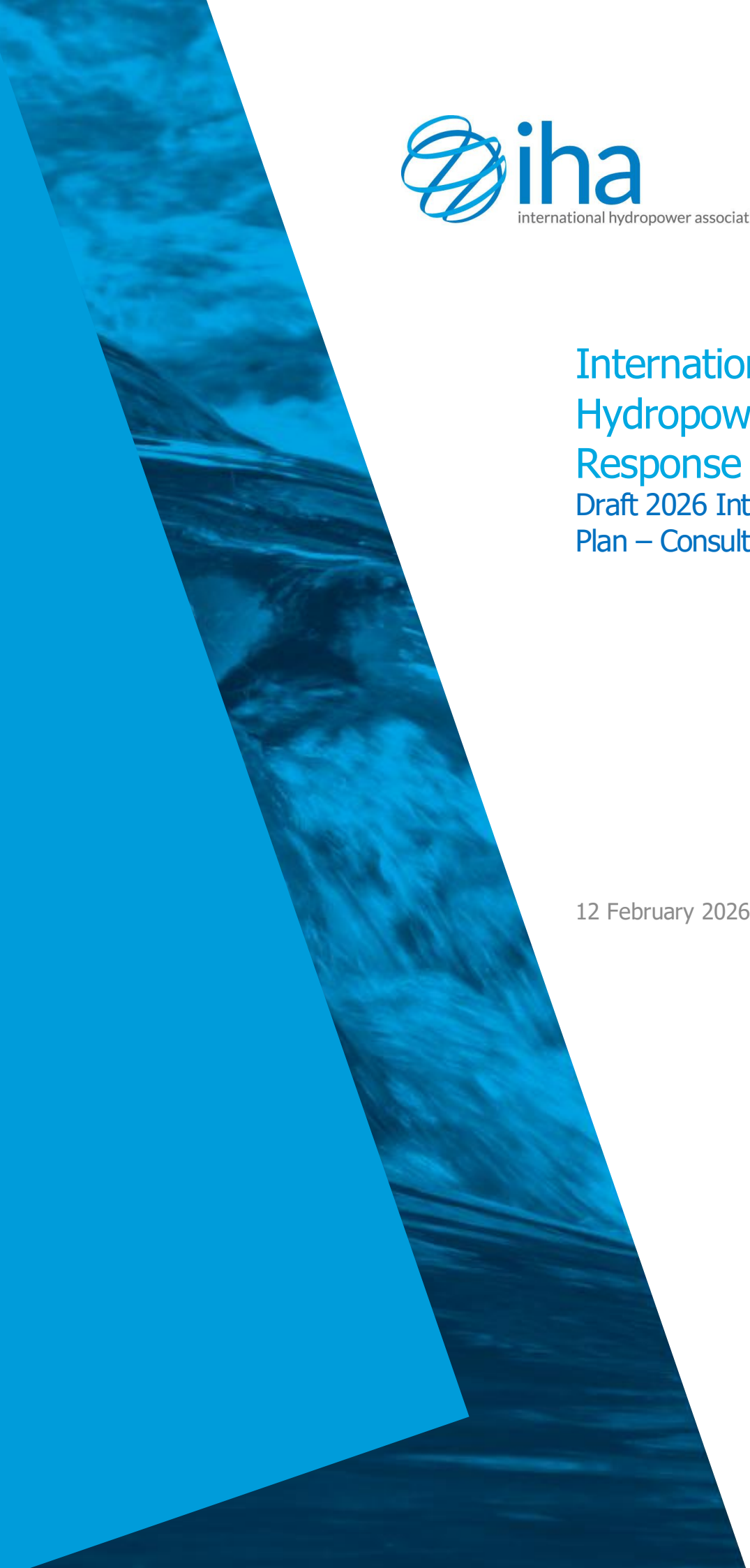

International Hydropower Association Response

Draft 2026 Integrated System Plan – Consultation

12 February 2026

Introduction

The International Hydropower Association (IHA) welcomes the opportunity to respond to the Australian Energy Market Operator's (AEMO) draft Integrated System Plan (ISP) 2026. As an industry that has supported Australia's electricity system for decades, we strongly endorse the ISP's central conclusion that renewables supported by storage and strengthened transmission is the least-cost path to 2050.

The IHA is the voice of sustainable hydropower. We are a non-profit membership organisation with members operating in over 120 countries. Our President, Malcolm Turnbull, this week convened almost 100 participants in Canberra to present recommendations on pumped storage to Hon Minister Chris Bowen and several other policymakers.

Australia's electricity system is entering a decisive decade. As coal and gas plants retire and renewables expand across the National Electricity Market (NEM), one question will define our energy future: can we keep the lights on when the wind doesn't blow, and the sun doesn't shine?

We welcome the draft 2026 ISP which clearly sets the scale of the task: storage must grow to 55 GW/618 GWh by 2050 to maintain reliable, affordable power. Meeting this target requires storage that can firm renewables for extended durations, not just during daily peaks. In this context, pumped storage – or 'water batteries' - will be indispensable, as they are:

- **Clean, green, mass-scale and affordable** - it is a zero emissions source of long duration (8 hours or more) firming, which is needed to maintain reliability during renewable lulls;
- **Provide generation for generation**s – Has a very long asset life, providing intergenerational benefits over its 50–100-year lifespan;
- **Energy security for Australia's future** – provides the critical system services and firmed energy delivery required to keep our grid stable: inertia, ramping, frequency control, rapid ramping, system strength, and black-start capability;
- **Energy sovereignty** – relies only on water and elevation, not complex international supply chains.

These attributes make hydropower a cornerstone of energy security, ensuring the system can ride through multiday periods of low wind and solar, avoid unserved energy, and stabilise prices in tight conditions. When integrated with variable wind and solar generation, which Australia already has in abundance, long-duration energy storage such as pumped storage enables continuous 24/7 carbon-free energy supply. Large-capacity storage is mission-critical for Australia's electrified future economy and for decarbonising existing industrial loads that require firm, around-the-clock power —including aluminium, steel, chemicals, and data centres.

The hydropower industry welcomed seeing that hydropower was strongly included in the draft ISP, especially to support VRE grids. Existing hydropower is an immense resource for the grid and has provided stable electricity for decades. While we do not expect new conventional hydropower to be built in Australia, the existing hydropower sites continue to be important assets to the NEM, as a backbone to the electricity grid. The Clean Energy Council has previously stated that "Hydropower is therefore central to NEM decarbonisation. Governments and policy makers must design markets and incentive mechanisms that properly reflect the full value that hydropower can provide." It is critical that the ISP continues to recognise the important role that existing hydropower plays and its continued importance to contribute to future NEM function.

To support the ISP's storage targets new pumped storage plants offer a compelling solution: they create jobs, provide cost-effective long-term energy storage, and work complementarily with chemical batteries by covering multi-day discharge periods and deep firming requirements beyond

typical battery duration. However, pumped storage is not being built at the pace and scale required. Without urgent targeted action to fix planning frameworks, market settings, approvals and investment risk, policy settings, Australia will fall short– risking higher prices, reduced reliability and delayed decarbonisation.

The International Hydropower Association (IHA) and its Australian members recently assessed the current barriers to the build-out of new pumped storage and provided recommendations to the Commonwealth Government that will deliver the pace and scale of projects needed to meet Australia's future energy needs. We are grateful for the opportunity to share these with AEMO and apply those most relevant to the draft ISP.

The following recommendations were made:

1. Embed long duration storage in national energy planning.
2. Reinforce market signals for long duration storage
3. Promote risk sharing investment models
4. Streamline approvals
5. Support early-stage development
6. Prioritise strategic infrastructure for national energy security

Where relevant we have expounded on them for the draft ISP response, as well as working with our members and the wider hydropower sector.

IHA Response

In reviewing the Draft ISP and responding to AEMO's consultation questions, the hydropower sector emphasises the Recommendation 1, 2, and 6 from our "Energy Secure Australia" publication which will be essential for aligning the draft ISP with real-world investment conditions, system needs, and long-duration reliability requirements.

Recommendation 1 — Embed long duration storage in national energy planning.

AEMO's draft ISP correctly recognises the irreplaceable contribution of hydropower to system security, seasonal balancing and reliability, especially during renewable droughts. The ISP draft notes that hydropower firms renewables through long periods without sun or wind, conditions, particularly winter, and support reliability across days, weeks and seasons.

As an industry, we emphasise:

- The NEM's existing 7 GW of hydropower will be relied upon more heavily as coal exits. These assets deliver inertia, vital system strength and deep-duration balancing at lower system cost than alternatives.
- Many hydropower plants are decades old and require significant reinvestment, yet remain least-cost long-duration assets in the NEM.
- Future pumped storage hydropower is also recognised in the draft ISP, and industry strongly supports this continued acknowledgment; however, we would note there has been significant change in the
- Hydropower must remain central to the development path outlined in the ISP, especially as huge amounts of VRE enters the market – the ISP should strengthen its considerations for reliability (firming).

Pumped storage projects are forever assets when completed but have been poorly served by system planning frameworks and market signals that reward immediate returns over long-term

security. Long-term system planning should recognise the importance of long-duration storage in managing multi-day and seasonal reliability risks, and that pumped storage projects are intergenerational grid insurance assets.

Recommended actions:

- Work with states to adopt clear targets for long duration storage across the NEM, allowing these projects to be included in the ISP and other forecasting and system planning and procurement processes.
- Support long-duration storage as 8+ hours in planning requirements and deep storage as 24+ hours in planning requirements.

The ISP is a critical tool that directly influences state planning, and vice versa, creating a circular reference of sorts. By having a clear national and/or state assessment of long duration energy storage across the NEM, this will identify the gap that exists to firm renewables and support existing as well as future generation. Analysis performed by the Australia National University has demonstrated a clear need for long duration storage, especially as coal and gas exits.

Standard economic analysis struggles to properly value pumped hydro infrastructure that delivers benefits over many decades. Discounting methods sharply reduce the long-term benefits of the infrastructure, understating the enduring contribution of these assets.

The points made in the draft ISP on least-cost modelling are well noted; however, this can produce outcomes such as the overbuild of VRE as a way to avoid further investment in capacity or transmission. AEMO should continue to evaluate if this modelling approach provides the best information for decision makers for long duration storage. Furthermore, AEMO should develop tailored cost-benefit appraisal approaches for pumped storage that recognise the intergenerational benefits of these long- lived assets and use those approaches to work with states to embed long duration storage in electricity sector targets and system planning processes.

Recommendation 2 — Reinforce market signals for long duration storage

By the mid-2030s, around 20 GW of coal capacity will retire, removing a major source of dispatchable power. Pumped storage can fill the hole left by coal. However, without clear market signals, investment in long duration storage will lag, increasing pressure on gas supplies and risking higher consumer prices. At present:

- Long-duration storage (beyond 8 hours) is not commercially viable under current settings largely due to existing coal plants masking the future need for firming and storage[1];
- Hydropower refurbishment requires steady long-term signals; and
- Pumped storage development relies on early-works support and risk-sharing in many jurisdictions.

To support the above issues, the NEM Wholesale Market Settings Review includes the new Electricity Services Entry Mechanism (ESEM) to overcome the investment barriers faced by new projects, which should be tailored to recognise what pumped storage uniquely delivers. We hope that this mechanism will support the ambitions of the draft ISP.

The ISP rightly identifies the need for a mix of shallow, medium and deep storage. However, current market settings—including the Cumulative Price Threshold equating to ~8 hours of Market

[1] "Incomplete markets, pumped hydro storage and the role of policy in Australia's national electricity market", Simshauser P.; Gohdes, N.; *Energy Policy,* Vol 204, (2025)

Price Cap exposure—do not support investment in storage durations beyond ~8 hours. This limits investor appetite for medium (4–12 h) and deep (>12 h) storage despite their system value. As an international body, we see the need for system planners to consider deep storage increasing around the world, especially considering gas closure and inertia and frequency services playing vital roles to support oscillations in grid frequency. Hydropower, and pumped storage, can provide ancillary service benefits, and are some of the few technologies with deep storage capabilities essential for black start, as well as dunkelflaute periods.

Recommended actions

- Work with states to determine and publish out of market strategic reserve requirements to respond to high-impact low probability events. The Draft ISP assumes development of 12-hour storages despite no market incentive for such durations today. This is something that has been discussed as part of the Wholesale Market Framework Review, as Reserve capacity and should be explored further.
- Work with AEMO and transmission providers to determine and publish detailed essential system services requirements to maintain grid security and stability.
- Pumped storage projects cannot currently recover costs under existing market structures. The ISP should distinguish clearly between:
    - Commercially feasible durations under today's market design, and
    - System-optimal durations in the least-cost plan that looks to the future of deep storage.
- Support additional states in enabling long-term contracts for pumped storage, e.g. NSW Long Term Energy Service Agreement (LTESA).

We believe the ISP's breakdown of Shallow, Medium and Deep storage should be better aligned with the current market settings. This would better communicate the storage needs that are likely to be commercialised in the NEM.

While separate from the draft ISP, the ESEM will be used for states to support the generation; however, this depends on them identifying a need for pumped hydro, and including it in an auction. Therefore, the previous point on a clear target of long duration storage will be vital to ensuring that pumped hydropower is included in the new market mechanism. The ESEM framework has the potential to promote significant investment to meet long duration storage targets but needs states to highlight storage and flexibility targets, hence the significant importance of the draft ISP on state-based initiatives.

Pumped storage also has the potential to provide multiple ESEM services, including shaping, firming, strategic reserves and essential system services. Early decision making and publication of strategic reserve and essential system services requirements would allow projects to stack multiple revenue streams to support commercial viability, and increase confidence in, and the competitiveness of, tender processes The industry looks forward working to support a reserve market. This clarification will strengthen the ISP's credibility and highlights where complementary market reforms—such as those raised in the Nelson market settings review—may be required in the future.

Lastly, the LTESA while currently only an instrument for NSW was met with great excitement by the hydropower industry as a key to unlock revenue visibility for pumped storage; however, only one pumped storage project has been awarded a tender following six auctions. The industry welcomes the opportunity to work with AEMO Services to create a pumped storage specific tender, and/or mechanical storage tender, that recognises the distinct challenges facing these projects. Given AEMO Services is currently reviewing a hybrid Generation LTESA tender, a specific pumped

storage LTESA tender would be welcome to support the necessary ambitions of the draft ISP. This could be then utilised by other states in the NEM.

Recommendation 6 - Prioritise strategic infrastructure for national energy security

The NEM Wholesale Market Settings Review noted that "strategic and bulk energy services that can be shared across regions" are vital. Transmission is the means to unlock pumped storage's national system value, rather than treating assets as state-based resources.

Recommended action:

- Ensure transmission planning accounts for pumped storage's role in strengthening resilience and supporting renewable integration, so firm capacity can flow across regions: maintaining Australia's energy security.

Deliberate coordination of network infrastructure with the location and scale of generation and storage will be crucial to ensuring consumers share the value of deep storage in the system. As governments reconsider and adjust network planning responsibilities and methodologies at national and state levels, it is important that this coordination is front of mind to manage system reliability, security and affordability as coal-fired power stations close.

While we understand the preference to utilise existing infrastructure, e.g., via Power Flow control option, this will significantly impact pumped storage ability to support Sydney's transmission infrastructure. If built in a timely manner, the 500kV option provides the hosting capacity required to utilise the gigawatts of firming power from Snowy 2.0 and incoming VNI West flows; whereas, the Power Flow Control option risks creating a premature bottleneck at Bannaby that will constrain renewable dispatch and threaten the reliability of supply to Sydney.

Industry has highlighted to us that the delay to the Sydney South Ring transmission (2037-38) will cause significant bottlenecks to transmission in South Sydney, constrain generation, including critical exports from Snowy 2.0 and any new renewable capacity that access Humelink. Our concern is that it risks load shedding in Sydney. Pumped hydropower is a grid insurance asset but can only provide this insurance against load shedding and blackouts if connected in a timely manner.

Interconnection is vital to enabling least-cost sharing of renewable resources, firming capacity and reserves across regions, particularly as thermal plants retire. Interconnection projects identified in the ISP allow pumped hydro resources to provide firm capacity where needed if built in a timely manner. However, without these links, Australia risks higher costs and reduced reliability during prolonged low wind/ solar periods, undermining national energy security. Therefore, transmission coordination is pivotal to energy security: interconnectors and intrastate reinforcements ensure pumped hydro can move firm capacity to the right place at the right time, keeping the system reliable.

Additional information – modelling and services:

It is vital that the ISP fully captures the potential of long-duration pumped storage. We further appreciate the ISP adjusting its approach from a technology agnostic to that of valuing the WACC. The recent draft GenCost report, we noted that pumped storage is effectively cheaper than batteries, especially at longer durations.

Snowy 2.0's 160-hour duration dwarfs the ISP's deep-storage category (<16 GWh). However, there is still immense additional potential across Australia, with more than 20-30 projects which could be actively considered as well as NEM-connected states having >250,000 GWh of pumped storage potential.

Recent analysis performed by ANU found that a 100% renewable NEM supported by large-scale pumped storage is reliable and has similar system cost to a gas-dependent alternative[2]. The analysis further noted that gas turbines face doubling of costs and 7–8-year delays, adding reliability risk when long-duration storage is the more resilient alternative.

Given these findings, the hydropower industry encourages AEMO to revisit:

- the modelling envelope for long-duration pumped storage;
- the assumed cost and scale parameters;
- the simplified representation of long-duration storage in ISP modelling;

This will future-proof ISP insights and better reflect emerging pumped hydro economics.

It is important that government plan for reliability as consumers ultimately pay for grid firming. Support mechanisms must value pumped storage during high- impact events and optimise assets through forecasting to ensure grid security.

Electricity System Services and how pumped storage supports Australia's grid:

ESEM Service	Pumped Hydro Capability	Why Pumped Hydro Is Well Suited to provide services in all ESEM categories
Shaping	✓✓✓	Large MWh storage, flexible charging/discharging, high efficiency over daily–weekly cycles
Firming	✓✓✓	Can deliver sustained output for days to weeks, directly replacing coal reliability
Strategic Reserves	✓✓✓	Very large energy volumes, low utilisation tolerance, high reliability for extreme events
Essential System Service	✓✓✓	Provides inertia, fast ramp rates fault current, voltage support inherently as synchronous plant. Pumped storage's provides reactive power which strengthens electricity systems in regions with high variable renewable energy penetration.
Long Term Reliability / Tenor Support	✓✓✓	50–100-year asset life aligns strongly with long-term contracting and intergenerational value
Zero- Emissions Overlay	✓✓✓	Mature, proven, zero-emissions firming at scale with strong policy alignment
Black start (system restart)	✓✓✓	Pumped storage plants are uniquely placed to support in the event of grid failures.

Conclusion

As a hydropower industry body, we strongly support the Draft ISP's direction and AEMO's scenario-based, least-cost approach. Our recommendations aim to strengthen the ISP's alignment with:

- real-world investment signals
- system-wide reliability needs

[2]"Replacing Gas with Low-cost, Abundant Long-duration Pumped Hydro in Electricity Systems", Weber, T.; Cheng, C.; Thawley, H.; Catchpole, K.; Blakers, A.; Lu, B.; Zhao, J.; and Nadolny, A.(2025), https://arxiv.org/abs/2512.20286.

- proven long-duration storage capabilities
- practical VRE-firming dependencies
- and ensuring strategic infrastructure for national energy security.

Hydropower—both existing and new pumped hydro—will remain a cornerstone of Australia's clean, reliable, least-cost electricity system. The industry looks forward to continued collaboration with AEMO as the Final 2026 ISP is developed.