

Hydropower – The Guardian of the Energy Transition

We, the undersigned, stand united in our call to European decision-makers to promote hydropower as a vital cornerstone of our renewable energy future. As Europe embarks on its journey towards climate neutrality, we are convinced that hydropower is crucial in securing electricity supply, sustaining industrial competitiveness, and ensuring affordability for households.

A reliable and trustworthy technology with a remarkable history

The EU hydropower fleet stands as a living testament to domestic expertise, driven by a committed workforce with long standing expertise, while utilising locally available materials. Every phase of its development exemplifies a commitment to efficiency and affordability. These power plants were engineered to endure for generations, ensuring a consistent and reliable power supply. In addition to run-of river plants that guarantee a steady power output, reservoirs have been strategically constructed to accumulate water during periods of heightened precipitation and snow melting. This stored water is then harnessed to generate power during times of increased demand. These robust plants have not only contributed to prosperity and social welfare of rural areas but have also played a pivotal role in enabling the transformation of major cities through electrification. They are symbols of unity and they stand for an era of progress.

Hydropower's unparalleled reliability and flexibility have proven to be effective in bridging the gaps between supply and demand. This is due not only to the flexible generation from reservoir and run-off river plants, but also to pumped storage facilities. This third type of hydropower allows for the storing of surplus electricity during periods of abundance and made available when demand peaks. The combinations result in improved accessibility to power and increased security of supply across Europe, promoting a thriving society and a robust economy.

Recognise the diversity of hydropower – run-of-river, reservoir and pumped storage plants – providing flexible renewable electricity generation and storage to ensure an efficient and reliable power system for decades.

A sector committed to biodiversity conservation and enhancement

The simultaneous trends of population growth and urbanization, coupled with the increasing demand for areas for settlements, agriculture and the use of water for industrial purposes and power generation, have led to considerable pressure on rivers and their ecosystems. To avoid, minimise and offset negative effects, the hydropower sector has undertaken intensive research and development efforts. Through the implementation of both constructive and operational measures, substantial progress for biodiversity has been realised and the ongoing commitment to holistic, nature positive approaches reflect the trajectory towards sustainability and responsible resource management. In this regard, it is pointed out that hydropower plants account for less than 10% of barriers in European riversⁱ, with hydropower operators diligently implementing extensive mitigation measures to ensure river continuity. Enhancing European water bodies in line with EU Water and Nature legislation implies addressing all sectors involved, by balancing interest and sharing efforts. In this regard, the hydropower sector is eager to exchange valuable experience and actively seeks collaborative opportunities.

Acknowledge the sector's efforts to avoiding, minimizing, and compensating environmental impact through habitat preservation, restoration, and river continuity enhancement.

Hydropower, a crucial element of the energy transition

Today hydropower is the second-largest renewable energy source in the EU, generating 355 TWhⁱⁱ of electricity annually and offering essential services for the secure and stable operation of the electricity grid. The reservoirs and related run-of river plants provide renewable electricity generation in a flexible manner both short and long term. Despite the noteworthy development of other electricity storage technologies, today, pumped storage hydropower accounts for over 90% of available EU storage capacity^{iii,iv}, standing as a mature technology capable of accommodating electricity storage needs ranging from minutely to seasonal^v timescales. The binding 42.5% renewables target in the Renewable Energy Directive commits the EU to adding more than 1000 GW^{vi} of new variable renewable electricity capacity from wind and photovoltaics (PV), equivalent to the total current capacity installed (fossil, nuclear and RES), in less than six years. As we strive to meet this target, flexible generation and storage capacities will become central. Hydropower holds immense potential in effectively integrating this variable generation, avoiding curtailment in times of exceeding power output and ensuring security of supply in periods of shortages.

To meet tomorrow's flexibility demand and, in this context, fully exploit the potential of hydropower, a technology-neutral, stable regulatory environment is needed to strengthen the long-term visibility and confidence of plant owners, operators and investors. Furthermore, it is crucial that market interventions are avoided, and that market principles are maintained to enable efficient dispatch and storage of electricity (i.e., flexible sources are activated when they offer the greatest value to the electricity system). While public support mechanisms can provide short-term signals and catalyse essential long-term investments in hydropower, they must align with existing regulations allowing flexible plants to maximise their incomes on various markets. These mechanisms should not exclusively prioritise new constructions but instead focus on optimizing and expanding the utilization of existing hydropower assets.

Promote hydropower as a key contributor to the EU's decarbonisation objectives. To unlock its full potential, ensure a stable legislative framework to bolster long-term visibility and investor confidence, crucial for large capital investments. In this regard, remove obstacles and accelerate permitting procedures for all hydropower projects alongside wind and PV.

A European success story with global relevance

Europe has solidified its standing as a world leader in hydropower technology. Leveraging a transparent and sustainable European value chain, hydropower offers significant autonomy from critical raw materials^{vii} and fossil fuels imports, skilled labour or technological deficits. On this basis, European project developers, operators, and equipment manufacturers are strategically well positioned to take advantage of the immense opportunities arising from the substantial investments in the modernisation of existing and the development of new hydropower plants in Europe and around the world^{viii}. While the EU is trying to build robust supply chains for technologies where dependencies on third countries are prominent, hydropower presents an immediate solution.

Securing Europe's competitive edge in hydropower technologies is imperative to mitigate external vulnerabilities, fortify the supply chain, and bolster the continent's quest for sovereignty and global relevance.

Mature and exceptionally efficient

Hydropower plants have an outstanding lifespan, providing electricity for generations up to 100 years and beyond. Expressed in terms of the energy payback ratio – a measure of energy generated compared to energy expended in building, operating, maintaining, and decommissioning the plant – hydropower surpasses all other electricity generation technologies^{ix}. Despite its already remarkable efficiency and lifespan, both science and industries consistently allocate substantial resources to research and development, with the aim of further enhancing hydropower's capabilities.

Hydropower not only distinguishes itself from a technical perspective but also in terms of its cost-effectiveness. This fact has been validated by the World Bank^x and the International Renewable Energy Agency^{xi}, both of which recognise hydropower as one of the most competitive in terms of levelised costs of electricity among all generation technologies.

Investing in emerging technologies is undoubtedly significant and attractive; however, to ensure a successful and timely energy transition, it is crucial to recognise and reinforce established and mature technologies like hydropower to their fullest potential. This can be achieved by refurbishing existing plants and building new ones that take advantage of this mature yet still cutting-edge technology.

Crucial in adapting to climate change

Recent years have highlighted the importance of implementing a comprehensive water management strategy, especially considering the increasing frequency of extreme weather events resulting in either excessive or insufficient water flows. Hydropower plants offer numerous benefits for climate change adaptation. They not only can serve to regulate flood events and strategically release water during drought periods to safeguard ecosystems and agriculture, as well as facilitate navigation. They also play a crucial role in ensuring a reliable water supply for a wide spectrum of applications, including drinking, irrigation, industrial processes, and firefighting. In this context, it is essential to bear in mind that hydropower generation harnesses the energy of flowing water without causing substantial alterations to its quality or quantity.

Leverage the strengths of hydropower in implementing effective water resilience and climate change adaptation measures and unleash its diverse benefits for society, the economy, and the environment, beyond the electricity system.

A call for vocal advocates

Although EU legislation recognises the indispensable role of hydropower across various dossiers, such as the Water Framework Directive, Renewable Energy Directive, Taxonomy Regulation, Nature Restoration Regulation, and Electricity Market Design, it is imperative to rally strong advocates. These champions are essential to unlock the full potential of EU hydropower, dispel prejudiced perceptions, and foster a shift towards a conversation grounded in tangible reality. This transformation is paramount, ensuring that the European Green Deal becomes an undeniable success story, delivering benefits to society, the economy, and the environment in equal manner.

ⁱ Quaranta, E., et al. [Digitalization and real-time control to mitigate environmental impacts along rivers: Focus on artificial barriers, hydropower systems and European priorities](#), Science of The Total Environment, 2023.

ⁱⁱ Elda by Eurelectric 2024 – <https://electricity-data.eurelectric.org/>, data basis 2023.

ⁱⁱⁱ European Commission, Directorate-General for Energy, Andrey, C., Barberi, P., Nuffel, L., et al., [Study on energy storage : contribution to the security of the electricity supply in Europe](#), Publications Office, 2020.

^{iv} European Parliament, ITRE Committee, [Report on a comprehensive European approach to energy storage](#) (2019/2189(INI)), 2020.

^v Hunt, J. & Byers, E., [Seasonal Pumped-Storage: An Integrated Approach for Hydropower, Water Management and Energy Storage](#). In: Colloquium CIGRE “Rotating Electrical Machines for Power Generation”, 2017, Austria.

^{vi} [Power Barometer 2023](#) & [Decarbonisation Speedways Study 2023](#) by Eurelectric

^{vii} European Commission, [A foresight study - Critical raw materials for strategic technologies and sectors in the EU](#), 2020; International Energy Agency, [The role of critical raw minerals in clean energy Transition](#), 2021; [McKinsey analysis January 2022](#).

^{viii} International Renewable Energy Agency (IRENA), [The changing role of hydropower: Challenges and opportunities](#), 2023, Abu Dhabi.

^{ix} Donnelly, C. R., et al. [Climate Change and Waterpower - Reducing the Impacts and Adapting to a New Reality](#), 2019

^x World Bank Group, Govinda R. Timilsina, [Policy Research Working Paper 9303 - Demystifying the Costs of Electricity Generation Technologies](#), 2020.

^{xi} International Renewable Energy Agency (IRENA), [Renewable Power Generation – Cost in 2021](#), 2021.