Anthea Harris
Chief Executive Officer
Energy Security Board
Email to: info@esb.org.au

25 July 2022

Re: Capacity Mechanism – High-level design Paper

Dear Anthea,

The Energy Efficiency Council (EEC) thanks you for the opportunity to comment on the Energy Security Board's (ESB) Capacity Mechanism High-level Design Paper. The EEC's detailed submission is attached, and this letter highlights five key points for the ESB and relevant governments:

1. The EEC agrees with the ESB that reforms are required to deliver the lowest-cost mix of capacity to ensure that demand and supply are matched at all times. The EEC needs to see more analysis to take a firm position on the merits of a capacity mechanism as part of these reforms. Capacity mechanisms can vary wildly in their design, and the potential costs and benefits cannot be determined until the full design is proposed;
2. The EEC welcomes the ESB's recognition that demand-response can provide capacity, and strongly argue that energy efficiency and load shifting (e.g. heating water at midday) also provide capacity. In fact, the International Energy Agency has identified energy efficiency as the largest source of capacity in energy markets. Energy efficiency already provides significant capacity in Australia - for example, minimum energy efficiency standards for fridges and freezers alone permanently reduce the base load for electricity by 360 MW. However, Australia could create far larger volumes of demand-side capacity through energy market reforms and adopting measures that are common in other developed countries, such as stronger building standards.
3. The EEC makes the following three specific recommendations:
    - If the ESB develops a capacity mechanism, it is critical that demand-response, energy efficiency and load shifting can all bid for capacity. If the capacity mechanism excludes these resources, and only covers generation and storage, it will result in much higher energy bills for Australians. Drawing on experiences from places like Vermont, tailored methods for incorporating energy efficiency will: enable much better alignment of supply- and demand-side resources; send clear signals to relevant policy makers; and lower energy costs.
    - Changes to governance are essential to ensure that all elements of the NEM, not just a capacity market, encourage cheapest mix of demand- and supply-side resources. The EEC recommends that governments and market institutions adopt the European Union's energy market principle *'Energy Efficiency First'*; and
    - Unlocking demand-side capacity will require a combination of energy market reform and policies that lie outside the energy market (e.g. building standards). The energy sector needs to engage more extensively with these other policy areas that influence energy demand.
4. The merits of a capacity mechanism should be assessed based on its ability to address long-term capacity challenges. We shouldn't introduce a capacity mechanism in response to the acute challenges facing the NEM in 2022, which largely relate to fuel costs and dispatch issues, not capacity. The current challenges facing the NEM should

be resolved by measures that address dispatch, such as improved baselining for the Demand Response Mechanism and adjustments to the Cumulative Price Threshold.

The EEC looks forward to working closely with the ESB as it continues its important work on reforming the NEM. For further information please contact me on rob.murray-leach@eec.org.au or 0414 065 556.

Yours sincerely

Rob Murray-Leach
Head of Policy, Energy Efficiency Council

energy efficiency
COUNCIL

Energy Efficiency Council submission to the ESB Capacity Mechanism – High-Level Design Paper

Summary

As noted in the introductory letter, the EEC argues:

- Reforms are required to deliver the lowest-cost mix of capacity to ensure that demand and supply are matched at all times. The EEC needs to see more analysis to take a firm position on the merits of a capacity mechanism as part of these reforms;
- Energy efficiency, load shifting and demand response can provide a huge volume of reliable and low-cost capacity;
- The EEC recommends:
    - If the ESB develops a capacity mechanism, it is critical that not only demand-response, but also energy efficiency and load shifting, can bid for capacity;
    - Governments and market institutions should adopt the European Union's energy market principle *'Energy Efficiency First'*; and
    - The energy sector needs to engage more extensively with other policy areas that influence energy demand.
- The merits of a capacity mechanism should be assessed based on its ability to address long-term capacity challenges, rather than the current energy crisis.

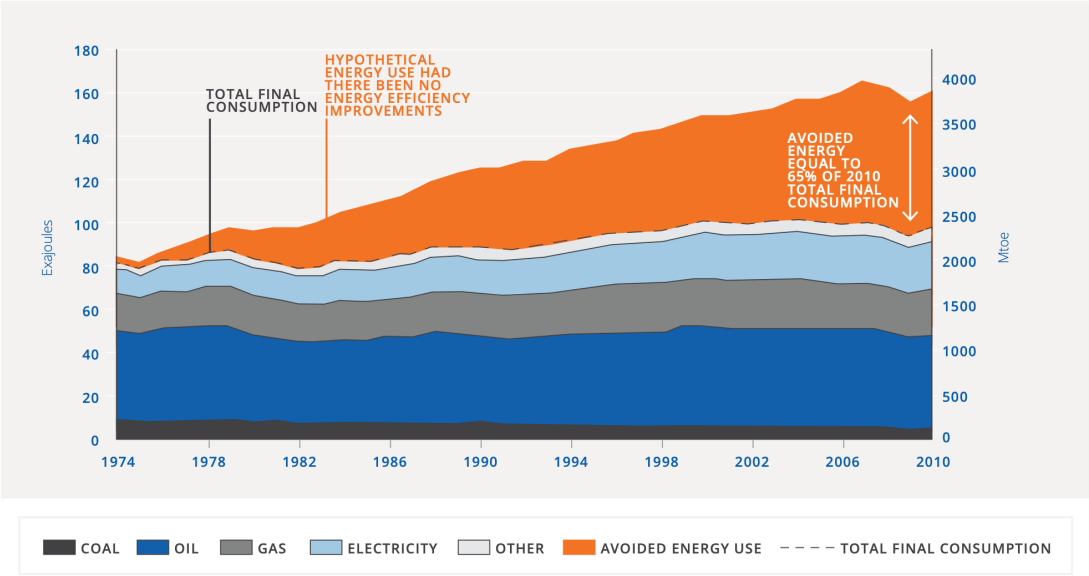
Demand-side capacity

The design of market reforms needs to start with a clear definition of the problem. The Design Paper roughly defines the problem as *'at some times there is insufficient capacity to meet demand in the National Electricity Market (NEM)'*. However, the problem needs to be more precisely defined as '*demand and supply cannot be reliably matched at specific periods of time'*. In other words, both supply and demand can be adjusted.

This distinction has major practical ramifications, as changes to demand at specific times can help us reliably match supply and demand. The majority of energy efficiency measures deliver savings at specific times – for example, improving the thermal efficiency Australian homes would reduce the need for generation in both summer afternoons and winter evenings, but has less impact on midday demand.

Improvements in energy efficiency, load-shifting and demand response can be framed as either demand reduction or provision of capacity. The International Energy Agency has assessed energy efficiency as the **single largest source of capacity** added to energy markets in 11 countries (including Australia) over a forty-year period.

Figure 1: Total avoided energy use from energy efficiency in 11 OECD countries



Source: International Energy Agency 2013, *Energy Efficiency Market Report 2013*, IEA, Paris.

The EEC welcomes the ESB's recognition that demand-response can provide capacity, and notes that energy efficiency and load shifting potentially provide an even greater volume of long-duration capacity. These resources also provide incredibly reliable capacity – for example, if more efficient street-lights are installed that require half as much energy, they will not 'fail' and suddenly double the demand for energy.

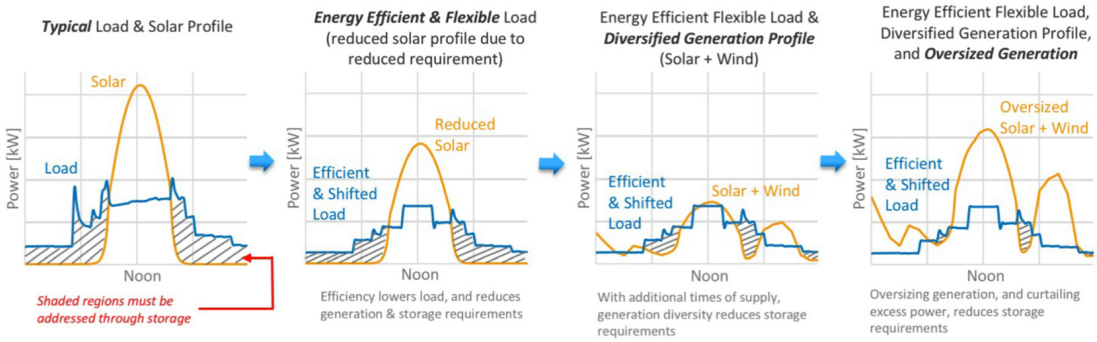
The times when supply and demand are mismatched are evolving and, given the growing penetration of distributed solar photovoltaic, we believe that these should be called 'critical capacity periods' rather than 'peak demand periods'. There are likely to be four types of critical capacity period, three of which are predictable and one of which is not:

- **Summer afternoon critical period:** evenings when home air conditioning is switched on and solar PV output declines. This is already a critical period in the NEM, but is relatively short, typically lasting a few hours. In particular, improving the thermal efficiency of homes and the efficiency of air conditioning will dramatically reduce this capacity issue.

- **Winter overnight critical period:** evening, nights and early mornings in southern states, when energy that is being generated or released from storage is substantially lower than demand. This will become an increasingly significant issue for the NEM as the proportion of renewable generation increases and space heating is electrified. Unlike the summer critical period, winter critical periods could last over eight hours and will effectively define the volume (and therefore cost) of storage needed for the NEM. Like the summer critical period, improving the thermal efficiency of homes and the efficiency of heating air conditng will dramatically reduce this capacity issue. Shifting residential water heating from overnight to the middle of the day will also assist with the winter critical period.
- **Midday critical period:** unlike the previous two critical periods, the midday critical period is caused by solar generation exceeding demand. While this critical period needs different solutions to the previous two critical periods, a key solution is shifting water heating and electric vehicle (EV) charging into the middle of the day.
- **Unpredictable:** Sometimes mismatches between supply and demand are caused by unpredictable weather or losses in generation or network. While unpredictable critical periods will need resources that can be dispatchable at broad range of times, the volume of dispatchable resources needed will be impacted by underlying demand.

If we simply rely on storage to address these critical capacity periods, it will result in extraordinarily high energy prices. Instead, we need a combination of storage, energy management, generation overbuild and diversified type and location generation. The fact the volume of storage required will be impacted by these other factors means that a target for energy storage will be far more expensive than a multi-technology approach to capacity.

Figure 2: Demonstrating energy storage needs and methods for reducing its capacity



Source: Houssainy, S. and Livingood, W. 2021 "Optimal strategies for a cost-effective and reliable 100% renewable electric grid", *Journal of Renewable and Sustainable Energy vol 13.*

The 'good' news is that, compared to other advanced economies, Australia has only mobilised a fraction of its energy efficiency potential. This means that there is huge untapped demand-side capacity. For example, around 8 million homes in Australia were built before efficiency standards were introduced into the National Construction Code (NCC), and their aggregate energy demand during summer and winter peaks could be reduced by well over 30 per cent.

Australia can dramatically improve our energy performance simply by adopting approaches that are standard in Europe, the US and Asia. In particular, the EEC strongly recommends that the ESB adopt the European principle that is confusing termed 'Energy Efficiency First' (EE First). EE First does not mean that energy management should be given precedence over supply-side resources - it means that supply and demand should be considered together 'first', before decisions are made, to ensure that we don't default to a supply-side solution and the most cost-effective mix of demand- and supply-side options and deployed.

Demand-side in a capacity mechanism

The EEC strongly argues that any approach to address capacity issues in the NEM must incorporate the full range of demand-side resources. If we fail to consider demand-side options, or simply integrating supply and demand by predicting demand and treating it as fixed, we will fail to match supply and demand in a way that is reliable, affordable and sustainable.

Should a capacity mechanism be introduced, it must follow the principle of technology neutrality and allow demand-side resources (including energy efficiency, permanent load-shifting and demand response) to compete with supply-side resources. The EEC agrees that the characteristics of capacity need to be considered in the level of support for various forms of capacity, including: time of operation, duration and reliability. However, these characteristics do not favour supply side – rather they vary between different forms of supply-side and demand-side resources. For example, both residential thermal efficiency and storage is highly coincident with summer and winter critical peak periods, whereas solar PV is not. Similarly, both energy efficiency and hydro are long-duration, while smaller batteries are not.

There are a number of approaches to include demand-side resources in a capacity mechanism. Resources like demand response can bid-in to an auction alongside generation in a fairly straightforward way, although they are likely to require aggregation. However, many energy efficiency resources will need to participate in tailored ways, and the price signal alone will not result in their dispatch. These resources could participate by retailers, energy service companies, governments or other organisations bidding them in and using the funds to contribute to energy efficiency programs, such as meter rollouts and building ratings. Including these resources in a capacity mechanism will note only provide funding to ensure they are dispatched but, just as critically, will lower the overall price in any auction and ensure a more accurate matching between supply and demand.

While the price signal from a capacity mechanism will, on its own, only unlock a fraction of the potential demand-side capacity in Australia, enabling supply and demand to interact in a capacity mechanism will support a better matching of supply and demand, especially in NEM planning and government policies. Combining a capacity mechanism with appropriate policies, such as energy efficiency ratings for homes and commercial buildings, would ensure that Australian's energy needs are met reliably and at the lowest cost.

Therefore, the EEC strongly recommends that the ESB engage both Australian and international experts, such as the Regulatory Assistance Project, to design either a capacity mechanism, or alternative/complementary markets reforms to ensure that supply and demand in the NEM can be matched.

Answers to specific questions

Question 1: What measures could be put in place to improve AEMO's forecasting process and to ensure the best information from retailers and large customers on their likely demand?

To forecast demand, AEMO needs to have detailed, bottom-up analysis of demand and trends that impact on it, including changes in energy efficiency and load shifting. The EEC congratulates AEMO on the significant effort it has put into enhancing its demand-side projections in recent years, and notes that funding for demand projections will have to be significantly increased to better model the *time* of when demand will occur. The EEC argues that AEMO's modelling should, at the very least, have a low, medium and high energy management scenario, to make clear the potential impacts of the rate of energy productivity improvement in Australia rising closer to rates in other countries.

Question 2: Do you agree that the capacity mechanism should provide for multiple zones being the existing NEM regions?

Should the ESB pursue a capacity mechanism, it should provide for multiple zones to reflect where demand and supply occur. Given increasing decentralisation of supply resources and the growing potential to adjust dem and when it occurs, this zoning should be on as fine a resolution as makes economic sense - at the very least to the resolution of existing NEM regions.

Question 3: Is there sufficient evidence to say that the at-risk periods can be defined on a time-based definition?

Based on the current available information and current trends, three of the at-risk periods appear to be quite clearly defined, and one is not. The EEC has identified the following four critical periods:

- **Summer afternoon critical period:** evenings when home air conditioning is switched on and solar PV output declines. This is already a critical period in the NEM, but is relatively short, typically lasting a few hours. In particular, improving the thermal efficiency of homes and the efficiency of air conditioning will dramatically reduce this capacity issue.
- **Winter overnight critical period:** evening, nights and early mornings in southern states, when energy that is being generated or released from storage is substantially lower than demand. This will become an increasingly significant issue for the NEM as the proportion of renewable generation increases and space heating is electrified. Unlike the summer critical period, winter critical periods could last over eight hours and will effectively define the volume (and therefore cost) of storage needed for the NEM. Like the summer critical period, improving the thermal efficiency of homes and the efficiency of heating air conditioning will dramatically reduce this capacity issue. Shifting residential water heating from overnight to the middle of the day will also assist with the winter critical period.
- **Midday critical period:** unlike the previous two critical periods, the midday critical period is caused by solar generation exceeding demand. While this critical period needs different solutions to the previous two critical periods, a key solution is shifting water heating and electric vehicle (EV) charging into the middle of the day.
- **Unpredictable:** Sometimes mismatches between supply and demand are caused by unpredictable weather or losses in generation or network. The resources required for unpredictable critical periods need to be dispatchable at a broader range of times.

Question 4: If there is a risk of the emergence of more than one at-risk period in the NEM, how should that be addressed.

As noted above, there is an almost certainty that many parts of the NEM will have four types of at-risk period. The summer afternoon critical period and the winter overnight critical period could be predicted and matched to supply and demand side resources. Resources for the unpredictable critical period should build off relevant time-based resources, but will need to be dispatched at any time and might be better classified as emergency resources with very high dispatch costs, or very high undesirability of dispatch.

For example, residential thermal efficiency is best dispatched as a regular resource that activates every evening and over-nights, and cold store demand-response might want to be regularly dispatched for short periods in order to secure an income stream. In contrast, demand response in smelters might be extremely high cost and only appropriately dispatched every two-to-five years. This latter kind of capacity might be better dispatched through an emergency mechanism than a general capacity mechanism, or at the very least a separate stream in a capacity mechanism.

Question 5: The de-rating factors produced by different at-risk period definitions and modelling methodologies can show large ranges particularly for non-traditional technologies. How should this and potential year to year variability in de-rating factors be addressed.

If capacity providers provide better and regular data to the market operator on their available (including demand response), it means that the market operator is less reliant on crude projections and can more accurately predict capacity requirements seconds, minutes and hours ahead. Better data reduces the variability in modelling.

Questions 6: What approaches should be used to de-rate different technologies? Should different approaches apply to different technologies?

Both supply-side and demand-side technologies have a range of different features that should be considered in de-rating.

- **Resource availability coincidence with at-risk periods.** For example, solar PV and energy savings from activities that occur during daylight hours will provide *on their own* very little capacity at 10pm in winter. However, they could contribute to winter night capacity via storage.
- **Duration of resource.** As noted earlier, some resources have a long (or infinite) dispatch period, such as energy efficiency and coal-fired generation. Others, such as demand-response and batteries have very specific durations.
- **Reliability.** While resources like energy efficiency and storage are almost 100 per cent reliable, resources such as wind are more unpredictably variable, and resources like coal-fired generation are subject to outages.
- **Ramping speed and flexibility.** Some resources can be dispatched rapidly (e.g. batteries and automated demand response) while others require more time for ramping (e.g. coal-fired generation).

While the EEC believes that these types of factor should be fairly applied to all technologies offering capacity, we recognise that there might be merit in slightly different approaches for de-rating different technologies to account for issues like measurement and verification.

Question 7: What is the right balance between transparency/simplicity and accuracy?

This question can only be asked in specific, not as a general principle.

Question 8: Should de-rating factors be determined at a technology class/region level or at a station level.

The approach to de-rating will vary by technology type and scale. For example, for very large forms of capacity such as coal-fired generators, it will be critical to determine de-rating at a plant level. For capacity such as distributed solar PV or energy efficiency, it would be more appropriate to determine de-rating at a technology or regional level.

Question 37 Do you think the MPC should be reduced if a capacity mechanism is introduced, and if so, by how much? What key issues should the ESB take into account when considering this issue?

The level of the Market Price Cap (MPC) has two impacts on the energy market – it provides a signal for investment in capacity and a signal for dispatch of higher cost (but rarely needed) resources, such as demand response that involves factories forgoing production.

The EEC expects that a capacity mechanism would likely reduce the MPC necessary to drive investment in capacity. However, the MPC will still provide a complementary price-signal to drive investment, particularly for resources that might be needed outside the 'at risk' times set in the capacity mechanism. A capacity mechanism should be seen as a complement to, not a replacement for, the wholesale energy price in driving investment.

Furthermore, the MPC will still need to be high enough to dispatch critical and high-cost resources.

Given these complexities, the EEC does not have a specific recommendation for the level that the MPC should be reduced to. Instead, the EEC recommends MPC should be reviewed following the design of a capacity mechanism.

Other questions in the ESB paper

The EEC does not have comments on the other questions in the ESB paper at this time.