The global voice of sustainable hydropower

iha
international hydropower association

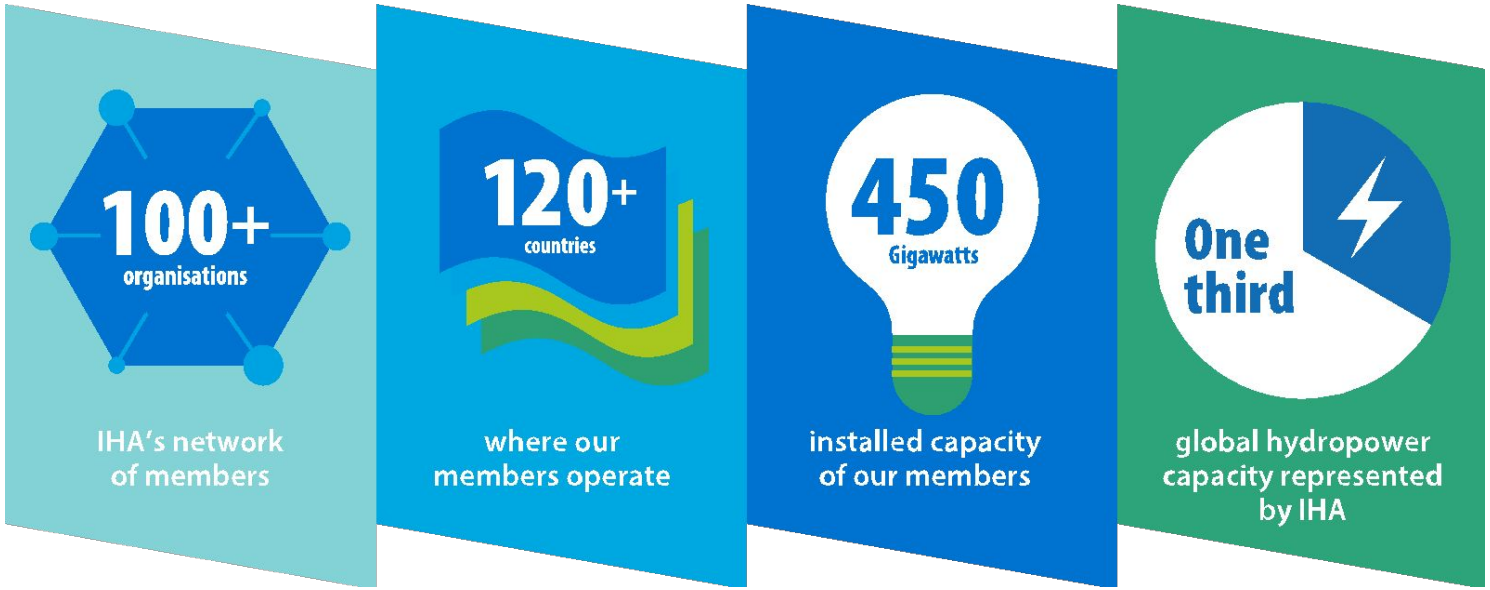
hydropower.org

Policy Tools to support Pumped Storage Hydropower

5 June 2025
Asia Clean Energy Forum, Manila

IHA is an evidence and values-based advocacy organisation

The International Hydropower Association (IHA) is the global voice of sustainable hydropower. It is a non-profit values-based membership association.
IHA members are committed to the responsible and sustainable development and operation of hydropower.



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IHA Members

Operating in more than 120 countries, IHA's members include the world's leading utilities and IPPs, OEMs, EPC contractors and consultancies.

IHA represents 100+ organisations committed to the responsible and sustainable development and operation of hydropower.

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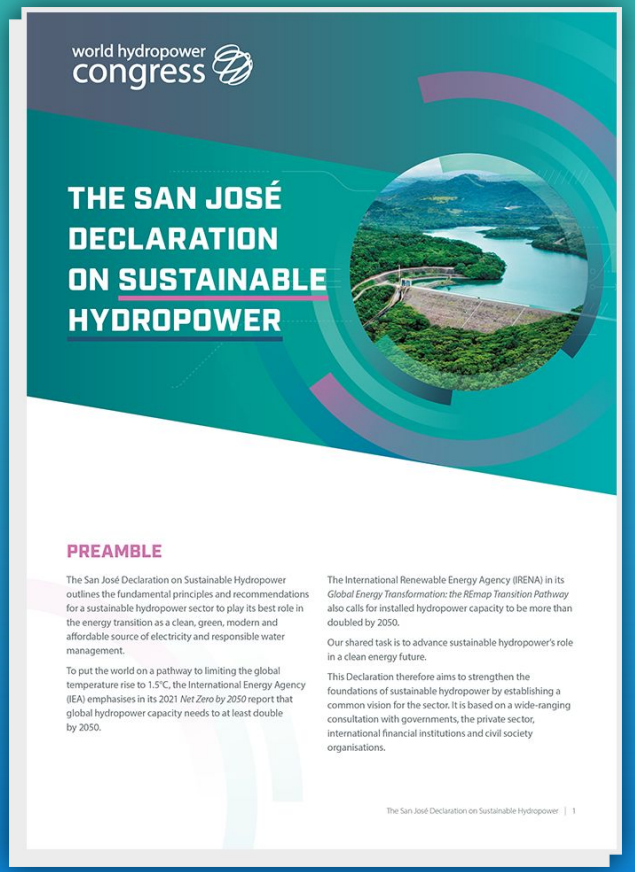
IHA priorities

"Sustainable hydropower is a clean, green, modern and affordable solution to climate change. Going forward, the only acceptable hydropower is sustainable hydropower ."

The San José Declaration on Sustainable Hydropower

- **Global Communications and Advocacy**
- **Advancing pumped storage**
- **Making the most of existing infrastructure**
- **A thriving hydropower sustainability standard**
- **Improving the investment climate**



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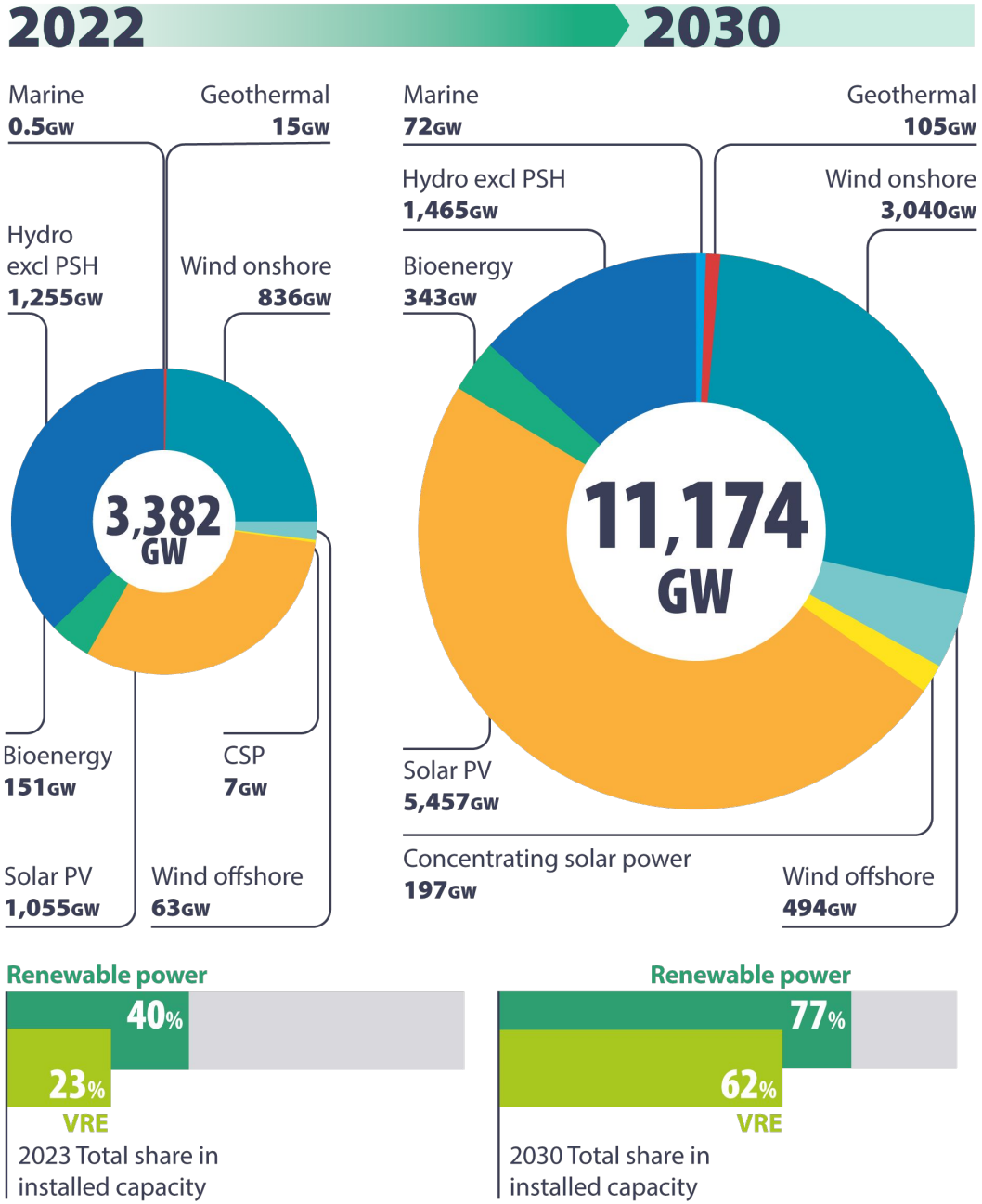
VRE drives the need for PSH

World leaders at COP28 in Dubai committed to "tripling up" the world's renewable generation capacity from 3.8TW in 2022 to 11.2TW in 2030.

This will require a massive upscaling of variable renewable energy (VRE), especially wind and solar.

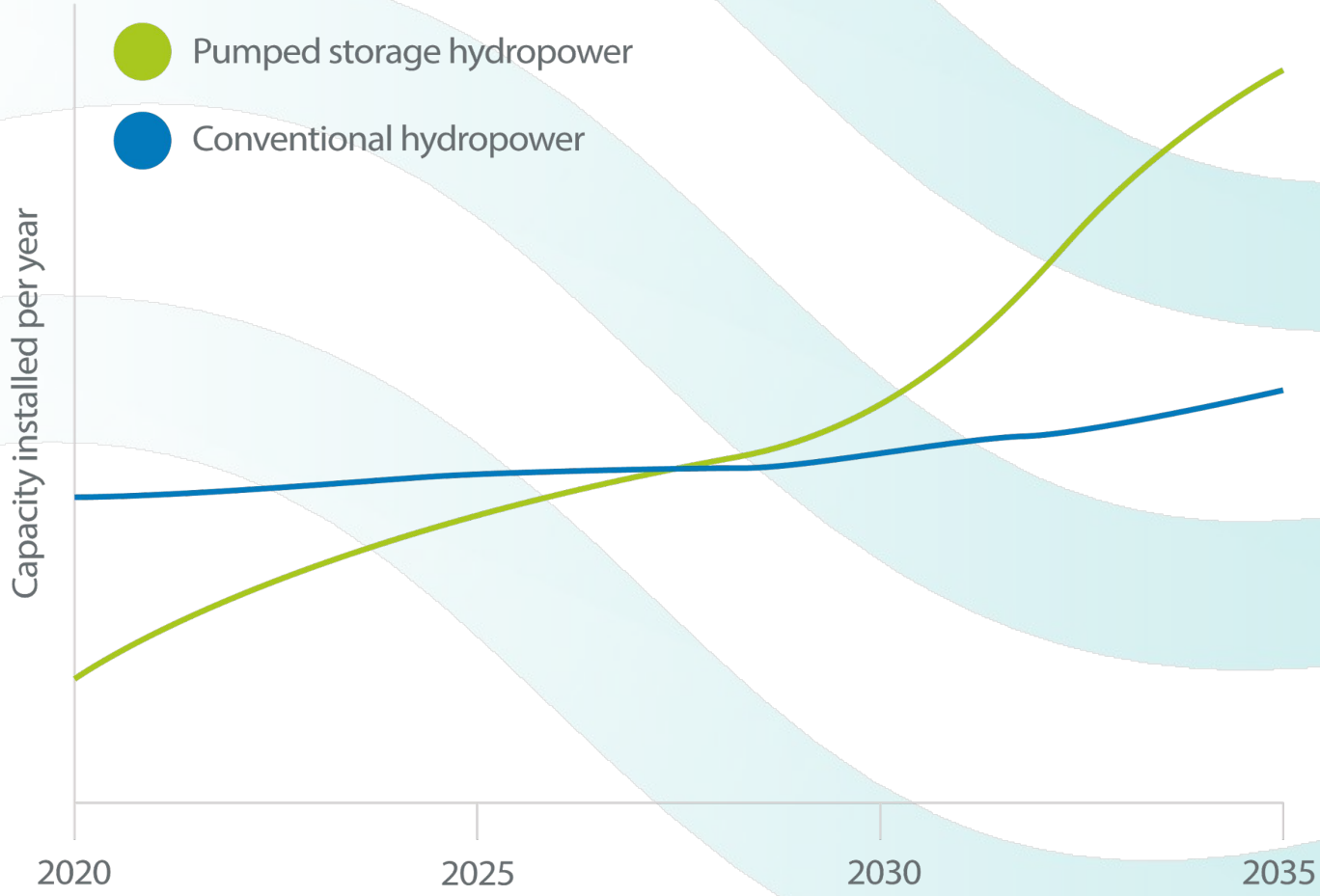
Pumped Storage is the only mature long-duration storage technology that can provide the flexibility and resilience needed at scale to support this growth.

Meeting this target and net zero by the middle of this century will require PSH to grow substantially from the 180GW installed at the end of 2023.

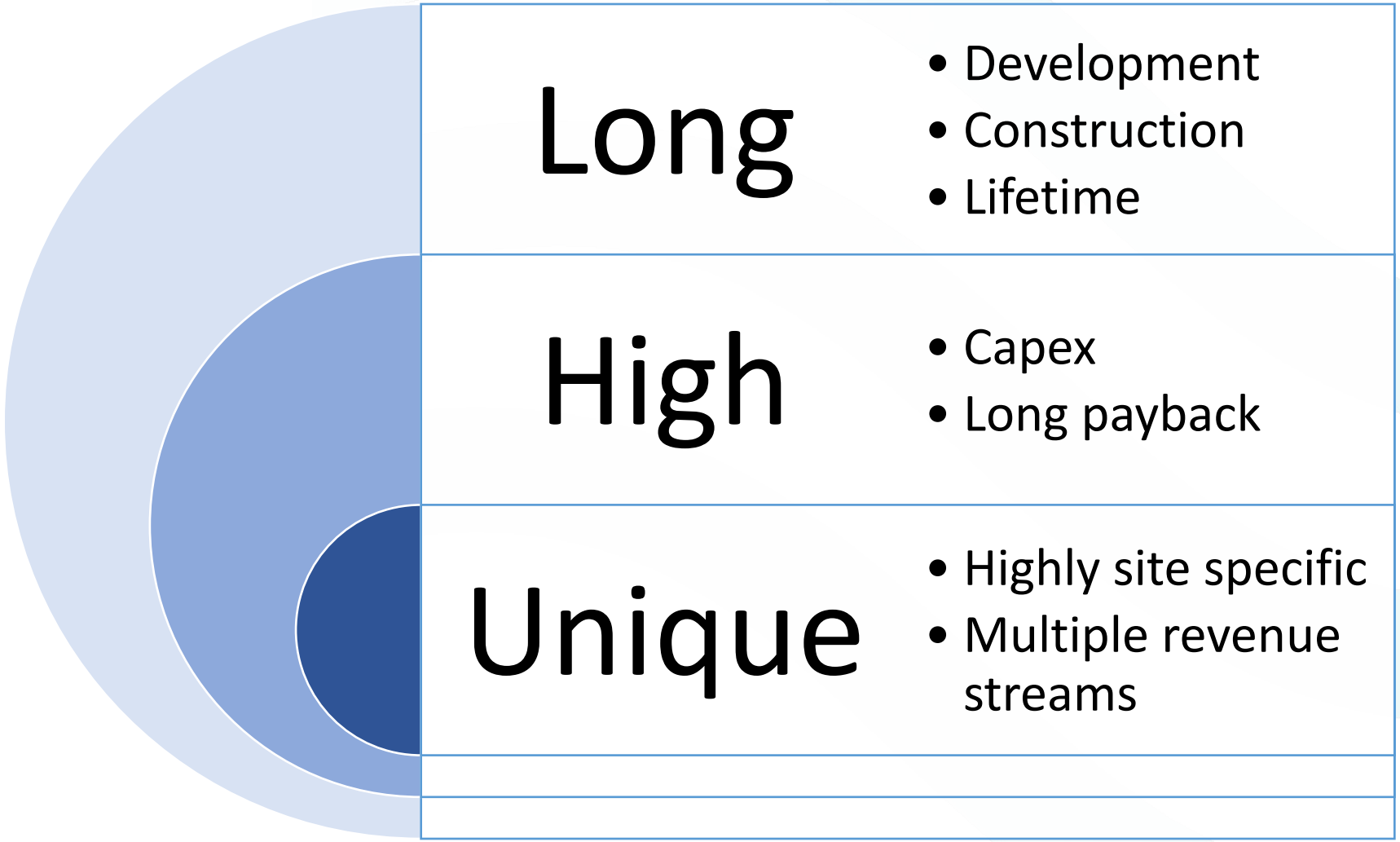


What can we expect from hydropower in the future?

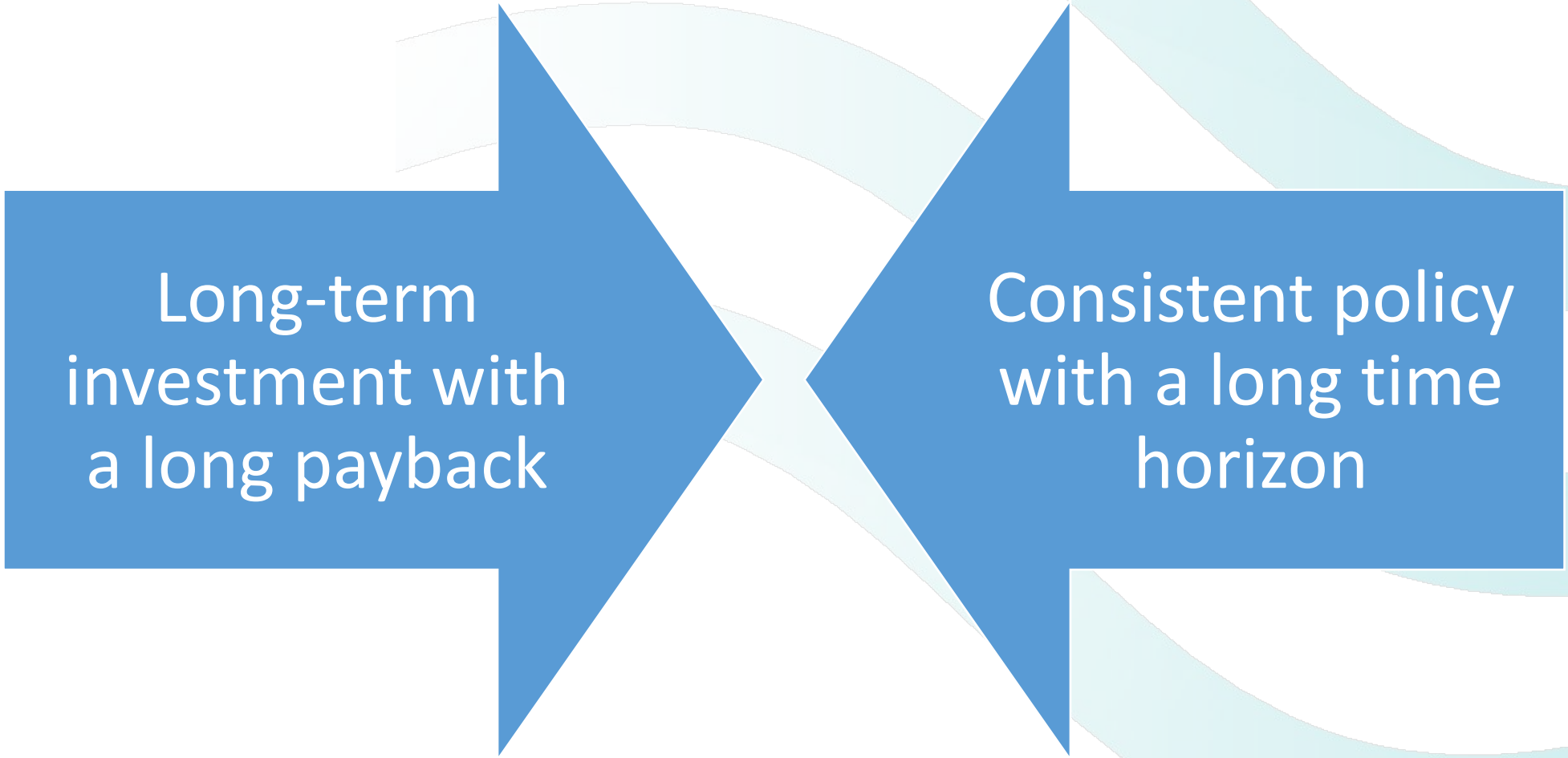
- We are approaching point at which pumped storage will provide more additional capacity than conventional hydropower.
- Whilst pipeline looks increasingly healthy in countries/regions like India, Europe, and Australia, it is dominated by China which accounts for around 80% of pumped storage capacity built in next decade.



Why is Pumped Storage difficult?



Private sector developed – public-sector enabled



Barriers to PSH development:

Planning and modelling

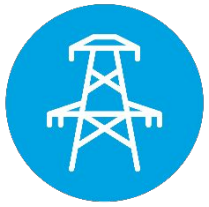
- Many markets lack long-term modelling or targets for long duration storage needs.

Licensing and permitting

- Large infrastructure projects such as new PSH development are subject to long processes.

Financial Considerations

- Long-term electricity and ancillary services prices are difficult to forecast and subject to wider government policies.
- In many markets not all services provided by PSH are remunerated.
- In some markets existing PSH plant margins are being squeezed by carbon-intensive gas.



Storage Classification

- In several countries, PSH plants are classified both as a generation asset and as a final consumer, requiring them to pay grid access fees twice.

Two versions

Publication

Read more here

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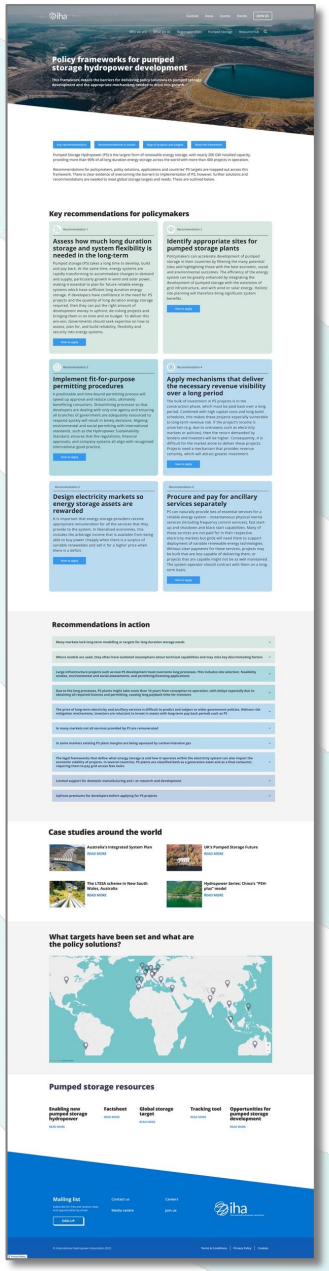
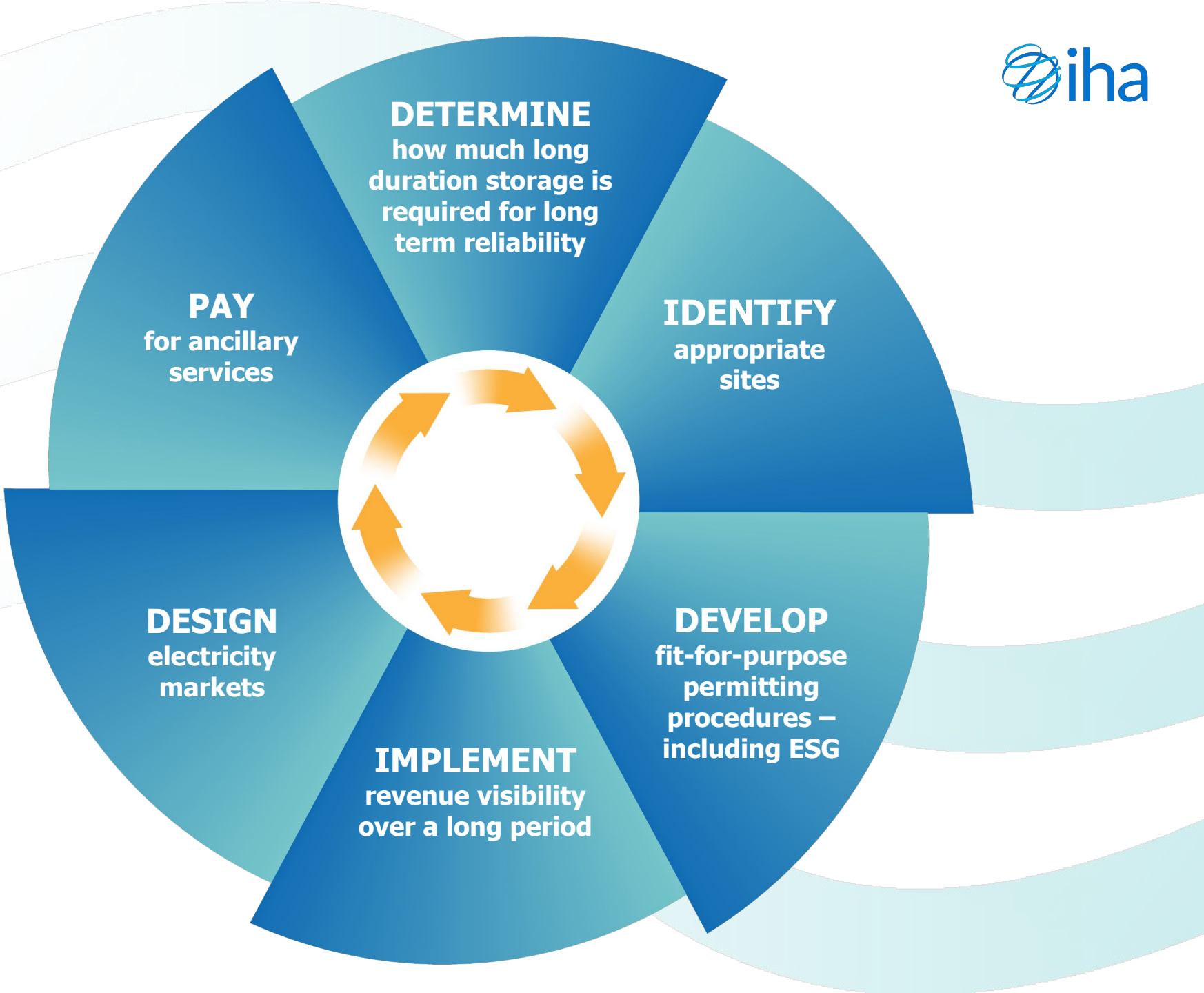


Website Landing page

Read more here

Actions Governments can take to support PSH:



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Translating recommendations to policy

RECOMMENDATION	BARRIERS	HIGH-LEVEL POLICY SOLUTIONS
RECOMMENDATIONS 1 & 2 **Planning and modelling**	• Many markets lack long-term modelling or targets for long duration storage needs. • Where models are used, they often have outdated assumptions about technical capabilities and may miss key discriminating factors.	• **Modelling and planning for energy storage and flexibility:** This can include analysis of energy storage and flexibility targets by a national transmission system operator (TSO).[1] • **National targets for energy storage included in legislation and/or strategy documents:** National strategic plans, e.g. National Energy and Climate Plans, that indicate a national target for energy storage, including pumped storage, give important signals to the market. This could be done with framework legislation - to indicate storage as critical infrastructure.
RECOMMENDATION 3 **Licensing and permitting**	• Large infrastructure projects such as new PS development must overcome long processes. This includes site selection, feasibility studies, environmental and social assessments, and permitting/licensing applications. • Due to the long processes, PS plants might take more than 10 years from conception to operation, with delays especially due to obtaining all required licenses and permitting, causing long payback time for investors.	• **Accelerated permitting:** Create a streamlined permitting process for pumped storage developments, which ensures environmental and sustainability good practice. The Hydropower Sustainability Standard provides an internationally recognised framework for this that can be embedded into national legislation and financial approvals.
RECOMMENDATIONS 4, 5 & 6 **Financial considerations**	• The price of long-term electricity and ancillary services is difficult to predict and subject to wider government policies. Without risk mitigation mechanisms, investors are reluctant to invest in assets with long-term pay back periods such as PS. • In many markets not all services provided by PS are remunerated. • In some markets existing PS plant margins are being squeezed by carbon-intensive gas.	• **Financial support:** Direct financial support in the form of grants or in-kind contributions, for instance grant funding for carrying out permitting or improvements to existing dams to allow for PS. Support could include provision of enabling infrastructure, such as roads. • **Revenue certainty:** Create a long-term revenue visibility through various mechanisms: - **Capacity / availability payments** – these are fixed payments that recognise the value of pumped storage to the system, providing a revenue floor. - **Revenue subsidies** – payments per unit of energy generated, with projects able to benefit from market revenue on top of these. - **Fixed output prices** – these work like revenue subsidies, but PS projects would not be able to benefit from market revenues on top. - **Tax incentives** – these can be fixed like capacity payments or related to generation. - **Cap and floor regime** – an agency would top up revenue to a pre-set level if market income dropped below this, while if revenue goes above a higher level, then the PS operator would need to pay at least some of that income back. - **Performance-based payments** – fixed payments but related to achievement of performance goals. • **Services are remunerated**: TSO to recognise and effectively remunerate services that are not currently adequately monetised.
RECOMMENDATION 5 **Storage classification**	• The legal frameworks that define what energy storage is and how it operates within the electricity system can also impact the economic viability of projects. In several countries, PS plants are classified both as a generation asset and as a final consumer, requiring them to pay grid access fees twice.	• **Energy storage classification:** Energy ministry and/or regulator to ensure an appropriate classification for energy storage which applies to pumped hydro, or a separate classification for pumped storage. • **Grid fee / pumping exemptions:** Prevent double taxation or storage assets from having to pay grid access fees twice, or waiving transmission when paying for transmission network charges if pumping renewable energy. • **Grid asset:** Where appropriate, consider energy storage as owned and operated by the grid.
Miscellaneous	• Limited support for domestic manufacturing and / or research and development. • Upfront premiums for developers before applying for PS projects.	• Manufacturing / R&D supported domestically to ensure supply chain and labour can support both project development and operational assets; thereby supporting security of supply. • Ensure no upfront premium is required by developers for project allocation.

[1] Useful resources can be found on the IRENA website. A good example of modelling for storage is this government-commissioned study from Great Britain.

A catalogue of policy

The table below summarises the policies used in a number of countries to overcome the barriers to implementation of PS.

RECOMMENDATION	COUNTRY/REGION	POLICY SOLUTION APPLICATIONS
Financing / Planning and modelling / Storage Classification / Licensing and Permitting	India	Pumped storage guidelines developed to promote development of PS. These set out: • Transparent criteria forwarding project sites. • Self-identification of off-river pumped storage sites. • Removal of upfront premium for project allocation. • Market reforms for monetisation of ancillary services provided by pumped storage. • Government land, if available, at concessional rate to the developers on an annual lease rent basis. • Exemption of pumped storage plants from free power obligation. • Rationalisation of Environmental Clearances for off-river pumped storage sites. • Utilisation of exhausted mines for development of pumped storage plants. National Framework for promoting energy storage systems. Hydropower and pumped storage consumption obligations for designated consumers. Waiver of Inter State Transmission System (ISTS) charges. Budgetary support towards cost of enabling infrastructure (i.e. roads and bridges). Faster decision-times for Pumped Storage Projects through guidelines for formulation of detailed project reports for Pumped Storage. Storage Classification by Central Energy Administration / Ministry of Power. A national pumped storage target of 27.7 GW by 2031-32 was based on a CEA study that indicated the pumped storage exploitable potential is about 181.4GW.
Planning and modelling / Storage Classification	EU	Member States are required to assess and draw up a report on the need for flexibility. Based on these reports, each Member State will define an indicative national objective for demand side response and storage. This indicative national objective will also be reflected in Member States' integrated national energy and climate plans (Electricity markets design reform). EU Member states are required to submit National energy and climate plans (NECPs) which cover activities from 2021-2030 on decarbonisation, energy efficiency, energy security, internal energy market, as well as research and innovation. Many include hydropower and pumped storage activities. Each country must submit a progress report every two years to support implementation. The first update was due in 2023. Revision of the Energy Taxation Directive made it possible to consider energy storage facilities as redistributors so to avoid double taxation (Revision of the Energy Taxation Directive - Fit for 55 package).
Planning and modelling / Storage classification / Financing	China	14th Five-Year Plan (2021-2025) highlights energy storage as a priority to enhance consuming and storing renewable energy. The National Energy Administration (NEA) has set an ambitious target of 120GW PS to be commissioned by 2030. A key approach by China has been the "PS-plus" model, which sees planning for large renewable energy zones or corridors matched with the development of PS capacity. The grid operates some of the energy storage (the State Grid in the North and China Southern Power Grid in the South with some local grids operating). Pumped storage revenue models and pricing mechanisms have been developed. These include a "two-part tariff": a fixed element set by government authorities that is paid based on meeting peak demand and providing ancillary services; and a floating element for the arbitrage value of charging the PS when power is cheap.
Financing	United States	Tax credits under the Inflation Reduction Act. Capacity market payments. Direct funding (Bipartisan Infrastructure Law) which includes financial assistance to eligible entities to carry out project design, transmission studies, power market assessments and permitting for a pumped storage project to facilitate long-term storage of renewable electricity.
Planning and Modelling / Licensing and Permitting	Portugal	Portugal has set a target for hydropower, within which it has set an objective of 3.9 GW of pumped storage by 2030. It has also established strict criteria for the selection of sites that require an integrated analysis of environmental, social and economic components.

Listing PS targets globally

Country pumped storage targets

Collated information about countries' long-duration energy storage targets is also available, and if they have specific PS elements to those [link to interactive map on hydropower.org]. This is updated regularly.

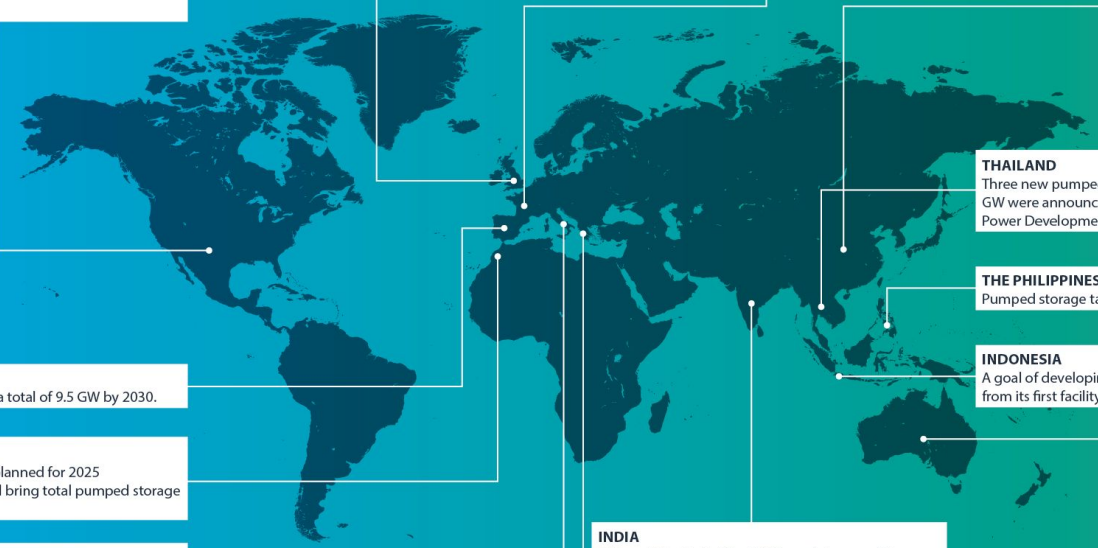
UNITED STATES
There are 91 new PS projects of around 85 GW in various stages of permitting and development.

California's Regulator, California Public Utilities Commission, has identified the need for 1GW of PS, or other long-duration storage with similar attributes, by 2026 and other states have begun to set energy storage targets.

GREAT BRITAIN
The National Energy System Operator estimates that GB will require 5-8GW / 81-99 GWh of long duration energy storage by 2030. Around 10 GW of PS projects are at different stages of development.

FRANCE
French "Programmation Pluriannuelle de l'Énergie" forecasts an additional 1.5 GW of PS before 2035 (Ministère de la transition écologique. Programmations pluriannuelles de l'énergie, 2021).

CHINA
NEA plan includes 62 GW to be constructed by 2030 and 120 GW by 2035 and modernising PS industry system with advanced technology.



THAILAND
Three new pumped storage projects of almost 2.5 GW were announced and are planned for 2037 (Draft Power Development Plan 2024).

THE PHILIPPINES
Pumped storage target to 2.4 GW by 2050.

INDONESIA
A goal of developing 1.9GW PS by 2030, including from its first facility, Upper Cisokan (PLN, 2021).

SPAIN
Increase in 3.5 GW PS for a total of 9.5 GW by 2030.

MOROCCO
300MW Ifahsa project is planned for 2025 commissioning which will bring total pumped storage to 815MW.

ITALY
Italy's grid operator has indicated that it will require 71GWh of new utility scale electricity storage capacity by 2030, with a nominal storage duration of 8-hours charge targeted. TERNA anticipates at least 9GW of both charging and discharging power will need to be built (TERNA, 2023).

GREECE
National Energy and Climate Plan notes a target of 2.2GW PS by 2030.

INDIA
National Electricity Plan 2023 predicts a need for 7.45 GW of PS by 2027, 18.98 GW by 2030, and 27GW / 175.18 GWh by 2032. By 2047, CEA predicts the energy storage requirements to increase to 2,380GWh (540 GWh from PS) due to the addition of a larger amount of renewable energy considering the net zero emissions targets set for 2070. (MNRE, 2023).

AUSTRALIA
2024 Integrated System Plan concludes that Australia will need to quadruple the firming capacity from utility-scale batteries, pumped hydro and other hydro, with up to 56 GW / 660 GWh of dispatchable storage and 15 GW of flexible gas by 2050 (AEMO, 2024).

Paris | 9 - 10 September 2025

International Forum Pumped Storage Hydropower

Speakers at the last Forum in 2021 included:

Mark Carney
Prime Minister of Canada

Han Jun, Former President, CTG

Jennifer Granholm, US Energy Secretary

Hon Malcolm Turnbull, IHA President

Book your place now

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Invites have been sent to - Ministers and Heads of all 50+ GAPS participants and CEOs of all 100+ IHA members