21 June 2024

Submission to the Review of Long Duration Storage Consultation Paper

Upper Hunter Hydro (**UHH**) welcomes the opportunity to make a submission to the NSW Department of Climate Change, Energy, the Environment and Water's (**Department**) Review of Long Duration Storage (Part 6 of the *Electricity Infrastructure Investment Act 2020*) Consultation Paper (the **Review**).

In UHH's view:

1. The ***need for long duration storage (LDS) of at least 8 hours is likely to grow*** beyond the current development pathway under the Electricity Infrastructure Roadmap (**Roadmap**) because:
    - LDS is lower cost storage on a per MWh basis than shorter duration storage;
    - LDS (and particularly pumped hydro) offers a range of ancillary benefits including increased network hosting capacity, system stability benefits from synchronous generation and substantially more local jobs;
    - Recent academic research concludes that the modelling used by system planners simplifies the energy system in ways which may understate the energy resources required to address peak demand and renewable lulls; and
    - The modelling prepared by AEMO Services for the purposes of the Review is framed around NSW's electricity system needs as at 2030. This approach does not have regard to the increasing value of LDS as the penetration of renewable energy increases post 2030.
2. ***Policy uncertainty stifles investment***. Private sector investors need confidence in government policy to put their funds towards projects which meet those policy parameters. This is particularly the case for storage, where revenue modelling is more straight-forward for short duration projects in the absence of government policy. A major benefit of the Roadmap is that it is legislated and retains bipartisan support. Material amendments to that legislation which cast doubt over its long-term approach to infrastructure needs may stall project investment, further delaying the energy transition and increasing its cost.

UHH recommends that the NSW Government adopts an approach which balances any near-term reliability risks with long-term system needs for LDS. This includes:

1. Retaining the ***current definition of LDS*** and ***legislating a 2035 minimum LDS objective*** (which addresses any unacceptable reliability risks arising from coal closures scheduled for the 2030's, gas infrastructure constraints and challenges with the planning and construction of transmission and wind farms);
2. Enhancing the assessment of LDS and publishing further information on the financial value attributed to these projects;
3. Running firming tenders to address any residual short-term risks; and
4. Continuing to build a pipeline of prospective LDS projects that can compete for long-term energy services agreements (**LTESA**).

Upper Hunter Hydro

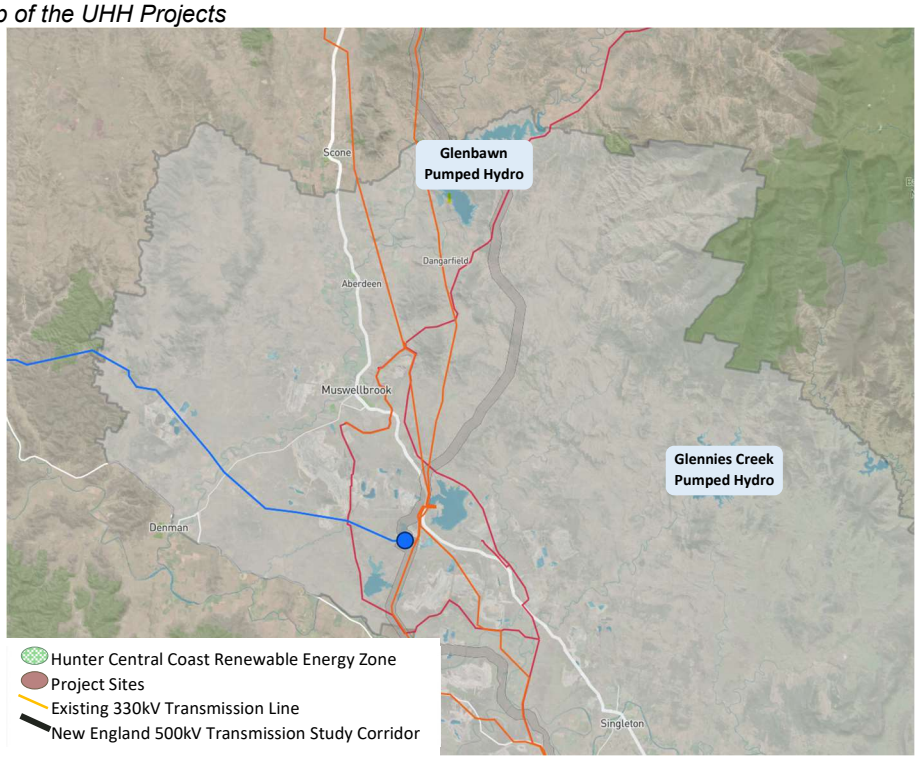
UHH is the proponent of two large pumped hydro projects in the Hunter region of NSW. These projects are the:

- Glenbawn Pumped Hydro, a 7,700MWh pumped hydro which is currently configured as a 770MW 10 hour scheme; and
- Glennies Creek Pumped Hydro, a 6,420MWh pumped hydro which is currently configured as a 642MW 10 hour scheme,

(together the **Projects**).

The Projects are primarily located on WaterNSW sites and leverage the existing dams as lower reservoirs, with upper reservoirs to be constructed in the ridges surrounding the dam catchment area. UHH was awarded the rights to investigate the development of the Projects following an extensive, competitive tender process run by WaterNSW under the Renewable Energy and Storage Program.

Figure 1: Map of the UHH Projects



The Projects are expected to support approximately 1,400 construction jobs and 80 ongoing operations jobs. The Projects present a unique opportunity to leverage existing infrastructure in the Hunter region to generate clean, dispatchable electricity and create new economic opportunities for the local community and workforce as coal mines and coal fired power stations in the region reach the end of their lives.

Long Duration Storage under the Electricity Infrastructure Roadmap

The Roadmap is a long-term plan to replace the State's ageing coal fired powers stations with new clean energy sources. The Roadmap currently sets out objectives to build enough LDS necessary to meet the reliability standard, including at least 2GW/16GWh of LDS infrastructure by 2030.[1] These objectives were designed to accelerate projects in advance of the closures of the State's coal fired power stations, acknowledging that a 'just in time' delivery approach did not properly account for the risk of accelerated coal closures and any delivery delays in the new infrastructure.[2]

To support these objectives, the NSW Government has invested at least $100 million in long duration storage infrastructure including:

- Funding via the Emerging Energy Program
- ~$50 million under the Pumped Hydro Recoverable Grants program
- A further $24 million to expand the Pumped Hydro Recoverable Grants program
- $23.5 million to undertake pumped hydro feasibility studies on WaterNSW dams
- Significant resourcing within WaterNSW to run the Renewable Energy and Storage Program

The NSW Government has also allocated a further $1 billion in the Energy Security Corporation which proposes to support "*technologies, including energy storage and enabling technologies, that contribute to the reliability, security or sustainability of electricity supply*."[3] This significant investment coupled with the LDS targets has produced a strong pipeline of pumped hydro projects in NSW.

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[1] Section 44, *Electricity Infrastructure Investment Act (2020)* NSW.

[2] NSW Department of Planning, Industry and Environment, *NSW Electricity Infrastructure Roadmap Detailed Report*, 5.

[3] See section 32(1), *Energy Security Corporation Bill 2024 (First Print)*, introduced to the NSW Parliament on 4 June 2024.

Table 1: Publicly announced pumped hydro projects in NSW

Proponent	Project	Power (MW)	Duration (hours)	Energy Storage (MWh)
EnergyAustralia	Lake Lyell	335	8	2,680
Oven Mountain	Oven Mountain	900	8-12	9,000
ATCO	Central West	325	8	2,600
ACEN	Pheonix	800	12	9,600
AGL and Idemitsu	Muswellbrook	500	8	4,000
EDF & Walcha Energy	Dungowan	300	10	3,000
Mirus & Energy Estate	Dungowan 2	700	10-14	8,400
ZEN Energy	Western Sydney	1,000	8	8,000
Upper Hunter Hydro	Glenbawn	770	10	7,700
Upper Hunter Hydro	Glennies Creek	642	10	6,420
Yancoal	Stratford Renewable Energy Hub	300	12	3,600
BHP	Mt Arthur	Not disclosed	Not disclosed	Not disclosed
	Totals	**~6.6GW**		**~65GWh**

Per Table 1, pumped hydro projects in NSW have clustered at or above the minimum 8 hour duration currently prescribed by the Roadmap. This illustrates the market response to the NSW Government's policies to date.

While some projects are taking longer to develop than originally anticipated, delays are not unique to this class of energy infrastructure and do not diminish the need for LDS. Many of the projects outlined above are progressing well on their development schedule as expertise (both in the private and public sector including within WaterNSW) and regulatory frameworks (such as in planning assessment) continue to evolve.

Benefits of LDS

LDS will play an important role in the NSW grid for a number of reasons.

1. Storage diversification and reliability

First, it is important to invest in a diversified portfolio of storage technologies. While short duration batteries will play an important role in firming wind and solar on a daily basis, technology and operating risks should be spread across a range of dispatchable storage types and durations.

For example, pumped hydro is proven technology that has been deployed around the world for over a century, with over 175GW of pumped hydro installed globally.[4] Pumped hydro can both turn on within about 20 seconds and run for periods of many hours through to days. These long duration storage projects are important to allow NSW to manage the increasing deployment of renewables, especially in light of recent work by the AEMC's Reliability Panel which finds that at 70+% renewable penetration the mean unserved energy event will last approximately 7 hours.[5]

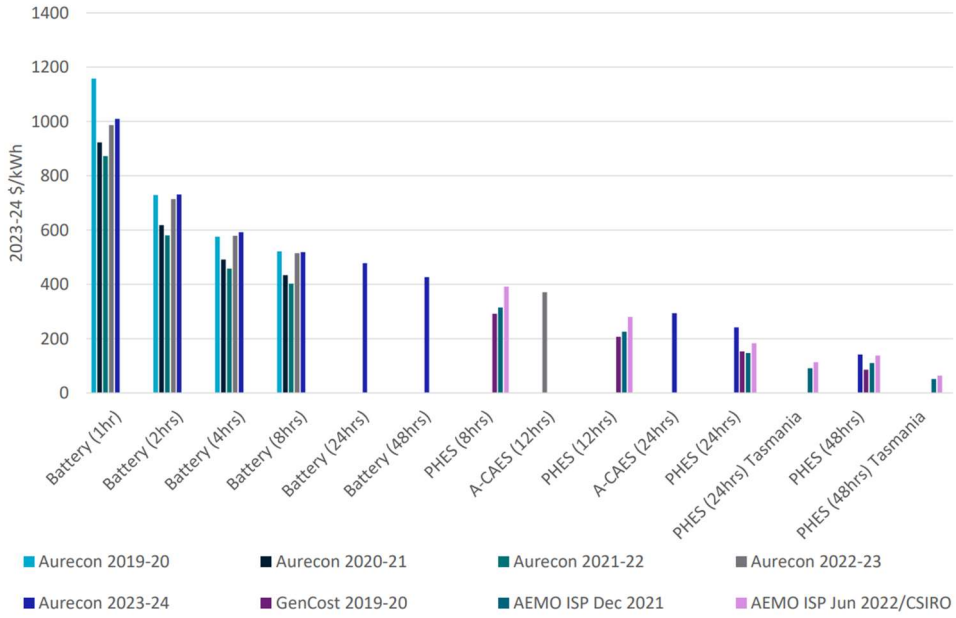
2. Lower total system costs

Long duration storage is also important to achieve the lowest total system cost for the NSW energy transition. The CSIRO's GenCost report finds that capital costs per unit of energy storage decreases as the duration increases. In the case of pumped hydro, the lower cost per unit of longer duration energy storage is driven by the lower marginal cost of increasing the size of the upper reservoir while other major costs remain relatively constant.

[4] Blakers, A. et al, Australian National University, *An atlas of pumped hydro energy storage*, 21 September 2017, 2.

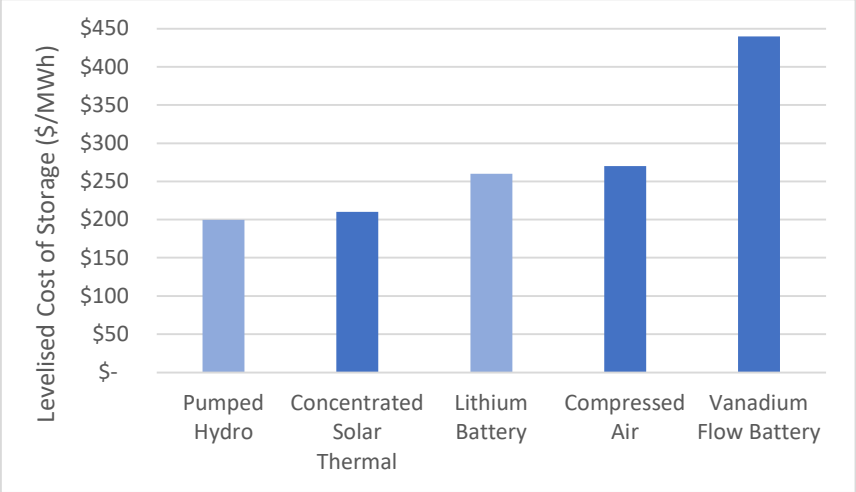
[5] AEMC Reliability Panel, *Review of the form of the reliability standard and administered price cap,* 18 April 2024, 57.

Chart 1: Capital costs of storage technologies (CSIRO GenCost 2023-24)



There are an increasing number of technologies competing in the long duration storage space, however on a levelised cost of storage basis (which considers costs over a project's lifetime) the CSIRO finds that in 2025, the levelised cost of storage of an 8 hour pumped hydro project is forecast to be about 30% cheaper per megawatt hour than an 8 hour lithium-ion battery project (see Chart 2).[6] Some of the drivers behind the lower levelised cost of pumped hydro include its higher lifetime cycling capability and significantly longer technical life.

Chart 2: Levelised cost of 8-hour storage (2025, 230 annual cycles) [7]



While long duration batteries are coming down the cost curve, the cost reductions are yet to be realised and not guaranteed. Future battery costs will be driven by a range of factors, including critical mineral availability and supply chains which must be considered from a risk and diversification perspective.

3. *Pumped hydro has a long asset life with stable storage capacity*

Pumped hydro has a lifespan of about 80-100 years[8] and when properly maintained, the civil infrastructure such as the dams and tunnels have an indefinite economic life. The degradation of pumped hydro is negligible. In

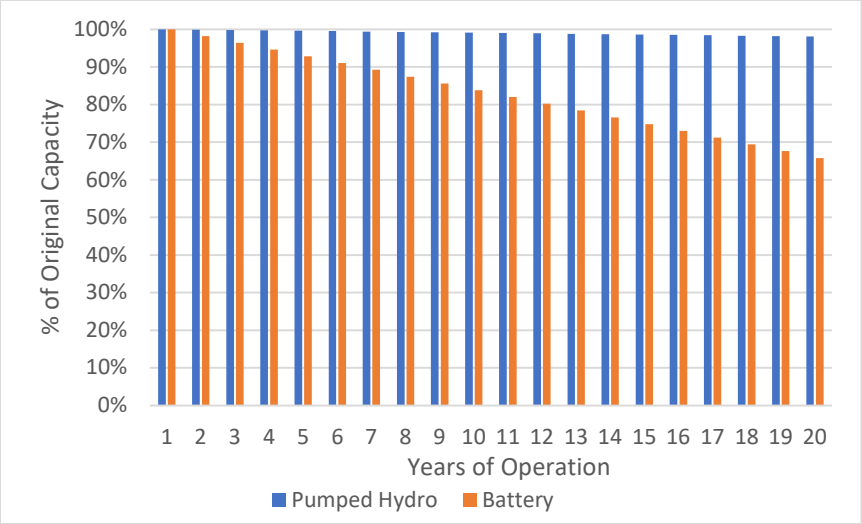
[6] CSIRO, *Renewable Energy Storage Roadmap*, March 2023, 54.

[7] Reproduced from CSIRO, *Renewable Energy Storage Roadmap*, March 2023, 54.

[8] Aurecon, *2023 Cost and Technical Parameters Review prepared for AEMO*, 15 December 2023, 138-139.

contrast, the technical life of a utility scale battery is roughly 15-20 years, as the plant degrades to approximately 60-65% of its initial capacity over this time (based on one cycle per day).[9] As a result, batteries need to be refurbished or replaced in the near-term, involving additional cost, administrative burden and waste.

Chart 3: Pumped hydro v battery degradation[10]



Pumped hydro is long term infrastructure that, like transmission, railways, bridges and tunnels, provides intergenerational benefits. Indeed, countries around the world including the US, Japan and Spain that have relied on pumped hydro for decades and are continuing to reap the benefits through the energy transition. Tumut 3 (600MW of pumping capacity) has been operating since 1973. Queensland's 570MW Wivenhoe pumped hydro plant has been operating since 1984. A portfolio of well-maintained pumped hydro schemes can underpin the reliability of NSW for decades, operating alongside wind, solar and other forms of short term and emerging storage technologies.

4. *LDS provides additional system co-benefits*

LDS provides the following additional system benefits:

- *Lower cost of new entrant renewables:* without sufficient storage, intermittent renewables will face progressively higher levels of curtailment. This means the cost of new renewable projects and associated generation LTESA costs may rise. Long duration storage can absorb otherwise spilled energy and reduce overall system costs.
- *Enhanced grid services:* synchronous LDS can provide black start capabilities, frequency regulation, spinning reserve and voltage stabilisation functions that are important to maintain system security in a high renewable penetration future as traditional providers of these services exit the market.
- *Avoided transmission upgrades*: LDS can defer or reduce the need for network upgrades by balancing load profiles and absorbing excess energy, thereby optimising and increasing the effective carrying capacity of existing infrastructure. This minimises costly transmission upgrades that are presenting ongoing social licence challenges in regional NSW.
- *Avoided emissions and gas infrastructure upgrades*: LDS can displace gas generation, which reduces actual emissions, the cost of carbon offsets and defers or reduces the need to upgrade pipelines and storage facilities.

Many of these services are undervalued under existing market conditions. A future market with underinvestment in pumped hydro is likely to require AEMO or network planning bodies like the Energy Corporation of NSW (**EnergyCo**) to procure synchronous condensers, grid batteries and other technologies that provide a synthetic response at additional cost. EnergyCo has pointed to the "*opportunities to leverage the synchronous generation [of connected pumped hydro] to release broader network benefits.*"[11]

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[9] Aurecon, *2023 Cost and Technical Parameters Review prepared for AEMO*, 15 December 2023, 144-145.

[10] Produced from information set out in Aurecon, *2023 Cost and Technical Parameters Review prepared for AEMO*, 15 December 2023, 138-145.

[11] EnergyCo, *NSW Network Infrastructure Strategy – Appendices*, May 2023, 3.

5. *Pumped hydro supports more jobs and local supply chains*

Finally, the bulk of the cost and jobs associated with a battery is in its manufacturing. This largely occurs overseas. Conversely, the bulk of the costs for pumped hydro is in the construction period, supporting local workers and businesses, especially in regional Australia.

For example, the Oven Mountain Pumped Hydro project near Armidale states that it will support an average annual workforce of up 783 jobs during peak construction.[12] In comparison, the Waratah Super Battery – one of the largest batteries in Australia – is expected to support 150 construction jobs and for a much shorter period.[13]

We also draw your attention in particular to projects such as the Muswellbrook, Western Sydney and UHH schemes which are planning to repurpose mining voids and/or existing dams as reservoirs, creating new job opportunities for some of the local communities facing the economic challenges of the energy transition. Similar plans are being developed at BHP's Mt Arthur site in the Hunter[14] and Yancoal's Stratford site near Gloucester.[15]

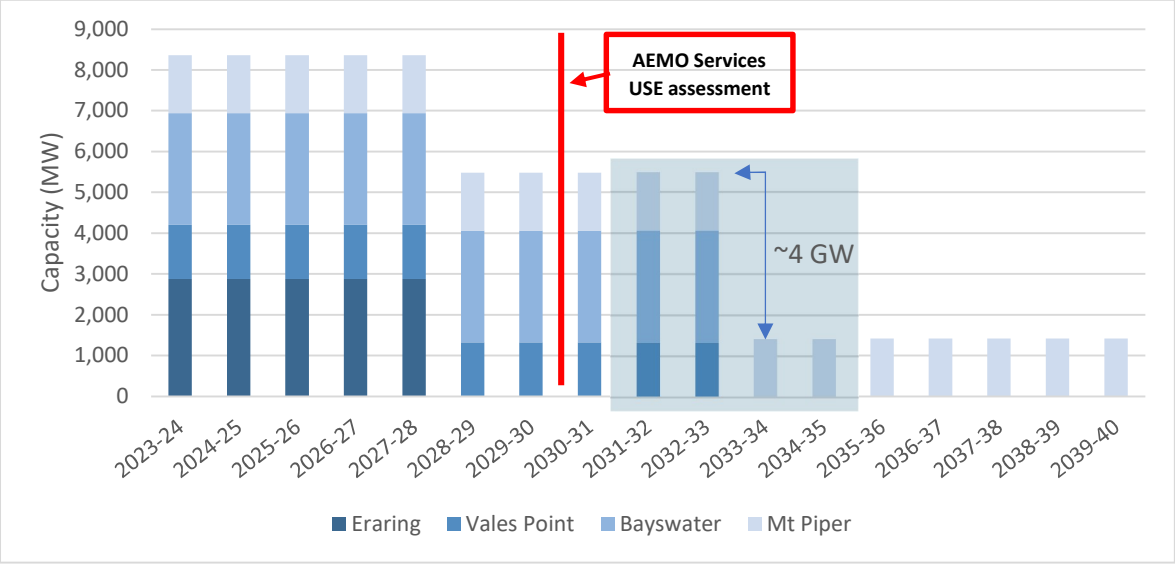
The economic benefits of pumped hydro are being increasingly recognised internationally, with India pursuing pumped hydro as a priority because pumped storage projects "*primarily use indigenous technologies and domestically produced materials [as opposed to] batteries [which] are heavily import-dependent*."[16] Even in China (the world centre of battery manufacturing), pumped hydro is being aggressively expanded. The 2023 installed base of 48GW of pumped hydro in China is estimated to expand to 212GW by 2030 and 300GW by 2035.[17]

Despite ongoing plans to establish local battery manufacturing capabilities in Australia, efforts to capture the local jobs and economic benefits of the energy transition should be pursued holistically and not via one storage technology alone.

Need for LDS in NSW

The mid 2030's presents one of the most challenging parts of the NSW energy transition, with the announced closures of approximately 4GW of combined capacity from the Bayswater and Vales Point coal fired power stations and the transition of the 1.4GW Mt Piper coal fired power station to a reserve role.[18] This means that over 65% of coal closures are announced to occur *after* the 2030 point in time assessment adopted in the AEMO Services modelling (see Chart 4).

Chart 4: NSW Announced Coal Retirements



[12] Oven Mountain Pumped Hydro, *Environmental Impact Statement*, Appendix Z Economic Assessment, 15.

[13] Waratah Super Battery, *Environmental Impact Statement*, 15.

[14] BHP, *Mt Arthur Coal Mine Modification Report,* September 2023, Figure ES-3.

[15] Yancoal, *Stratford Renewable Energy Hub,* November 2023, 1.

[16] Government of India, Ministry of Power, *Guidelines to promote development of Pump Storage Projects*, 10 April 2023, 3.

[17] BNEF, Shannon Dong, *China Turns to Pumped Hydro Storage for Green Future*, 22 March 2024.

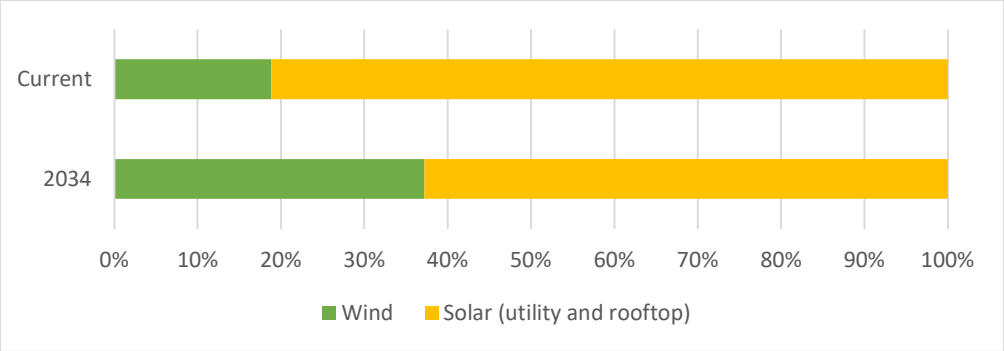
[18] EnergyAustralia, *Climate Transition Action Plan 2023*, 4.

While the current development pathways in the Infrastructure Investment Objectives (**IIO**) report coupled with the Commonwealth Capacity Investment Scheme (**CIS**) go a long way to replacing the infrastructure required to maintain reliability up to 2030, UHH believes that the current LDS development pathway does not adequately address NSW's long term storage requirements into and beyond the 2030s.

Under the current IIO report, AEMO Services is currently forecasting that 2.2GW of long duration storage (8+ hours) is required by 2040. Many of the assumptions that contribute to this forecast are drawn from AEMO's Integrated System Plan (**ISP**). While the latest ISP is a valuable and sophisticated resource, its current forecasts are at risk of underestimating the storage requirements for NSW for a number of reasons including:

- *Gas infrastructure constraints:* an assumption that the gas market is 'endlessly flexible', despite recent research which suggests that pipeline and storage constraints may limit the gas supply needed to adequately meet demand during winter months.[19]
- *No national battery rebate:* the 'step change' scenario for distributed storage is underpinned in part by an unrealised assumption that the Commonwealth will establish a national household battery rebate that subsidises 50% of the capital costs.[20]
- *Slower transmission rollout:* ongoing delays to transmission projects could increase energy storage requirements by 2-5 times.[21]
- *More solar than wind:* under AEMO Services forecasts, the proportion of wind to solar in NSW is forecast to almost double within the next 10 years (see Chart 5). Lengthy planning assessment processes coupled with rising civil construction costs for wind farms while solar PV continues to fall in cost may see solar continue to grow at a faster pace than wind, therefore increasing storage requirements.

Chart 5: Mix of Wind and Solar in NSW



UHH draws your attention to the recent work of Professor Paul Simshauser, CEO of Powerlink Queensland, and Associate Professor Joel Gilmore from Griffith University which suggests that a long duration storage[22] target of 162GWh of storage spread across the NEM (in addition to existing pumped hydro projects, Snowy 2.0 and Kidston) with a capacity of at least 9GW by 2035 is appropriate.[23] This translates to a NSW requirement of approximately 56GWh of long duration storage (in addition to existing pumped hydro and Snowy 2.0) with a capacity of at least 3.5GW.[24]

Responses to the Review questions

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

Summary of response

- The minimum duration for LDS infrastructure in NSW should remain as 8 hours, with a more rigorous assessment to value additional hours and LDS co-benefits (refer to response to Question 2).

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[19] Simshauser, P. & Gilmore, J., *Solving for 'y': demand shocks from Australia's gas turbine fleet*, March 2024, 25.

[20] See Green Energy Markets, *Final Projections for distributed energy resources – solar PV and stationary energy battery systems – Report for AEMO*, December 2022, 54. The step change distributed battery scenario in the ISP takes the average of the Green Energy Markets forecast and CSIRO, *Small-scale solar PV and battery projections 2022*.

[21] Blakers, A., et al, *A zero-carbon, reliable and affordable energy future in Australia,* 1 April 2021.

[22] Long duration storage in this context means storage technologies with at least eight hours duration.

[23] Simshauser, P. & Gilmore, J., *Solving for 'y': demand shocks from Australia's gas turbine fleet*, March 2024, 19.

[24] NSW requirements derived from discussions with Professor Simshauser and Professor Gilmore.

- The NSW Government should pursue amendments to the *Electricity Infrastructure Investment Act 2020* (**EII Act**) to prescribe a minimum 2035 objective for LDS of 56GWh with a capacity of at least 3.5GW (with continued scope to award earlier if appropriate).
- Any residual 2030 reliability gaps should be addressed via firming tenders consistent with the long-term framework set out in the Roadmap.

Detailed response

Having regard to the benefits and need for LDS set out above, changing the definition of LDS to a duration lower than 8 hours to address a 2030 reliability gap risks undermining the investment confidence needed to develop these projects.

The drafting proposed by AEMO Services to lower the duration to 4 hours but "*preference projects of 8 hours or more*" and/or "*limit the Consumer Trustee's ability to recommend projects with a duration of less than 8 hours to circumstances where this is prudent to address near-term reliability risks*" does not provide a strong enough basis to invest tens of millions of dollars in a true long duration storage project with confidence that it will be competitive in LDS LTESA tenders.

In this regard, the AEMO Services approach adopts a narrow focus on short-term system needs at the potential expense of the long-term system needs and interests of consumers. The 2030 point in time assessment of unserved energy used is at odds with the long-term nature of the Roadmap and the need to continue to build replacement infrastructure beyond 2030.

Instead, the NSW Government should address any near-term reliability risks under the existing Roadmap framework via the Minister issuing a direction to the Consumer Trustee to conduct competitive tenders for firming LTESAs. Under the latest Energy Security Target Monitor Report, AEMO forecasts an EST breach in 2030 under the central scenario[25] which should provide the Minister with the administrative pathway to direct a firming tender if deemed necessary. If the NSW Government believes that the pathway to direct a firming tender is too restrictive, then targeted amendments to these provisions in the EII Act should be pursued to create the required flexibility.

In parallel with any short-term actions, the NSW Government should pursue amendments to the EII Act to prescribe a minimum 2035 objective for LDS. As described above, recent work from Professor Simshauser and Professor Gilmore suggests that this objective should be at least 56GWh of long duration storage (in addition to existing pumped hydro and Snowy 2.0) with capacity of at least 3.5GW. A 2035 minimum objective for LDS will send a clear investment signal to developers and capital providers that aligns with both coal closure timelines and realistic LDS development timeframes.

Any additional analysis to determine the preferred minimum LDS objective should also consider the following issues identified in a review of the AEMO Services modelling:

- the modelling should consider the capital costs of long duration storage projects that are greater than 8 hours but shorter than 24 hours (which captures the vast majority of projects proposed in NSW per Table 1);
- any discrepancies between the duration of unserved energy events between AEMO Services and the AEMC Reliability Panel should be addressed;
- the modelling should consider the impacts of short duration capacity likely to be contracted in NSW under the Capacity Investment Scheme (**CIS**); and
- sensitivities for the issues raised with respect to the ISP's storage assumptions above.

Many of these issues may be explained by discrepancies between the assumptions of different market bodies or timing mismatches between the modelling and a new report being published. This in and of itself shows the risk of changing course on changing the definition of LDS to address a short-term reliability gap.

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

Summary of response

- No, the minimum duration of LDS should remain legislated.

[25] AEMO, *Energy Security Target Monitor Report,* October 2023, 3.

Detailed response

Investors are unlikely to incur the significant development costs associated with developing an LDS project when the minimum duration requirements can be changed without the oversight of the NSW Parliament.

Pumped hydro projects are typically designed from the outset to maximise the energy storage potential of the upper reservoir. This energy storage is then configured to best meet the market's requirements for power versus duration, by increasing or decreasing the size of the tunnels/penstocks and associated infrastructure. At the earlier stages of pumped hydro development, this configuration can be changed. However, as the project reaches the latter stages of development, this configuration cannot be changed without significant adverse cost and time implications.

Investors must be confident in the duration configuration (having regard to market needs, private offtake requirements and LDS LTESA competitiveness) to continue to incur development costs at the accelerated rate required of the NSW energy transition. A regulation making power to set minimum LDS durations does not provide that sufficient degree of confidence.

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

Summary of response

- The NSW Government should via regulations require the Consumer Trustee when making recommendations about LDS LTESAs to take into account the financial value of:
    - additional storage above 8 hours (based on at least 20-year forecasts of unserved energy including any unacceptable tail risks)
    - project lifespan
    - reduced curtailment of renewables
    - system services (including black start capabilities, frequency regulation, spinning reserve and voltage stabilisation)
    - avoided or deferred transmission upgrades
    - avoided or deferred gas infrastructure upgrades
    - avoided emissions (or carbon offset costs) from displacing gas fired generation
- The NSW Government should require the Consumer Trustee via regulations to issue quantitative market guidance on how it values the benefits described above.
- The NSW Government should run additional rounds under the Pumped Hydro Recoverable Grants Program, starting with the existing allocated funding. Additional funding could be sourced from the Energy Security Corporation, with a premium paid by proponents if the grant is recovered on Final Investment Decision to meet the minimum rate of return requirements.

Detailed response

Improvements to LDS assessment

AEMO Services publishes detailed information on its LTESA tender processes and assessment approach which is commendable and of significant value to the market. This includes information on how it assesses the financial value of a project. Proposals to improve this process and provide greater market awareness (and therefore more competitive bids) are set out below.

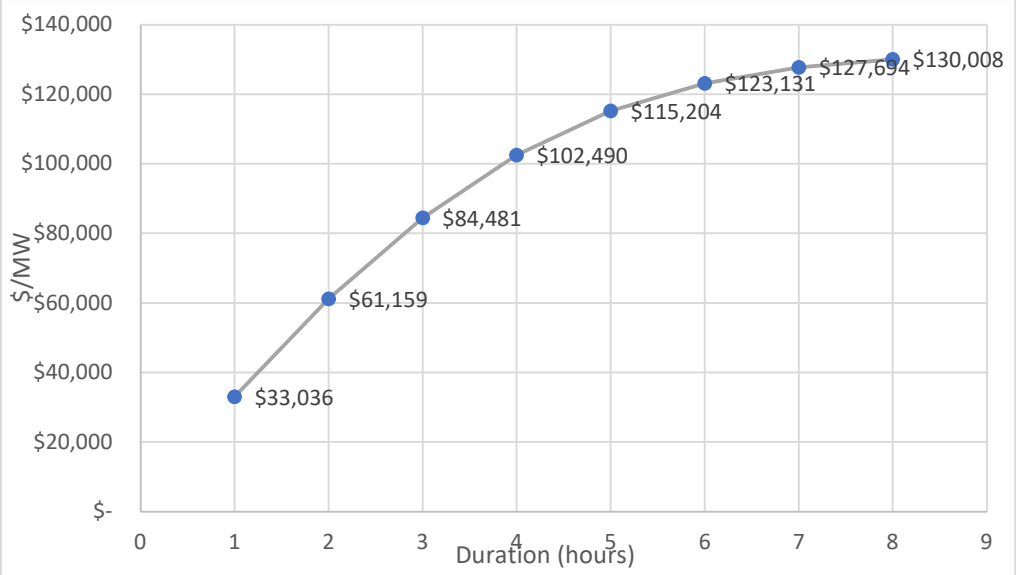
1. Value avoided unserved energy over a horizon of at least 20 years

Under current assessment guidance, AEMO Services considers the impact an LDS project will have on avoided unserved energy as part of its financial value assessment. It does so by modelling each project against the unserved energy events forecast for the next 10 years in the Electricity Statement of Opportunities (**ESOO**).[26]

It is unclear whether any reliability benefits are attributed to, and if so to what extent, for projects that provide reliability benefits beyond the next 10 years (ie. into the mid-2030s). This concern arises in particular from the guidelines published by AEMO Services for Tender 2 which suggests that there was rapidly diminishing value attributed to projects of a longer duration. Chart 6 illustrates the information published by AEMO Services on the value of the contribution of a project bidding under Tender 2 to unserved energy, which was derived from the 10 year forecasts in the 2022 ESOO.

[26] AEMO Services, *Market Briefing Note: The financial value of long duration storage projects*, 13 October 2022, 3.

Chart 6: Value of Avoided Unserved Energy (AEMO Services guidance for indicative 300MW firming project)[27]



This guidance suggests that avoided unserved energy is only valued over a 10 year horizon. This is concerning because the latest ESOO does not yet capture the period after which a suite of NSW coal fired power stations are set to retire. In so doing, this assessment process risks taking a short-sighted view of what dispatchable storage is ultimately required to replace the retiring power stations by the mid-2030s and beyond. This risks driving developers to projects of minimum durations as these represent the strongest business case, despite any system needs for deeper storage.

While the approach illustrated by Chart 6 may be appropriate for firming tenders that are intended to address near-term reliability risks, it raises concerns for LDS projects that may only be commissioned in the later years of the ESOO but with deeper storage and longer lifespans.

To address this, the NSW Government should make a regulation that requires the Consumer Trustee assess the contribution of LDS projects to addressing unserved energy across over a period of at least 20 years, including the value of durations longer than 8 hours.

2. Value other system benefits of LDS and publish further guidance

The NSW Government should consider making regulations to require the Consumer Trustee to assess the value of the broader system benefits provided by LDS described in the summary above.

This should be coupled with a regulation that requires the Consumer Trustee to publish additional quantitative guidance in how it values these benefits to limit unhelpful speculation and assumptions that arise from any 'black box' parts of the assessment process.

Encourage more competitive LDS bids via support for pre-bid costs

While pumped hydro has a lower levelised cost of storage once operational, due to its complexity it involves significantly more upfront cost, time and risk to reach the stage where investors can bid competitively in an LTESA tender. Pumped hydro projects are major civil infrastructure projects which take a number of years to plan, develop, design and construct. The planning and geotechnical works are complex and development costs can run into the tens of millions of dollars before a developer can successfully bid for an LTESA.

On the other hand, short duration storage projects incur significantly lower development costs before an LTESA bid can be submitted.[28] This allows battery developers to have the confidence of an LTESA in place at lower upfront risk, even though an LDS project may ultimately provide equal or better financial value for consumers.

The simplest approach to continue to incentivise the most competitive LDS LTESA bids from pumped hydro projects is to continue to extend the Pumped Hydro Recoverable Grants Program. This is an established program

[27] AEMO Services, *Guidelines – Tender Round 2 Firming Infrastructure,* March 2023, 56.

[28] See development cost estimates in Aurecon, *2023 Cost and Technical Parameters Review prepared for AEMO*, 15 December 2023, 146.

which has already delivered a pipeline of projects that will increase competitive tension for LTESAs and deliver more cost-effective outcomes for consumers.

Once the existing funding for the program is exhausted, a similar model could be established by the Energy Security Corporation with a premium paid on recovered grant funds if the project reaches Financial Investment Decision (so as to meet the rate of return requirements).

Question 4: *Should the NSW Government introduce amendments to the LDS definition to clarify it can include aggregated LDS infrastructure across multiple sites? Should aggregated LDS infrastructure need to register on AEMO's NEM Registration and Exemption List and participate in central dispatch?*

While UHH does not object to this proposal in principle, any disaggregated infrastructure must be contractually or otherwise bound to operate as an LDS project.

Additional remarks on next steps

While UHH supports ongoing improvements to the Roadmap architecture, there is a real risk that material amendments to the EII Act, like those that are contemplated by Question 1 of the Consultation Paper, undermine investment confidence in the Roadmap, in particular the 20-year development pathway and the 10-year tender plans. This would be a disappointing outcome given the substantial work that has occurred to date to develop a long term, enduring energy policy for NSW.

UHH encourages the NSW Government to resolve its preferred position, consult on any draft legislation or regulations and pursue the relevant reforms as quickly as possible. The NSW Government should not wait until closer to the launch of next LDS tender (currently scheduled for Q2 2025) to finalise any changes. LDS projects are developed in accordance with detailed schedules which include significant dependencies. Delays to parts of the schedule (such as deferring decisions on storage duration configurations until the Review is finalised) risks further pushing back LDS delivery timelines.