

19 October 2020

Dr Kerry Schott, AO,
Independent Chair,
Energy Security Board

Response to P2025 Market Design Consultation Paper

Dear Kerry,

Please find attached a detailed commentary on both the ESB's Post-2025 Market Design Consultation Paper and, just as importantly, the on the critical need for action to ensure that existing synchronous generators continue to provide essential 24/7 dispatchable energy and all of the Essential Services required to ensure System Security and Reliability of the NEM going forward until like-for-like replacement at lower cost to electricity consumers is in place and operational.

I have adopted a "High Level" approach to this attached commentary and recommendations, noting that Delta Electricity is responding in detail to the Consultation Paper and the various Questions raised therein. I have specifically drawn on technical materials from the ESB and AEMO to demonstrate the high-risk nature of the ESB's Consultation Paper proposals.

As someone with over 60 years' experience in the Australian Energy Industry, I must say that I found the Consultation Paper both disappointing and, quite frankly, wanting in terms of fully acknowledging the high risk nature of many of the ideas and proposals presented therein, and in total contrast to the planning and consultation with practicing industry professionals prior to the original launch of the NEM. It is also alarming that the Consultation Paper does not make any mention of the evidence presented in the March 2020 AEMO Quarterly Energy Dynamics Report of the need for minimum levels of synchronous dispatchable generation required in an islanded South Australia for 18 days in February 2020, and therefore does not have regard for the significant essential learnings from this occurrence, at huge cost to South Australian electricity consumers, and the relevance to the current urgings for such similar closures of existing power stations and reliance on wind and solar in the entire NEM, which would then be an islanded electricity supply system without support from interconnected neighbouring States or countries, such as South Australia was in February.

- I addressed these issues in detail in an email to you and the heads of the other Energy Agencies, as well as to the Federal Energy Minister, in March, to which I still have not received any reply nor acknowledgement. I have attached this email to these materials given the significance of that islanding event and the essential lessons that simply cannot be ignored.

I found it also fundamentally and conceptually wanting for so much of the discussion and commentary in the background Consultation Papers to be around wholesale pool price relief and short-term savings in wholesale power supply costs, when generation and transmission investment relies on more than 2 million (five-minute) trading intervals over at least twenty years to be able to deliver low-cost wholesale power to population centres, with reasonable expectations of an eventual return on the highly-capital-intensive investment, whatever the technology.

It is totally incomprehensible for a market design discussion to entertain a notion of external grants and subsidies by governments, eventually paid for by electricity consumers, without the test of overall benefit in the delivered cost of supply to end-consumers bearing all such on-costs involved, yet this is even allowed to be discussed in a context of “modernising the transmission network”.

Possibly of even greater disappointment in relation to the whole tenor of this consultation on possible solutions for a new market structure to replace the now “not-fit-for-purpose” NEM, is that the ESB has from its establishment, for some reason or other, ignored the fundamental independent responsibilities of generators and retailers under the NEM design, for generators to meet every single demand for electricity supply to businesses and residences, every micro-second (instant) of every day, and of every year into the future that it is committed to be in service, and for retailers to compete to ensure that all electricity customers are guaranteed this assured electricity supply with certainty of competitive and affordable cost.

- It has been inexplicable that the ESB, and also AEMO, have been intent on imposing responsibilities for specific generation sourcing on electricity retailers, at odds with the fundamental NEM design concept of separating the physical generation and supply dispatch responsibilities from the financial contract market designed to ensure price certainty of reliable electricity supply to end-consumers, by way of open and competitive contracting with generators in a wholesale market under terms that deliver competitive lowest-cost based on long-term returns to generators for their highly-capital-intensive 24/7 dispatchable investments. These were fundamental principles when the NEM was first established, and they are just as valid today for market participants in the generation and retail sectors, in contrast to the investment imperatives in the regulated monopolies in the transmission sector.
- The myth that renewable and intermittent non-synchronous and non-dispatchable wind and solar power generation have ever been lower in cost than the short-run marginal cost of displaced existing fossil-fuel-fired generation, at any instant, should have been called out and de-bunked by the responsible electricity market managers and regulators responsible for the safe, secure and reliable operation of the NEM, rather than leaving it to politicians who appointed them to their responsible positions, but with responsibility to oversee the organisation that is required to deliver low-cost reliable electricity supply.

The fact that AEMO, and subject to the various interacting responsibilities of the ESB, the AEMC and the AER, have demonstrably mismanaged the uptake of intermittent wind and solar generation, despite experience in overseas jurisdictions such as Ireland and detailed analysis from the International Energy Agency (IEA), first published in 2016, as to the limits on wind and solar generation in the context of the continued operation of a secure and reliable electricity system, should have warranted corrective action by governments that are signatories to the National Electricity Market Law. The consequences have included the totally reprehensible shutdown and demolition of an efficient low-cost base-load coal-fired power station in South Australia (Northern), and the premature closure without notice of the Hazelwood Victorian power station, both previously major contributors of low-cost power supply in these two States at one-third of the wholesale electricity prices seen in those States following their closures.

It is particularly disappointing to me personally that the ESB, from its establishment, overturned the prior expressed “technology-agnostic” beliefs of both the former Prime Minister, Hon Malcolm Turnbull and the then Treasurer, Hon Scott Morrison, that with the legislated levels of renewables under the Renewable Energy Target Scheme (RET), existing generation businesses in Australia were well-placed to maintain reliability and security of supply of low competitive-priced power, within the capacities of the existing generators to remain in service at their minimum outputs, but with the benefit of market ancillary services as were being implemented in a similar islanded system in Ireland.

The idea that eminently professionally capable people with no direct personal experience as a participant in the complex energy market should be appointed to oversee for governments the management, control and regulation of this complex market, is fairly open to question, without the strongest counsel and professional support of market participants. This is especially at question when the eminent professional experience has not only not included any open & competitive market experience and has been exclusively in regulated monopolies, such as Australia’s transmission corporations.

- But when the conscientious counsel of respected senior industry representatives, from others and including my commentary here, and many times previously, with facts and factual detail that are not only not responded to in any way, but not even given light in the public consultation process, it is more than fair to warn about the capability of this process overseen by the very managers and controllers and regulators who have brought the Australian economy to this dire threat of loss of industry and jobs due to internationally-uncompetitive energy pricing and declining reliability and potential threats to supply capability with pressures for premature closures of existing low-cost coal-fired power stations without definite plans for replacement and definite impacts on the reliability and cost of future electricity supply.
- It is inexplicable that the evidence of the practical limitations of the extent of intermittent wind and solar generation without sufficient dispatchable synchronous generation support in an islanded electricity supply system, which was laid bear with the disconnection and islanding of South Australia for eighteen days in February 2020, so well reported on in the AEMO Quarterly Energy Dynamics Report, of March 2020, are not considered relevant in the backgrounding for this public consultation.
- I was disappointed not to receive any response from my detailed counsel to you and the other ESB members and to the Minister, Hon Angus Taylor MP, by email of 29 March 2020, of “Essential Learnings from SA Separation from the NEM, and from Huge Costs of Excess Solar and Wind”, based on the evidence and the thorough reporting in the AEMO Quarterly Energy Dynamics Report. It is relevant to this consultation process, and accordingly I am including as a second attachment to this commentary, and commend it to the ESB and to the Governments responsible for delivery of low-cost sustainable reliable electricity to businesses and residences in Australia.

- The evidence from the 18-day islanding of the South Australian electricity supply network in February is totally at odds to the acceptance by the ESB that wind and solar could by 2025 supply 88% average midday winter net demand across the entire NEM. The experience in the islanded South Australian system in February and comparable international experience demonstrate just how fanciful this is for any islanded electricity systems with no interconnections to neighbouring States or countries.

It has long been my expressed view that imposing responsibilities for national transmission planning on the designated National Energy Market Manager (AEMO), and also of AEMO acting as a Victorian Transmission Market Participant, are both gross and demonstrable conflicts-of-interest to the prime responsibility for AEMO to ensure reliable, secure and open-competitive supply of power in the five States and ACT, and have contributed to the demonstrably poor management of the uptake of renewables to date, not least in part caused by independent actions by State Governments. In the present management of the energy transition to cleaner generation sources, this conflict has led to AEMO's prime responsibilities being subordinated to much of the current prophesising of all sorts of capabilities of transmission to replace low-cost generation, despite the obvious conflict of interest as a result of the guaranteed returns to the regulated transmission monopolies of such transmission proposals to be paid by electricity consumers.

As should be acknowledged at the outset of a this public consultation, there is no known technology capable of replacing the greater portion of the essential services that were, and are still currently, provided by the ~22,000MW of large scale 24/7 coal-fired generators that have been critical for NEM System Security and Reliability, and for the continued supply of low-cost base-load dispatchable generation, and still capable of being supplied by these generators at low cost as their original capital costs have been largely amortised (although subject to increasing refurbishment and life-extension costs to be serviced), and recognising that the necessary transmission infrastructure is in place versus the requirement to build new transmission infrastructure at significant cost for new renewable generation.

The ESB's highest priority now, as before, should be to ensure that the current fleet of coal-fired generators remain in service until like-for-like replacement capacity has been fully committed and is operational. Immediate steps are therefore needed to properly remunerate these facilities for the system support services of frequency and voltage control, as well as for spinning reserve capability of ramping up output to meet peak demand as solar generation falls away every day. Failure to act urgently to adopt such necessary fundamental solutions will further undermine the commercial viability of existing synchronous generators that provide these essential services critical to maintaining System Security and Reliability, increasing the risk of "inefficient" exit of coal-fired generators, as the ESB Deputy Chair alluded a couple of time on the 1 October Consultation Webinar, with consequential risks to the operation of the NEM and of higher electricity prices.

The security and reliability of supply of 24/7 dispatchable power to businesses and residences at low cost by existing coal-fired power stations, by way of wholesale contracting to retailers, should be the bench-mark against which the ESB should assess the adequacy and acceptability of replacement 24/7 dispatchable generation and supply capability, and an open and competitive technology-neutral market would much more assuredly deliver the new technology to facilitate the greatest possible greenhouse abatement across all sectors in Australia, as in other countries.

The ESB should therefore shift its focus from “managing” the exit of existing synchronous dispatchable coal-fired generators to one of maintaining these assets in place for as long as necessary to protect System Security and Reliability of the NEM. Additionally it should adopt a genuine “Technology Neutral” approach and, in line with this, acknowledge that all potential resources, including possible life extensions of existing fossil-fuel-fired generators, should be considered as potential providers of the necessary Essential Services going forward, with the lowest cost resource being selected.

Additionally, the ESB, together with the AER, should be acting to ensure that the market in Australia is able to rapidly catch up with the rest of the world, which is concentrating its greenhouse emission reduction efforts on the electrification of the transport sector, with wider positive national economic and health benefits, as well as much greater and less disruptive greenhouse mitigation. Electrification of the transport sector necessitates significant growth in electricity demand, mainly in off-peak periods, and mainly when excess output from solar and wind generation in Australia is causing serious load management problems and consequential curtailment of solar generation capability. Electrification of the transport sector would result in this excess renewables generation being absorbed, and assist in managing increasing renewable power growth, particularly from household roof-top solar PV.

Many of the options the ESB is presenting in the Consultation Paper are not practical, or workable, and this could continue to be the case well beyond 2025. They are essentially at a conceptual (theoretical) stage in relation to the potential retirement of the `22,000MW existing generation capability, and a number of key alternative technologies for the provision of Essential Services required to maintain System Security and Reliability have not been “tried and proven”. Further, the necessary market design and technological developments, and assessments of electricity retail price impacts, may take longer than. A precautionary, staged approach to the development and implementation of the Post-2025 NEM Design (in terms of minimising risks and holding extra reserve) should therefore be adopted.

Additionally, a number of the options the ESB is presenting fail any test of replacing the bench-mark 24/7 “all-year” low-cost dispatchable capability of the existing coal-fired generators. Too much of the debate, pursued by those intent on pressing for the premature closure of essential coal-fired generators in this consultative process, concentrate on parts of the matrix necessary to deliver such whole 24/7 “all-year” low-cost replacement “solutions”, and too often governments are being pressed to financially support such parts of solutions, instead of leaving it to competent “technology-agnostic” generation developers to assemble all the parts of solutions to compete in open competition with other consortia, such as the ACCC Chair, Rod Sims, recommended in the ACCC’s 2018 Retail Electricity Pricing Inquiry Report.

I therefore cannot support the position in the Consultation Paper that Energy Ministers should sign off on the Post-2025 NEM Design in 2021, in such a state of unknown feasible solutions, or of the cost of 24/7 replacement solutions. A Ministerial sign-off that would allow the closure of the existing base-load dispatchable low-cost generators, without even the knowledge of any technology that could serve the country after the closure of generators presently supplying 65% of Australia’s electricity supply, would mean that there is insufficient governance in the further development, and subsequent implementation, of the NEM Design changes. Given the critical importance of a safe and secure electricity system for business (and jobs), as well as households and community living standards, additional arrangements to ensure full transparency and accountability for decisions to move from one stage of the ESB’s Roadmap to the next are required. This could involve the relevant agency (AEMO) providing a detailed report in support of a

recommendation to move from one stage to the next that would be publicly available, and with Ministers being required to sign off on any such recommendation.

My very-direct high-level comments I am offering here are, with all due respect, designed to draw attention to fundamental flaws I consider have prevented more immediate and satisfactory solutions coming out of the present energy market management, control and regulation processes, and out of your Energy Security Board processes. My high-level comments here are complementary to the detailed comments by the respected management at Delta Electricity, who, like me, are “technology-agnostic” generation and supply market specialists, with lifetime careers of excellence in serving the energy demand requirements of Australian businesses, mainly. I therefore commend their more structured responses in a separate submission to your consultation process.

I would welcome the opportunity to discuss my concerns and suggestions with you, and other members of the ESB, as the Post-2025 NEM Design work is further progressed.

Yours sincerely,

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Attachment:



Essential Learnings
from SA Separation

RESPONSE TO ESB POST 2025 MARKET DESIGN CONSULTATION PAPER

- SUPPORTING MATERIALS

INTRODUCTION

As someone with over 60 years' experience in the Australian Energy Industry, I fully endorse the views of the Australian Energy Market Operator that:

"Modern power systems are giant, multi-faceted machines.....While the power system is being transformed, the laws of physics that determine electrical flows do not change. To maintain a secure and reliable system, a range of interdependent technical and operational needs must be met at all times..... Interactions in any power system are highly complex and dynamic. Operating a power system involves a continuum of decisions.....This work culminates in the continuous matching of supply with demand and constant provision of essential **voltage** and **frequency** management services, ensuring sufficient reserves so the power system is robust enough to cope with unexpected events and stay within the power system operational design limits" (AEMO, Power System Requirements Reference Paper, July 2020).

And as someone with over 60 years' experience in the Australian Energy Industry I am deeply concerned as to the approach the Energy Security Board, and its member agencies, are taking to:

1. Addressing the immediate risks for System Security and Reliability in the National Electricity Market, when key domestic and international agencies such as the International Energy Agency have been sounding the alarm on these risks for some time and the necessary fundamental (versus piecemeal or interim) solutions are readily at hand. Failure to act urgently to adopt the necessary fundamental solutions will further undermine the commercial viability of existing synchronous generators that provide Essential Services critical to maintaining System Security and Reliability and fast-ramp response from "spinning reserve" each day when the sun goes down, increasing the risk of early exit of existing coal-fired generators, with consequential serious risks to the operation of the NEM and higher electricity prices.
2. The development of Post 2025 NEM Design which is tasked with addressing these same issues of System Security and Reliability within a framework of effectively promoting the "transitioning" of the NEM to a significantly higher level of renewables (both Large Scale and household solar PV), where the ESB's approach is highly conceptual and, in many cases, highly theoretical. Based on its current statements, the ESB will be asking Commonwealth and State Energy Ministers to sign off on its proposed new NEM design next year without sufficient detail as to either the feasibility or cost of replacing existing 24/7 dispatchable power plants, or how this new NEM design will operate in practice and without the necessary checks and balances to ensure that the various changes and initiatives under its transitional roadmap will not be introduced without appropriate

testing to provide the necessary certainty that they will not undermine System Security and Reliability and, thus, threaten Australia's electricity system.

This paper addresses the key issues of:

- The critical role of existing 24/7 **synchronous generators** to maintaining System Security and Reliability and fast-ramp response for "spinning reserve" when reducing to minimum operational outputs to accommodate mandated intermittent wind and solar generation.
- How **non-synchronous weather driven generation** is significantly, and increasingly, undermining System Security and Reliability by displacing this synchronous generation and, thus, the associated "Essential Services" produced by these synchronous generators.
- The need to take action in the short term to protect the viability of these critical dispatchable **synchronous generators**, both in terms the provision of Essential Services and the availability of dispatchable supply to maintain the necessary flexibility in the NEM to ensure demand and supply are continuously matched. The paper therefore supports a "Technology Neutral" approach to the provision of Essential Services under which all potential resources should be considered as potential providers of Essential Services going forward, with the lowest cost resource being selected (including possible life extensions of existing thermal generators), and notes that this approach is recommended in the FTI Consulting report "Essential System Services in the National Electricity Market" that was specifically prepared for the ESB as input into its Consultation Paper.

As there is no known technology to replace the greater portion of the security services currently provided by large scale 24/7 dispatchable synchronous generators that are critical for NEM System Security and Reliability, it is essential that the current fleet of coal fired generators remain in service until like-for-like replacement capacity has been fully committed and is operational. In order to maintain this critical synchronous generation, immediate steps need to be taken to expedite measures to properly remunerate these plants for the system support services of frequency and voltage in particular, as well as the introduction of remuneration arrangements for spinning reserve capable of ramping up output to meet peak demand as solar generation inevitably falls away every day.

Additionally this paper questions whether many of the options the ESB is presenting in the Post-2025 NEM Design Consultation Paper are practical, or workable. There is a need to adopt a very cautious approach to the introduction of new technologies designed to replace the Essential Services now supplied by existing dispatchable synchronous generators and the market mechanisms proposed, to ensure efficient and exit and replacement which is price-beneficial to electricity consumers, not just reflective in reduced wholesale pool prices, to which most generation, supply and consumption is indifferent..

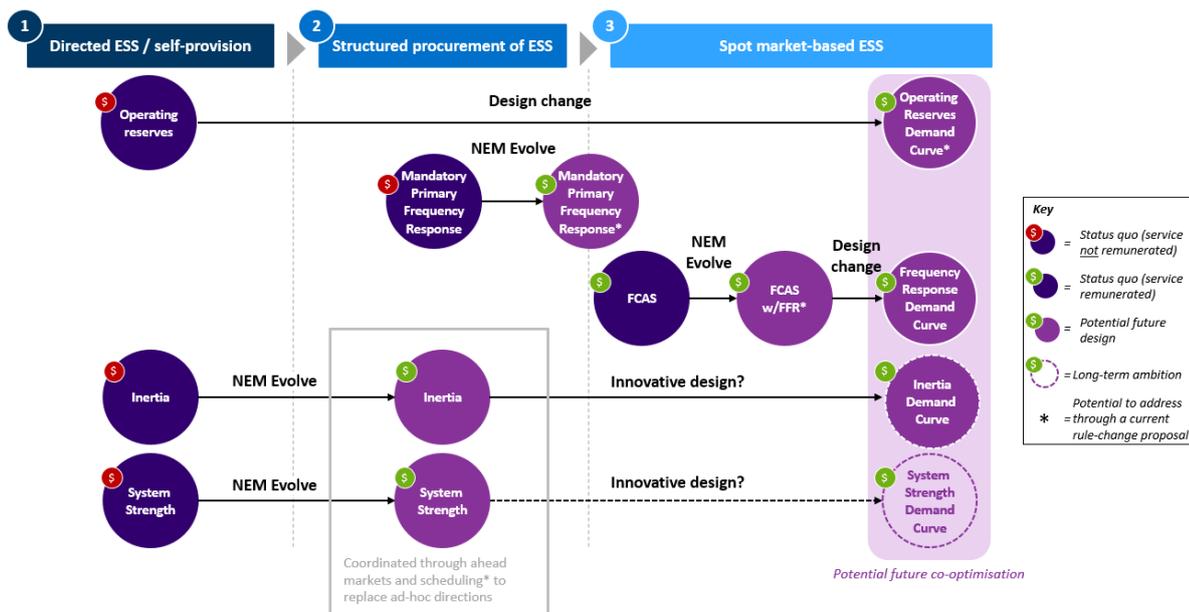
A precautionary approach to the development and implementation of the Post 2025 NEM Design (in terms of minimising risks and holding extra reserve) is therefore recommended to ensure System Security and Reliability is maintained as the NEM progressively "transitions" to a higher level of intermittent generation and alternative technologies must necessarily be introduced to "firm" this intermittent generation. This precautionary approach should, as noted above,

therefore involve maintaining the current fleet of thermal synchronous generators in service until like-for-like replacement capacity has been fully committed and is operational. This could be seen to be similar to the arrangements in Ireland under which a staged approach has been adopted to relaxing power system operational limits linked to minimum numbers of synchronous generators online.

AEMO has previously commented favourably on the adoption of such a staged approach as part of a precautionary approach to change in its “Maintaining Power System Security with High Penetrations of Wind and Solar Generation” report, with favourable references to the approach adopted in Ireland. It is also noted that the FTI Consulting report “Essential System Services in the National Electricity Market” specifically prepared for the ESB as input into its Consultation Paper supported a cautious staged impact-assessment approach to operationalising a new Essential Services procurement and scheduling framework.

Lastly this response to the ESB Consultation Paper questions the appropriateness of the ESB recommending an approach whereby Commonwealth and State Energy Ministers will be asked to sign off on its Post 2025 NEM Design recommendations when many of the proposals are still at a conceptual (theoretical) stage and a number of key alternative technologies for the provision of Essential Services required to maintain System Security and Reliability have not been “tried and proven” and, as noted by the ESB, the necessary market design and technological developments may take longer than 2025 for some Essential Services. This is particularly the case with respect to the development, and subsequent implementation of a spot market for System Strength as highlighted in the following figure in the Consultation Paper:

FIGURE 23 A POSSIBLE ROADMAP OF PROCUREMENT AND SCHEDULING OPTIONS FOR ESSENTIAL SYSTEM SERVICES



The adoption of a staged, precautionary approach would help in addressing the risks with the approach presented by the ESB. However, given the critical importance of a safe and secure electricity system for business (and jobs), as well as households, it is recommended that Ministers request the ESB to prepare an additional set of recommendations to ensure full

transparency and accountability for decisions to move from one stage of the ESB's Roadmap to the next, with the relevant agency providing a detailed report in support of a recommendation to move from one stage to the next that would be publicly available, and with Ministers being required to sign off on any such recommendation, on a credible path to ensuring electricity end-customer price relief and 24/7 system security and reliability of supply to meet system demands.

BACKGROUND

When the NEM was established over 20 years ago, its success was built on a small number of large thermal (predominantly coal-fired) **synchronous** generators. Dispatchable synchronous generators are critical to the operation of an electricity system as they provide services (frequency control, inertia, voltage and system strength) to provide system security. They also provided reliable and low-cost power.

However these services, referred to as "Essential Services", are effectively provided as a by-product of the energy produced by existing fossil-fuel-fired generators – and, as such, they were not valued and, as a result, the NEM agencies did not develop any mechanism (until recently) to signal the need for, or pay for, these services.

Variable, or intermittent, renewable energy generation (VRE) is not synchronous; solar and wind generation are **non-synchronous**, with the result that as the proportion of energy being supplied into the NEM by VRE increases beyond a critical point, these Essential Services can be short of requirements at times, forcing the Australian Energy Market Operator (AEMO) to intervene. This problem was highlighted by the ESB as "Critical" in its 2019 Health of the National Electricity Market report, with the ESB stating:

".....security is a critical issue at present and in the future. The operation of the NEM requires the system be maintained within defined limits to deliver electricity to consumers that is safe and of a consistent quality. The parameters that are important include frequency, voltage, inertia, and system strength. Failure to maintain these security parameters within their defined limits can damage the power system and lead to supply interruptions. Increasing penetration of variable renewable energy resources and distributed energy resources is making it more difficult to maintain security.....One indication that the NEM is in a critical state of security at present is that AEMO has had to intervene significantly in the operations of the NEM. These interventions have been done to maintain system security over the last two years" (Pages 18 & 20).

And as AEMO stated in its April 2020 Renewable Integration Study: Stage 1 Report:

".....the number of online synchronous generators being displaced by increasing penetrations of IBR (ie, Inverter-based resources, or intermittent renewables), without compensation for the loss of synchronous services. As a result, system strength and inertia have reduced, and the system is reaching the bounds of known stability limits" (Page 29).

Intermittent generation (ie, wind and solar) are, by their very nature, variable, creating additional risks in relation to the reliable operation of Australia's electricity system. This risk to Reliability is being exacerbated by the high, and still increasing, take-up of household (rooftop) solar. Ie, these weather driven sources of generation are increasing variability and uncertainty in the NEM, creating significant swings in demand on synchronous generators, on top of continual variable despatch demand counter-intermittent to the VRE. What is now happening in a number of jurisdictions, overseas and in Australia, is a significant hollowing out of demand for

the in-service dispatchable synchronous generators during the day, and increasing evening demand ramp-up to the traditional evening peak demand period. This is creating 2 critical issues for AEMO in the management of the NEM:

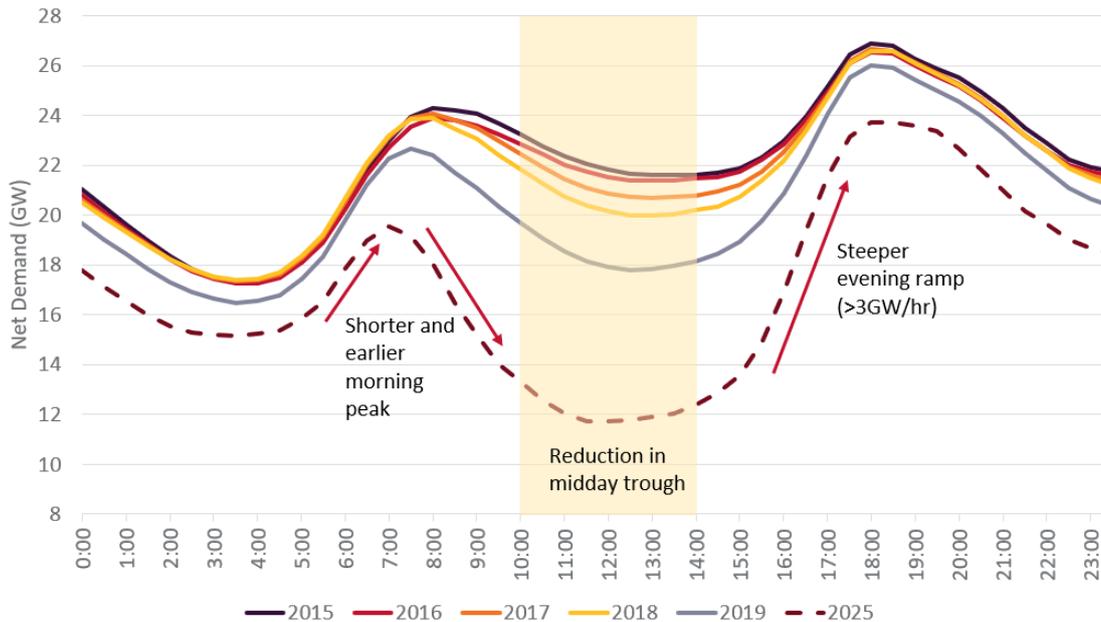
1. Minimum load management.
 - System security issues develop for AEMO as system demand falls due to excess energy from these weather driven sources because synchronous generators need a minimum level of demand to operate, and their operation is required to provide many of the Essential Services necessary to keep the system secure.
2. Managing the increasingly large ramp in demand for energy that needs to be covered between the solar peak at midday and the evening peak.
 - This potential excess level of weather generated energy may force synchronous dispatchable generation to below operational minimum output levels, forcing such plant out-of-service, and threatening the capability of the system to ramp-up to meet evening peak demand.

AEMO particularly noted in its April 2020 report (at pages 56 and 57-58):

“This study indicates that variability and uncertainty driven by weather-dependent resources will keep increasing to 2025. This increase is occurring on both the supply and demand side (due to increased utility wind and solar generation and the increased uptake of DPV (ie, household solar PV)). To effectively integrate higher levels of variable renewable energy (VRE) while maintaining a secure and reliable grid, the system needs access to adequate sources of flexibility that can respond to the constantly varying supply-demand balance, as well as headroom to cover uncertainty. Where there is an increasing need for system flexibility under higher penetrations of VRE, there may be less flexibility available when required in some regions of the NEM, due, for example, to synchronous generation retirements, or displacement of online synchronous generation during high VRE periods.....”

“As the installed capacity of VRE grows, so does the magnitude of ramps and the potential for them to impact system operation.....The magnitude of hourly net demand ramps is projected to increase significantly out to 2025, with variability in VRE outpacing underlying demand as the main driver of these ramps. The net demand curves in Figure 16 (below) highlight the increased system flexibility that will be required to respond to both expected and unexpected changes in supply and demand. The “duck curve” in Figure 16 has become familiar to the industry, with net demand falling in the middle of the day and rising quickly in the evening. This figure highlights that in 2025 – compared to the experience of 2015-19 – evening ramps will be much larger than experienced historically, due to increased penetrations of wind and solar.....”:

Figure 16 NEM average winter net demand curves, actual 2015-19 and projected in 2025 under Draft 2020 ISP Central generation build



The evidence from the 18-day islanding of the South Australian electricity supply network in February is totally at odds to the acceptance by AEMO, as above, that wind and solar could by 2025 supply 88% average midday winter net demand across the entire NEM. The experience in the islanded South Australian system in February and comparable international experience demonstrate just how fanciful this is for any islanded electricity systems with no interconnections to neighbouring States or countries.

It is inexplicable however that the evidence of the practical limitations of the extent of intermittent wind and solar generation without sufficient dispatchable synchronous generation support in an islanded electricity supply system, which was laid bear with the disconnection and islanding of South Australia for eighteen days in February 2020, so well reported on in the AEMO Quarterly Energy Dynamics Report, of March 2020, are not considered relevant in the backgrounding for this public consultation.

THE FUNDAMENTAL ISSUE THAT THE ESB NEEDS TO ADDRESS

The secure and reliable operation of the NEM is critically dependent on the Essential Services now provided as by-products by existing dispatchable synchronous generators. Additionally synchronous generators have traditionally supplied the energy required for ramping purposes and operate on a 24/7 dispatchable basis, helping to ensure the continuous supply of energy to businesses and households. VRE, on the other hand, does not have all of these capabilities and, thus, must be “firmed” and supported by synchronous generators. However increasing penetration of VRE, both utility scale and household solar PV, are displacing synchronous generation, undermining the continued financial viability of their operations – and, thus, increasing the early exit of these synchronous generators. Increased penetration of VRE is, therefore, creating a downward spiral in terms of the ability of traditional synchronous generators being able to supply Essential Services and Energy when required to ensure System Security and reliability of the NEM.

Despite this critical role of synchronous generators in helping to maintain system security and reliability, as well as flexibility in the NEM, the ESB's Post 2025 NEM Design Consultation Paper contains no measures to immediately protect these critical NEM assets. Additionally, although many of the issues associated with ensuring the availability of key Essential Services and flexibility that have been previously well flagged by both the ESB and AEMO and, importantly, the relevant reports that have referenced a number of overseas initiatives to address these issues, the ESB Consultation Paper contains no recommendations for immediate action.

[Footnote:

- ESB, Post 2025 Market design Issues Paper, September, 2019;
- AEMO, Maintaining Power System Security with High penetrations of Wind and Solar Generation, October, 2019;
- ESB, System Services and Ahead Markets, April, 2020; and
- AEMO, Power System Requirements, July 2020.]

The actions to support system control and reliability of supply with high levels of uptake of intermittent non-synchronous renewables in a comparable "essentially islanded" electricity supply system, in Ireland, offers a stark contrast to the permitted closures of essential dispatchable generation capability in Australia to below a recognised generation reserve considering the age and capabilities in all credible circumstances of available capability at reasonable dispatch price, and in contrast to the inaction in introducing reasonable Essential Service payments to existing dispatchable generators being marginalised by the mandated uptake of non-synchronous wind and solar in Australia,

A priority area of focus of the ESB Consultation Paper is on "managing" the exit of these critical assets, and reducing the risk of early closures of existing thermal generation. However some of its proposals presented in the Consultation Paper propose to deny existing coal-fired generators additional revenue to improve their current financial ability and/or fund life extensions as a potential low cost alternative for the provision of Essential Services and some propose to accelerate their closure, and in fact are totally in conflict with any notion that there are private investors in an open-competitive market, specifically:

- The "floating" of the option of the introduction of an Economic Rent Tax on "abnormal profits" accruing to coal-fired generators that remain in operation following the exit of other coal fired plants.
 - The explanation provided by the ESB (at pages 52-53) demonstrates that the ESB is motivated to deny remaining coal-fired generators additional revenue for Essential Services provided if that could enhance their viability and potentially be used for life extension or efficiency purposes.
 - This is inequitable and discriminatory as it targets a specific sector of the generation sector, as well as denying a potential low-cost option for addressing the risks created by increased VRE in the NEM.
 - This is also contrary to the repeated calls for "efficient exit" of existing coal-fired power stations, which would require that there is feasible replacement dispatchable generation that could be committed and operational prior to the existing plant closure and deliver net savings to electricity consumers, which cannot be demonstrated for the greater portion of the existing 22,000MW of coal-fired generation connected to the NEM.

- The Grattan Institute capital sequestration or escrow proposal under which coal fired generators would be required to nominate their own closure windows and make ongoing payments to AEMO which would be held against compliance with their nominated window.
 - This proposal limits the efficient re-deployment of scarce capital to potentially higher return areas, and would remove the possibility of life extension where this could be justified economically and in terms of helping to protect System Security and Reliability.
 - Proposals by non-participant commentators to impose costs on existing private sector investors in low-cost generation businesses, without concern for the end-costs and availability of continuing reliable electricity supply, is hardly a plausible start to an “efficient exit” process.

The Consultation Paper does not canvas any consideration as to whether extending the life of existing fossil-fuel-fired generators could provide a much lower alternative cost of protecting System Security and Reliability as the NEM “transitions” to a higher level of Renewables and new alternative technologies for providing Essential Services are proven and the proposed new market designs and proposed new market-based mechanisms are fully developed, trialled and proven. The continued operation of existing generators would not undermine the achievement of Commonwealth and State Government carbon emission reduction targets given the significant amount of renewables investment to date, and currently in the pipeline.

This failure of the Consultation process to give any consideration to urgently recompensing existing synchronous generators for the Essential Services they provide, to not consider life extension options as potentially much lower cost alternatives to the options canvassed in the Consultation Paper, would appear to be inconsistent with ESB’s own Workstream Assessment Criteria: Technology Neutrality, with this item specifically stating:

“Regulatory arrangements must be flexible to changing market conditions and take into account the full range of potential market and network solutions. They should support the right mix of resources over time.....” (page 122).

The approach to this Consultation also appears to be inconsistent with the approach advocated by AEMO in its Power System Requirements reference paper on the need for a portfolio of technical solutions:

“Efficient policy frameworks will take a portfolio approach to sourcing system services, making optimal use of the capabilities of all assets in the power system, which, when used in combination, should be capable of providing the same or better system performance than in the past. There is a need to operate the system under a range of operating conditions, including normal, contingency, abnormal and extreme abnormal. A suite of products and technical solution need to be available to deliver an operable system across all these scenarios” (page 27).

It is further noted that this “Technology Neutral” approach is recommended in the FTI Consulting report “Essential System Services in the National Electricity Market” that was specifically prepared for the ESB as input into its Consultation Paper.

It is therefore strongly recommended that the ESB fully endorse the principle of “Technology Neutrality” by acknowledging that all potential resources, including existing thermal generators and possible life extensions of existing thermal generators, should be considered as potential providers of Essential Services going forward, with the lowest cost resource being selected.

THE NEED FOR IMMEDIATE ACTIONS

The ESB's Post-2025 Market Design Consultation Paper has been produced in line with Energy Ministers tasking it to develop a long term framework that will preserve the security and reliability of the NEM at least cost as the system transitions to a significantly higher level of renewables. However the ESB has also been tasked with providing advice on implementing interim measures to preserve system security and reliability, with a number of relevant reports being initiated by the ESB, AEMO and the Australian Energy Market Commission (AEMC), although the timeframe on appropriate decisions being taken is not sufficiently clear and does not appear to sufficiently recognise the need for urgent action in a number of priority areas. Any significant undermining of system and security over the next 5 years (ie, through to 2025) because of failure to respond to well recognised issues concerning risks to System Security and Reliability of the NEM could jeopardise the operation of the NEM post 2025 and, thus, undermine the outcomes the ESB is seeking to achieve through this Consultation Paper process.

As noted above, the key issues surrounding the continued provision of Essential Services by existing synchronous generators and the need for flexibility in the system are well recognised, and have been fully documented in various reports from the ESB and AEMO, as well as materials released by the AEMC. In fact, a 2017 International Energy Agency (IEA) report, "Getting Wind and Sun onto the Grid: A Manual for Policy Makers", particularly highlighted the risks, and appropriate responses by energy agencies, to increasing levels of VRE in the grid.

It is well recognised that the appropriate responses to the issues highlighted in this paper would involve the introduction of mechanisms for remunerating the existing 24/7 dispatchable synchronous generators for the system support of frequency and voltage they currently provide, as well as remunerating spinning reserve capable of ramping up output to meet peak power demands as weather dependent (renewable) generators, particularly solar, falls away – as they inevitably do.

The AEMC is currently considering a number of Rule Change requests to address these issues, including:

- **Delta Electricity – Capacity commitment mechanism for system security and reliability services** – proposal to introduce an ex-ante, day ahead capacity commitment mechanism and payment to provide access to operational reserve and other required system security or reliability services.
- **Delta Electricity – Introduction of ramping services** – proposal to introduce 30-minute raise and lower "ramping" services using the existing framework for FCAS market design.

Early adoption of these changes will help ensure that thermal synchronous generation is able to continue to operate to provide critical Essential Services and meet rapid changes in the supply and demand of energy between the middle of the day and the lead into (and during) peak periods in the evening.

As clearly acknowledged by the ESB, there is no known technology to replace all of the security services currently provided by large scale 24/7 dispatchable synchronous generators:

“The NEM, like all large-scale AC power systems, requires synchronous resources. The global electricity supply industry is researching and running trials to reduce reliance on carbon-intensive synchronous generation to decarbonise electricity systems, but there are currently no gigawatt scale power systems that do not rely on synchronous resources for grid stability and resilience. While new VRE renewable and battery technologies can provide some services and may in the future provide more services, they cannot currently replace all of the security services provided by synchronous resources, such as system strength and inertia.....As synchronous units come offline, their contribution to system security is removed from the system. This dynamic results in times where there could be insufficient essential technical capabilities despite abundant energy supply.....” (ESB, System Services and Ahead Markets (April 2020), page 9).

It is therefore critical that the current fleet of coal fired generators remain in service until like-for-like replacement capacity has been fully committed and is operational. The primary focus should therefore be on maintaining the existing fleet of thermal synchronous generators, rather than seeking to “manage” their exit, until it can be clearly determined that the necessary level of like-for-like replacement capacity is in place to ensure that System Security and Reliability would not be jeopardised as a result of the closure of one or more units of a thermal synchronous generator.

NEO OBLIGATIONS REQUIRE GOVERNMENT AND ENERGY AGENCIES TO ADOPT A PRECAUTIONARY APPROACH TO IMPLEMENTING THE ESB’S POST 2025 NEM DESIGN

The over-riding provision governing the energy agencies with respect to the operation of the NEM is the National Electricity Objective (NEO) as set out in the National Electricity Law (NEL). The NEO is expressed in the following terms, noting the strong emphasis on the reliability and security of supply of electricity:

“To promote efficient investment in, and efficient operation and use of, electricity services for the long-term interests of consumers of electricity with respect to:

- (a) price, quality, safety, reliability and security of supply of electricity; and
- (b) the reliability, safety and security of the national electricity system”.

The ESB is, through its Post-2025 NEM Design Consultation Paper, essentially proposing to take the NEM into “unchartered waters” and is seeking sign off by Commonwealth and State Energy Ministers for its final recommendations in 2021 despite considerable uncertainties around the operation of required new technologies and market mechanisms. Additionally, the ESB’s preferred approach in terms of the development of market mechanisms for the various Essential Services would need to be fully developed and demonstrate “depth” in order to be sufficiently confident that they will achieve the ESB’s goals and expected outcomes. As a result, the approach to Government decision-making being advocated involves insufficient governmental

oversight in this critical area after 2021. Given the significant emphasis in the NEO on Reliability and System Security, this would be inconsistent with both the NEO NEL.

This concern is re-enforced by a number of statements by AEMO and the ESB about the risks going forward, and the fact that these agencies appear to be downplaying these risks as part of their advocacy efforts. These concerns are further re-enforced by the fact that AEMO has previously expressed support for a staged approach to implementing changes, and that the FTI Consulting report "Essential System Services in the National Electricity Market" specifically prepared for the ESB as input into its Consultation Paper supported a cautious staged impact-assessment approach to operationalising a new Essential Services procurement and scheduling framework.

As previously highlighted, there is no known technology to replace all of the essential system support services currently provided by the ~22,000MW of existing 24/7 dispatchable synchronous generators. Additionally, it is recognised that there will be considerable difficulty in developing a real time market for some services. The ESB Consultation Paper particularly highlights uncertainties in the areas of "inertia" and "system strength":

- "Potentially new technologies producing forms of "synthetic" or "virtual" inertia. While such technology is under active development and two battery installations in the NEM are being trialled, the extent to which these technologies can deliver the system requirements and replace or supplement synchronous inertia is unknown"; ESB Consultation Paper, page 67
- "The AEMC's System Strength review outlines the difficulties of defining system strength in a manner that allows spot market-based procurement, noting as CSIRO does that, currently at least, "system strength lacks a metric" and may be characterised as by the Public Interest Advocacy Centre more as "an outcome, rather than a service". As such, it is not currently possible to use a spot market for procurement and pricing of system strength"; ESB Consultation Paper page 69

AEMO also noted in its "Maintaining Power System Security with High Penetrations of Wind and Solar Generation:

- "Change can introduce new risks to power system security, and the velocity of this change means there is less time to understand and mitigate new risks. New plant that is added to the system can introduce new risks to the security of the system. Risks associated with new technologies such as inverter-based resources can be more complex and harder to simulate, and these risks are often not as well understood" (page 29).

And although AEMO's Renewable Integration Study: Stage 1 report is positive in terms of the NEM being able to operate securely with higher levels of VRE, this report contains an important footnote highlighting that AEMO is, in fact, aware of the significant number of risks involved and raises the prospect of the potential need for constraints on some generation sources:

"In recommending actions and highlighting positive potential outcomes, AEMO does not underestimate the extent of work that will be required to successfully adapt the NEM. This includes the ongoing need for system limits that at times constrain the output of various generation sources. This study also identified a number of unchartered operating conditions

emerging in the NEM by 2025. AEMO will continue investigation and analysis to identify and address additional limits and barriers that emerge” (page 62).

AEMO therefore recommended a staged approach to managing the transition of the NEM with an increasing proportion of energy being provided by VRE:

- “As the system transitions to new operational configurations with increasing wind and solar and decreasing conventional generation online, it will be important to test these new operational configurations in a way which minimises both the risk to system and the impact on market operation. This could take the form of setting transitional safety nets in each region of the NEM to operating with combinations of fewer synchronous machines and increasing levels of IBR. A progressive approach could then be taken to lowering these safety nets as improved operating practices and new technology demonstrate – under a sufficient combination of operating conditions – that the system can be operated securely with combinations of fewer synchronous machines and increasing levels of IBR. The RIS International Review noted that EirGrid in Ireland has taken a similar approach to the progressive increase in inverter-based resources (IBR) and reduction in synchronous generation” (AEMO, Renewable Integration Study: Stage 1 report, page 67).

- **“International power system operators have taken a staged approach to operating power systems with progressively less synchronous generation online. A similar approach could be considered in Australia.**

- Of the operators surveyed, EirGrid (Ireland and Northern Ireland) is taking a staged approach to relaxing power system operational limits related to minimum numbers of synchronous generators online.
- Consideration should be given to how new system conditions can be trialled safely in the NEM and SWIS. This could include taking a precautionary approach (such as mitigating risks and holding extra reserve) for a period (for example, one year) while the system is operated closer to its limits (for example, with fewer synchronous generators online) to build experience and confidence, before accepting those conditions as a new norm” (AEMO, Maintaining Power System Security with High Penetrations of Wind and Solar Generation, page 4).

It is therefore appropriate to question whether many of the options the ESB is presenting in the Post 2025 NEM Design Consultation Paper are practical, or workable, at least in the foreseeable future.

As a result, there is a need for a very cautious approach to be adopted with respect to the introduction of new technologies designed to replace the Essential Services now supplied by thermal synchronous generators and the associated proposed market mechanisms, as well as the development and operation of real-time markets for individual services.

A precautionary approach to the development and implementation of the Post 2025 NEM Design (in terms of minimising risks and holding extra reserve) is therefore recommended. This will help ensure System Security and Reliability as the NEM transitions to a higher level of

intermittent generation and alternative technologies are introduced to “firm” this intermittent generation; ie, there is a like-for-like replacement of retiring thermal synchronous generators.

The ESB should therefore be requested to closely review the approach being pursued by Ireland and whether this system, or a variation thereof, should be adopted in Australia.

And, in line with this recommended precautionary approach, it is appropriate to question the appropriateness of the ESB proposing that Commonwealth and State Energy Ministers will be asked to sign off on its Post 2025 NEM Design recommendations in 2021, when many of the proposals are still at a conceptual (theoretical) stage and a number of key alternative technologies for the provision of Essential Services required to maintain System Security and Reliability have not been “tried and proven” and the necessary market design and technological developments may take longer than 2025 for some Essential Services.

The adoption of a staged, precautionary approach would help in addressing the risks with the approach presented by the ESB. However, given the critical importance of a safe and secure electricity system for business (and jobs), as well as households, it is recommended that Ministers request the ESB to prepare an additional set of recommendations to ensure full transparency and accountability for decisions to move from one stage of the ESB’s Roadmap to the next, with the relevant agency (AEMO) providing a detailed report in support of a recommendation to move from one stage to the next that would be publicly available, and with Ministers being required to sign off on any such recommendation.

CONCLUSION

There is no known technology to replace all of the security services currently provided by large scale 24/7 dispatchable synchronous generators that are critical for NEM System Security and Reliability.

It is therefore critical that the current fleet of coal fired generators remain in service until like-for-like replacement capacity has been fully committed and is operational.

Immediate steps therefore need to be taken to expedite measures to properly remunerate these plants for the system support services of frequency and voltage, as well as the introduction of remuneration arrangements for spinning reserve capable of ramping up output to meet peak demand as solar generation falls away every day. Failure to act urgently to adopt the necessary fundamental solutions will further undermine the commercial viability of existing dispatchable synchronous generators that provide Essential Services critical to maintaining System Security and Reliability, increasing the risk of premature early exit of coal-fired generators, with consequential risks to the operation of the NEM and higher electricity prices.

The ESB should therefore shift its focus from “managing” the exit of existing coal-fired generators to one of maintaining these assets in place for as long as necessary to protect System Security and Reliability of the NEM.

The two options contained in the ESB Consultation Paper that could accelerate the closure of coal fired generators should be rejected, and the ESB should adopt a genuine “Technology Neutral” approach and, in line with this, acknowledge that all potential resources, including existing fossil-fuel-fired generators and possible life-extensions of existing generators, should be

considered as potential providers of Essential Services going forward as part of the transition to cleaner energy sources, with the lowest cost resource being selected.

Many of the options the ESB is presenting in the Consultation Paper are not practical, or workable, and this could continue to be the case well beyond 2025. They are essentially at a conceptual (theoretical) stage and a number of key alternative technologies for the provision of Essential Services required to maintain System Security and Reliability have not been “tried and proven”.

Further, the necessary market design and technological developments may take longer than 2025 for some Essential Services. A precautionary approach to the development and implementation of the Post-2025 NEM Design (in terms of minimising risks and holding extra reserve) is therefore recommended.

Against this background, it would be inappropriate for Commonwealth and State Energy Ministers to sign off on the ESB’s Post-2025 NEM Design recommendations in 2021, as currently proposed by the ESB. Given the critical importance of a safe and secure electricity system for business (and jobs), as well as mfor households, additional arrangements to ensure full transparency and accountability for decisions to move from one stage of the ESB’s Roadmap to the next are required. This could involve the relevant agency (AEMO) providing a detailed report in support of a recommendation to move from one stage to the next, that would be publicly available, and with Ministers being required to sign off on any such recommendation.

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