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New South Wales Government

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Review of Long Duration Storage

AGL Energy (AGL) welcomes the opportunity to provide feedback on the New South Wales Government Department of Climate Change, Energy, the Environment and Water (DCCEE) Review of Long Duration Storage (LDS) consultation paper.

Proudly Australian for more than 186 years, AGL supplies around 4.3 million energy and telecommunications customer services. AGL is committed to providing our customers simple, fair, and accessible essential services as they decarbonise and electrify the way they live, work, and move.

AGL operates Australia's largest private electricity generation portfolio within the National Electricity Market (NEM), comprising coal and gas-fired generation, renewable energy sources such as wind, hydro and solar, batteries and other firming technology, and gas production and storage assets. We are building on our history as one of Australia's leading private investors in renewable energy to now lead the business of transition to a lower emissions, affordable and smart energy future in line with the goals of our Climate Transition Action Plan.

Developing Pumped Hydro Energy Storage (PHES) and other synchronous LDS technologies is integral to ensuring reliability and affordability as Australia transitions to a renewable energy system.

We recognise the importance of PHES to maintain grid reliability, balance intermittent renewable energy sources, provide essential system services and facilitate the decarbonisation of our energy supply. In addition to providing deep storage and flexible, dispatchable generation, PHES is synchronous and inherently capable of providing system strength, real inertia, black start, and voltage/frequency control services. PHES also has an asset lifecycle four to five times that of shorter duration storage technologies such as batteries. With its ability to store large amounts of energy over extended periods and respond swiftly to fluctuating demand, long duration PHES is indispensable for achieving sustainability objectives in the NEM.

AGL is the largest private owner and operator of hydro generation in Australia, with 785MW of hydro generation located in Victoria and NSW.

PHES and other key LDS technologies face significant challenges to develop, including high initial capital investment, complex and lengthy assessment processes, and lack of supporting markets. A stable policy and investment environment is essential for the development of PHES projects, in addition to new markets that reflect the value of medium to long duration storage and essential system services.

When the NSW Government legislated emissions reduction targets it stated that "it provides business and industry with energy and investment certainty." Similarly, the legislated targets for LDS under the NSW Electricity Infrastructure Roadmap (Roadmap) provide an important anchor of policy stability and should not be amended to be reduced. To reduce these targets now threatens investment in the development of LDS projects that will be essential for the NSW energy system from the early 2030s.

AGL recognises the challenges for 2030 and the opportunity to develop more short term (4-hour) storage. We consider the risk of storage gaps could be addressed through additional procurement of 4-hour storage, beyond planned tenders. We support a process to set a 2033 target for storage. Additional storage beyond planned targets will be needed by 2033, to coincide with the retirement of coal-fired generation.



Question 1: What is an appropriate minimum duration for long duration storage infrastructure in NSW for 2030?

We recommend NSW maintain its current legislated definition of the minimum duration for long duration storage infrastructure at 8 hours for 2030. We consider there may be benefit for an additional target for 2033, discussed further below.

As the NEM becomes more reliant on intermittent renewables, storage is ideally suited to manage the system need for more continuous supply. Investment signals for storage to meet 4-hour lulls in renewable supply are stronger than those for longer durations because they occur more frequently. Investment to meet 4-hour lulls is also more economic since 4-hour batteries have proliferated. In contrast, LDS has higher costs due to longer lead times and planning assessment. Investment incentives for longer durations are therefore weaker and it is appropriate that NSW target these durations and include an 8-hour minimum.

LDS such as PHES offers a range of benefits compared to shorter duration batteries, including:

- Deeper reserve capacity
- Synchronous generation and associated system services
- Significantly longer asset life (50-100 years compared to 15-20 years)
- Fewer issues associated with asset degradation over time

A renewables-based energy system would greatly benefit from LDS for rare reliability events. Energy storage beyond 4 hours requires an additional marginal premium but typically has very few opportunities to earn revenues. In particular, PHES requires higher capital expenditure upfront and longer lead times to develop than battery energy storage; however, it is only able to capitalise on the maximum value of its deep storage capacity during relatively rare reliability events.

It is crucial the future energy system is developed with a spectrum of storage and firming, encompassing short, medium, and long-term technologies. If the definition of LDS is shortened then the market for development for 8-hour+ storage would essentially cease, consequently risking the reliability of the entire energy system.

Question 2: Should the Minister have regulation making powers to change the minimum duration of long duration storage infrastructure over time?

No. We recommend the Minister not be given regulation making powers to change the minimum duration of LDS infrastructure as this will undermine regulatory and investment certainty. We consider any proposed changes to the legislation or regulation should be accompanied by appropriate consultation to ensure it remains fit for purpose.

Regulatory & investment certainty

AGL notes it has invested in a project that has been awarded funding under the NSW Government Pumped Hydro Recoverable Grants Program and that the project is currently on schedule to meet the requirements of the long duration energy storage (LDES) long term energy service agreement (LTESA) by 2030. However, any changes to the current regulatory landscape may undermine this development. We consider there are limited incentives to develop PHES without a well-defined, consistent, market support mechanism.

Policy stability is critical for the energy transition. LDS technologies, particularly PHES, will play an essential role in delivering reliable and affordable power in a high renewables system. We note market investment decisions have been underpinned by existing legislated targets for policy certainty for LDS, namely PHES developments. Changing the definition of LDS from 8 hours to 4 hours will significantly affect the competitiveness and economic feasibility of these projects. It will fundamentally erode investor confidence in the overall NSW Roadmap and threaten all investment in LDS technologies.



AGL notes the strategic objective of the Roadmap was to support NSW to address energy supply gaps over the coal-fired generation closure period. We consider this should remain the overall focus rather than the target for the 2030 date when three coal-fired generators are still expected to be in operation in NSW.

We note developing long duration PHES is already a significant challenge for the market, given the:

- High initial capex requirement
- Extended and complex environmental approvals
- Sensitivities associated with social license and water resource as a shared asset
- Technical complexity of pumped hydro projects
- Lack of supportive market mechanisms or incentives

We note that since the release of the Roadmap in 2020, the development of PHES has not progressed at the expected pace to meet the 2GW LDS capacity target for 2030. We consider the market is still working towards the 2030 target. Any disruption to this target would further reduce the pace of development and undermine prospects for PHES in the early 2030s, just as a significant portion of coal-fired generation is expected to retire.

The current definition of LDS would also see storage options in excess of 8 hours be developed (10, 12, 24 hours etc.) which may be crucial to maintain supply in the event of longer renewable droughts. Shortening the definition to 4 hours would likely undermine this. LDS with deeper energy reserves will also displace reliance on emissions intensive gas firming.

AGL notes the current state of PHES developments across the NEM. Given there are limited incentives for investment in PHES in different jurisdictional and national schemes, there is a material risk of a substantial lack of LDS in the NEM heading into the 2030 coal closure period. AGL does not consider these reliability risks are comprehensively addressed through shorter duration (4 hour) batteries.

We note the Commonwealth Capacity Investment Scheme (CIS) is based on assumptions around pre-defined commitments to be delivered through jurisdictional mechanisms. Thus, it would be prudent for jurisdictions not to amend existing legislated targets.

We consider it is paramount that the NSW Government consider the following factors when assessing the current regulatory settings for LDS:

- Stable investment environment. Providing market signals to incentivise expansion of current hydro facilities and creation of “Bluefield” and greenfield PHES.
- Streamlined planning and approvals process. for “Bluefield” and greenfield PHES (currently greater than five-year development and approval process).
- New markets that reflect the value of LDS, and contributions to system security/auxiliary services.

AEMO modelling

AGL notes Australian Energy Market Operator Services Limited (AEMO Services) has undertaken a review into the storage requirements of the NSW market. We consider AEMO Services’ modelling represents a theoretical minimum cost analysis to meet the 2030 LDS target and lacks consideration of the needs of the energy system over the long term. We consider there are some notable limitations to this analysis since it is based on solving for lowest cost energy storage based on a purely mathematical perspective, however there are many factors and complexities in real-world project delivery and operation, as well as benefits associated with LDS, which have been excluded from the analysis.

AEMO’s analysis does not adequately value the broader public benefit of long duration PHES in guarding against tail risks, in providing synchronous generation and associated system strength services, and in



providing greater price certainty for the market by enabling the creation and trading of contracts that better hedge against high wholesale prices (compared to shorter duration batteries).

We note AEMO's modelling identifies the development pathway for LDS based on the assumption that existing coal fired generation closure dates will remain the same. However, this is unlikely. For example, the modelling assumes Mt Piper power station will continue operation until 2040; however, the owner has publicly announced the intention to shift the station to a "reserve" role as early as the 2030s. AGL therefore considers a consistent regulatory mechanism is necessary to underwrite the development of long duration PHES in order to cover the gap from retiring coal fired generation.

Diversity of technology

We note there are range of benefits associated with long duration PHES technology that should be appropriately evaluated before amending any regulatory settings which may inhibit PHES development. We consider the long-term reliability of the energy system is best served by investing and developing a portfolio of diverse technology types that deliver the optimal combination of reliability and sustainability outcomes at an efficient cost.

- Long duration PHES provides dispatchable and flexible generation to meet peak demand with deeper reserve capacity, store excess generation during peak solar hours, and cover the tail risk of long wind or solar droughts.
- PHES also produces synchronous generation which is similar to existing thermal generation technologies and aligns with the configuration of the existing energy system. This enables PHES to provide numerous benefits in terms of system strength, voltage control, inertia, black start, and frequency control, particularly when compared to shorter duration BESS.
- PHES has a proven asset life in the order of 50 to 100 years or more. This is significantly longer than the asset life of relatively new and unproven BESS technologies which are estimated in the order of approximately 15 – 20 years.
- PHES is capable of maintaining its original storage capacity and discharge capabilities, with ongoing maintenance, to a greater degree compared to BESS technologies which typically experience a material degradation to their storage and discharge capacities over the lifetime of the asset.

A diversified portfolio of storage assets over the next five to ten years i.e. a mix of long and short duration storage technologies, will ensure a more secure and resilient energy system. The alternative would involve achieving existing targets relying solely on short duration storage technologies while relegating the development of LDS to the back end of the 2030s. It is imperative we continue to incentivise a range of storage technologies throughout the energy transition now to capitalise on the advantages of different storage technologies and avoid single points of failure. Particularly as the longer duration and system service capability of batteries are only emerging and are still immature.

Reliability & tail risk

AGL notes AEMO's modelling recommends an LDS definition of 4 hours while highlighting the importance of addressing reliability tail risks.

The Australian Energy Market Commission's (AEMC) Reliability Panel Review of the form of the reliability standard and administered price cap explores the nature of unserved energy with increasing variable renewable energy (VRE) penetration in the NEM. The probability of tail risk reliability events will progressively rise with increasing VRE coupled with the retirement of coal-fired generation.

AGL notes LDS technologies are better suited to providing resilience against tail risk due to deeper storage capabilities. Given this is the case, AGL queries how tail risk and the issue of unserved energy will be addressed by the proposed recommendation to shorten the definition of LDS, thereby reducing the



development of LDS technologies such as PHES and promoting the development of shorter duration batteries. AGL considers there is a broader public good in developing an energy system with appropriate levels of LDS to minimise negative reliability outcomes.

Targets beyond 2030

AGL notes LDS technologies such as PHES typically require long lead times for development. We note 2030 targets for the CIS and NSW Roadmap may not necessarily be conducive with the current development timelines for LDS projects.

We consider there is value in identifying a target for LDS beyond 2030 which would provide a clear investment signal to ensure ongoing development. AGL considers a target for 2033 would be most appropriate as this would coincide with both the target closure of AGL's Bayswater and Vales Point power stations. We consider this sequential target should involve discretionary tender round(s) to add more LDS and short duration storage, as required.

Contract markets

AGL notes all of the analysis conducted by DCCEE and AEMO thus far excludes the impact of storage on the contracts market. AGL considers LDS technologies such as PHES will support the development of a diverse range of derivative contracts, similar to the existing contracts market underpinned by substantial reserves of coal fired generation. This would enhance contract market liquidity and allow retailers to continue to manage their exposure to the spot market and shield consumers from high wholesale prices. It is unlikely the contracts market would continue to be able to provide such products with an energy system where energy storage is comprised almost entirely of short duration battery energy storage systems (BESS).

Alternative options to support storage

AGL considers there is limited incentive for market investment in long duration PHES without the existing 8-hour definition of LDS in the NSW Roadmap.

We note the current trajectory of storage development may not meet the NSW target of 2GW of capacity with 16GWh of storage by 2030. We recognise maintaining reliability in all years through the energy transition is essential. We suggest additional procurement for 4-hour storage could be explored if there are concerns that there may be a shortage of storage by 2030, rather than amend a legislative definition which has the consequences identified in this submission.

We recommend maintaining existing regulatory settings and including additional tender rounds for storage, as required. We find there is merit in holding specific tender rounds for 8-hour LDS and 4-hour storage. Without incentives/unique tenders for LDS (8-hour) storage, we expect there is limited scope for their development within the NEM.

AGL considers there is also merit in using a firming LTESA to meet the target for 2030 overall.

LTESA merit criteria

Question 3: How can the infrastructure objectives and LDS tenders be improved to support a diverse range of long duration storage projects?

AGL notes the importance of LDS technologies such as PHES have not been adequately captured in the assessment of LDS tenders. We consider there are a range of factors that should be taken into account when awarding LDS tenders, beyond simply the lowest cost solution. These include:

- Reliability resilience, including diversity of supply



- Contribution to system security and services
- Impact on contract markets
- Deferred network infrastructure
- Recognition of the development risk and cost uncertainty in certain types of technologies such as PHEs which may require more flexibility in the terms of an LTESA

AGL considers there is benefit in providing transparency of merit criteria weightings and potentially assigning greater weighting to undervalued criteria e.g. system strength.

We note storage tenders have historically tended to favour BESS projects; however, we consider there is a need to take a longer-term view of the energy system beyond simply achieving the 2030 target through a single technology type. We find there is a need to review the existing LDS merit criteria to ensure it is better designed to incentivise AEMO Services towards longer duration projects that serve the public interest.

If you have any queries about this submission, please contact Alifur Rahman on [REDACTED] or at [REDACTED]

Yours sincerely,

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Wholesale Markets Regulation