

Hydrostor submission to the Industry-led Electricity Contract Co-design Consultation

Executive Summary

Hydrostor welcomes the opportunity to provide feedback to ASL on the proposed contract structures for the Electricity Services Entry Mechanism (ESEM) and recognises the extensive work ASL has undertaken with industry to co-design the proposals.

The proposed Dynamic Time of Day Block Spread Swap appears capable of supporting participation by Advanced Compressed Air Energy Storage, subject to targeted clarification. Hydrostor supports the day-ahead nomination of charge and discharge periods, the limit of two charge and two discharge blocks per day, and the 30-minute minimum block length. These features provide a practical basis for operational planning and materially reduce timing uncertainty compared with an ex-post design.

Hydrostor does not support the proposed \$600/MWh firming cap in its current form. The product would expose the seller to every trading interval above the strike price, without a limit linked to the project's accredited duration, stored energy, or annual liability. A diversified portfolio or fuel-based generator with continuous access to fuel may be better placed to manage this exposure. For a stand-alone, energy-limited LDES project financed on a limited-recourse basis, it could reduce debt capacity, increase the required premium, or make the contractual risk unfinanceable.

The proposed firming product also provides little additional contracted value for duration beyond the approximately eight-hour eligibility threshold. It may consequently favour the lowest-cost technology capable of meeting the minimum requirement, rather than procuring the additional endurance needed during prolonged renewable shortfalls. Strategic reserve procurement may complement the standard product, but its discretionary and jurisdiction-specific nature means it should not substitute for recognising duration within the core firming contract.

The proposed later-years contracting model also requires flexibility for capital-intensive, long-lead-time projects. LDES projects need sufficient revenue certainty from the commencement of operations, while commercial counterparties may be unwilling to contract many years ahead of delivery. A later-years ESEM contract may not support financial close if the project must first secure a bankable early-years position that is not commercially available.

Hydrostor recommends that the final design:

- retain the core shaping product, with clear nomination, fallback and product-stacking rules;
- allow sellers to nominate shaping duration and contract capacity, including participation over part of a project's capability;
- prevent the same high-price interval from creating duplicative shaping and firming liabilities;
- recognise additional duration through separately valued and tradable tranches;
- establish clear event, recharge, outage, force majeure, buyback, and maximum-liability arrangements;
- provide flexibility in contract commencement, tenor, and coverage for capital-intensive, long-lead-time projects; and

- test the products against representative A-CAES and other LDES projects, rather than relying principally on gas turbine and battery assumptions.

About Hydrostor

Hydrostor is a developer of Advanced Compressed Air Energy Storage (A-CAES), a long-duration, emissions-free storage technology designed to support reliable electricity systems with increasing levels of renewable generation.

A-CAES uses electricity to compress air, captures and stores the heat produced during compression, and stores the compressed air in a purpose-built underground cavern. When electricity is required, the stored air and heat are recombined to drive a synchronous generator. The technology does not rely on natural gas and can be located independently of the natural salt formations required by conventional compressed air energy storage.

A-CAES is suited to durations of eight hours and above and has an expected operating life of more than 50 years without the augmentation associated with electrochemical degradation. In addition to sustained energy, it can provide synchronous inertia, frequency response, voltage support, reserve and other system services. Its combination of capacity, endurance and synchronous capability means it can contribute to shaping, firming, network support and system security from a single facility.

Hydrostor has operating facilities in Canada and is developing large-scale projects internationally. In Australia, Hydrostor is progressing the Silver City Energy Storage Centre in Broken Hill, New South Wales: a 200 MW / 1,600 MWh project selected by Transgrid to provide network reliability services and supported through New South Wales' long-term energy service arrangements. Hydrostor's comments in this submission are informed by the practical development and financing requirements of that project and the broader A-CAES portfolio.

Shaping Feedback

The proposed structure can support LDES

Hydrostor supports ex-ante, day-ahead nomination of charge and discharge periods. Advanced certainty over the settlement windows is important for operational planning and financeability. It allows an LDES project, including A-CAES, to plan charging and state of charge, schedule compression and generation, coordinate other contractual commitments, and take any physical or financial action required to manage its exposure.

This approach is materially more financeable than an ex-post design, under which the seller would need to anticipate the trading intervals ultimately selected for settlement. Where those intervals are not known in advance, lenders are more likely to treat the associated revenue as merchant or discount it materially for debt-sizing purposes.

Hydrostor also supports the proposed limit of two charge and two discharge blocks per day, with a minimum block length of 30 minutes. These settings provide sufficient operational flexibility to address morning and evening system needs without creating unnecessarily fragmented operating periods. Sellers should be able to nominate shaping duration and contract capacity, including contracting only part of a project's capability while retaining clearly allocated MW and MWh for firming, system services, network support, and merchant participation.

Forecast and nomination risk should be transparent

Day-ahead nomination reduces timing uncertainty but does not eliminate forecast and basis risk. Charge and discharge blocks would be selected using forecast residual demand, while settlement would be calculated using actual regional prices. Forecast high-residual-demand periods may not ultimately correspond with the highest prices, and material price events may occur outside the nominated blocks.

The nomination methodology should therefore be transparent, reproducible, and supported by back-testing for each region and product duration. Published results should include eight-hour products and report:

- nominated against realised spreads;
- the frequency of split blocks;
- the distribution of block lengths; and
- material forecast errors.

Nominations should become final once published and should not be retrospectively amended other than through a defined error-correction process. The contract should also include fixed fallback blocks or another predetermined methodology where forecast data or the nomination process are unavailable.

Implementation should be technology neutral in outcome

The proposed settlement structure assumes equal charge and discharge durations and quantities and does not expressly account for round-trip efficiency, auxiliary consumption, or differences between charging and generating capacity. These costs may be reflected in bids, but the auction design and supporting analysis should not assume the operating characteristics of a lithium-ion battery.

The final design should confirm that sellers may:

- nominate contract capacity and shaping duration;
- contract only part of a project's capacity;
- reflect efficiency, auxiliary consumption, and operating costs transparently in their bids; and
- carry state of charge between Daily Shaping Periods without an assumed physical reset.

Subject to these clarifications, the shaping contract could provide a meaningful component of an A-CAES project's revenue stack. Further project-specific modelling is required before it can be relied upon as a complete investment pathway for capital-intensive LDES.

Firming Feedback

Financial exposure should reflect accredited physical capability

LDES has finite stored energy and must manage state of charge, recharge opportunities, round-trip losses, auxiliary consumption, outages, and network availability. The proposed cap would nevertheless expose the seller in every trading interval in which the regional price exceeds \$600/MWh, irrespective of whether the project has:

- exhausted its stored energy;
- had a reasonable opportunity to recharge;
- been constrained from charging or generating; or
- already operated for its accredited duration.

The product therefore requires the financial equivalent of unlimited endurance from an asset that qualifies by demonstrating approximately eight hours of physical endurance. This disconnect is most material during consecutive high-price days, prolonged renewable shortfalls, sustained network constraints, and periods in which charging energy is scarce or expensive.

Hydrostor does not propose insulating sellers from ordinary operating risk. Sellers should remain responsible for risks they can reasonably control. The concern is that the proposed design allocates potentially unlimited exposure to a finite-energy asset, including risks that cannot always be controlled or efficiently hedged within a single-asset project-finance structure.

The product does not value incremental duration

The approximately eight-hour qualification threshold establishes a minimum physical capability, while the contract premium is principally determined by contracted MW. An eight-hour project and a 12-, 16-, or 24-hour project could therefore sell the same MW product without the longer-duration project receiving proportionate value for its additional stored energy.

This is likely to favour the lowest-cost technology capable of meeting the minimum threshold, weaken the investment case for additional energy capacity, and leave longer renewable shortfalls under-procured.

Commercial evaluation should recognise both:

- capacity, being the MW a project can provide; and
- endurance, being the period for which that output can be sustained during system stress.

Strategic reserve procurement may provide an additional pathway for capability beyond the standard firming duration, but it should complement rather than replace duration recognition in the core product. Reserve volumes, timing, locations, and contract terms remain uncertain and cannot be assumed to support financial close. Where a project provides both services, the arrangements must clearly allocate MW, MWh, state of charge, recharge rights, activation priority, and financial exposure.

Outage and tail exposure may undermine bankability

An outage coinciding with a scarcity event could leave the seller with a substantial naked financial position. Buying back that position may be prohibitively expensive, and market liquidity may be limited precisely when multiple participants are seeking cover.

For a limited-recourse LDES project, this exposure is likely to result in:

- larger reserve accounts and contingent facilities;
- lower debt capacity;
- more restrictive operating and state-of-charge covenants;
- higher required equity returns; and
- higher cap premiums.

Some tail exposures may remain outside lender and investor risk appetite regardless of the expected project return.

The bankability assessment should focus on revenue that lenders can recognise in debt sizing and downside cases. Merchant revenue below the strike may contribute to project economics, but it is not equivalent to contracted revenue and should not be assumed to offset an otherwise unmanageable liability.

The product should be tested against representative LDES projects

The investment case for a firming product was grounded in the need to bring forward long-duration storage, including pumped hydro and newer LDES technologies that face material contracting and financing barriers. These technologies are expected to provide sustained firming as variable renewable generation increases and conventional generation retires.

Hydrostor understands that gas eligibility was subsequently retained to ensure the reforms could operate across different regional resource mixes, including in Queensland. Gas should be accommodated within the product, but its inclusion should not displace long-duration storage as the starting point for contract design and modelling.

The current analysis begins principally with a gas turbine and asks whether other technologies can manage the resulting cap product. This risks embedding assumptions suited to fuel-based generation, including the ability to continue operating while fuel remains available, into a product intended to support finite-energy storage.

LDES has materially different investment and operating characteristics, including:

- high upfront capital expenditure;
- subsurface construction and development risk for technologies such as A-CAES and pumped hydro;
- a direct relationship between capital cost and storage duration;
- long development, construction, and commissioning periods;
- finite stored energy and the need to recharge;
- round-trip losses and auxiliary energy consumption; and
- asset lives extending materially beyond conventional contract terms.

A contract can be technology neutral in its drafting while remaining technology selective in its commercial outcome. If the standard product is designed around gas turbine economics and unlimited financial endurance, LDES may qualify formally but be unable to price or finance the resulting exposure.

Hydrostor recommends that the firming product first be designed and tested against representative LDES projects, including A-CAES, pumped hydro, and long-duration batteries at eight-hour, 12-hour, 24-hour, and multi-day durations. Gas generation should then be tested against the same structure to ensure that the product also accommodates regional firming requirements and different fuel-based technologies.

The modelling should assess:

- expected project economics;
- debt capacity and downside cash flows;
- outage and force majeure exposure;
- finite energy and recharge requirements;
- consecutive and back-to-back scarcity events;
- network and charging constraints; and
- the value and cost of additional duration.

The objective should be a firming contract designed to finance the long-duration capability that prompted the need for the product, while remaining sufficiently standardised and flexible to allow gas and other eligible technologies to compete.

Recommended amendments

Hydrostor recommends replacing the unlimited firming obligation with a standardised cap-hour budget aligned with the project's accredited duration.

For example, a 100 MW project accredited for eight hours would settle the cap for up to 800 MWh of qualifying intervals during a defined event. Once that budget was exhausted, the project's liability would cease until the contractual reset. This would preserve meaningful buyer protection while aligning financial exposure with the physical capability procured.

Additional endurance should be contracted through separately valued tranches, such as:

- a base tranche covering the first eight cap-hours;
- an extended tranche covering cap-hours 9–16; and
- a deep-duration tranche covering cap-hours 17–24 or beyond.

This structure would reveal and remunerate the value of additional duration rather than treating all projects that meet the minimum threshold as equivalent.

The final design should also:

- define when an event begins and ends, when non-consecutive high-price intervals form part of the same event, and when the cap-hour budget resets;
- establish minimum recharge periods and the treatment of back-to-back events;
- address circumstances in which charging or generation is prevented by network conditions, market intervention, or compulsory directions;
- apply a maximum annual or rolling liability per contracted MW;
- provide transparent volume-reduction, buyback, and close-out mechanisms;
- provide narrowly defined protection for uncontrollable events, including prolonged transmission outages, compulsory curtailment, market suspension, major casualty events, and specified changes in law; and
- allow sellers to nominate the proportion of project capacity subject to the cap.

Contract timing should accommodate long-lead-time projects

Hydrostor recognises the rationale for directing ESEM contracts principally to later project years, with commercial counterparties supporting the initial operating period. This approach is more challenging for capital-intensive LDES projects.

A long-lead-time project may need to secure early-years offtake five or more years before commercial operation. Lenders will also require revenue certainty from the commencement of operations, when completion risk and debt-service requirements are most material. A later-years ESEM contract may have limited value for financial close if the project must first secure a bankable early-years position that is not commercially available.

Implementation should therefore provide flexibility in:

- the first calculation period and contract commencement date;
- the duration of required commercial offtake;
- treatment of construction and commissioning delays;
- contract tenor; and
- the ability to sculpt premiums across the debt term.

Without this flexibility, the mechanism risks supporting projects that can already resolve their initial contracting gap, rather than enabling new entry by capital-intensive, long-lead-time LDES.

Conclusion

Hydrostor supports ASL's objective of developing standardised and tradable contracts that can mobilise new investment in shaping and firming capability. The shaping proposal provides a credible foundation for participation by A-CAES and other LDES technologies, provided the final arrangements are clear, predictable and capable of being combined with other revenue streams without duplicative exposure.

The proposed firming cap requires material amendment. Its financial obligation should be aligned with the physical capability being procured, additional duration should be valued explicitly, and tail risks should be bounded so that projects can be financed while buyers retain meaningful protection against high prices.

Hydrostor encourages ASL to undertake further modelling with representative LDES projects and to continue the co-design process with developers, buyers, lenders and investors before settling the final products. Hydrostor would welcome the opportunity to work with ASL and industry on the detailed design, modelling and implementation of these arrangements.