Joint Programme on Hydropower

Annual Report 2021

EERA
European Energy Research Alliance
Hydropower

From the Coordinator

The green transition has started, and hydropower is a large ingrediency in the renewable energy mix in Europe. With the increased level of electrification and the large share of intermittent renewable energy sources, the safety of energy supply and stability of the electrical grid will experience tough challenges in the years to come. Hydropower is in my opinion the key technology that can provide the energy system in Europe with the necessary flexibility to address these challenges by supporting other renewable sources like wind and solar with its capabilities.

In 2021, we have focused quite a lot on the establishment of consortiums that works with the development of project proposals towards the Horizon Europe calls. This have resulted in an active collaboration in between members and I have observed that the network in between our members in our JP has flourished. I believe this is the reason that JP Hydropower is growing, and in 2021 we have welcomed 3 new members. This have happened in spite of the Covid-19 situation where travelling has been restricted and social distancing has been the practice among us. All of us have become used to digital meetings and we are using our time at work more efficient. However, I look forward to the possibility to physically meet with you all in 2022.

Ole Gunnar Dahlhaug , JP Coordinator

From the Manager

The past year has been a year of great improvement for the Joint Programme, under all possible points of view. Not only there has been an ever-increasing number of project consortia being built throughout the JP, but activities have spilt over to other initiatives and the engagement of all members have been notably high.

I am particularly proud of having hosted, in November, our first meeting in person since the beginning of 2020. It was a unique experience, signalling the return to something similar to normal meetings.

In 2022, I expect the Joint Programme to grow even stronger in terms of collaboration beyond project proposals. The community has created, in the past two years, a solid base to build upon in terms of advancing research and knowledge in hydropower. The recent war in Ukraine has shown, more strongly than ever, that relying on fossil fuels is more delicate than thought. Renewables are the future, and hydropower is an integral part of this scenario. The technology will need to prove this to the audiences that are most relevant, but the work brought forward in 2021 provides good hopes for the years to come. In a system that will be more green and digital than ever, hydropower will play once more the role of a crucial enabler.

Raffaele Guerini, JP Manager

In 2021, the Joint Programme added 3 new members to the group:

The additions represent precious new opportunities for networking and project building activities. They also bring the total number of members to 32, increasing the reach of the Joint Programme both geographically and in terms of topics covered. The newest members cover three different activities under the labelling of our Sub Programmes, contributing to SP3 (Markets and Grids), SP4 (Environmental Issues) and SP6 (Digitalisation).

vrvis zentrum für virtual reality und visualisierung forschungs-gmbh

ENERGIE INSTITUT an der Johannes Kepler Universität Linz

University of Strathclyde Glasgow

Membership per country:

- Austria: 5
- Belgium: 1
- Czech Republic: 2
- Germany: 3
- Italy: 2
- Norway: 3
- Poland: 2
- Romania: 1
- Scotland: 1
- Slovenia: 1
- Spain: 2
- Sweden: 2
- Switzerland: 3
- Turkey: 1

The Management Board of the Joint Programme

NTNU

Ole Gunnar Dahlhaug

Raffaele Guerini

SP1

NTNU

Pål-Tore Storli

UNIPD NEW

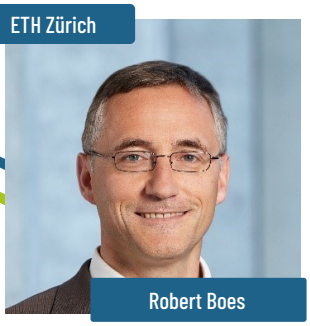
Giovanna Cavazzini

SP2

TU Braunschweig

Jochen Aberle

ETH Zürich



Robert Boes

SP3

SINTEF NEW

Michael Belsnes

TU Graz

Robert Schürhuber

SP4

LTU

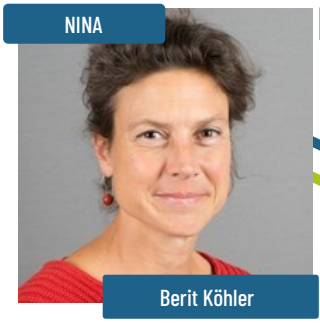
Staffan Lundström

EI Linz

David Finger

SP5

NINA



Berit Köhler

BERA (ULB)

Patrick Hendrick

SP6

TU Wien

Eduard Doujak

VRVis NEW

Johanna Schmidt

HORIZON EUROPE

Networking activities are key for the development of a solid and cohesive community.

For this reason, the Joint Programme has organised in 2021 a series of Consortium Building meetings around the calls of the Horizon Europe Work Programme for 2021 and 2022. The calls' main aim was to explore possibilities for collaboration between the different organisations that are members of the JP. The meetings effectively gave space to all participants to express their capabilities and their desired involvement in the different topics, helping the community to understand the available expertise and areas of interest.

8 Online Meetings

19 Participating Members

7 Consortia Built

4 Research Calls

- Energy Sector Integration
- Hidden Hydropower
- Innovative Storage
- Digitalisation of Hydropower

Some of our members' key publications throughout the year:

Special Issue in Water – Advances and Challenges in Hydropower

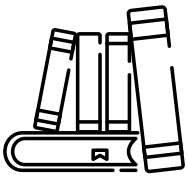
A Special Issue was organized by proff. J. Aberle and R. Boes, coordinators of Sub Programme 2. This special issue focused on hydraulic structures such as dams, weirs, intakes, tunnel systems, power stations, spillways, and outlets from the waterways, which in turn represent one of the backbones for the generation of hydroelectricity. Contributions were invited to address the development of novel and innovative solutions for improving the reliability, efficiency, safety, and environmental friendliness of hydropower infrastructure and reservoirs. This included contributions focusing on analytical considerations, scale model investigations, numerical simulations and field investigations. Special emphasis was placed on the further development of hybrid modelling strategies, i.e. the combined application of hydraulic scale models, numerical models and/or field investigations to make full use of the advantages and to minimize the uncertainties associated with the different modelling strategies.

The Special Issue received a total of 20 submissions. One paper is still in review, one manuscript has been withdrawn, six papers have been rejected, and 20 paper are published.

Link to publication:
https://www.mdpi.com/journal/water/special_issues/advances_hydropower

Participation to Electricity Users Survey

Within the ongoing Norwegian research centre HydroCen, members of Sub Programme 5 participated to a large representative survey among electricity users/customers in Sweden, Great Britain, Germany and Norway with more than 1000 respondents per country, including also a discrete choice experiment, focusing on the use, acceptance of hydropower as a renewable energy source (incl. willingness-to-pay). The results are of large interest in regard to the topics of SP 5, and two scientific articles were submitted and are under review.



Contribution to the Encyclopedia of Energy Storage

Patrick Hendrick, Sub Programme 5 Vice-Coordinator, had invited members of SP 5 to contribute to the planned Encyclopedia of Energy Storage with a chapter on the social acceptance of pumped hydropower. The resulting book chapter was accepted and has recently been published, incl. case studies from three different countries

Link to publication: Social Acceptance of Pumped Hydroelectricity Energy Storage (PHES) - ScienceDirect

Bringing hydropower research to the spotlight is one of the most important tasks for our community.

For this reason, participating in conferences and workshops is vital to the activities performed at JP level. Our researchers are not only discovering the technology of the present and the future, but they also work hard to share this knowledge with the relevant audiences. the attention communication will ensure that the developments in hydropower research will not go unnoticed, and contribute to the important objectives set by the European Union with the European Green Deal and the Fit for 55 legislation. Hydropower will be a key factor for the success of those initiatives, but it will not be easy if crucial stakeholders are not updated on the latest research results.

April

JP Hydropower Sessions on EGU2021:

- Innovation in hydropower operations and planning to integrate renewable energy sources and optimize the Water-Energy Nexus
- Sustainability as a challenge to face and a goal to reach: interdisciplinary approach to support raw materials and energy supply

June

Hydropower: how to avoid potential pollution sources and to mitigate environmental impacts by innovative measures and concepts

Speakers from JP Hydro: Ole Gunnar Dahlhaug (JP Coordinator), Guerini Raffaele (JP Manager)

September

Sustainability and Acceptability of Hydropower as Part of the Clean Energy Transition

Speakers from JP Hydro: Berit Kohler (SP 5), Staffan Lundstrom (SP 4)

Other events:

- August 26: Workshop on turbine abrasion (organized by ETH Zurich) in Brig (Switzerland);
- September 15 -17: Hydraulic Engineering Symposium at ETH Zurich (Hydraulic engineering in times of energy transition, water protection and climate change)

SP 1

Hydroelectric Units

19 organisations

22 researchers

SP 2

Hydropower Structures

14 organisations

17 researchers

SP 3

Grid, Systems Integration and Markets

13 organisations

13 researchers

SP 4

Water resources, environmental impacts and climate adaptation

14 organisations

19 researchers

SP 5

Social acceptance, engagement and policy

7 organisations

13 researchers

SP 6

Digitalisation

17 organisations

17 researchers

Developing design criteria for hydraulic structures based on the latest knowledge in the fields of environmental hydraulics, hydraulic engineering and river morphodynamics is a key to sustainable hydropower generation

Jochen Aberle, SP 2 Coordinator

Given the current power market situation in Europe we experience that security of supply is a key challenge, and cost of not supplying and capacity shortage gives hydropower wind in the sails. kWh's are not the same independent of source, and some of the best kWh's are from hydropower. Therefore we investigate how market solutions and grid integration of hydropower can support the vision of clean affordable energy for all European citizens.

Michael S. Belsnes, SP 3 Coordinator

DIRT-X

FlexWatter

HydroFlex

Resemo

FranSed

XFLEX HYDRO

HydroCen
NORWEGIAN RESEARCH CENTRE FOR HYDROPOWER TECHNOLOGY

ALPHEUS

HYPOS

AFC4Hydro

LIFE4FISH

HYDROPOWER EUROPE

What challenges will define the way forward for the Joint Programme?

Major initiatives at EU Level

The EU SET Plan and the Clean Energy Transition Partnership represent the most important possibilities to make hydropower more prominent in the Clean Energy Transition landscape in Europe. The SET Plan is currently undergoing a revamp process, and hydropower's absence from its list of key technologies has been the elephant in the room for years. Similarly, the Clean Energy Transition Partnership (in which the Joint Programme had an active role, contributing to its Strategic Research and Innovation Agenda) will represent a possibilities for researchers to receive more funding for activities in the hydropower sector. Participating in these two major efforts will boost the relevance of the hydropower R&I community.

Reaching out to the community

The Joint Programme is not alone in its efforts to bring the sector into the future. Other relevant actors, in the EU but also the international scene, are working hard to bring the technology under the spotlight of citizens and policymakers. The JP should aim at unifying efforts with similar initiatives, finding common grounds and expanding multilaterally its outreach. The way forward sees the JP meeting more regularly with partners and initiating constant dialogue with researchers from the hydropower and the broad Clean Energy Transition scene.

Increase mobility across the Joint Programme

To create a further sense of community, but also to exploit the untapped potential in mobility exchanges that the JP can offer, this is a feature that the JP will need to offer in the future. The cross-sectorial knowledge that is provided by the Sub Programmes is a precious feature to bring up young and multi-faceted new researchers in the hydropower sector. A system for fruitful and interesting exchange will be created, making it attractive to spend a period abroad at a JP member's institution.