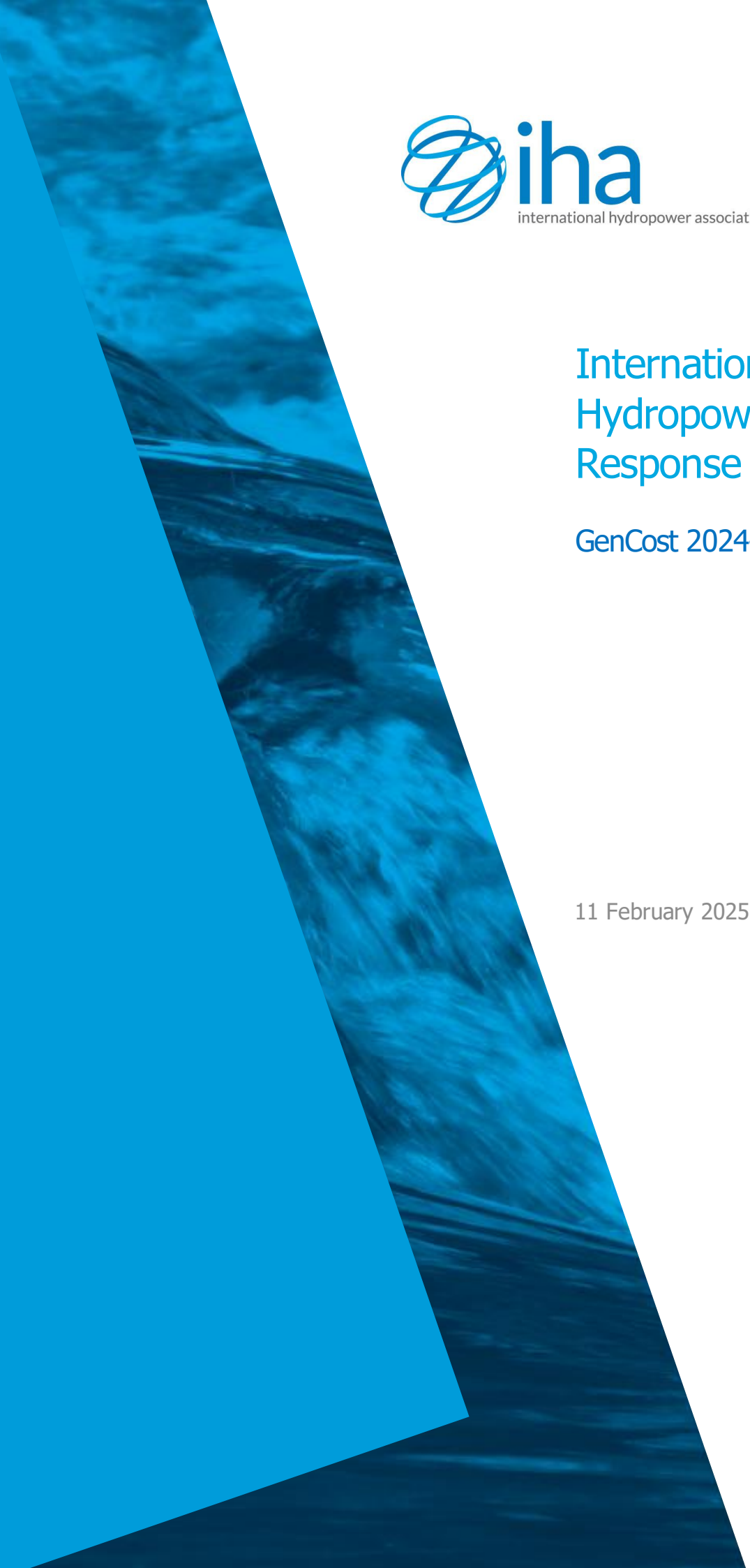


International Hydropower Association Response

GenCost 2024-25 Consultation

11 February 2025

FORECASTING AND PLANNING
Australia Energy Market Operator,

TO WHOM IT MAY CONCERN:

The International Hydropower Association welcomes the opportunity to respond to the timely consultation on the GenCost draft report from Australia's Commonwealth Scientific and Industrial Research Organisation (CSIRO) and Australian Energy Market Operator (AEMO). As the GenCost report covers many technologies, we are only focussing on the aspects that relate to the hydropower and pumped storage technologies.

The International Hydropower Association (IHA) is the voice of sustainable hydropower. We are a non-profit membership organisation with 100 members operating in over 120 countries who operate over a third of the installed global hydropower capacity. Members also include many of the hydropower supply chain which provide a significant proportion of the skill-base that undertakes the studies and delivers the project designs that the GenCost is based on.

As part of our activities to prepare a response to the draft report, we consulted with our global pumped storage hydropower working group, discussed in a meeting with our Australian members, and circulated our response for direct feedback and inputs.

No project or site is the same

All hydropower and pumped storage projects will be based on numerous assessments for the feasibility across environmental and techno-economic considerations. Costs vary greatly between sites, similar to any other type of large-scale infrastructure project.

As part of IHA's recent activities, with members and wider industry we consulted globally to ascertain what measures might be taken to reduce cost and schedule overrun. This resulted in the "Guidance note for key decision makers to de-risk pumped storage investments," which notes that "each project will face its own unique challenges, for which there will be project specific solutions." Therefore, to tar all projects as having the same high costs does not reflect the reality of what is done in practice. The industry working group, which included Australian stakeholders, noted the importance of de-risking for the project, rather than for one party. In particular, the first recommendation of project development is to focus investment on activities that actively de-risk the project: The greater the investment, the greater the confidence of overall project success.

As all pumped storage projects are unique large-scale infrastructure investments, projects will have varying costs for each element. For example, the indirect costs of having materials and labour flown to remote areas can add to project CAPEX. We would encourage all stakeholders to promote sustainable hydropower that has minimal impact and select pumped hydro sites that seek to ultimately reduce cost overrun where possible.

10-hour pumped storage methodology

Since the draft GenCost report was released, the IHA has had many of its members raise concerns with the costs attributed to pumped storage hydropower (PSH), advising IHA that there are figures presented in the report that are not reflective of the current industry understanding of PSH scheme costs, nor representative of the projects being developed by its members. The major concern raised by IHA members relates to the cost estimates of the example 10-hour, 500MW pumped hydro project. This concern is exemplified by Figure 3-3 from the report as extracted below:

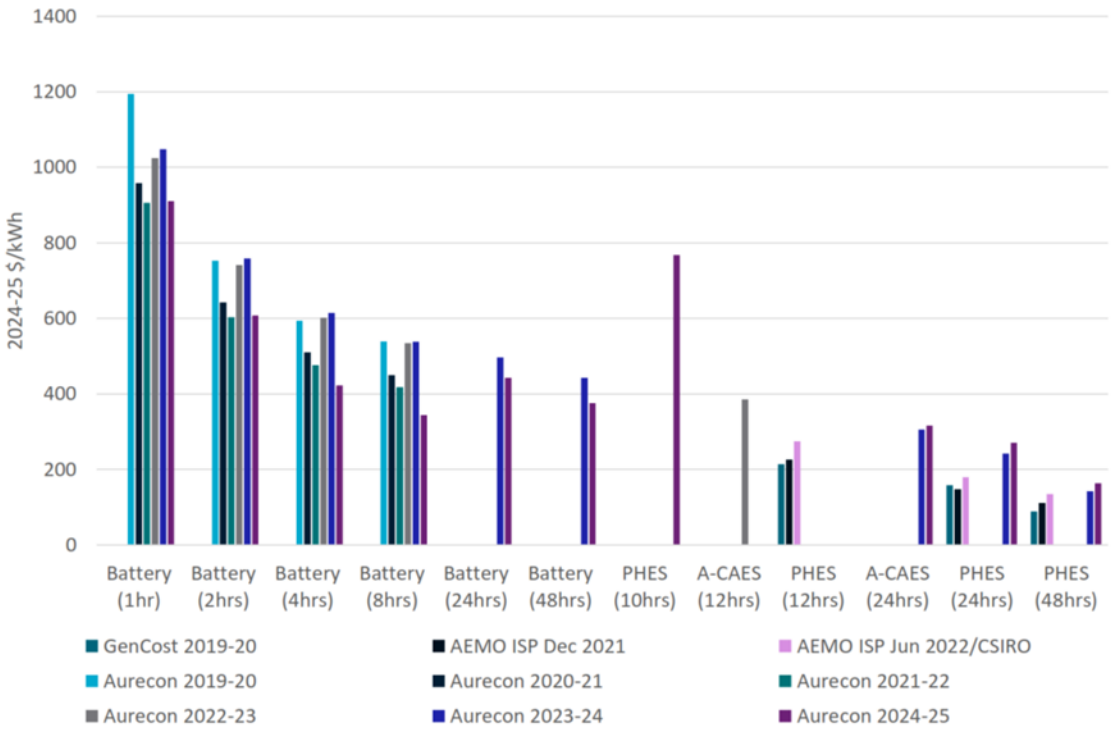
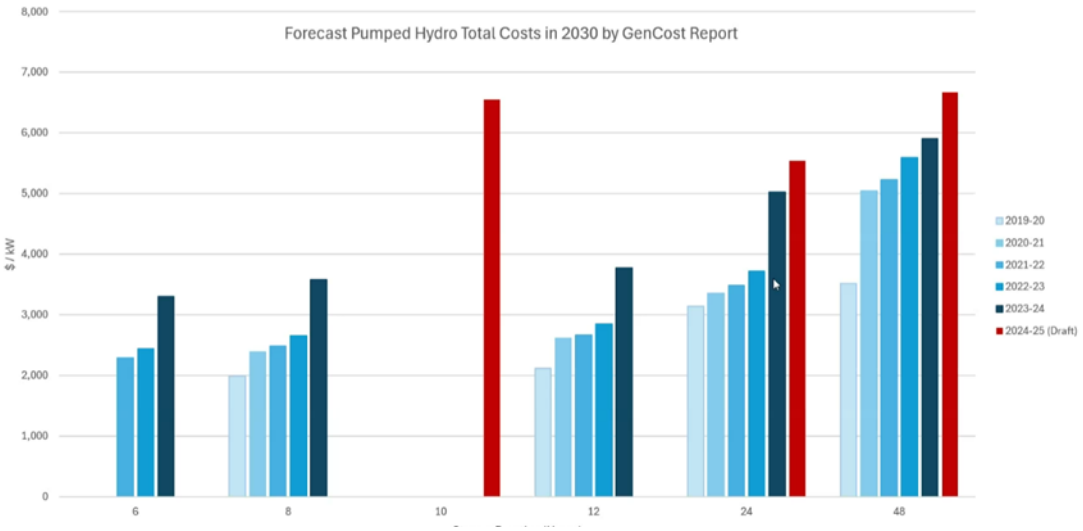


Figure 3-3 Capital costs of storage technologies in $/kWh (total cost basis)

We note that the cost of the 10-hours of pumped storage appears strongly as an outlier on this graph. Furthermore, if this graph was changed from a $/kWh to $/kW, it would infer that a 10-hour project is more expensive per kW to build than a 24-hour project, and in the same cost vicinity as a 48-hour project. The below graph illustrates this, plotting the 2030 pumped hydro cost estimates from the last six GenCost reports. Comparing GenCost report estimates for the same year (2030 in this instance) clearly depicts the very large anomaly found in the latest estimates.



IHA queries the number of datapoints that have been used in the assessment of the 10-hour PHES costs, as such a strong outlier suggests a very limited dataset that is likely sourced from projects that are either non-optimally sited, first industry movers or have experienced unnecessary cost overruns during construction. If so, these should not be used to represent the rest of the industry and the many high-quality projects being developed by IHA members in Australia and globally.

IHA is unable to ascertain what assumptions, and which projects have been utilised in the assessment of the 10-hour pumped hydro project capital costs and recommends that these figures be reviewed in detail and that the industry would benefit from detailed clarification on the methodology utilised.

As currently drafted, the high costs of 10-hours of pumped storage will directly have negative implications for the hydropower industry in Australia. The potential adoption of these figures in the Integrated System Plan will undoubtedly impact on government and policy support for pumped hydro which the IHA sees as an important technology to provide much-needed long-duration energy storage, both in the short term during the Australian energy transition and, due to the long project lifetimes, in the long term into the distant future.

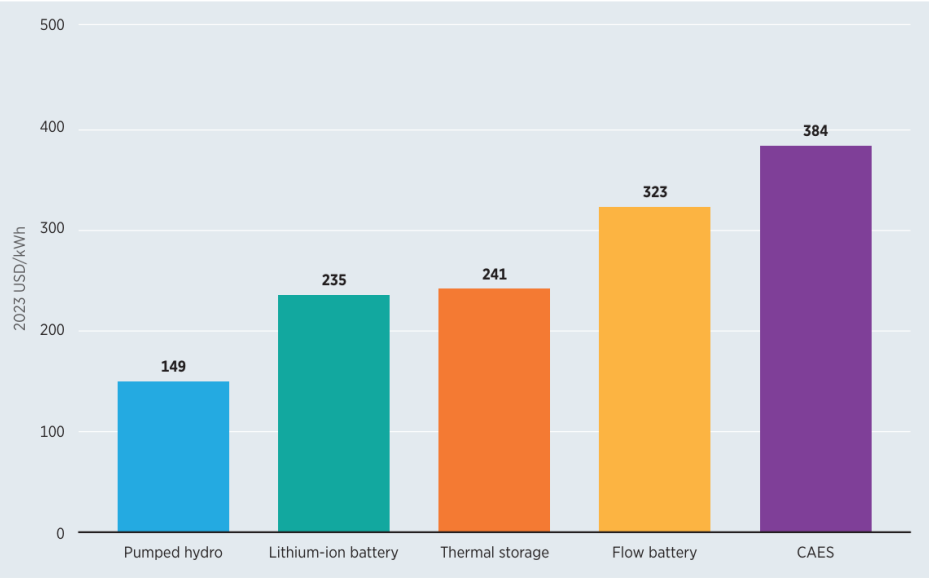
In summary, as no pumped hydro project or site is the same, the IHA and its members have concerns about the implications of the 10-hour pumped hydro costs in the GenCost report being representative of expensive, or suboptimal pumped hydro schemes. If these figures are then utilised by governments, consultants and energy market modellers, this will have an adverse effect on the viability of taking medium to long duration pumped hydro projects to FID in Australia, affecting the industry as a whole.

Comparing prices globally:

When looking into a breakdown of the costs for global pumped storage figures, the figures included in the overall CSIRO GenCost 2024-25 Draft report for 10-hours of pumped storage appear significantly higher than those from the IRENA Renewable Energy Costs Report from 2024. While the resources used for Australian projects will be local, the resource and supply chain are global, so we would consider that the global price should hold some weight, especially when considering the below is for 6-hour duration.

> Using the available cost data for LDES from 129 projects with storage durations above 6 hours – combined with a number of secondary data sources – the average price per technology can be seen in Figure 6.7 below. Pumped storage is still the most competitive, with a global average installed cost of USD 149/kWh.

Figure 6.7 LDES global average cost per technology



Source: AURORA(2022, 2023); BNEF (2024b); DESNZ (2023).
Note: CAES = Compressed Air Energy Storage; kWh = kilowatt hour.

Disagreement on development costs:

Concerns have been raised by IHA members regarding the assumed AUD200-400 million in land and development costs for a 500MW, 10 hour pumped hydro project as asserted in the *2024 Energy Technology Cost and Technical Parameter Review*.

From speaking with industry, this range is well beyond what private sector developers are currently developing for similar projects, and well beyond what would be palatable for them. It is unclear what cost assumptions are at the core of this range, so IHA recommends that this be reviewed to better align with the current industry practices.

New Methodology

IHA assumes that a new methodology of assessing pumped hydro costs has been implemented to arrive at such differing cost estimates from previous GenCost reports. IHA and its members seek to better understand this methodology and the core assumptions and evidence that underpin this latest update.

When consulting with the Australian hydropower sector, there were great concerns around all 8-12-hour projects in the industry only being represented by a single, 10-hour cost estimate data point in a table. Furthermore, that it was unclear whether the 10-hour figure represented an average or one project.

As stated at the start of this submission, hydropower and pumped storage projects have site specific elements that mean that each project will have unique pricing. Electing one data point, that is widely considered by the industry to be excessively high, and have it be representative of all pumped storage projects for that duration will have negative impacts on the Australian hydropower industry. The IHA would encourage the GenCost report to review whether it is including unrealistic or unviable pumped hydro projects or assumptions in its data set. As examples, this may include developments that are no longer progressing due to being financially unfeasible, first industry movers, projects that have received significant government support, and projects with cost overruns that wouldn't be implemented today at their now-known price points.

The IHA also recommends using a sliding scale, or a range, for the potential cost of pumped hydro projects. Given the wide range of potential project capital costs, it would be most reasonable to estimate that projects at the lower end of the capital cost scale are the most suitable to represent optimal pumped hydro sites that can, and should, be delivered into the system.

Conclusions

The IHA appreciates the opportunity to provide feedback on the draft GenCost report and its treatment of pumped storage costs. As outlined in this submission, the assumptions and methodologies used in the report raise significant concerns among our members and industry stakeholders, particularly regarding the representation of 10-hour pumped hydro costs. And further that no 8-hour storage costs were shown, despite there being a major group of projects being developed with that duration. The reliance on potentially unrepresentative data points risks distorting perceptions of project feasibility, investment attractiveness, and the role of pumped hydro in Australia's energy transition.

Given the importance of long-duration energy storage for grid reliability and decarbonisation, it is crucial that cost estimates accurately reflect industry experience, global benchmarks, and the real-world diversity of project conditions. We strongly encourage a reassessment of the methodology, a review of cost assumptions, and greater transparency in data selection. A more nuanced approach that provides more weighting to optimally developed projects would deliver a more accurate basis for policy and investment decisions.

IHA and its members remain committed to supporting the development of pumped storage as a critical enabler of Australia's clean energy future. We welcome further engagement with the CSIRO

to refine these estimates and ensure they contribute constructively to energy planning and market confidence.

As part of AEMO's wider consultations on Inputs and Market Scenarios, we would encourage any electricity system modelling that is undertaken to consider additional capabilities that an asset like pumped storage be assessed on. This process should use a comprehensive set of parameters, including not only the storage capacity, but also improved flexibility and dispatchability of the asset. The project XFLEX HYDRO has created a comprehensive list of parameters to be used in order to judge the flexibility of an asset. Additional information about these parameters can be found using the following link (Page 12, section 1.3): XFLEX HYDRO final White Paper.

We look forward to supporting the CSIRO and AEMO in their ongoing analysis and reporting on the Australian electricity industry. The hydropower sector stands ready to support through existing assets, as well as the development of new pumped storage projects to support both electricity and water storage for Australian citizens.

Yours sincerely,

International Hydropower Association

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About IHA

The International Hydropower Association (IHA) is the voice of sustainable hydropower. We are a non-profit membership organisation with 100 members operating in over 120 countries who operate over a third of the installed global hydropower capacity.

Our mission is to advance sustainable hydropower by building and sharing knowledge on its role in renewable energy systems, responsible freshwater management and climate change solutions. We achieve this through research and policy initiatives and championing sustainable good practices. We provide information and guidance to decision-makers and practitioners. Our in-house experts provide regular, exclusive briefings on news developments, sector trends and international good practices.

We monitor sector developments and maintain a global hydropower database.

International Forum on Pumped Storage Hydropower

Pumped storage hydropower (PSH) is the largest form of installed flexibility, with nearly 180GW reported globally in 2023 and many governments setting targets for quantities to support their renewable energy targets in line with Net Zero. However, there have been limited to no developments of PSH in liberalised electricity markets in the past 40 years, and this is because development is best sustained through a revenue stabilisation mechanism that ensures long-term revenue visibility.

To address the lack of development of PSH, the International Forum on Pumped Storage Hydropower (IFPSH) was launched in 2020, jointly chaired by the Kelly Speakes-Bachman, U.S. Principal Deputy Assistant Secretary at Department of Energy and Former Prime Minister of Australia, Malcolm Turnbull. The Forum was a multi-stakeholder platform that brought together expertise from governments, the hydropower industry, financial institutions, academia and NGOs to shape and enhance the role of pumped storage in future power systems.

The IHA acted as Secretariat to the International Forum and its three working groups. These working groups were: Sustainability; Capabilities and Costs, and Innovations; and Policy and Markets. Each working group had multiple outputs, including for the Policy and Markets a General paper and Country specific papers, including one for Australia.

For the Policy and Markets Working Group, it identified critical barriers to the deployment of pumped storage hydropower, which included some of those listed by DESNZ in its consultation on LDES.

Following on from this work, IHA has now established the Global Alliance for Pumped Storage (GAPS) to continue this work. In particular, it is coordinating governmental input to the International Forum on Pumped Storage being held in Paris in September 2025. This event will convene the global industry, governments and NGOs to drive forward the implementation of this key technology.

Other supporting activities

More recently, IHA has established a Working Group to coordinate the development and delivery of pumped storage hydropower. The purpose of the working group was initially to draft guidance for new market entrants considering development of pumped storage hydropower. The Guidance Note was published in July 2024 and includes good practice principles to apply across the development phases of a PSH asset. We would strongly recommend any persons entering into pumped storage to review the Guidance Note to Enable de-risking of pumped storage projects. The working group behind the Guidance Note consisted of many Australian stakeholders who were seeking to address lowering development expenditure on projects to ensure smooth delivery.

IHA has recently published a Pumped Storage Policy Toolkit which includes six recommendations for policymakers to support pumped storage:

- Determine how much LDES is needed
- Identify appropriate sites
- Develop fit-for purpose permitting procedures
- Implement revenue visibility over a long period
- Design electricity markets
- Pay for ancillary services

In addition, IHA has supported the development of the Hydropower Sustainability Alliance (HSA), which acts as the Secretariat for the international Hydropower Sustainability Standard. The Standard is a robust assessment and certification framework that ensures accountability and assurance in hydropower development. While IHA and HSA are separate entities, IHA encourages all members to have their projects certified to demonstrate international good practice.