Tuesday, 18 June 2024

To New South Wales Department of Climate Change, Energy, the Environment and Water

The Clean Energy Council (CEC) is the peak body for the clean energy industry in Australia, representing nearly 1,000 of the leading businesses operating in renewable energy, energy storage, and renewable hydrogen. The CEC is committed to accelerating the decarbonisation of Australia's energy system as rapidly as possible while maintaining a secure and reliable supply of electricity for customers.

We welcome the opportunity to comment on the review of the long duration storage (LDS) definition in relation to how it operated under the Long-Term Energy Service Agreement (LTESA).

The importance of LDS

LDS will play an increasing role as coal-fired generation retires and additional firmed, dispatchable capacity is needed to meet future demand.

Besides energy, many system services are carried out by thermal fossil fuel generation, which will also need replacing. These include inertia, voltage stability and system strength. Many forms of LDS are well positioned to provide these services.

The current NEM wholesale and contract markets are not designed to drive investment in LDS to replace coal-fired generation. Its therefore critically important that out of market government support mechanisms exist, to drive in this critical investment.

The CEC draws attention to designing policy based on modelling that doesn't fully take into account gas supply side risks and the implications for system reliability. Upstream supply constraints and a lack of gas pipeline capacity will make GPG un untenable solution. LDS is far better placed to meet the reliability and security needs of the system, while helping to keep prices down for consumers.

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In our recent Future of Long Duration Energy Storage report[1], the CEC has shown through modelling that LDS can halve the required need for GPG at higher renewable energy penetration. It can help meet peak demand periods, support daily ramping needs, provide sustained energy during seasonal shortfalls, and have a powerful effect on emissions reduction.

It has already been mentioned that the energy provided by LDS can be considered partly a public good[2], bringing value to the power system by firming renewables, reducing technical and economic curtailment, minimising reliance on costly and likely constrained GPG, and addressing tail risk of unserved energy events on a long-term horizon.

When balancing shot-term reliability needs with long-term investment it is essential to consider the larger picture under which the Electricity Infrastructure Roadmap (Roadmap) operates. The CEC considers that LDS remains an essential component of the storage portfolio needed to meet future reliability needs at the lowest cost to New South Wales consumers.

Many LDS technologies have long lead times as a result of construction timelines or being less established in Australia, are relatively capital intensive but bring significant reliability benefits to the system, with have long operational lives of 60+ years.

Shorter duration storage technologies, such as lithium batteries have shorter construction times, are less capital intensive and have shorter operational life in the range of 20+ years.

The LDS LTESA is trying to strike a delicate balance between these technologies with distinct commercial and operational features, and unique contributions to overall system reliability. Both have an essential role to play in supporting and decarbonising the electricity grid.

The CEC recognises the complexity of the task in terms of balancing short and long term system needs. However, we strongly recommend that consideration be given to the timeframes for building long duration storage solutions, so these assets are in place and fully integrated into the system when they will be most needed, in the mid-2030s onwards.

Accordingly, a mechanism is needed to incentivise investment in LDS today, in order to meet the needs of the system tomorrow.

We therefore recommend the department consider how to maintain certainty for investors in all kinds of storage technologies, of both shorter and longer duration. If the department decides to move away from the legislated 8-hour duration target, it will be necessary to replace this with a signal that provides equivalent clarity and certainty for investors. We do not make a specific policy recommendation here, other than noting that it will be very difficult to develop mechanisms that can provide an equivalent level of certainty to a legislated 8-hour target.

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[1] Clean Energy Council, 2024, *The future of long duration energy storage: keeping the lights o in a carbon constrained world*
[2] Simshauser, P, and Gohdes, N, 2024, *3-Party Covenant Financing of 'Semi-Regulated' Pumped Hydro Assets*, Centre for Applied Energy Economics and Policy Research, Griffith University

Below are a set of principles that inform and frame the response to the consultation.

Diversification

A diverse set of technologies are best suited to meet reliability and maintain system security

Low cost to consumers

What customers pay should reflect a least cost energy system that is reliable, stable, secure and affordable

Long term planning

Decisions taken today will have impact in the future and keeping a long-term view allows for better insurance against the unknowns

Flexibility

Government should maintain flexibility in implementing policies aligned with what is required in a period of transition

Question 1 - Changing the definition for LDS to 4 hours

The proposition to change the LDS definition is based around the main reliability risks identified in the Electricity Statement of Opportunities (ESOO) in the near-term. At the same time, the ESOO also acknowledges that technologies that have the capacity to provide firmed capacity continuously, such as deep storage (defined by the Integrated System Plan as 12 hours or more) will provide the greatest reliability benefit.

It is important to note that the ESOO modelling covers a period of only 10 years, which is not sufficient to capture the timeframe when most coal-fired generation will retire. While it is necessary to incentivise technological deployment in the short-term, this does not adequately consider the full scope of changing reliability risk in the power system. As AEMO has identified in the Integrated System Plan, seasonal shortfall events coupled with increased coal generation outage rates are likely to see more prolonged reliability at risk events begin to take effect, beyond the short-term horizon of the ESOO.

With coal in the generation mix, shorter energy storage durations are appropriate. This is because of the large volumes of energy storage available in the form of coal reserves. However, as these assets retire, mothballed or suffer unplanned failures, these energy reserves will need to be replaced. Longer duration energy storage, with significant carrying capacity, is the best way to achieve this.

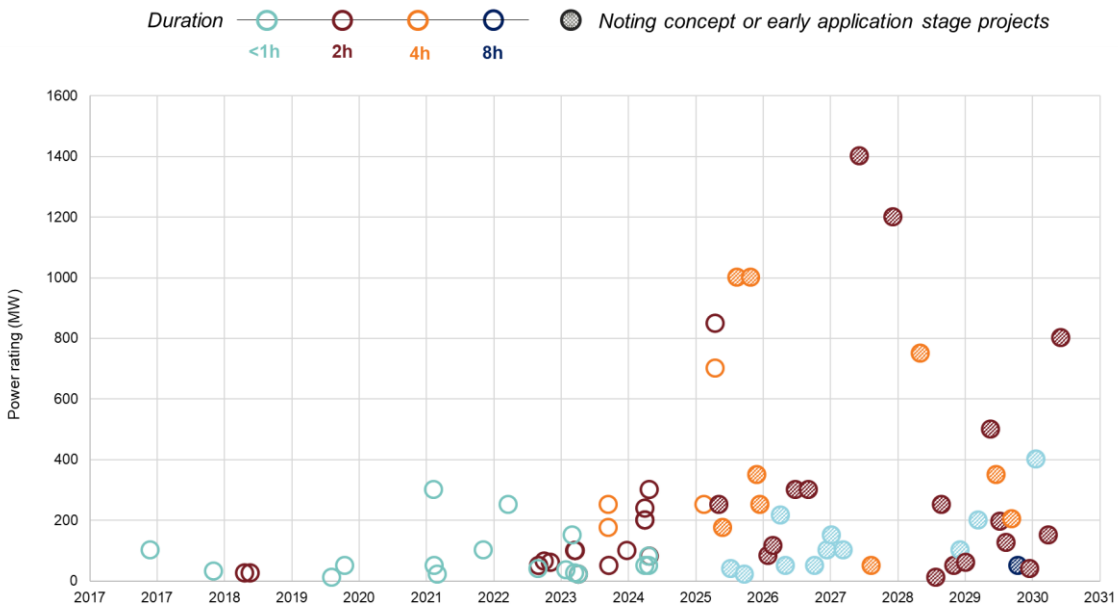
Clear investment signals are needed to drive in the investment in shorter duration storage in the short term, to manage more immediate reliability risks, as well as longer duration storage in the longer term, to manage emerging reliability risks. However, in both cases these signals are needed right now, so that investment and development of LDS assets can get underway and allow this capacity to be made available to the system when it is most needed.

Much of the reliability risk identified in New South Wales comes from delayed projects, both for battery and pumped hydro projects. Factors that contribute to these delays are not entirely in a developer's control. A few that can be listed include uncertainty around storage policies, supply chain bottlenecks in relation to procurement, connection delays due to complexities related to batteries delivering multiple services, and slow progress in streamlining planning approvals.

When the NSW Government legislated the 8-hour LDS definition it put in motion a suite of pumped hydro projects proposals. Industry followed government policy since targeted support for LDS is required. However, the 2030 target has proven unrealistic for many of these projects, particularly pumped hydro. Successful projects take time and several CEC members have indicated difficulties in meeting 2030 deadlines in delivering accurate costings, approval requirements, and, similar to other large scale renewable energy projects, community engagement timeframes. Not everyone has international and local experience which furthers increases the likelihood of underestimates.

On the other hand, new battery projects are delivering higher power, which can translate into longer duration depending on how the battery is configured to meet a longer duration requirement or fill in a gap in the market. As the figure below exemplifies, in the short term, we are seeing more battery projects in the range of 4-hour duration, but with steadily increasing power ratings.

Figure 1. Duration and capacity of battery projects in existence, proposed or concept in the NEM (*Source: Rystad Energy: Battery projects*)



The 2024 Reliability Panel[3] showed that unserved energy events of less than 6 hours are expected to 2040. There also seems to be a convergence of literature and other international studies towards 6 hours duration in 2040 for power systems with high levels of renewable energy (albeit other countries have a different energy mix that includes nuclear and larger hydroelectric power capacity)[4]. From an energy arbitrage perspective, the spot market drives investment in the particular mix of storage technologies, likely trending around the 4 to 6 hour mark to manage current price exposures. We also note the post-2030 market review is likely to focus on what can be done in addition to the existing market settings.

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[3] AEMC, 2024, Draft Report Review of the form of the reliability standard and administered price cap

[4] Jorgenson, J. et.al., 2022, *Grid operational impacts of widespread storage deployment*, CO, National Renewable Energy Laboratory, Figure 1, page 4 and McConnell, D., et.al., 2015, *Estimating the value of electricity storage in an energy-only wholesale market*, Applied Energy, Vol 159, pages 422-432, doi: 10.1016/j.apenergy.2015.09.006

Given the above, we consider there are a number of consequences that may flow from changing the minimum requirement to 4-hour duration.

LDS investment impacts from reducing the 8-hour requirement

Current market price signals do not place a value of duration longer than approximately 4 to 6 hours. This means that industry will unlikely to be able to finance longer duration projects even if those projects provide material reliability and security benefits to consumers and the power system in the long term.

Currently the LDS LTESA framework is the only underwriting mechanism specifically targeted towards longer duration storage. As such, it is the only mechanism in place that overcomes this current gap in the market frameworks. The 8-hour requirement is a particularly clear and strong signal that helps overcome this uncertainty.

Removal of the 8-hour requirement will therefore materially weaken the investment signal for longer duration energy storage.

This comes at the time when connection, supply chain, planning and project construction risks already create uncertainty in regard to investment in LDS. Maintaining the current duration would allow LDS projects currently in earlier stages of development to continue, increasing the likelihood of delivery of these reliability benefits sooner.

Closing the reliability gap

The CEC acknowledges that different reliability risks occur over different time frames.

We therefore appreciate the underlying rationale for reducing the duration requirement, on the basis this may allow more projects to access the LDS LTESA and support short term reliability. This will take advantage of market ready technologies – particularly batteries - that can be built now, allowing for a faster resolution of the reliability gap identified in the ESOO. We also note that the firming LTESAs are still an available intervention from the Energy Minister to further supplement procurement of shorter duration.

The Capacity Investment Scheme also accounts for reliability in the merit criteria and favours technologies of 4-hour duration.

However, we also note that reliability at risk periods will change markedly from 2030 onwards, as evidenced in AEMO's draft ISP, with seasonal supply shortfall events becoming more prevalent (likely exacerbated by worsening thermal coal generator performance). LDS is well placed to manage these medium to longer term reliability risks.

It follows that underwriting schemes need to be in place now to support investment in the LDS that will be needed in the 2030s and 2040s. Failure to commence this build now creates a risk of over reliance on shorter duration assets, or gas generation, when these reliability at risk periods start to be an issue.

It is important for all renewable energy forms of generation and storage to be promoted on the basis of reducing emissions and shortening the time fossil fuel generation needs to be in the system. Batteries and pumped hydro, along other forms of LDS technologies, should form part of a portfolio approach.

On this basis we consider there may be merit in setting a specific LDS target and associated underwriting mechanism to 2035. Such a mechanism would ensure LDS projects continue to be developed and would account for the timeframe when coal-fired generation will retire. This will

also better enable development of longer lead time assets, which may struggle to meet 2030 targets.

Comparing costs and value

AEMO Services has undertaken a useful analysis of build cost (both in total value – b$; and normalised cost - $/GWh) based on different portfolios. By normalised cost, the difference between longer and shorter duration storage is evident. By total value, the difference between portfolios that have a percentage of longer duration storage of 8 hours or 24 hours is not significant (Portfolios 3, 4, 5 and 6). In fact, portfolios with 100% 4-hour battery and 80% 4-hour battery and 20% 48-hour have the same build cost of $b4.68.

The lowest cost portfolio, Portfolio 4, with *95% 4-hour battery and 5% 8-hour battery* is only 11% less costly (or $520 million) than Portfolio 7 with *60% 4-hour battery, 20% 8-hour battery and 20% 24-hour pumped hydro*. The additional system benefits provided by this diverse portfolio are likely to offset the additional cost. Also there may be more LDS technologies able to be commercially competitive in the future, with strong signals that value duration.

Additional durations

There has also been an exclusion of other durations such as 10 hours, 12 hours or 16 hours. Not all pumped hydro projects can benefit from longer duration of 48 hours due to site constraints and capex. At the same time, other LDS technologies, such as compressed air energy storage, different types of redox flow batteries, and concentrated solar with thermal energy storage can fill in the gap. Importantly, they complement each other as some provide grid stability services, while others provide a safe and easy to implement energy solution. Pumped hydro projects also converge around a 10-hour storage duration.

Longer timeframe

Equally beneficial would have been for the modelling to consider a longer timeframe, potentially to 2040 when many of the benefits of LDS will be realised and coal-fired generation is all but retired. Decisions taken today will reverberate to how reliability risks are managed in the future and what technologies can be deployed. Diversification of portfolio is essential on this task.

Question 2 – Ministerial regulation making powers

The CEC considers that investment in LDS can be supported with duration requirements that are established in legislation rather than changed through regulation. The overacting purpose of the Roadmap is to provide industry with certainty in the long term. The firming LTESAs are already a tool for the Energy Minister to direct firming capability to be built in time to address a material breach of the Energy Security Target.

We do not consider any of the alternative solutions are likely to provide material certainty to investors. For example, if the Consumer Trustee were to define duration requirements in a Guideline or other document, this would not provide much certainty that the value won't change again in future. Similarly, defining the value in regulation also reduces certainty, as a change would be at the discretion of the minister of the day.

We urge the Department to consider the importance of maintaining investment certainty. The choice of *where* the LDS definition is located will be just as important as its absolute value, in terms of providing this certainty to investors.

While we agree that flexibility is needed, we do not support the option where the Consumer Trustee recommends projects with a duration less than 8-hours on a case by case basis. This would be equivalent to a black box. LDS projects, including pumped hydro projects, are multi-million-dollar investments that require a high degree of confidence in the evaluation process. The CEC considers that duration should not be treated as an add-on in the case of the LDS LTESAs.

Question 3 - Mechanism to encourage LDS

If the Government decides to set an interim minimum duration of 4-hour to 2030, we consider this should not deter consideration of other options to incentivise LDS in New South Wales.

In addition to a separate underwriting scheme with a 2035 date, we consider that targeted concessional financial support could play a role in bringing in LDS. Such financing could be delivered by the NSW Energy Security Corporation.

One specific financing model has already been put forward by Paul Simshauser and Nicholas Gohdes[5] in a paper published in March 2024. The 3-Party Covenant Financing model describes how projects with long operational life and high upfront capital (or high value but higher risk) can be supported:

- *First revenue stream*: The public good component of the LDS, such as improving investment in renewable energy, reducing reliance on GPG, and lowering energy emissions is part of a semi-regulated arrangement.
- *Second revenue stream*: The private components of the asset can continue to provide energy arbitrage, selling $300 caps, and other system services operating is part of merchant arrangement.
- *Third revenue stream*: The intermediate duration reserve payment designed to minimise the cost of capacity is part of the regulated arrangement.

The Government would be able to determine what levels of storage durations are required, not unlike the LTESA. The regulated payment would then be added to the usual cost recovery process and the regulated payment would be funded by a consumer rate base. If the price of caps falls below the threshold, the regulated revenue would be expended to cover the gap, while if it rises above the threshold, it would be returned to consumers acting as a “financial shock absorber”. This model is attractive because the current energy-only market does not value duration, which is a function entirely covered by coal-fired generation.

While this model was proposed with pumped hydro in mind, it could also be applied to other forms of LDS that might need support to bridge the gap that exists in current energy market design.

The government can also formulate a mechanism that closely resembles the existing Reliability and Emergency Reserve Tender Framework that allows AEMO to procure bilateral contracts through a tender process. The mechanism would procure long-term reserve contracts where a reliability gap is identified through the ESOO. The cost of the supporting the contracts upon activation is borne either by the government as procurer or by consumers through energy retailers.

[5] Simshauser, P, and Gohdes, N, 2024, *3-Party Covenant Financing of ‘Semi-Regulated’ Pumped Hydro Assets*, Centre for Applied Energy Economics and Policy Research, Griffith University

As discussed above, consideration of a 2035 minimum LDS targets is well placed to incentivise the delivery of LDS projects. This timeframe would be better suited the development of pumped hydro that currently take between 3-5 years for project design and 4-8 years to construct[6]. At the same time, it would support other LDS technologies and send clear signals around investment.

Question 4 – Aggregated infrastructure

One untapped resource is small-scale aggregated resources such as community batteries operated by distribution networks and virtual power plants (VPPs). The CEC supports the consideration of these technologies on the principle that driving competition and diversification allows the least cost technology to deliver benefits to customers.

There are some regulatory and commercial elements that still need to be understood and then implemented:

- Community batteries operated by distribution networks are regulated by the AER and need to first satisfy local needs. The remaining energy can be used by aggregators.
- Due to how small-scale batteries are utilised, it first creates value for the consumer (in the form of participation in frequency control and wholesale markets) and what is left can be used by aggregators.
- The commercial case for aggregators could improve with access to LDS LTESA, however, they draw most of the value from shorter firming. They may be better placed to be included in firming LTESA.
- Dispatch in the NEM would have to be different since these resources are more complex to forecast, given they serve the customer first.

The Capacity Investment Scheme is also considering how to incentivise customers to participate in orchestration. Once there is more clarity around the way they would participate, there would be more scope to integrate them in the mix of dispatched firmed power.

As always, the CEC welcomes further engagement from the New South Wales Department of Climate Change, Energy, the Environment and Water on this review. Further queries can be directed to Ana Spataru at aspataru@cleanenergycouncil.org.au.

Kind regards

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[6] Aurecon, 2023 *Cost and Technical Parameters Review prepared for AEMO*, 15 December 2023, 138.