

## Hydropower as a catalyst and facilitator for the clean, safe and independent energy transition in Europe.

### Key Messages:

- Given Europe's ambition to raise the renewables target to 45%<sup>1</sup> hydropower is critical to ensure Europe's energy system has the necessary renewable electricity and flexibility to protect grid stability from intermittent renewable energy, to sustain the green transition.
- While hydropower is the largest renewable non-intermittent electricity supplier in the World and in Europe, there remains significant potential, mainly through refurbishments, new multipurpose storage projects and pumped-storage powerplants.
- More funding is needed in research and innovation to deploy solutions at the scale required in support of sustainable solutions that offer win-win situations for the environment and from an operational perspective.
- Europe must protect against periods of dunkelflaute by including flexible power generation and dispatchable large capacity renewable storage, like hydropower, in national targets.
- To ensure there is enough hydropower to meet Europe's decarbonization goals and maintain energy security, hydropower must have a prominent role within the Strategic Energy Technology (SET) Plan.
- The upcoming ETIP will serve as the basis for collaboration between stakeholders on hydropower and increase their visibility within the SET Plan.

### ***The important role of hydropower with significant potential***

Hydropower is a key technology for the energy transition and the largest renewable energy source in Europe. In 2019, electricity production from hydropower in Europe was 653 TWh/year<sup>2</sup> (334 TWh/year within the EU<sup>3</sup>). This is equivalent to around 36% of the electricity coming from renewable sources in the EU and 10% of the entire generation mix, contributing significantly to achieving EU targets for energy and climate<sup>4</sup>. Throughout the last century,

<sup>1</sup> As part of the REPowerEU plan, The Commission is proposing to increase the EU's 2030 target for renewables from the current 40% to 45%.

<sup>2</sup> International Hydropower Association. (2020). 2020 Hydro Power Status Report: England, IHA

<sup>3</sup> EUROSTAT. (2020). Electricity generation statistics 2020. [https://ec.europa.eu/eurostat/statistics-explained/index.php/Electricity\\_generation\\_statistics\\_%E2%80%93\\_first\\_results#Production\\_of\\_electricity](https://ec.europa.eu/eurostat/statistics-explained/index.php/Electricity_generation_statistics_%E2%80%93_first_results#Production_of_electricity)

<sup>4</sup> EURELECTRIC and VGB Powertech. (2018). Facts of Hydropower in the EU.

[https://www.vgb.org/hydropower\\_fact\\_sheets\\_2018-dfid-91827.html#:~:text=So%20far%2C%20hydropower%20is%20the,to%20achieving%20the%20EU%20targets.](https://www.vgb.org/hydropower_fact_sheets_2018-dfid-91827.html#:~:text=So%20far%2C%20hydropower%20is%20the,to%20achieving%20the%20EU%20targets.)



HYDROPOWER  
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THE INTERNATIONAL ENERGY AGENCY TECHNOLOGY  
COLLABORATION PROGRAMME ON HYDROPOWER  
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hydropower has proved a climate-friendly, safe, reliable, and competitive source of renewable power generation and storage.

Today, we have only used 65% of the economically feasible hydropower potential that is available in Europe and Turkey, suggesting there is considerable untapped resource even taking into account that not all of this potential may be developed due to environmental barriers. Many countries rely on hydropower for a significant portion of their electricity generation. In 14 countries the share is between 25 and 50 %, in four more it is between 50 and 90% (Austria, Greenland, Switzerland and Iceland) and in Albania and Norway hydropower provides more than 90% of their electricity. This reveals that in more than half of the countries on the European continent, hydropower contributes an important share of their electricity generation mix and will be critical to support the energy transition<sup>5</sup>. The potential for additional deployment of hydropower in the mid-term can be estimated, rather conservatively for the European Continent, as some 20% increase of the total yearly energy production in an environmentally friendly way, comprising about 10% due to uprating and modernization of existing powerplants<sup>6</sup> and some 10% by new storage powerplants designed as multipurpose projects, including flood and drought protection, flow regime and biotope restoration, leisure activities etc., creating a win-win situation between all involved stakeholders.

**Thus, hydropower has all the criteria to serve as a catalyst in achieving the energy transition in Europe, providing a safe and independent supply of renewable electricity.**

### ***Hydropower as a catalyst must have a prominent role in the SET Plan***

Hydropower is dispatchable, flexible and can store large amounts of renewable energy, making it an important part of any future low carbon energy scenario. **This makes it a superb partner to other renewable sources, and so hydropower must have a prominent role in the SET Plan.**

With an increase in the level of electrification and a larger share of intermittent renewable energy sources, the safety of energy supply and stability of the electrical grid will be a critical challenge to manage. Hydropower and the associated Pumped-Storage Systems is the key that can provide the energy system in Europe with the necessary flexibility to address these challenges posed by large shares of wind and solar power sources. Given the intermittency of these sources, hydropower plants can match the fluctuations in energy demand and supply by providing critical energy and flexible power services to electricity networks with long-term

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<sup>5</sup> Fry et al. (2022). Research themes and strategic actions to promote hydropower as a catalyst for the energy transition in Europe. *Journal on Hydropower & Dams*. 29: Issue 3, pp. 37-47, [https://www.researchgate.net/publication/359920604\\_Research\\_themes\\_and\\_strategic\\_actions\\_to\\_promote\\_hydro\\_power\\_as\\_a\\_catalyst\\_for\\_the\\_energy\\_transition](https://www.researchgate.net/publication/359920604_Research_themes_and_strategic_actions_to_promote_hydro_power_as_a_catalyst_for_the_energy_transition)

<sup>6</sup> Quaranta et al. (2021). Assessing the energy potential of modernizing the European hydropower fleet. *Energy Conversion and Management*, Volume 246, 114655, ISSN 0196-8904, <https://doi.org/10.1016/j.enconman.2021.114655>

reserves. Storage and flexibility from today's existing hydropower plants exceeds all worldwide battery storage available today, including electric vehicles, by a factor of 2 300<sup>11</sup>. According to the ACER electricity market analysis of April 2022, flexibility and storage are key areas that need a European focus. More storage and flexibility are needed and must be provided by complementary technologies, including both hydropower storage and batteries.

### ***Barriers to overcome for hydropower development in Europe***

Today potential investors are facing significant hurdles which must be overcome:

- More storage hydropower and pumped storage schemes will be needed to provide energy storage and flexibility to balance volatile renewables, but the need for such system storage and flexibility needs to be acknowledged and prioritised by policy makers.
- Existing, generally acknowledged social and environmental standards and sustainability criteria must be applied in all projects to secure the support of NGOs and civil society by finding compromises in combination with mitigation and compensation measures..
- Electricity markets differ from region to region and often, as a result of legacy market arrangements, do not pay for services needed and provided by hydropower. Thus, the markets rules need to be adapted to remunerate flexibility services and storage in a fair way to attract the necessary investments.
- The regulatory situation around water rights, environmental clearances, construction permits and legal opportunities to oppose projects often leads to situations where it can take many years before a decision can be made. For private investors the risk is often too high in the early stages if it is uncertain whether a project can ultimately be implemented. This is simply not an option for many private investors and means the risk needs to be better shared.
- Large hydropower projects require very high initial investments while the technical lifetime spans 50 to 80 years. Nevertheless, predicting energy tariffs over such a long lifetime involves high uncertainty and water rights are often granted for only half the technical lifetime, thus adding risks and uncertainty for investors. In other sectors, such as offshore wind, long term price visibility and certainty has secured huge amounts of investment in new capacity. A similar approach for hydropower would enable new investment at scale.

Some countries have taken steps to systematically address these barriers by creating conditions to make investments into hydropower more attractive. Other countries have pledged to achieve net zero greenhouse gas emissions, but there is a lack of concrete policies and short-term plans to support such pledges.

### ***Public awareness does not recognise the important role of hydropower***

Increasing public awareness about the benefits of hydropower is key to securing the European Green Deal. Information availability, dialogue with society, and strategies towards social acceptance are actions that require immediate attention. It is important to stress that the technology has been updated and that there are sustainable solutions that offer win-win situations for the environment and from an operational perspective

Hydropower contributes immensely to global and EU climate change mitigation and adaptation goals. Hydropower reservoirs provide numerous benefits to mitigating the negative impacts of climate change through energy and non-energy-based applications (e.g., agriculture, drinking water, cooling of power station, etc.). Among the renewable energy technologies, hydropower has the best climate change indicator, ozone layer depletion indicator, and energy returned on energy invested indicator.<sup>7</sup> Hydropower is also the best suited renewable energy for reducing pressure on mineral resources.<sup>6</sup>

While being a robust technology, the possibilities to make hydropower safer, more environmentally friendly, sustainable, and efficient are within our reach. Hydropower boasts a wide and vibrant community of researchers, providers, and industrial partners working towards a cleaner, greener future for the sector. Supporting the sector with funding and opportunities is necessary now more than ever. The introduction of digitalization, artificial intelligence, more stringent environmental standards and advancements in hydropower units has unveiled a revitalisation for the sector, at least in Europe and North America. By funding additional research, it would further boost hydropower's immense, sustainable potential.

### ***The recently released Research and Innovation Agendas<sup>8,9</sup>, and Strategic Industry Roadmap confirm the important role of hydropower and potential for further development.***

The Hydropower Europe Forum, supported by the European Union's Horizon 2020 Research and Innovation Programme, has prepared a Research and Innovation Agenda (RIA) and a Strategic Industry Roadmap (SIR) that includes recommendations under 18 research themes and 11 strategic directions.<sup>10</sup>

Digitalization will create new economic opportunities for hydropower operators and will potentially reduce the costs and increase the income for the entire lifespan of hydropower assets. Innovative digital technologies will improve turbine yields and productivity while

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<sup>7</sup> CIRAIG (2014). Rapport Technique - Comparaison des filières de production d'électricité et des bouquets d'énergie électrique Novembre, 2014. <https://www.hydroquebec.com/data/developpement-durable/pdf/comparaison-filieres-et-bouquets.pdf>.

<sup>8</sup> Strategic Industry Roadmap and Research & Innovation Agenda <https://hydropower-europe.eu/publications/strategic-industry-roadmap-and-research--innovation-agenda/>

<sup>9</sup> [https://www.eera-hydropower.eu/component/attachments/?task=download&id=571:EERA\\_2021](https://www.eera-hydropower.eu/component/attachments/?task=download&id=571:EERA_2021)

<sup>10</sup> Strategic Industry Roadmap and Research & Innovation Agenda <https://hydropower-europe.eu/publications/strategic-industry-roadmap-and-research--innovation-agenda/>

driving down costs in design, operations and maintenance, thereby reducing the cost of energy and enabling more efficient deployment of other renewables such as solar and wind. Since hydropower is situated at the crossroads of two major issues for development – water and energy – hydropower reservoirs can often deliver services beyond electricity supply. These services include mitigation of freshwater scarcity by providing security during low flow and drought as well as supporting drinking water supply, irrigation, flood control, fish farming and navigation services. Many reservoirs in Europe have created new biotopes and have become a tourist attraction with high potential for leisure activities. Therefore, multipurpose hydropower projects may have an enabling role beyond the electricity sector to secure freshwater availability and thus contribute directly to the Water-Food-Energy NEXUS approach.

Further innovative hydropower deployment is essential to ensure environmentally compatible solutions. To protect flora and fauna, it is necessary to improve innovative freshwater connectivity solutions for biodiversity protection and to better understand the potential effects of improvement in regulated rivers on a “case by case” basis, and to adapt solutions based on specific locations of hydropower sites. Researching and producing solutions to reduce negative impacts of hydropower plants on the environment is of the utmost importance to the hydropower community. Actions to ensure that only sustainable hydropower is developed and operated will help foster improved public perception and social acceptance of hydropower as a clean, renewable, and environmentally compatible energy source.

***Europe must be aware that hydropower is a vital domestic renewable energy source and the backbone to the European energy transition***

It is crucial that Europe recognises the role played by hydropower in its own current and future electricity system. Through the sustainable management of water, hydropower has a positive spillover on the handling of water resources needed for public services; these services include irrigation, flood and drought prevention, fish farming, transportation on inland waterways, and water supplies<sup>11</sup>.

Hydropower plays a pivotal role in the framework of the European decarbonisation strategy, helping to prevent and mitigate the impact of global warming and climate change through the generation of renewable energy. Failing to seriously consider hydropower as a safe, flexible, and independent form of electricity supply in the energy transition will make it much harder to ‘keep the lights on’ in a green, secure energy system. Failing to include and recognise hydropower may also make the ambition of the European Green Deal much more difficult to achieve, if not to say impossible.

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<sup>11</sup> IEA (2021), *Hydropower Special Market Report*, IEA, Paris <https://www.iea.org/reports/hydropower-special-market-report>