Newsletter #2

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Hydroflex website

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Newsletter Contents

1. Greetings from the WP leaders - WP 6: My vision for the Hydroflex project

In the first HydroFlex newsletter, the project coordinator, professor Ole Gunnar Dahlhaug, NTNU presented his vision for the project. In this issue and coming

newsletter we will challenge each of the work package leaders to present their vision for the HydroFlex project. Here is Bjarne Børresen, section leader for mechanical hydropower at Multiconsult Norge as and Hydroflex leader of WP 6 - Communication, dissemination and exploitation:

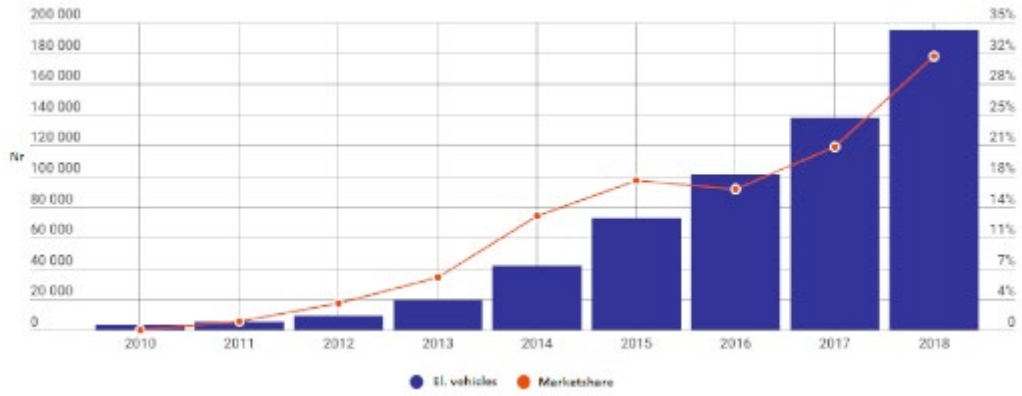
The goals of the HydroFlex project – increased flexibility of hydropower plants and focus on system services while ensuring good environmental design in a market-based power system, epitomize the change in the industry in the three decades that I have been engaged in hydropower. As a young turbine designer, I believed that peak efficiency was the 'holy grail'. So did the clients. At the time, the specifications hardly contained any details regarding off-design conditions or number of start-stops. The main system requirement was the ability to operate on an isolated grid. In 1990, the liberalization of the Norwegian and later Nordic power market started. In the following decade, there was a gradual realization that there were relations between market designs, operating pattern, requirements for the power plant design, and wear and maintenance cost.

For many, the first EU climate and energy package (20-20-20 targets), launched in 2007, was the first proof of a radical change in the European power system. A decade later the headlines exemplifying the worldwide change is quite striking:

- Denmark has a share of 41% from wind power (2018)
- April 22. 2019 – 77 % of the power production in Germany comes from renewable energy
- The net installed capacity of wind power in Europe in 2019 is expected to reach 189 GW
- Falling RE costs: How Can Modellers Keep up? (title of IRENA workshop, May 2019)

When Norway, as part of the EEA agreement, decided to adhere to EU's 20-20-20 goals, ambitious goals for private transportation was put forward. By 2020, the number of electric vehicles should be 70 000. The combination of very good incentives based on cross party agreement, active lobbying of NGOs and business associations combined with prominent technical developments, have resulted in a

striking success of the electrification of private transport (with the current prediction reaching 210 000).



As part of the cross party agreement of Norway's commitment to EUs 20-20-20 goals, a target for 70 000 electric vehicles in 2020 was set. Based on the current statistics it is expected that the final number will be almost three times that value.

This long and winding introduction is meant to underline the importance of the goal for the HydroFlex project. The changes in the power system, both on the production side as well on the consumption side, which we speculated and theorized about 10-20 years ago, are happening just in front of us. Accordingly, it is my vision, and the goal for WP 6, that the results we jointly develop in the various work packages of the HydroFlex project, related to turbine technology, electrical machines, environmental design and market modelling, not only results in publications, thesis monographs and conference presentations, but are also brought out of laboratories and computer models and implemented in new hydropower projects and refurbishment, redesign or modernization of existing hydropower plants.

With regards,
Bjarne Børresen

2. PHD Candidates - The Hydroflex engine

A well-kept secret in most research and development projects is the importance of the PhD student in pulling the brunt of the work load. So also with HydroFlex where 7 PhD students so far has been engaged in the various work packages. This symbiosis between research and education also benefits the PhD candidates. Publically funded R&D projects such as HydroFlex have been through an extensive review process by top specialist in the field before securing funding. Such a securitization ensures that the candidate are working in the forefront of the research field on highly relevant topics.

Hydroflex project have had the privilege to capture the following PhD Candidates:

Name	University	PhD subject	WP
Marija Lazarevikj	Ss. Cyril and Methodius Universityin, Skopje	Optimization of guide vanes system in Francis turbine with dynamic loads and stress analysis	3
Filip Stojkovski	Ss. Cyril and Methodius Universityin, Skopje	CFD Optimization and Experimentation for the guide vanes geometry suitable for High Head	3
Jesline Joy	Luleå University of Technology	Study of Pressure Pulsations and Mitigation of RVR in Francis-99 Draft Tube	3
Chengjun Tang	Chalmers University of Technology	Converter Design for Hydro Turbine	4
Roberto Felicetti	Uppsala University	Alternative excitation systems finalized to the generator self-start	4
Reza Sargazi	Norwegian University of Science and Technology,	The Effect of Static Converters on Electric Field Grading Insulation Layer in Rotating Machines	5
Anton Burman	Luleå University of Technology	Flow Scenario Modelling in Proximity to Hydropower Plants with Rapidly Changing Flow Conditions	5

3. Headlines / Activities

3.1 Inspiring WP3 workshop in Trondheim

WP3 participants from NTNU and EDR&Medeso met in Trondheim to discuss how to optimize turbine design for operation with high flexibility.

3.2 Successful measurements at the Porjus Hydropower Plant

The WP4 team from Uppsala University, Sweden, developed a distributed parameter model for the U9 rotor winding in the Porjus Hydropower Plant, which is capable to describe the field winding stress during high-voltage/high-frequency switching supply.

3.3 Field work at Nidelva and Ume älv

It has been an active autumn for HydroFlex partners in work package 5. In order to set up the hydraulic models for the environmental assessment of flexible hydropower, the teams from NTNU and LTU were out in the field at Nidelva river in Trondheim, Norway, and Ume älv in Sweden

3.4 New publications and conference presentations

Paper: Performance of A Two-Dimensional Hydraulic Model for the Evaluation of Stranding Areas and Characterization of Rapid Fluctuations in Hydropeaking Rivers. Juarez, A, Adeva-Bustos, A, Alfredsen, K & Dønnum, B (2019):

Conference Paper: Investigation of the possibilities for development of a variable speed hydraulic turbine. Markov, Z, Stojkovski, F, Lazarevikj, M & Iliev, I (2018).

HydroFlex report: Three European Energy Scenarios

Webinar: Three European Energy Scenarios

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