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Mr Ted O'Brien MP
Chair, Standing Committee on Environment and Energy
PO Box 6021,
Parliament House
CANBERRA ACT 2600

By email: Environment.Reps@aph.gov.au

Dear Chair

AEMC submission to the Inquiry into the prerequisites for nuclear energy in Australia

The Australian Energy Market Commission (AEMC or Commission) welcomes the opportunity to make a submission to the Inquiry. We note the Committee will specifically inquire into and report on the circumstances and prerequisites necessary for any future government's consideration of nuclear energy generation including small modular reactor technologies in Australia. Issues being considered include waste management, transport and storage, health and safety, environmental impacts, energy affordability and reliability, economic feasibility, community engagement, workforce capability, security implications, national consensus, and any other relevant matter.

The AEMC is the expert energy policy adviser to Australian governments. Underpinning our work in the electricity industry is the National Electricity Objective (NEO), which requires an explicit focus on the long-term interests of electricity consumers in our rule making decisions and advice. In particular, the AEMC's objective is to promote efficient investment in and efficient use of energy services with respect to safety, security, reliability and price.

The AEMC recognises that the Commonwealth Government supports an energy system which delivers affordable and reliable energy to consumers while fulfilling Australia's international emissions reduction obligations. With this in mind, the AEMC's submission to the Inquiry will advise predominantly on the following matters encompassed by the terms of reference:

- energy affordability and reliability, and
- economic feasibility,

The key points discussed in the AEMC's submission are:

1. **The AEMC is technology neutral and designs market incentive and regulatory frameworks to deliver cost-efficient provision of energy to consumers, regardless of the generation technology that delivers these outcomes.**
2. **In a transitioning sector and market, generation plant with high capital costs and long lead times carry increased levels of investment risk.**
3. **The national energy market (NEM) provides incentives to invest in generation capacity that is available when customers and the power system need it. Current and forecasted demand patterns signal a need for dispatchable generation that is flexible to complement growing investment in variable renewable energy.**

Technology neutrality

The AEMC has always advocated for a technology-neutral approach when it comes to supporting investment in the energy sector. This is because uncertainty is a key feature of our energy system. It cannot be predicted how changes to consumer behaviour and new technology will impact the energy market. The AEMC believes that the efficiencies of the NEM are realised through healthy competition and market forces that promote innovation in technologies that best serve the needs of the system and consumers at least cost.

Our principles of market design mean we make regulatory frameworks that do not benefit, nor discriminate against, any particular technology. The AEMC seeks to design frameworks where no particular technology's opportunity to compete in the energy market is prejudiced by the Rules themselves.

The AEMC does monitor market trends to inform its decisions about market and regulatory design. Recent analysis of the emerging shape of customer demand, and the implications of this on future investment in generation is included later in this submission. In order to facilitate consumers in getting the best outcome regardless of the technologies and business models available at any one time, the AEMC designs regulatory and market-based frameworks that provide the information, incentives and tools to drive industry to deliver what consumers value in a sustainable manner, over the long term.

In practice, this means the private sector invests in and supplies generation and demand response services when and where it is needed and market institutions ensure appropriate safety nets are in place and are executed if the market fails to deliver reliable supply. In this way, the majority of the investment risks are borne by market participants that have the information and capital to bear them, rather than being shouldered by energy consumers or taxpayers.

Investment in a future power system

The NEM is designed to send price signals for investment in capacity that has characteristics to meet demand. In a secure, reliable power system, the generation mix closely reflects the shape of consumer demand as it varies over time.

In the NEM, customer demand is met by the lowest cost combination of energy available at any one time. Currently, renewable technologies, such as wind and solar PV have very low operating costs, and as such, they displace generation from traditional thermal generators. Therefore, to determine how much "room" there is for a new "firm" or "dispatchable" generation, we must remove the amount of generation provided by "non-firm" technologies from the aggregate demand curve. The demand that is left over is termed *residual demand*.

Investment in the future power system will need to include generating technologies (or demand response capability) that can fill this residual demand gap. The size and shape of residual demand will be a key influencer of future investment in new generation and demand response capacity.

Trends affecting residual demand that will in turn affect future investment decisions

In recent years, the AEMC has observed three key trends that are changing the profile of residual electricity demand. These changes are:

1. flat demand growth in the NEM;
2. changes in the large-scale generation mix; and
3. the rapid up-take of behind-the-meter rooftop PV.

The combination of flat demand with increasing intermittent generation leads to significant changes in the size and profile of residual demand and has significant implications for the optimal future generation mix.[1]

The market and technological trends observed mean that future generation will need to be sufficiently flexible to meet the changing profile of residual demand. These changes in residual demand mean:

- traditional thermal technologies that are designed to operate at high capacity factors and have correspondingly low ramp rates and high start-up costs, are unlikely to be dispatched at the levels required for efficient operation.
- flexible technologies, such as peaking gas plants, pumped hydro and battery storage, are likely to be better suited to the changing profile of residual demand.

Current investment trends

As the NEM undergoes a transition to higher penetrations of intermittent generation, the supply, demand and consequently prices become more variable and less predictable. This, along with other factors like capital costs, construction lead time, technology risk and the level of certainty around future government decisions relating to energy or emissions reduction policies contribute to the level of investment risk the private sector is willing to take on. In this environment, generation that has high capital costs and long lead times becomes a high-risk commitment. Whilst nuclear plants have relatively low operating costs, they are typically characterised by very high capital costs and long lead times for project development.

International experience suggests nuclear plants have a 10-15 year lead time and 60 year plant life. There are uncertainties and associated risks in predicting the economic viability of a plant over the next 75 years, particularly in the context of the transitioning energy industry in Australia. Similarly, nuclear power carries substantial capital cost uncertainty, likely due to lack of industry convergence to, and experience with, any particular nuclear generation technology.

Dispatchability and Flexibility

The portion of residual demand that can always be assumed to exist regardless of the output of "non-firm" variable renewables is traditionally referred to as "baseload" demand. As discussed in the subsequent section of this submission, the concept of baseload demand is becoming outdated as flexible or dispatchable plant becomes a natural complement to new higher penetrations of renewables that will continue to enter the NEM.

Nuclear plants are commonly thought to be relevant for meeting baseload demand by generating at or near full output for the majority of the time. This means they have a "high capacity factor".

Current and forecasted trends for residual demand indicate that "baseload" demand is decreasing or non-existent at times across the NEM due to shifting generation and demand patterns making residual demand profiles more variable. South Australia has already experienced periods of time of no residual demand when all of the state's energy demand has been met by renewables alone. As the penetration of variable renewables increases, these incidences will be more likely to occur throughout the NEM.

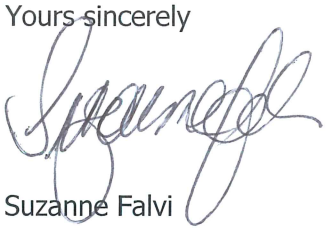
[1] See https://www.ceda.com.au/Digital-hub/Blogs/CEDA-Blog/March-2019/The-changing-nature-of-electricity-generation-investment

The Australian Energy Market Operator's Energy Statement of Opportunities (ESOO) 2018 projects that, over the next 20 years, NEM-wide minimum demand is set to decrease by 40% from 15 GW to 9 GW while variable renewable capacity will increase from 13.5 GW to 41 GW. This is likely to result in residual demand that is peaky and highly variable, signalling a need for dispatchable plant that is small, agile and flexible.

Regardless of a technologies physical capability to ramp up and down, the economic viability of that technology relies on it being able to maximise its energy output when prices are sufficiently high and to minimise its energy output when prices are too low.

I would be happy to provide more information on any matters that may assist the Committee in its deliberations. In the meantime, please do not hesitate to contact me directly on [redacted] or [redacted]

Yours sincerely



Suzanne Falvi

Executive General Manager

Background

The Australian Energy Market Commission's (AEMC) role is to make and amend the rules that underpin the energy system and market in a manner consistent with the long-term interests of consumers. We also advise governments on how to develop flexible and resilient markets that benefit consumers over time. Our objective is to deliver effective and efficient rules to promote efficient investment in and efficient use of energy services with respect to safety, security, reliability and price. The rules we make and the advice we provide aim to set the foundations and incentives for a market structure that drives industry to deliver what consumers value in a sustainable manner, over the long term.

The AEMC is one of three energy market bodies that carry out the day to day operation, regulation and evolution of the energy sector.

- The **Australian Energy Market Commission** makes and amends the rules that underpin energy sector activity and provides advice to government on energy sector design.
- The **Australian Energy Market Operator** runs the physical systems balancing supply and demand for energy in real time, as well as running the financial market that supports this.
- The **Australian Energy Regulator** polices the system and oversees the economic regulation of the monopoly network sector.

Both individually, and collectively through the Energy Security Board, the market bodies are working collaboratively to create an energy sector that can meet consumer needs as they evolve over time.

The AEMC's priority areas of reform

The AEMC is focussed on five key trends taking place in the market and is prioritising reforms in these areas so customers can access safe, secure reliable energy at the lowest possible costs as the sector transitions.

- **Generator access and transmission pricing**
  A shift from larger, geographically concentrated generation to smaller, geographically dispersed generation is occurring. This requires us to re-think how we plan and develop markets, so we get investment in the right kit, in the right place at the right time to deliver reliable supply to customers.
- **Power system security**
  Power system services that were previously provided for free as a by-product of certain types of generation are now not necessarily provided by new generation entering the system. This requires us to find new ways of procuring enough of these technical services to keep the power system secure.
- **Integrating distributed energy resources**
  Customers are increasingly adopting small-scale solar and energy storage technologies. This requires us to re-think how network infrastructure is used so customers and the grid can get the most out of these technologies.
- **Digitalisation of energy supply**
  The power system and market are increasingly underpinned by digital technologies that make it easier to choose and control how, when and where power is delivered and used. We are increasingly focussing on embracing market frameworks so customers can reap the benefits of these technologies.
- **Aligning financial incentives with physical needs to deliver reliable supply**
  More variable demand from customers and more variable supply from generators makes forecasting a challenge and adds risk to operational and investment decisions. We are focussed on maintaining the link between the financial incentives facing market participants and the physical needs of the system.

The AEMC is working with our stakeholders to take us from where we are today, to where consumers want to be in the future.