

4 September 2017

Hon. Josh Frydenberg MP
Minister for the Environment & Energy
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House of Representatives
Parliament House
Canberra ACT 2600

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Dear Minister Frydenberg,

Re: Advice to the Commonwealth relating to Australia's National Electricity Market

This letter and attached reports are provided in response to your letter received 28 June 2017, requesting information and advice on the risks to reliability and affordability posed by the recent exit of thermal generation and anticipated similar exit events over the next ten years.

The Australian Energy Market Operator (AEMO) welcomes the opportunity to advise the Commonwealth on this matter. Our advice and recommendations are the result of a multi-faceted approach that included analysis and evaluation of system needs and market trends, consultation with industry, investors and consumer groups, and review of similar systems and trends outside Australia and the various approaches that are being adopted around the world.

In the analysis attached, we have sought to provide advice on the core issues you raised, including:

- Adequacy of current and forecast levels of dispatchable generation to meet the National Electricity Market (NEM) reliability standard over the next 10 years;
- Sensitivity of wholesale electricity prices and price volatility to varying levels of dispatchable generation;
- Optimal level of dispatchable generation which will be required in the short-term to stabilise wholesale electricity prices to support private investment, noting that it will be some time before longer-term market reforms fully take effect; and
- Relative merits of different mechanisms which could be adopted to meet short-term market needs.

The transformation challenge

Like others around the world, Australia's energy system is undergoing unprecedented transformation. Changes include progressive retirement of an aging traditional power generation fleet, flattening grid demand growth, increase prices in domestic gas due to international LNG markets, rapid growth of variable renewable energy resources, increased penetration of rooftop solar, advances in storage capability and the ability to access and exploit increasingly large amounts of data. All these are radically changing the dynamics of the power system.

Today, older baseload units find it increasingly difficult to compete in this environment. These units have historically relied on relatively constant high production levels and stable revenues. In general, they are not well suited to respond to rapidly varying energy system needs. Their business model will be further challenged by the increasing variability in the system and falling costs of competitive sources of energy.

Evidence of these radical transformations can be seen in the portfolio of supply resources in the NEM over the last decade. During this period, 5199 megawatts (MW) of baseload generation has retired. Over the same time period, these resources have been replaced with 2895 MW gas-fired generation, 273 MW hydro, 91 MW liquid fuel, 2965 MW wind, 265 MW grid-scale solar, and 186 MW of other sources of generation, such as biomass. Since 2014, these new supply resources have been predominantly renewables.

In addition, the NEM has witnessed unprecedented growth of rooftop solar PV units – from 14,064 units in 2008 to 1,691,840 units (estimated output of 4,917 MW) in 2017. As of 1 July 2017, there are 21,721 MW of connection requests in train comprising 10,678 MW for large scale wind and 11,043 MW for large scale solar.

As a result of this changed dynamic and the recent closure of Hazelwood Power Station, the near term supply-demand balance in parts of the NEM is very tight. Further closures or mothballing of thermal power stations in these regions could be expected, however they may yet not be announced. This highlights the rapid transformation in the sector. This is true primarily in Victoria and South Australia over the next several years, and in New South Wales following the closure of Liddell Power Station planned for 2022.

While AEMO anticipates sufficient capability to meet customer demand during most hours of the year, the overall responsiveness and resilience of the system is at risk from increased vulnerability to climatic events, such as extended periods of high temperatures and/or the risk of loss of major generation units or disruption to interconnector capacity.

As recently as Saturday 2nd September, due to low demand, high but variable output of renewables and the requirement to manage system strength at the time, AEMO was forced to exercise powers to direct a thermal generator in South Australia to remain online for almost 48 hours. This direction coincided with the need to impose limits on the interconnector between Victoria and South Australia to manage potential impacts of severe weather on the power system over the same period. Using powers of direction to meet the need for a level of conventional plant in these circumstances is necessary but undesirable. It generally leads to higher costs to customers through intervention pricing and the payment of compensation.

AEMO's role – balance the system

To avoid the risk of supply interruptions, the NEM will require additional investments and new approaches to ensure AEMO has a reliable portfolio of dispatchable energy resources that are capable of responding quickly and effectively to the dynamic needs of the system. As a system operator, AEMO's role is to maintain system balance. It is the physics of the power system that define the requirements for balance.

AEMO's goal is to provide clear advice on the system needs and maintain an informed view of appropriate mechanisms to meet those needs from the market, whether supply based, demand based, storage or network investments, or a combination thereof. Based upon the changes we see in the system, we are concerned that the current energy only market design is not sufficiently valuing resource flexibility and dispatchability, and that in the absence of a market design change, sufficient investments in new resources or existing resources that

provide dispatchable capability are unlikely to occur. We note our observations on this requirement are consistent with similar findings in the Finkel review.

AEMO's view is that optimal approaches towards ensuring an efficient balanced system must target mechanisms that allow the greatest practical level of competition and innovation. This will allow AEMO to operate a NEM, which along with the external financial markets, produces the most economically efficient results for consumers.

It must also be said that AEMO, similar to other market and system operators around the world, cannot commit to operating a power system to achieve 100% reliability at all times. There are a number of variable factors that can, at any one time or simultaneously, have an adverse impact on maintaining system balance. These factors are generally out of AEMO's control such as major environmental events, bushfires or floods, and/or unplanned asset faults and failures.

The short term need for strategic reserve resources

AEMO is specifically recommending the development of a strategic reserve wherein over the foreseeable future, AEMO will regularly contract for energy resources to use during emergency conditions. The development of this strategic reserve can be designed to complement the current market design and can be adapted from the current proof of concept for demand resources that ARENA and AEMO are conducting.

For summer 2017-18, AEMO has expended considerable effort in pursuing 1000 MWs of strategic reserves through the Reliability and Emergency Reserve Trader (RERT) mechanism, an innovative program with ARENA to pursue new sources of demand response, and working with the South Australian and Victorian governments to connect their emergency diesel generators and storage investments. AEMO continues to work with the various participants to acquire these resources for the summer.

In 2018 through 2021, reliability risks reduce due to decreasing demand through energy efficiency and new generation coming on line. We note, however, that because all of the resources that are under construction are variable renewables, there is an increased risk of involuntary load shedding if the resources are at very low output due to weather conditions, particularly if at the same time there is a loss of a major dispatchable generating unit; both probable events during heat waves. Since the long notice RERT mechanism will not be available after this year, and to address this reliability risk, AEMO is recommending the development of a strategic reserve auction, similar to the approach we have taken with ARENA for demand response in the NEM.

Due to the planned new variable resources coming on line, the level of recommended reserves will decrease over the near term (until Liddell closure in 2022). At this time, AEMO anticipates a declining strategic reserve requirement from 450 to 150 MWs to meet system reserve needs for summer 2018 - 2021. We recommend developing a process to forecast the reserve requirements annually so we can take advantage of best available information and help contain consumers' costs. Consistent with the Energy Council's report to COAG on the Finkel Review, AEMO proposes to work with its Expert Advisory Panel of industry participants and the Energy Security Board (ESB) to further develop the design of such a reserve mechanism and propose it for consideration and adoption by the COAG Energy Council by the end of 2017, for implementation in 2018.

We note that by design, a strategic reserve mechanism comprises energy resources that do not participate in the wholesale market. In some instances, this may include mothballed generator units that can demonstrate they would otherwise not be economic and hence,

unavailable in the market. Strategic reserve mechanisms are designed not to impact independent decisions by investors and developers to retain and/or develop new market resources and therefore are not intrusive into the market.

The longer term need for extended market design

AEMO also evaluated the potential risk that absent further change, the NEM would continue to lose dispatchable energy capability and not have sufficient investment in appropriate new capability. This analysis led AEMO to conclude that without extensions to the current market design, it cannot provide adequate and sustainable price signals to either maintain dispatchable capability or incentivise new development at the level necessary to maintain system reliability. AEMO is particularly concerned that the system will need such capability to preserve reliability through the retirement of Liddell Power Station. Time is of the essence to obtain the appropriate level of resources to support overall system reliability.

Indeed, AEMO's initial analysis indicates the market will need incremental new dispatchable resources to replace Liddell Power Station when it closes in 2022 as announced by AGL. Our initial analysis shows that the amount required may be as much as 1 GW. Further analysis is warranted, however this amount would increase if other resources either do not come on line and/or are retired in the interim.

For that reason, AEMO proposes immediate development of an approach to retaining and incentivising investment in dispatchable capability in the NEM to complement the development of the strategic reserve mechanism outlined above. Consistent with the Energy Council's adoption of the Finkel Review recommendations and its report to COAG on the Finkel Review, this work should be completed for consideration by the COAG Energy Council by mid-2018.

AEMO is indifferent to what fuels or technology resources are utilised. Rather, as the independent operator our primary role is to ensure that the resource is able to meet the demands of the system at a time and at a location where it is necessary, i.e. that it is dispatchable (controllable by AEMO) and responds to meet the ever-more dynamic conditions for system balance. Maintaining an adequate portfolio of diverse resources also assists in managing price risk and such resources could be made up from, generation, pumped storage, behind the meter, flexible demand resources or flexible network capability.

AEMO recommendations to add new dispatchable capability

AEMO recommends our further analysis and advice cover the following components:

1. Consideration and recommendation of the appropriate level of dispatchable resources that should be maintained in the NEM by region, and for the wider system. AEMO observes that the COAG Energy Council has already agreed that AEMO should conduct this analysis.
2. Evaluation of current resources in the NEM, their vulnerability to retirement, and capability to meet system requirements with existing or new capital investments. As required by the COAG Energy Council, AEMO will develop a register of expected retirements. We also are recommending a review of existing resources and assessment of whether there are opportunities for cost effective investment under the right type of market mechanisms.
3. Consideration and development of appropriate approaches to compensate for dispatchability to ensure optimal retention and investments in dispatchable resources that assist in physically balancing the system. This last part of the evaluation will consider the appropriate market mechanisms long-term and any mid-term actions that can and should be immediately undertaken. This analysis will necessarily include consideration of the market

changes articulated in the Finkel recommendations, including the consideration of demand side markets and mandatory day ahead commitments, the articulation of a Generator Reliability Obligation, and the development of further approaches to gain investment in flexible capability. For this aspect of its analysis, AEMO will consult with industry and consumers through its Expert Panel and working groups, the academic community, and the Australian Energy Market Commission, which we note very recently announced it is undertaking a similar study. This work will also involve the coordination and oversight provided by the ESB.

Every major grid worldwide is facing this challenge

In closing, AEMO cannot help but observe that its concerns and conclusions for the need for new mechanisms are not unique. In the European, Asian and United States markets, it is increasingly recognised that absent changes in market design to retain and incentivise appropriate levels of investment in system security and reliability, power markets and systems will be at risk of failure and criticism. This challenge arises at a time when the overall economies in the OECD nations are increasingly dependent on economically efficient electricity, and to varying degrees are pursuing reduced carbon intensity. In order to maintain a smooth transition to a future that is increasingly reliant on variable renewable resources, energy authorities are actively considering market design changes to support a smooth, consumer facing transition.

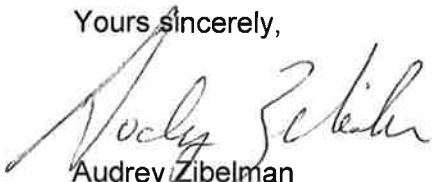
We note that a recent study published by the United States Department of Energy refers to Australia's experience of last summer as an example of why these changes are necessary and timely. As the power system and generation mix changes and without an extension on the existing market design, the level of intervention by AEMO needed to manage security and reliability is increasing, particularly as generation output becomes more dependent on weather conditions at any point in time.

In summary, AEMO appreciates the opportunity to provide the Commonwealth with its advice and recommended next steps. AEMO wishes to stress its observation that changes are needed is not a criticism of the current market system. Rather, and consistent with the COAG Energy Council's recent adoption of the Finkel recommendations, the tremendous changes we are witnessing in the power system require that we take urgent and deliberate action to ensure the system remains reliable, secure and allows consumers to gain value from the energy system.

AEMO is confident that with the support of the Commonwealth and States, we can work diligently and quickly through appropriate consultative processes to produce considered recommendations that can be adopted by the ESB and by the COAG Energy Council in a timeframe that allows us to meet energy policy objectives, and restore consumer confidence in the NEM.

As always, we look forward to an opportunity for further discussion on these matters.

Yours sincerely,



Audrey Zibelman

AEMO Managing Director and Chief Executive Officer