the circuit lengths which for 50 Hz means less than 600km) otherwise travelling wave analysis is required (see Schavemaker, P & Van der Sluis, L 2017, *Electrical power system essentials*, John Wiley & Sons.). The importance of these ‘laws’ is that how much power is carried on an individual transmission line is a function of all the other elements of the system.

²⁷ Biggar, D & Hesamzadeh, M 2014, *The economics of electricity markets*, Wiley. Page 79

- *Retail competition*, under which any customer can, in principle, purchase electric power from any supplier.

Because the NEM has moved to 'full retail contestability' it is assumed that it is an example of the third approach, but that is an error. The amount of energy purchased in any dispatch interval is determined by AEMO, except for the small number of directly participating large customers. The choice of quantity determines the price paid for the energy dispatched. That there is a subsequent settlement between generators and retailers managed by AEMO does not change the fundamental arrangement.

Recognising the current design is one of effectively a single buyer introduces the question of which of the other two alternatives should be considered. Later in this submission we will make the case for the second alternative, though with the Distribution System Operator managing a market within the distribution area.

Comments on the Paper

General Comments

We have found it hard to engage with the Paper, and to understand in many ways exactly what is being consulted on. Seven 'initiatives' are outlined, but only the COGATI reforms have been laid out in any kind of detail. We are unclear how the ESB proposes to move from the relatively general discussion to propositions to be put to Energy Ministers for implementation by the middle of next year.

A key deficiency is the failure of the Paper to outline the problems it is seeking to resolve, or if a problem is asserted what evidence has been used to determine the extent of the problem. Secondly to the extent that a problem may exist and be solved, there is little consideration for how long the solution may be valid. Finally, the relationship between the initiatives is not fully explored.

The lack of evidence

As an example of the first issue, on page 29 the Paper states:

Based on feedback from some stakeholders that the current design presents difficulties for investing in dispatchable generation, this section considers a range of options to stimulate such investment.

Similarly, on page 52 the Paper states:

Some stakeholders advise that governments are not willing to tolerate periods of high pricing that drive investment, and will instead intervene in the market.

There is a saying that 'the plural of anecdotes is not data.' Whoever these stakeholders are, they are probably not disinterested in the outcomes. Investors (and those who receive investment) will always argue a case for improvement in the investment climate – that doesn't mean there is a problem. The only evidence we have, the operation of the market over recent years, is that there is no need for any intervention on resource adequacy or to respond to the exit of thermal plant.

The cases of load shedding over recent years have been minor and avoidable. AEMO's use of inadequate temperature forecasts (since rectified) lay at the heart of the South Australian outage in February 2017²⁸, while January 2019 provided a great contrast in the approaches of two State Ministers whereby the Minister who asked for citizens assistance received that assistance and avoided load shedding.²⁹

²⁸ https://www.aemo.com.au/-/media/Files/Electricity/NEM/Market_Notices_and_Events/Power_System_Incident_Reports/2017/System-Event-Report-South-Australia-8-February-2017.pdf See Figure 7.

²⁹ "On the morning of January 25, Ms D'Ambrosio told a media conference she didn't anticipate load shedding being necessary. Later that morning, AEMO ordered load shedding." <https://www.abc.net.au/news/2019-12-06/what-is-load-shedding-and-how-does-it-work/11650096>
See https://www.aemo.com.au/-/media/Files/Electricity/NEM/Market_Notices_and_Events/Power_System_Incident_Reports/2019/Load-Shedding-in-VIC-on-24-and-25-January-2019.pdf for the Victorian Report

The shedding of smelter load is a planned design feature of the system. Smelters are useful as they provide both a large continuous load to support minimum load requirements of coal power stations and large loads able to be curtailed to address peaks; and they get very cheap electricity prices to reflect these characteristics.

As Energy Consumers Australia's CEO Lynne Gallagher says³⁰:

People will act to achieve a better outcome for themselves, their neighbours, and their community. We see this when there are public calls for people to reduce their electricity use to help keep the power on during very hot days, and to make sure others are safe and comfortable. In these situations, the community responds by voluntarily reducing load by hundreds of megawatts when things are finely balanced and could have gone the wrong way.

Ms Gallagher is able to base her claims not only on the behaviour exhibited by consumers in the cases referred to above but also by their stated intentions. Over the last five waves of the ECA Energy Consumer Sentiment Survey consumers have been asked:

As you may be aware, sometimes there are campaigns asking people to reduce their energy use during periods of very high demand (e.g. when everyone is using their air conditioning during very hot periods). Such campaigns are often backed by government agencies or respected community groups. If there was such a campaign asking that people reduce their energy use during a very hot period, which of the following would you be most likely to do?

Four responses were available –

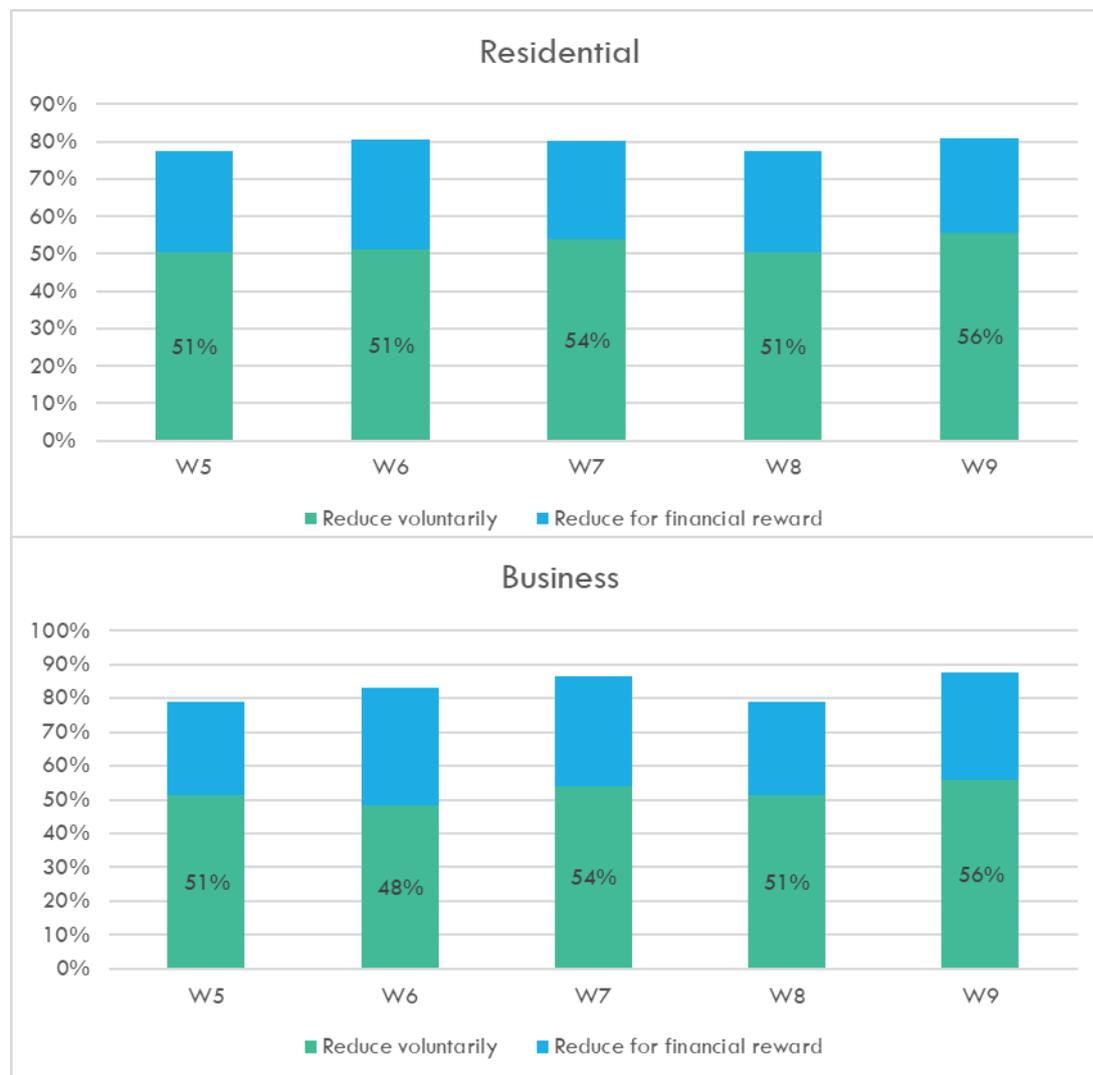
- Reduce my energy use as much as I can, even if I do not receive a financial incentive
- Reduce my energy use as much as I can, but only if I receive a financial incentive
- Not change my energy use
- Unsure

Between 10 and 12 percent of respondents were unsure. Figure 1 below shows the percentage of respondents who were sure what they do for both residential and business consumers. Almost consistently over 50% said they would reduce energy use voluntarily, while over 75% would reduce energy either voluntarily or in response to financial reward.

Voluntary short-term behaviour change is the single greatest untapped resource for addressing resource adequacy and, on a per consumer basis, is twice the size of potential demand reduction from trading relationships.

³⁰ <https://esdnews.com.au/qa-with-lynne-gallagher-energy-consumers-australia-ceo/>

Figure 1: ECA Energy Consumer Sentiment Survey responses to requests to reduce consumption



Longevity of solutions

The question of the duration of the applicability of solutions bedevils the discussion of ‘essential system services.’ This is nowhere clearer than the discussion of inertia.

The paper rightly points out that what is called ‘inertia’ is stored rotational kinetic energy. Simple physics is that a spinning object will continue to spin at a constant velocity unless a force is applied. If we conduct an experiment and spin a bicycle wheel on its axle, it actually does slow down because of friction. Thermodynamics tells us that the stored kinetic energy is dissipated as heat.

When the frequency of the power system drops some of the stored energy in spinning generators is released as electrical energy helping to address the power system issues that resulted in frequency decline. The wonders of governors then cut in to increase the flow of energy to restore the rotational speed of the generator.

The power system does not, however, need inertia. In fact, it is the inertia of all the spinning generators and loads that requires frequency to be tightly managed so that the forces applied in these machines are not too great when frequency changes. Inertia is, in many ways, the problem.

The essential system service is nothing more nor less than fast frequency response. Inertia is simply how this has been provided. A system design that seeks to perpetuate an amount of inertia (by, for example, providing a payment for inertia) is simply adding to the impediments to the energy system transition. It is not only a short-term response, it is a response that heads in the wrong direction.

The relationship between initiatives is not fully explored

Simply considering the first three initiatives – resource adequacy, thermal generation closure, and essential services — reflect the extent of the inter-relationship between initiatives. To put it simply, if there is a satisfactory process for resource adequacy and essential system services, is there any need for a thermal generation closure strategy?

The issue becomes more complex when the relationship is explored between two-sided markets and valuing demand flexibility and Distributed Energy Resources (DER). The goal of greater demand side participation in the market requires demand to be flexible and for this to be valued. Indeed, delineating DER and demand flexibility is even an error as the definitions used for DER include not only generation (usually rooftop PV) but also storage (usually batteries) and demand flexibility.

The linkages extend when we recognise the extent to which greater demand side participation becomes a resource adequacy mechanism, especially in the short term.

Comments on the ESB Approach

An atheoretical approach

Additional to the specific points raised above, we have an overall concern with what feels like an 'atheoretical' approach. Nowhere in the Paper is there any discussion of how theory of power system operation or economics of energy or market design is informing choices.

This is particularly disappointing since the ESB, in conjunction with ANU and the IEA, organised a Future Electricity Markets Summit over three days in November 2019.³¹ There has been no public output to date, with the academics involved advising the author that the summit papers would result in a special issue of *The Electricity Journal*. The special issue will be Volume 33 Issue 9 (November 2020) and many papers are already available as an 'in progress' publication of the journal.³² The abstracts of all the papers included in the special issue are included in an attachment to this submission.

There are many important insights in these papers, not least of which in the paper by Leslie et al which suggests that the COGATI reforms are more important than all the other initiatives being suggested.

Not focussing on what has changed

Earlier we provided the description by Wilson of the key characteristics of power markets that informed the design decisions of the 1990s. The need to consider alternative designs is driven by changes in these conditions.

The Paper attempts this on page 15, however it starts by describing the NEM design, not the circumstances behind the NEM design. Similarly, the description of the motivation for change is particularly vague, using phrases such as 'technology is changing' and noting that people 'are making choices that reduce emissions.'

We believe there are more specific descriptions of the differences that are necessary. We propose the following.

1. The system is changing from a small number of large things to a large number of small things.
2. Generation is increasingly by near-zero short run marginal cost facilities.
3. Generation and storage are increasingly being connected to the distribution network.
4. While physics requires that generation and load be balanced, the assumption of the 'non-storability of power' no longer applies.³³
5. The economies of scale in generation have declined, while the externalities in transmission have increased.
6. Distribution is experiencing the same non-convexities and externalities that apply to transmission.

³¹ <https://www.ica.org/events/future-electricity-markets-summit>

³² <https://www.sciencedirect.com/journal/the-electricity-journal/vol/33/issue/9>

³³ Technically electricity cannot be stored (though in DC circuits it can be stored in capacitors), however batteries make it possible to very rapidly convert the energy in ways that makes the electric power 'virtually storable.'

Central to all this is a change to the way supply and demand need to be balanced. In an era of large coal plants all elements of the supply chain reduced costs by levelling demand. This is no longer the case. Efficiency in the wholesale market requires demand to be balanced to supply, while technical efficiency for both transmission and distribution is still best promoted by levelling demand. This creates a tension that previously did not exist in how to achieve least cost outcomes.

The single biggest change remain storage. The 2020 ISP recognised the significance of storage investment for both short term purposes (within dispatch interval balancing and diurnal balancing) and longer term (especially to store summer sunshine for winter heating). Yet the approach in the Paper is to regard the growth of storage as a problem to be managed rather than an essential service to be encouraged. As an example, on page 108 the Paper asserts:

Accommodating new generation and storage within the grid is already posing difficulties associated with network congestion, low marginal loss factors (MLFs) and technical challenges.

Meanwhile, the equilibrium focus of economic analysis will assert that batteries cannot be 'investible' because they make their money from price arbitrage and the opportunity for arbitrage will be removed by batteries.³⁴

³⁴ This is akin to the economists' argument that there can't be a \$20 note on the footpath, because if it was someone would have already picked it up.

An Alternative Approach

The AEMC and the ESB are correct in identifying that an important part of new market design is greater demand-side participation. The characterisation of this as a 'two-sided market' is wrong; however, a true two-sided market is a pathway to effective demand-side participation.³⁵

The general theory of the economics of power systems has historically been built on the theory of peak-load pricing. Under this theory the utility charges users only its short-run marginal cost for power at off-peak times, but its charging at peak-times includes the allocation of all the fixed costs. In a pool market that pays the market clearing price to all units, the assumption then is that the generators always bid at SRMC but they get paid the SRMC of the marginal unit and hence recover their investment costs. This is the basis of the link between market price caps and investment incentives.

This approach ignores the question of what determines the SRMC of the generator. At an established coal mine the cost of extracting coal is largely unchanged from month to month, and yet there is a volatility in the price paid. The answer is, of course, that final prices in efficient markets are determined conjointly by supply and demand.

This is the fundamental reason why we need demand-side participation; we need demand to play its part in price determination. What that means for the operation of the bulk power system is that, ideally, all load should also be bid into the market and the clearing price determined by balancing both. This is a significant market reform, and we suggest requires a close analysis of whether the move from what we noted above is currently a 'single buyer' approach should be to wholesale competition or retail competition.

The AEMC/ESB approach favours the latter, albeit by creating a new designation for market participants. The alternative is to recognise that the conflicting incentives faced by distribution networks versus wholesale markets means the wholesale competition design is more effective. In this model an entity, which we will call the Distribution Market Operator (DMO), is required to prepare the bid schedule for the distribution area. The DMO determines its bids based on its own forecasts of passive customers and transactions it conducts with active customers. The DMO also needs to have at its command storage services it can use to balance any deviation between its dispatch interval forecasts and actual demand.

Properly designed DMO's would have the ability for parts of the distribution area to continue to operate, albeit with either high prices or some targeted load shedding, using local resources when islanded due to transmission failures. This is a far more cost-effective approach to resilience than further investment to 'ruggedise' assets.

A similar approach could be used for Renewable Energy Zones, with the REZ operator making combined semi-scheduled bids on behalf of the zone. With the addition of a modicum of battery

³⁵ See Havyatt, D 2020, 'Two-sided markets: application to electricity A working paper on market design in the Australian electricity market' for a critique of the AEMC/ESB approach.
https://www.researchgate.net/publication/342276396_Two-sided_markets_application_to_electricity_A_working_paper_on_market_design_in_the_Australian_electricity_market

storage and the use of better local weather monitoring these operators could get very precise on the amount of power available in each time period.

A model of the bulk power system as a collection of connection points between sub-networks that each have their own storage can also address a number of issues of essential system services. The need for essential system services arise either because of imbalances between energy dispatched and energy demanded or because of failure (including automated shut off) of plant (either generation or transmission).

The former can be greatly reduced by DSOs being required to only and exactly extract the amount of energy in their bid, using their access to storage to achieve this precision. The latter can be reduced by the ability of local resources to respond to the changed circumstances.

The resources of NICE do not make a full model of this alternative design feasible for inclusion in this submission. We note that the conclusion we reach about the operation of distribution networks are not consistent with any models considered by the OpEN project conducted by AEMO and Energy Networks Australia. However, we believe that project was also flawed by not being conducted in a way that consideration of wholesale market design change was contemplated.

Conclusion

We have not attempted to respond to all the ESB's consultation questions. Fundamentally we are responding only to the first consultation request of the ESB:

The potential solutions and how well the characteristics of these solutions address the challenges identified with the current market design. Where alternative solutions can be identified for discussion, these would also be welcome.

The ESB needs to engage with the power system needs all the way through to 2050, not just to 2025 or 2030. This submission argues that this approach needs to recognise that the bulk power system needs to be an approach where the participants are market operators of geographic regions of resources.

The management team at Energy Consumers Australia developed a description of three 'e' words to describe the approach to power system issues, each with a matching 'p' word to describe how the approach views consumers. This is outlined in Table 1.

Table 1: Three views of the power system

Approach	Views of Consumers	Description
Engineering	Pariahs	The system would work fine if it wasn't for the way consumers behave.
Economics	Pawns	The system can work fine if we create the right incentives for consumers to respond to.
Engaged	Partners	Consumers are the reason for the power system and it needs to be co-designed with them.

The Paper states that 'The ESB intends that the use of customer archetypes will assist consideration of how different aspects of the reform program might work in practice with different customer groups.' (Page 123). Earlier the paper identifies that the work on two-sided markets will be informed by the ECA work on archetypes to identify who can benefit, the required protections and assistance that might be required.

This latter description of the use of archetypes as a fundamental of the design is a component of an engaged approach. However, as outlined in the introduction the interests of consumers extends all the way back through the supply chain. For example, the implications of different approaches to resource adequacy have different consequences for different archetypes. This consideration shouldn't be part of the evaluation of designs, it should inform design.

Starting the analysis with the operation of distribution markets and working back is a more effective way of ensuring consumer interests are at the forefront of design issues.

Attachment

Overview of papers for the Special Issue of The Electricity Journal: The Future Electricity Market Summit

Peta Ashworth, Kenneth G.H. Baldwin, Michael Brear, Tony Chappel, Matt Garbutt, Cesar Alejandro Hernandez, Frank Jotzo, Iain MacGill and Tim Nelson

The Future Electricity Market Summit was held over three days (18–20 November, 2019) and comprised plenary sessions on the key themes, followed by breakout discussion sessions. The eight papers in this Special Issue reflect both the presentations and the discussions of these themes, and are aimed at identifying the key issues that will need to be addressed in the design of Future Electricity Markets in a decarbonised economy. The chapter abstracts contained in this overview provide a flavour for the thematic areas discussed.

1. End-to-end electricity market design: lessons from the Australian National Electricity Market

Iain MacGill and Ryan Esplin

Australia provides an interesting case study for the challenges of end-to-end electricity market design given its National Electricity Market (NEM) arrangements, growing utility wind and solar penetrations, and world leading uptake of distributed energy resources. In this paper, we consider lessons from the NEM for end-to-end market design that delivers a secure, affordable and clean energy future. We identify seven key challenges: 1) End-to-end electricity market design is a ‘markets’ integration challenge so interface design is a key task, 2) it isn’t clear where the ends lie in end-to-end market design given that efficient industry outcomes depend critically on fuel supply and consumer markets that lie outside formal electricity industry arrangements, 3) End-to-end market design requires broader policy and regulatory ‘side-to-side’ design, 4) Markets with major externalities are inefficient by design, 5) Technology change and market design can both reveal currently ‘unpriced’ industry costs and benefits, particularly in security services, 6) The key design challenge in end-to-end market design is the market and regulatory interface with energy consumers, and 7) widespread market failure is not an option in the electricity sector – end-to-end market design also requires design of ‘alternative’ frameworks. While we draw on NEM experiences, our framework would seem to have wider relevance to other jurisdictions now seeking to integrate higher renewable penetrations and distributed energy resources.

2. Sector coupling: supporting decarbonisation of the global energy system

Michael Brear, Ross Baldick, Ian Cronshaw and Magnus Olofsson

Natural gas provides significant energy supply, but also important flexibility services, especially in markets where winter heating load is high, and gas also provides flexibility and system services in power generation. These services are likely to become increasingly important as energy systems transition to lower carbon. But natural gas production and combustion must be phased out in a low carbon economy in applications where carbon capture and storage is not deployed. Options exist for decarbonizing the gas grid, enabling flexibility to be delivered with existing infrastructure. These include biologically derived methane, synthetic methane, and low carbon hydrogen, all potentially in a global context and deployed in sectors where decarbonisation is more difficult. Electric and hydrogen powered vehicles offer crucial routes to addressing

transport emissions. These also have significant potential to be flexible users of electricity, facilitating the integration of renewable generation. Future planning and policy options need to consider these options in an integrated, long-term approach.

3. Electricity system resilience in a world of increased climate change and cybersecurity risk

Elizabeth L. Ratnam, Kenneth G.H. Baldwin, Pierluigi Mancarella, Mark Howden and Lesley Seebeck

The shift to widely distributed forms of energy generation and storage, requiring increased interconnectivity to geographically balance supply with distributed demand for electricity, creates a more complex electrical network - the 'Internet of Energy'. A growing array of threats now impact the resilience of the electrical network including digitalisation, cybersecurity, technological changes of the power system, and the potential for climate change to expose the system to more extreme weather events. Whether distributed and renewable electricity systems will be more resilient through multiple pathways and redundancy, or less resilient due to greater cybersecurity risks than a conventional centralised electricity system, is the key focus of this paper.

4. Designing electricity markets for high penetrations of zero or low marginal cost intermittent energy sources

Gordon W. Leslie, David I. Stern, Akshay Shanker and Michael T. Hogan

This article explores key market design issues to be addressed in future electricity markets dominated by intermittent renewable generation with near zero private marginal costs for generating electricity. Changing technology mixes will change market outcomes, but they do not change the fundamental economic principles behind market design. Market-clearing prices in such a market are not necessarily mostly zero even in an energy-only market, especially with grid scale storage, an active demand side of the market, and scarcity pricing. However, increasing intermittent generator penetration increases the importance for adequately pricing scarcity and all network constraints and services. Such pricing is required to deliver investment incentives for the right technologies to locate at the right locations to efficiently maintain a stable and reliable electrical network.

5. Optimising the value of distributed energy resources

Lachlan Blackhall, Gabrielle Kuiper, Larissa Nicholls and Paul Scott

The uptake of distributed network-connected and consumer-owned Distributed Energy Resources (DER) represents a transformational change to the energy mix, structure and operation of our power systems and markets. If DER can be successfully integrated into our electricity networks and markets, there is the potential to benefit all electricity system users. This paper discusses some of the important technical, economic and social opportunities for, and challenges of, optimising the value of DER through the integration of DER into our electricity networks and markets.

6. Incorporating new power system security paradigms into low-carbon electricity markets

Ben Skinner, Pierluigi Mancarella, Maria Vrakopoulou and Ian Hiskens

Australian Electricity Markets are integrating variable renewable energy sources at rates faster than anywhere in the world. South Australia and Western Australia, in particular, are at the world's forefront of the consequential new challenges in maintaining a secure electricity grid. These emerge primarily with respect to frequency and voltage instability, converter interoperability, and variability and forecasting issues. As a result, operating strategies that worked well in energy markets dominated by conventional generators must be transformed to take into account the physical characteristics and probabilistic capabilities of emerging energy conversion processes. In turn, these approaches must be incorporated into the mechanisms and rules that will govern new low-carbon electricity markets. This article summarises recent research work in the field and then considers how technical insights underpinning these new security services could be adopted into a competitive market construct to enable a smooth transition towards sustainable electricity systems.

7. Australia's National Electricity Market: financing the transition

James Nelson

Australia has among the highest market share of coal-fired generation in the OECD. However, to honour its agreement to the Paris Commitment, the electricity sector will have to reduce its carbon intensity by at least 27.5 % from 2019 emissions. Under the existing market design, this would equate to an approximate 50 % increase in generation supply, with a requirement to invest in c. 3800 MW of new generation each year until 2030. Meanwhile, investor uncertainty is at an all-time high given market- and policy-driven factors, including the lack of clearly defined energy policy by Federal Government. Technical issues have also been a factor whereby some generators have had their output restricted for undetermined periods of time, and faced delays in commissioning which increases the costs of development for new renewable energy generators. No single solution to promote the investment in Australia's transition is evident, but a coordinated approach to policy design, and well considered investment in networks will be crucial.

8. Electricity markets in flux – the importance of a just transition

Tracey Dodd, Alan Rai, and Kellie Caught

Electricity is an essential service. Over the last decade the price of electricity in Australia has increased at an annual growth rate of 8%, more than twice that of wage growth (3.1 %) and nearly four times higher than inflation (2.3 %). Low-income households spend a greater proportion of weekly income on energy costs. They also face barriers in embracing new technologies such as rooftop solar photovoltaics, due to the high costs, as well as the split incentive problem for low-income renters. The shift to new technologies is also likely to impact communities that have been historically reliant upon centralised, fossil-fuel-based electricity production for jobs and economic activity. It will be important for policy makers to consider not just the impacts on low-income and vulnerable consumers of energy, but also communities impacted from the closure of fossil-fuel industries. This article explores the nature of a 'just transition' toward lower emissions within electricity markets, with a particular focus on end user pricing outcomes and significantly impacted communities (e.g., coal mining regions, etc).

Network of Illawarra Consumers of Energy
Response to the ESB's Post 2025 Market Design Consultation Paper
October 2020