ENGINEERS AUSTRALIA

National Energy Guarantee Consultation Paper

Engineers Australia Submission

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1.1 Engineers Australia

Engineers Australia is the peak body for the engineering profession in Australia. With over 100,000 individual members across Australia, we represent individuals from a wide range of disciplines and branches of engineering. Engineers Australia is constituted by Royal Charter to advance the science and practice of engineering for the benefit of the community. Engineers Australia's response is guided by our Charter and Code of Ethics which states that engineers act in the interest of the community, ahead of sectional or personal interests towards a sustainable future. Engineers are members of the community and share the community's aspirations for Australia's future prosperity.

1.2 Introduction

Engineers Australia appreciates the opportunity to respond to the Energy Security Board's National Energy Guarantee Consultation Paper. Engineers Australia believes that to successfully implement many of the new policy strategies and mechanisms outlined in the paper, engineering expertise and experience will be vital. Engineers are problem solvers, critical thinkers and practical innovators. Engineers are vital in the electricity generation, transmission, distribution and consumer sectors, and National Electricity Market (NEM) operations, and their valuable contribution to policy decisions and implementation should be carefully considered to achieve optimal outcomes. Also, the importance of the power system being operated safely for users and the public cannot be understated and this requires detailed engineering analysis and consideration.

Engineers Australia is a strong supporter of an energy policy which will deliver secure, reliable and affordable energy, while meeting emission reduction targets and progressing towards a more de-carbonised energy sector. Engineers Australia is supportive that the federal Government, through the Energy Security Board (ESB), and its National Energy Guarantee (NEG) is looking to address all of these issues, bringing together energy and climate policy. This submission from Engineers Australia will provide some initial comments on the NEG consultation paper, as well as addressing a select number of specific questions outlined in the paper which could benefit from engineering advice.

Engineers Australia notes the ESB's comments that the release of this paper is the first step in a consultation process that will occur over coming months, and looks forward to further consultation and input to this important body of work.

1.2.1 Contact details

Engineers Australia representatives would also be more than happy to meet with the ESB to discuss details of this submission. To do so, please contact Mark Stewart, Policy Advisor, on (02) 6270 6569 or MStewart@engineersaustralia.org.au.

1.3 Overview and overall consultation paper comments

Engineers Australia keenly anticipates further development of the NEG, with the aim of providing optimal solutions and much needed stability after years of energy policy uncertainty. Australia has been lacking a workable and stable energy policy for almost a decade, and the NEG has the potential to provide workable solutions, providing a framework to further develop in the future.

Pertinent to the development of this policy, Engineers Australia raises some further questions and some concerns about certain aspects of the policy which we believe are worthy of further discussion. Engineers Australia believes that further discussion of these issues will strengthen the current NEG policy, and we are happy to discuss any of the points raised with policy makers.

Integration of reviews

There needs to be a clear outline of how this policy consultation will work in conjunction with other NEM reviews that are currently underway. The ESB at the end of last year released the Health of the National Electricity Market Report (HOTN)[1] and, as the report notes, a number of reviews are underway or imminent.

Examples include:

- The current work of the Australian Energy Market Commission (AEMC) in assessing an inertia market mechanism through the recently initiated Frequency Control Frameworks Review.
- Australian Energy Market Operator's (AEMO) current Integrated System Plan consultation.
- Demand Response in the Wholesale Energy Market through AEMC's Reliability Frameworks Review.

For stakeholders it is unclear how these reviews will line up with the NEG, as the initial impression is they are possibly being treated in isolation, with no over-arching framework for how all the reviews interact with each other to achieve the required outcomes.

System Security and Reliability

One of the key requirements of the Independent Review of the Future Security of the NEM Report (Finkel Review) was to establish a secure (and consequently reliable) NEM. Essential security services are synchronous inertia, system strength and voltage management[2].

Engineers Australia has concerns for how the Reliability Obligation in the NEG will address the three security services, or clearly aligns with other current policy reviews to achieve these.

The NEG consultation paper states that the reliability requirement is on retailers to enter contracts related to dispatchable resources. However, the paper consultation does not define clearly what is considered an acceptable dispatchable resource. Engineers Australia believes the ESB needs to address this issue, who will define an acceptable dispatchable resource (and keep it up to date as new technologies emerge) and define parameters for these resources. A performance-based, technology agnostic, approach would be appropriate. The Preliminary Finkel Report stated that there are technical solutions that must be expedited as the NEM transitions from traditional energy sources to ones that are intermittent or non-synchronous[3]. Engineers Australia strongly supports research and integration of new technologies that will support inertia, system strength and voltage management, and recommends that the ESB take an active involvement in monitoring this, and possibly reporting the progress of this through the HOTN Report.

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[1] Energy Security Board, The Health of the National Electricity Market, 2017 Annual Report.

[2] Independent Review into the Future Security of the National Electricity Market: Blueprint for the future, Final Report, June 2017.

[3] Independent Review into the Future Security of the National Electricity Market, Preliminary Report, December 2016.

Interconnectors

The consultation paper only provides a brief mention of the flows and demands that can be met by interconnectors in section 5.7.3. Interconnectors play a vital role in meeting demand and creating a national system which can manage flows and available system inertia between jurisdictions.

The NEG Reliability Obligation is predicated on looking at each NEM Region individually over a forecast period. Although the Reliability Gap would include forecast interconnector flows into/out of that region, this must also be examined at a holistic NEM-wide level to achieve optimal outcomes. How the NEG interacts with AEMO's Integrated System Planning Review is therefore critical.

Further, the NEG is based on the non-regulated market entities responding to reliability gap triggers (with AEMO as procurer of last resort). Interconnectors are typically regulated assets built to a different set of Rules (RIT-T). This may be a disjoint in the approach.

It is important to also note that new interconnectors, as opposed to upgrades of interconnectors, have a far greater lead time than most contemporary generator developments. This includes obtaining planning approvals, plus the time it takes to build.

Engineers Australia will address this in further detail in addressing the question outlined in 5.7.3.

Forecasting

Engineers Australia applauds the ESB's role through the HOTN process in overseeing improvements in AEMO's forecasting methodologies, and envisions that the most critical foundations of the NEG policy will be the accuracy of forecasting and the forecasting timeframes to meet the reliability guarantee. Determining a timeframe for providing forecasts of potential gaps is not only vitally important to the overall reliability and security of the system, it also has implications on the types of technologies that can be used to address this gap. Different technologies have both different lead times, and project development and commissioning timeframes, so the forecasting timeframe will need to be carefully considered, to allow for both existing and new generation technologies, and to remain technology agnostic. Engineers Australia will address this in further detail in section 5.3.2.

Complexity and engineering expertise

The need for a stable energy policy is vital and the NEG has taken a positive direction in linking energy and climate policy together. However, policy makers must use caution in implementing this policy, as it is adding further complexity to operation of the NEM. There is always a risk that, by adding too much complexity to this policy, it could add further costs to those operating in the NEM, or to those who will have new obligations. Further costs and new obligations do risk the successful outcome of affordable electricity prices for consumers.

In deciding the final form of the NEG, the technical issues associated with each option needs to be fully understood prior to considering implementation. With that in mind, any new policy mechanism for the energy sector that adds NEM system requirements needs to consider the technical experts who make the system work: the engineers. All market parties, including those which will hold any new obligations, should ensure they have the required power systems engineering expertise or access to this expertise. The preliminary report of the Finkel review highlighted the need for technical solutions to be implemented into the system, and engineers are key stakeholders in this process.

1.4 Consultation questions

<u>Section 3: Emissions Requirement: Energy Security Board design elements</u>

3.2.2 Calculation of load

- What are stakeholders' views on the process to calculate a retailer's load?

Engineers Australia understands that the methodology set out by the NEG works for the calculation for a retailer's load in the wholesale spot market. However, there are some concerns about how the method would take into account the load being supplied behind the meter by local sources, most notably from rooftop PV and through savings in energy efficiency. Further, AEMO only has visibility and control over semi-scheduled/scheduled generation (>30 MW) and generation <5 MW is typically considered to be non-market. Engineers Australia recommends that the NEG outline how this will be calculated if there is no direct information to that effect.

Furthermore, as energy efficiency and more demand side response appear in the NEM, the ESB needs to give careful consideration to how these are treated under the retailer emissions obligation.

3.4.1 Use of offsets

- If offsets are permitted by the Commonwealth Government:

> *Should limits on individual retailers' use of offsets be set at an absolute level, regardless of retailer size? An absolute limit would represent a greater proportion of a smaller retailer's emissions than a larger retailer.*
>
> *Or, instead, should limits on individual retailers' use of offsets be based on the size of retailers' loads, such that offsets represent the same proportionate share of retailers' emissions regardless of retailer size?*
>
> *What are the pros and cons of each of the above approaches?*

Utilising offsets also offers (or reduces) reliability. If offsets were to be used, they must be coupled with providing reliability in the NEM via a suitable mechanism. De-coupling the emissions obligation and reliability obligation could be seen as disadvantageous.

3.7.2 Jurisdictional considerations

- What are stakeholder views on the operation of the emissions requirement in particular jurisdictions?

The operation of emissions requirement in different jurisdictions will need to be closely monitored, as different jurisdictions already have different set renewable energy targets (RET). Interconnectors will increase the complexities of meeting the emissions obligations in many different regions. Flows through an interconnector from a neighbouring region, with a different RET in place, may provide complications on meeting that jurisdiction's emissions obligation. This is due to the source of the imported electricity being difficult to identify. How can one jurisdiction guarantee that the flows imported through the interconnector are from zero emissions sources and therefore have the ability to meet the requirement under the emissions obligation?

Section 5 Reliability requirement

5.2 Designing the reliability requirement

Engineers Australia believes that the NEG must address the issue of system security. The Finkel Review recommendation 3.2 for an orderly transition was made in the context of needing a reliability obligation (recommendation 3.3) and the energy security obligation (recommendation 2.1). The ESB consultation paper does not appear to adequately address some of the major risks in providing an orderly transition, and the proposed mitigation measures may therefore be inefficient and ineffective.

As previously stated, Engineers Australia confirms the need to ensure interdependency of all the reviews mentioned in the HOTN and design of the NEG.

Further, the NEG is based on a region by region approach alone. It may emerge that sub-regions or particular parts of the NEM develop security/reliability issues. If that occurs, the ESB may need to consider whether the NEG approach is needed at a sub-regional level.

Engineers Australia has provided a more detailed response to the need for system security as Appendix A.

5.3.2 How should the gap be forecast

- What are stakeholder views on the length of the forecasting period?

- How should the forecasting methodology and assumptions be consulted on?

- Should the existing ESoO and MTPASA forecasting processes be adapted for determining the gap, or should a separate bespoke process be developed?

Engineers Australia would strongly support any methods which can improve the forecasting accuracy so that reliability gaps can be planned for, and mitigation measures can be put in place. The most common favoured (and suggested in the ESB stakeholder forum) timeframe for the length of the forecasting period has hovered between a three-year period to a 10-year period. The three-year time period would look to work in conjunction with the introduction of the three-year shut down notice period that has been introduced for power stations.

However, there are some concerns that this time period is far too short and that a longer time frame would be required. Sending a signal to the market about investment in new energy sources is critically important to continue to match the required demand. The suggested timeframe of three-years limits the scope of generation technology options which can respond to a reliability gap. Some generation technologies have the ability to be developed and established more rapidly than other technologies due to the lead times required of different power stations (renewable generation technologies compared to traditional synchronous forms of generation). This option prevents low cost alternatives with greater lead time, pushing electricity prices up further.

Careful consideration must be taken in developing this timeframe in the NEG, if it wishes to remain a technology agnostic policy, as the timeframe decision could have broader implications for different technology types, and customer costs if it is too long, or if it is too short. It can also discourage investment options such as interconnectors which have long lead times. Accurate forecasts that can be used in RIT-Ts will ensure least cost solutions are developed.

Not only should the length of the forecast be considered carefully but, additionally, obvious challenges with forecast accuracy should be considered as it will also influence the reliability of the predictions made. This is due to the numerous external factors including developments in generation types, behind the meter technologies, and energy efficiency savings through changing consumer habits over time. Flexibility needs to be at the forefront of any forecasting mechanism, whether it is through adapting the ESoO or MTPASA, or if it is a bespoke process designed for the NEG policy.

An additional issue is not just updating the forecast and reliability gap when existing generation announces decommissioning with the three-year forewarning. Just as critical to the forecast is to determine the inclusion of new energy sources that are only at the feasibility stage. Engineers Australia notes that AEMO's Integrated System Plan consultation stated that Snowy 2.0 and an additional Basslink interconnector were "proposed". Similarly, numerous wind farms and solar farms are currently being mooted. Which new generation sources should be included in the forecasting process? A clearly defined, transparent process which includes sensitivity studies is required.

In any event, Engineers Australia believes there should be harmonisation of reporting to reduce costs.

5.7.3 What forecasts should be used for allocation?

- How should load met by interconnectors be treated?

The consultation paper states that a source of difference will be the treatment of interconnectors, and that when AEMO assesses the future supply-demand position it models the expected flows along interconnectors. Engineers Australia believes that this is a significant point raised in the paper, and one that is worthy of further consideration for two particular reasons.

Firstly, as mentioned, interconnectors are an integral component of the NEM, and they play a vital role in meeting demand and producing system inertia, creating a national system which can manage flows between jurisdictions. The exchange that moves through the systems will create forecasting challenges that will need to be considered with assessing reliability gaps. Reliability on a region-by-region basis will need to include the potential of interconnector flows between the regions, to address potential reliability gaps and provide optimal balance to the entire NEM.

Secondly however, is a potential flaw in the current NEG policy as it does not allow interconnectors to play a more significant role in assisting in meeting the reliability gap. According to the NEG policy, when a potential gap is forecast, participants will be required to respond and alleviate any forecasted shortfall in what could be seen as a market-driven solution. However, it would appear that a new build of an interconnector, with their ability to transfer flows between regions and fill the gap, would not necessarily have the same ability to compete in alleviating this shortfall.

The current process for network companies to build a new interconnector is a strict and tightly regulated process (with long lead times), the RIT-T. It is unclear how the development of an interconnector could work in line with other market options due to the different and more difficult process for approval, even if it were the optimal solution to fill the gap.

5.11.1 Competitive markets

- What are stakeholder views on how the Guarantee may impact on competitive markets?

Engineers Australia has some concerns about the reliability guarantee's influence on smaller and mid-range retailers. Although some retailers will have capability through ownership of generation facilities, under the NEG's reliability obligation many other retailers will now find themselves with a requirement that previously was not there and this could lead to issues that influence their potential viability. Many may soon find that they need to rapidly expand their capabilities to address new obligations, whereas this would already be in place at some of the larger market participants. This could potentially raise the operational costs for these smaller market players, which in turn has the potential to drive up costs to consumers.

Appendix A

Engineering experience in operating secure and reliable power systems

Engineers Australia believes that the NEG must address the issue of system security. The Finkel Review recommendation 3.2 for an orderly transition was made in the context of needing a reliability obligation (recommendation 3.3) and the energy security obligation (recommendation 2.1). The ESB consultation paper does not appear to adequately address some of the major risks in providing an orderly transition, and the proposed mitigation measures may therefore be inefficient and ineffective.

The Preliminary Finkel Report highlighted that there are technical solutions to increase grid security and reliability. An area of concern is the power system security risks facing Australia in the rapid transition to inverter connected generation, as this needs to be addressed as many different thermal generators retire.

Traditional generation installed in the past was not designed to operate concurrently with an intermittent power production profile. The associated issues with a new operating mode not in the original design needs to be addressed. As the power system transitions, there is an expected increase in inverter-connected generation and load, while transmission is being augmented to facilitate an increase in the connection of large renewable sources. The changes that need to be managed include supply-demand adequacy with frequency regulation, system stability and quality of supply. Reduction in system inertia is a challenging engineering problem requiring electrical engineers to design a solution as the amount of rotational inertia in the system declines. The major concern is system stability, and with new faster control for inverters, in theory, power systems may remain stable with low or even no inertia.

Due consideration must be placed on parallel grid-forming inverters[4,5], replacing synchronous machines in the future for secure operation of the power system. However, new challenges emerge owing to the limited overload capability of inverters. A grid-forming inverter connection must have a mechanism to deliver sufficient short-circuit current and should provide artificial inertia for stabilising frequency. These design features require oversizing and so significant investment. To date, no commercial solution is available to provide parallel grid-forming inverters. Furthermore, technical feasibility of grid-forming inverters requires detailed research, engineering studies, prototyping and eventual operations experience.

Reduction in system strength is also of concern as traditional power system protection schemes may mal-operate under low system strength. With protection operating incorrectly this will compromise the safety of the power system assets, its users and the public.

This list of technical issues is not exhaustive, but illustrative of the need for detailed engineering input into the design and operation of the NEG.

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[4] Katiraei et al, 2008, *Microgrids management*, IEEE Power and Energy Magazine.

[5] Inverters in parallel grid-forming mode operate as synchronised voltage sources. Under normal operation, the power system must supply the connected loads with a sinusoidal waveform of acceptable magnitude, frequency and harmonic tolerance. When inverters are operated as voltage sources, they can help maintain required voltage/power profiles without a synchronous machine (regardless of load), provided the inverter's control system is suitably designed.

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