HydroFlex

Newsletter #1

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Hydroflex website

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Newsletter Contents

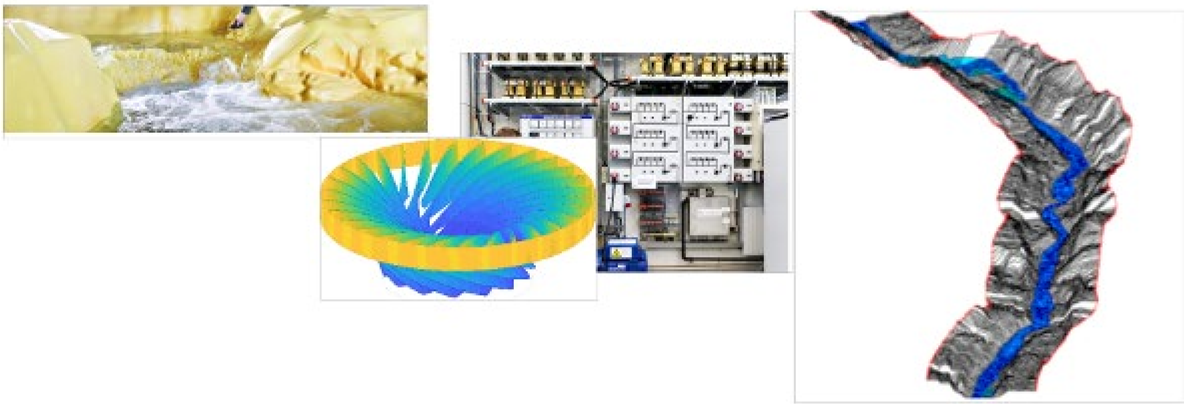
1. Kick-off for Hydroflex

35 participants from all five HydroFlex countries were gathered in Trondheim on June 13th to kick off the HydroFlex project. It was a very productive day with interesting presentations, good discussions and a lot of networking.

2. Greetings from the project coordinator

The transition from fossil fuels to renewables is an ongoing process and it is progressing with a pace that has been underestimated. Intermittent energy sources need flexibility from the hydropower system more than ever. This emphasize the need for our common efforts in the HydroFlex project. HydroFlex's objective is to develop new technology that increases the flexibility of hydropower, and my wish for our common ambition is to establish a project team that aims for goals that are bigger than we are – it will give each and one of us great rewards. The HydroFlex project was a collaborative work to establish, and it certainly will be a one for the work ahead of us. Now, as the project is in its early phase, it is important that all project participants recognize each other's work - the results will be dependent on it.

3. News from the Work Packages (WP)



3.1 WP2 Definition of scenarios and reference cases

In work package 2 (WP2), we aim to establish a reference framework that describes the demands hydropower plants are going to be confronted with in future transmission grids: How can such a flexible turbine – capable of more than 30 starts-and-stops per day – contribute to grid stability and will there be a market for this? To evaluate this, the need for the definition of scenarios arises and, is fundamental for the upcoming activities in WP2 itself and in the other work packages. Therefore, IAEW (RWTH Aachen University) is preparing a public report defining three future European energy scenarios. Based on the consensus of the workshop held in June 2018, IAEW spread a proposal of three scenarios through the consortium. The “Green Hydro” scenario with a high demand for hydropower flexibility, the “Reference” scenarios is a best guess scenario, and the “Prosumer” scenario is based on asumptions with regard to low demand of flexibility from hydropower. After consultation and integration of all given feedback, IAEW defined and developed those scenarios more detailed, forming a basis for the upcoming simulations.

3.2 WP 3 Flexibility of turbines

The contemporary electricity market demands a robust mechanism that allows the integration of various sources of energy. Power produced from intermittent energy sources, such as wind energy and solar energy, fluctuates, and it is very challenging to maintain the voltage frequency of the grid (around 50 Hz). This means that other generating units need to absorb the fluctuations (known as short peaks).
Hydraulic turbines are extensively used to absorb the short peaks due to their high flexibility of power generation. The numbers of short peaks and the ramping have significantly increased in the last two decades. Such high numbers of ramping have pushed the hydraulic turbines to the endurance limit, and the turbines have started to show signs of fatigue. The HydroFlex project aims to design and develop a turbine that allows power generation in conjunction with solar and wind, i.e., more start-stop cycles and high ramping rates. Two distinct approaches will be implemented, i. e., variable speed and improved fatigue characteristics.

In the third work package (WP3) of HydroFlex, we deal with the flexibility of turbines. We aim to design a turbine, which is capable of handling up to 30 start-stop cycles per day while accommodating variable power from wind and solar energy. Turbines are expected to operate off-design loads (i.e., far away from the design point, also known as the best efficiency point) for longer time and the variable speed approach will help to improve the dynamic stability and hydraulic efficiency at off-design loads.

Under WP3, we develop new designs of the turbine blades, guide vanes, stay vanes and draft tube aiming to reduce the adverse effects on the turbine during frequent starts and stops. When turbines are operated in a flexible manner to accommodate the variable electricity demand, the loading on the turbine blades changes frequently. That means such loading is time dependent

(or varies depending on power generation/demand), and this may lead to the development of fatigue crack in the blades. Keeping this in mind, HydroFlex also aims to develop a lifetime predicting tool that will help to predict the life expectancy of a turbine. In WP3, three universities (NTNU-Norway, UKiM-Macedonia and LTU-Sweden) and two industrial partners, EDR Medeso (consultancy company –Norway) and Rainpower (turbine Manufacturing company -Norway) are working together.

3.3 WP4 Flexibility of generator and converter

When non-dispatchable and intermittent renewable energy sources (wind and PV solar in particular) become key components of the energy mix, hydropower plants represent an important source of flexibility. Hydropower can support the grid and increase its flexibility when utilized as a dispatchable renewable energy source. One possible solution to reach this level of functionality and dispatchability required by the future electric grid is to enable variable speed hydropower generators.

To achieve that, on top of the high efficiency and reliability standards that characterize the hydropower industry, different technologies are required. For instance, novel converter and machine topologies to be able to reach low losses at different speeds and regimes as well as state of the art controllers and insulation systems that can cope with the new system requirements. These are all aspects, which we in HydroFlex WP4 are working on with a strong team of research and industry partners led by the Division of Electricity at Uppsala University.

3.4 WP5 Social acceptance and mitigation of environmental impact

In WP5, we focus on the social acceptance of flexible hydropower and on innovative methods to mitigate environmental impacts. The activities in the first six months of the project focused mainly on the latter.

The ACUR (Air Cushion Underground Reservoir) concept – a technology to mitigate highly fluctuating discharges into downstream river - has been presented for the project team and work is on-going on an ACUR simulation model of Nidelva (Nid river) and Ume älv (Ume river).

Further, we started to set up simulations of Bratsberg power plant (Nidelva). Modifications to represent Stornorrfors power plant (Ume river) are easily implemented. Personnel at Statkraft have been contacted regarding the physical system and the current operational limitations at Bratsberg.

The hydraulic models of Nidelva and Ume älv are under development where newly employed Research assistance, Ana Juarez (NTNU) and PhD-student Anton Burman (LTU) are main contributors. The review of biological data for Nidelva is in progress.

3.5 WP6 Communication, dissemination and exploitation

In WP6, we focus on the internal and external communication along with dissemination and possible exploitation of the results from the project.

The Detailed Communication, Dissemination and Exploitation Plan (DCDEP) for the HydroFlex project was issued on the 1st of August 2018. The aim is to ensure that the project results are spread to relevant stakeholders and the general public and embedded into other research, industry and policy during and beyond the project's duration. The release is the first verison of the DCDEP and this will be a live document throughout the project.

Thank you for your attention!

We hope this Newsletter has given you a good first look of the Hydroflex project and we hope you will concider to share this with other interested parties.

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