IHA Response | Consultation publique sur le soutien au développement des stations de transfert d'énergie par pompage

Questions

1. **To what extent do you consider public support for the development of PSH projects in France to be indispensable?**

The International Hydropower Association (IHA) welcomes the French Government considering the future needs of its system now, revising the original 1.5 GW target for additional pumped storage hydropower (PSH) from the Programmation Pluriannuele De L'Energie to 3 GW[1]. France is considering this revised energy storage target ahead of the European Union's prescribed schedule for storage targets. As part of the March 2023 Electricity Market Reform announcement, the Commission included a proposal to require Member States to assess their energy storage and flexibility needs and include targets within their National Energy and Climate Plans (NECPs) going forward.

The French electricity system is already relatively low carbon due to its large installed capacity of nuclear and further supported by ~ 26 GW of hydropower and nearly 6 GW installed pumped storage hydropower. In the 1970s and 80s, pumped storage hydropower was developed to support nuclear power, especially at night so that the nuclear assets could avoid reducing generation. As the largest form of energy storage globally, PSH's role is evolving to help the French electricity system avoid curtailing wind, and solar, whilst also avoiding a decrease to nuclear generation, thereby reducing the system costs. As the French electricity system continues to evolve to support the French Government's ambitious net zero plans, PSH's flexibility will become increasingly important.

There is already a demand for grid flexibility that existing French PSH assets support, and more is needed. During the European blackout of November 2006, hydropower played a crucial role to restore and stabilize the load balance. In France, the hydropower fleet, including PSH, increased its production to 4 GW in 40 minutes. Elsewhere in Europe a total of 1.6 GW of PSH in pumping mode stopped pumping to quickly react to the emergency and help restore generation and load balance.[2] More recently during the January 2021 Continental Europe Synchronous Area event, the synchronous area separated into two to avoid a black-out due to a fast voltage collapse and gradual difference in the frequencies of the two areas. Hydropower plants across Europe, including pumped storage, synchronised for frequency restoration, and in France RTE "pushed up some hydrogeneration to boost its balance upward by 3,500 MW for one hour", thereby stabilising the frequency of the grid[3]. As we move towards electricity grids with increasing amounts of variable wind and solar generation, the need for such system flexibility and responsiveness will only increase.

Historically, hydropower has been developed by large-scale state owned and operated enterprises, like Électricité de France. These state-owned enterprises, as vertically integrated companies had the benefit of considering the whole system needs. Because hydropower and PSH projects are large

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[1] https://www.ecologie.gouv.fr/sites/default/files/20200422%20Programmation%20pluriannuelle%20de%20l%27e%CC%81nergie.pdf

[2] Eurelectric. Hydro in Europe: Powering renewables. Full report. Brussels: Eurelectric Renewables Action Plan (RAP), 2011

[3] ENTSO-E February 2021, "Continental Europe Synchronous Area Separation on 8 January 2021: Interim Report"

undertakings in the national interest, it is important to have the political will of government backing them. By supporting largescale projects like PSH, it is also a means to support France's wider energy security ambitions, as it can reduce reliance on importing electricity, support French manufacturing and construction jobs, and thereby benefit France's economy. At the very least, public support either in policies, formal energy storage targets, or financial support are indispensable to French PSH project development.

One of the key challenges identified by the European working paper of the International Forum on Pumped Storage Hydropower (IFPSH), was a "lack of a regulatory framework which would ensure the necessary revenues visibility / certainty." The rationale for revenue visibility and certainty for this is that pumped storage hydropower projects require a large capital outlay and have a long payback period. Because of the large upfront costs, investors are exposed to a significant proportion of the lifetime cost of the project before revenues commence. Because of the required high upfront capital investment, a project might be seen as financially nonviable even for those projects otherwise deemed low risk. Public sector financial measures can be used to help mitigate risk, which is why it is critical that the French Government is considering and implements public sector measures to support PSH project development now.

Another key consideration is the lack of remuneration for the essential grid services that PSH currently provides and will provide in the future. Electricity markets, especially during the context of the energy transition, are immensely difficult to predict, meaning there is a lack of predictable revenue streams over the long period of project development; thereby making it difficult for developers. In addition, the current market and regulatory structures do not remunerate all the grid services that PSH can provide.[4] Developing markets for all the potential grid services that PSH assets can provide will allow operators access to additional revenue streams upon project completion. By implementing public support in the short-term and effectively monetising PSH's grid services, it will help developers create a business case in the medium-term.

Many pumped storage hydropower assets in France were developed, or redeveloped from existing hydropower assets, in the 1970s and 1980s, as noted previously, to support France's nuclear fleet. These vital assets are now 40 to 50 years old and will continue to play an important role if maintained appropriately. As France considers funding new PSH projects, any public support mechanism developed should also consider modernisation of existing assets. Modernisation can prolong life of France's existing assets and increase the range of flexibility services that PSH can provide to the French electricity system. The XFLEX Hydropower project, an EU Horizon 2020 project, is a demonstration project to showcase the means in which hydropower and PSH assets can provide a range of invaluable grid services to ensure that local and regional power grids remain reliable and resilient to current and future disruptions. As part of XFLEX project, the Grand Maison PSH project in France is demonstrating hydraulic short circuit with Pelton technology, to allow for pumping and turbine mode simultaneously[5]. This technology is easy to integrate into existing PSH projects and can enhance the power regulation services and operating ranges offered by PSH projects.

When governments publicly support large scale infrastructure, like PSH, through economic policies it makes it much easier for private investors to support capital expenditure upfront, knowing the business case for remuneration is already in place. By considering and implementing a specific policy

[4] A review of pumped hydro energy storage development in significant international electricity markets. Barbour, Edward, et al. August 2016, Renewable & Sustainable Energy Reviews, Vol. 61, pp. 421-432. English Version.
[5] XFLEX, Grand Maison, France Project https://www.xflexhydro.com/test-sites/grand-maison

for public support like additional remuneration, it is recognising PSH as special interest projects making it easier for private support.

Based on national governments implementing supportive policies, an additional investment type that the French Government might wish to consider supporting for PSH projects, either publicly funded or private, are green bonds. To support green financing and demonstrate good practices within the industry, the Hydropower Sustainability Standard was developed by governments, companies, environmental and social NGOs, and international financial institutions. It is the only sustainability standard in the renewables sector and is independently certified. The hydropower industry, working with the Climate Bonds Initiative (CBI), developed a Hydropower Criteria. Certification through the Standard is used to demonstrate compliance with the CBI's Hydropower Criteria and certify green bonds. PSH is also considered a technology that contributes substantially to climate change mitigation and climate change adaptation within the EU Taxonomy, and the CBI Hydropower Criteria have similar technical requirements as noted within the Delegated Acts of the Taxonomy.

French hydropower puts sustainability at its core. For example, Romanche-Gavet, a 94 MW run of-river facility, was assessed against the previous iteration of the Hydropower Sustainability Standard in 2013. The assessment found the project met proven best practices and had limited social and environmental impacts. Any new French PSH projects should be aligned with France's history of sustainability practices and international good practice like the Hydropower Sustainability Standard.

2. **What form of support do you consider most appropriate for the development of PSH projects (including forms of support not detailed above)? Why or why not?**

Other developed countries are considering, or have implemented, the following types of interventions:

> In July 2021, the **UK** Government issued a consultation on Large-scale Long Duration Energy Storage, and in August 2022, formally responded. They concluded that large scale long duration energy storage has "an important role to play", but it faces significant barriers to deployment under the current market framework. They indicated they would develop an appropriate policy to enable investment by 2024 to ensure sufficient long duration energy storage. Because the most requested option from responses was a '**Cap and Floor'** model like the one that was used to develop interconnectors, the government will carry out further analysis on the costs and benefits of intervention. A cap and floor model provides a minimum revenue to help developers secure financing, so that when revenues fall below the floor, they are topped up by consumers and conversely when the revenues exceed a certain threshold they are returned to consumers.
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> **Long Term Energy Service Agreements** (LTESAs) are an important means to value remuneration. The **Australian** state of New South Wales announced a means to develop PSH projects through competitive tender of LTESA contracts. The LTESA provides a fixed number of options to enter an annuity payment contract which can be exercised in each option period during the contract term, which is up to forty years. The annuity payment is made if the LTESA operator's net operational revenue is below its net revenue threshold and is limited such that it equals the lesser of: LTESA contracted annuity amount (maximum payment), or LTESA net revenue threshold – net operational revenues. The contracted LTESA would act in many ways like the French Government's proposed additional remuneration function. The NSW government also developed a $50m PSH recoverable grants programme as part of their Electricity Infrastructure Roadmap.
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> In March 2023, the **Polish** Government introduced a new law to make it easier for PSH development, as they recognised that there were barriers making investment harder. The

Law allows PSH to be integrated into decisions across multiple permitting authorities, and to make PSH a 'public purpose' investment.

In India and China there has been an emphasis placed on firm flexibility that PSH can provide. While Israel is utilizing an availability payment to ensure revenue visibility for PSH assets.

India recently announced a number of measures to increase the installed PSH, including the **Guidelines to Promote Development of Pumped Storage Projects** in which the finalised version was published 10 April 2023. The guidelines recognise the value of PSH projects to variable renewable energy integration, and that a comparison of the financial aspects undervalues and de-emphasises the economic benefits of PSH to the grid. The guidelines also indicate that the Government of India will ask the Appropriate Commission to ensure that services (e.g., spinning, inertia, reactive power etc.) are suitably monetized.

In addition to the Guidelines, the Indian Government in recent years provided financial support for enabling infrastructure (like roads and bridges), waiver of the inter-state transmission fees for renewable energy and storage, and created an energy storage obligation target.

In **China**, in addition to highlighting PSH as a priority for scaling up the delivery of variable renewable energy in their 13th and 14th Five Year Plans, they have implemented pricing support to develop PSH assets. These include[6]:

- *Capacity-based lease arrangements* – an annual payment to rent the facility to the grid company and generates a 5% return irrespective of amount generated.
- *Generation-based Feed in Tariff* – used by independent power producers (IPPs) or grid operators, where the State sets a generation-based tariff for each PSH project with the aim of covering the project's total construction and operation costs. Project owners are incentivised to generate more to increase revenues; however, ancillary services are not effectively rewarded.
- *Two-part Tariff* - a combination of a fixed annual capacity-based payment and generation-based tariff. The capacity payment is used to recover most fixed costs, related taxes, and the risk-return rate at 1-3% higher than risk-free rate. The capacity payment also reflects ancillary services provided, and remunerates for services such as system reserves, frequency and voltage regulations, and black start. The generation tariff assists with the variable costs in operation, such as generation and pumping losses.

Like the Australian state of New South Wales example, the **Israeli Electric Corporation** created an **availability payment** system for enabling private investment in PSH. The contracts will support the project over an 18–20-year timeframe, thereby providing a guaranteed payment to ensure development while also focusing on efficiency and a high level of resource performance.

These and many other policies that have been developed the French Government may wish to consider in the longer term, e.g., the United States Bilateral Infrastructure Law where PSH received an additional tax credit for ten years and funding towards projects. Direct government interventions highlight how countries are prioritising the rapid development of flexibility and in particular the

[6] For more on China's PSH Tariffs, please see the China Working Paper of the International Forum on Pumped Storage Hydropower.

importance of pumped storage hydropower in supporting their net zero ambitions. Thereby, helping to de-risking investment.

Of the three options, Additional Remuneration provides an important benefit given it will support revenue visibility and may help to smooth the debt repayment period. Additional Remuneration may help to provide a longer period for debt repayment, or debt tenor, which can help decrease the tariff so that it is closer to the levelized tariff with the twenty years of additional remuneration, or the point at which "break even" occurs. If projects have a shorter debt repayment period, then they may need a much higher tariff which could make them an unattractive investment. Thus, additional remuneration may help to reduce financial risks by securing a revenue stream that will effectively remunerate PSH assets, and thereby reduce revenue uncertainty. Because projects have a long lifespan, any debt repayments will be relatively short in comparison to the technical life span of a PSH asset (60-100 years).

For projects that may struggle to obtain upfront private capital investment due to their size, it may be immensely important to have an option available for additional remuneration plus investment aid. This is because with larger projects, investors will be more risk adverse. If the French Government can consider some capital funding for PSH projects (e.g., NSW's PSH Grant funding), in addition to the annual support, for these projects it will help developers to reach financial close and minimize the project's risks.

Therefore, we would advise that the public support mechanism should include annual repayment, as well as some applications of investment support.