



RevHydro Newsletter

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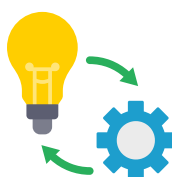
Project scope

RevHydro is a pioneering Horizon Europe project aimed at revolutionizing the refurbishment of hydropower systems across Europe. By developing innovative, sustainable, and retrofittable solutions for existing turbines, RevHydro addresses critical energy and environmental challenges. The project strives to enhance turbine efficiency, extend operational lifespan, reduce environmental impacts, and align hydropower operations with EU sustainability and climate goals.



Implementation period

RevHydro was launched in late 2024 and will continue until 2028, ensuring a comprehensive approach to research, development, testing, and implementation.



Regular meetings & collaboration

Consortium partners meet regularly to align research efforts, share progress, and refine strategies. These meetings foster cross-disciplinary collaboration and keep the project aligned with its goals.



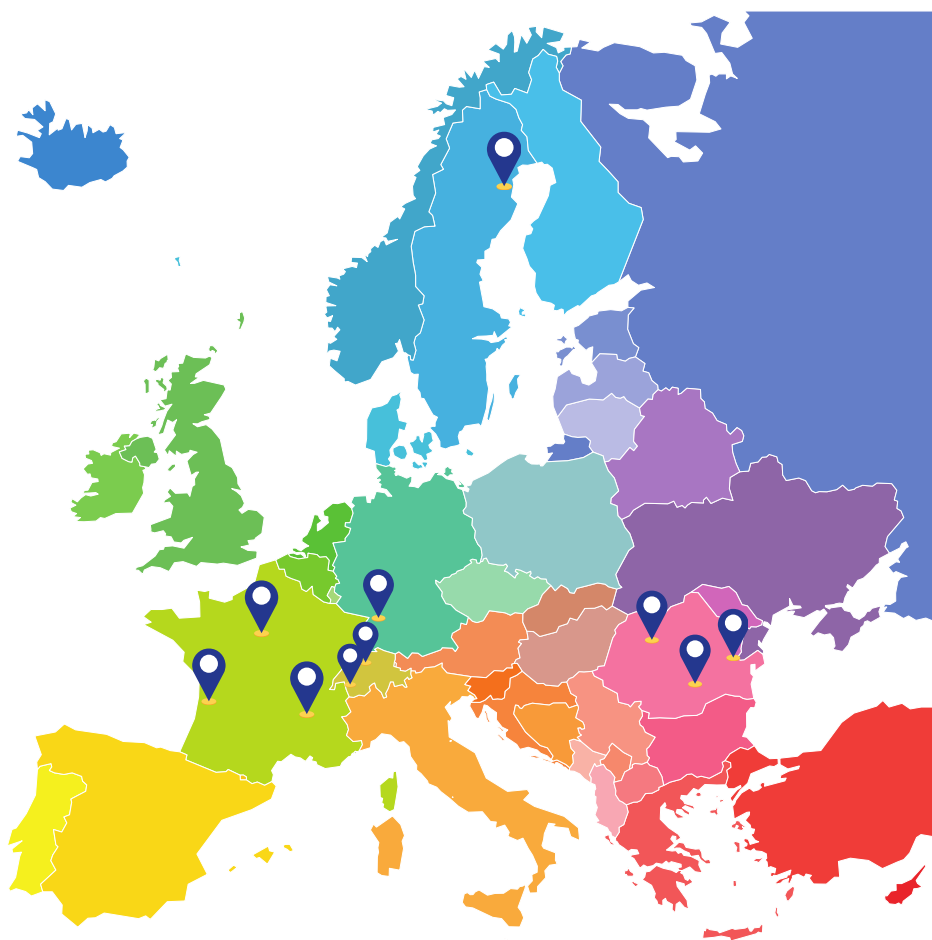


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Consortium partners



Map of Europe



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Main objectives

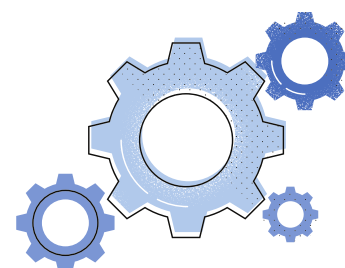
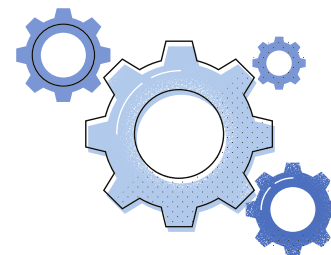
RevHydro focuses on four strategic objectives:

Quantifying turbine limitations through advanced modelling and analysis to guide refurbishment priorities.

Developing innovative flow control solutions for runners and draft tubes, including polymer extensions and guide vanes.

Implementing an Intelligent Fish Barrier (I-Fish) using acoustic, visual, and bubble stimuli combined with machine learning to protect aquatic biodiversity.

Ensuring sustainability and circular economy compliance by incorporating Life Cycle Assessments (LCA) and developing a Circular Economy Integration Indicator (CEII) for hydropower operations.



- *Runner model testing: The first runner model is undergoing advanced testing at GE Vernova's facility, designed to address inter-blade vortex effects and extend turbine life.*
- *Draft tube innovations: Luleå University of Technology is leading the development of draft tube flow control systems to stabilize operations under partial load.*
- *I-Fish system pilot: A lab-scale Intelligent Fish Barrier prototype is being tested at ICPE-CA, with machine-learning algorithms refining stimuli for species-specific responses.*
- *Circular economy framework: IRCEM is conducting Life Cycle Assessments of new technologies and developing sustainability criteria to guide the industry.*



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Test objectives:

- Collect extensive experimental data, including pressure fluctuations and runner stress, for use as a reference for designing mitigation solutions.
- Improve runner and draft tube design to reduce fatigue, optimise efficiency, and extend turbine lifespan.
- Validate numerical configurations developed by HES-SO and Stuttgart University.



GE Vernova leads the runner design, while draft tube modifications are handled by Luleå University of Technology (LTU). Based on the test results, a runner extension will be developed that can be added as a composite retrofit, reducing refurbishment costs and increasing operational flexibility.

Dr. Sandeep Kumar



Advanced measurements campaigns at LTU

Our post-doctoral researcher, Dr. Sandeep Kumar, is currently conducting laser Doppler velocimetry (LDV) measurements on a downscaled turbine model at LTU. These experiments aim to enhance our understanding of how the draft tube flow control system interacts with the rotating vortex rope and impacts overall system stability and efficiency.



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The measured data will:

- Support the development of low-fatigue, high-efficiency components.
- Be used to validate computational fluid dynamics (CFD) simulations created by our modeling partners.
- Provide critical input for the development of fish-friendly and noise-reducing turbine designs.



Ecological considerations: I-Fish and behavioural impacts

A recent study published in Science ([read it here](#)) highlights how the presence of anti-anxiety drugs in water bodies may alter fish behavior, making them less risk-averse. This finding may influence future fish deterrence strategies, such as the i-Fish system, as more docile fish may become less responsive to sensory barriers.



 The RevHydro project is monitoring these developments and assessing how such environmental factors can affect the efficiency of fish passage and deterrence methods integrated into hydropower infrastructure.



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Anticipated impact of RevHydro: before and after

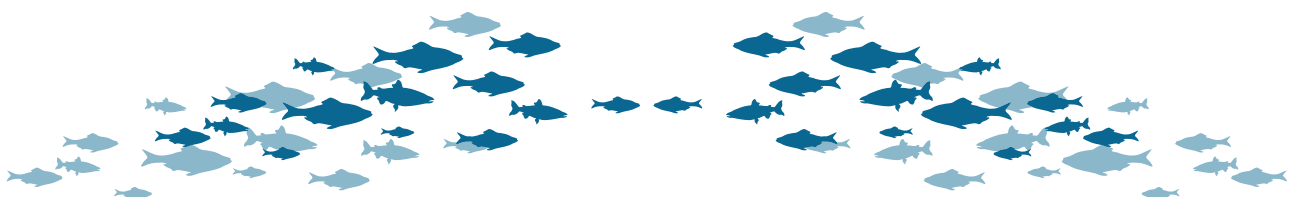
Hydropower efficiency

1. Current State: Many existing Francis turbines in Europe operate at reduced efficiency, especially under partial load, leading to energy losses and increased operational costs.
2. RevHydro Upgrade Target:
 - a. Efficiency Gains: Up to 5–10% improvement in turbine performance post-retrofit with runner extensions and draft tube flow control.
 - b. Extended Turbine Life: 10–15 years added lifespan for refurbished units, reducing the need for costly replacements.
 - c. CO₂ Reduction: Each upgraded unit could reduce CO₂ emissions by up to 1,000 tons/year by increasing renewable electricity output and reducing reliance on fossil backup.



Biodiversity and fish protection

1. Current challenge: Fish mortality rates at hydropower intakes can reach 5–10% in certain regions, affecting local biodiversity and fish populations.
2. RevHydro I-Fish system goal:
 - a. Fish mortality reduction: Up to 90% decrease in fish entering turbines, thanks to adaptive, non-invasive deterrence (bubble curtains, acoustic signals, strobe lighting).
 - b. Ecosystem resilience: Improved fish passage will support local ecosystems, potentially boosting populations of endangered species and maintaining ecological services.





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Circular economy contributions

1. Current practice: Turbine refurbishments are often piecemeal, with limited focus on recyclability or sustainability.
2. RevHydro approach:
 - a. Material savings: Up to 30% reduction in raw material use compared to manufacturing new turbines, by retrofitting with sustainable polymer extensions and modular vanes.
 - b. Waste reduction: Lower lifecycle waste and extended component life through modular designs and recyclable materials.
 - c. Sustainability score: Implementation of a Circular Economy Integration Indicator (CEII) to quantify environmental benefits and guide industry-wide adoption



Social & economic benefits

1. Training & knowledge transfer: 150+ stakeholders, including plant operators, policymakers, and researchers, trained in sustainable hydropower practices.
2. Global research contribution: Data from CFD simulations, experimental validations, and LCA assessments shared to advance hydropower science.
3. Stakeholder engagement: Ongoing workshops, social media outreach, and knowledge-sharing events to ensure wide dissemination and collaboration.





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Impact & statistics

 7 social media platforms active, with regular content updates and engagement.

 3,180 people reached, with 387 impressions across platforms (M6 report).

 26 publications produced, including simulation datasets and experimental results for the global hydropower community.

 100+ stakeholders engaged through workshops, webinars, and dissemination events.

Stay connected

- Follow RevHydro on [LinkedIn](#), [Facebook](#), [X\(Twitter\)](#), [Instagram](#), and [YouTube](#).
- Visit revhydro.eu for updates, publications, and project news.



Looking ahead

Upcoming milestones include the launch of the RevHydro YouTube channel, technical workshops and demo days, and continued refinement of turbine and fish barrier solutions. As we move forward, we invite stakeholders, researchers, and enthusiasts to engage with our journey towards a more sustainable hydropower future.

Thank you for your support!

Stay tuned for our next edition, where we'll share new insights, data, and stories from the RevHydro project.



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