HydroFlex Conference Publications, Public Workshops & Seminar Presentations

HydroFlex

Increasing the value of hydropower through increased flexibility

Deliverable 6.25 Conference publications 4

Work package	WP6 Communication, dissemination and exploitation
Task	Task 6.4 Publications and presentations
Lead beneficiary	Multiconsult
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Type of deliverable	Websites, patents filling, etc.
Dissemination level	Public

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1 Introduction

The dissemination of HydroFlex results at relevant conferences, workshops and seminars is key for ensuring a high scientific standard, relevance, collaboration between research and industry, and overall visibility. The project has stated the quantitative target of more than 12 conference contributions. This deliverable lists the presentations held at conferences, workshops and seminars, and the workshops/seminars arranged by HydroFlex and a list of articles submitted to several conferences in the entire project period. The peer-reviewed publications are listed in deliverable 6.21.

2 Presentations held at conferences, workshops and seminars

Chengjun Tang, Torbjorn Thiringer (2021): *Performance comparison of five-level NPC and ANPC converters in medium voltage drives for hydro power application*; 23rd European Conference on Power Electronics and Applications (EPE'21 ECCE Europe)

Burman, Andersson, Hellström; *Investigating Damping Properties in a Bypass River*; River Flow Conference; 2020

Børresen, B: Presentation of HydroFlex at the PTK Conference in Trondheim. March 2-4, 2020.

Burman, A, Andersson, A & Hellström, G: *Inherent Damping in a Bypass River*. Poster presentation at HydroFlex Workshop 1. Trondheim, May 27, 2019.

Charrassier, F: *Flexibility of Hydraulic Turbines – A Parametric Design Tool*. Poster presentationat HydroFlex Workshop 1. Trondheim, May 27, 2019.

Felicetti, R, Abrahamsen, J & Lundin, U: *A salient pole rotor winding model for fast switching current control*. Poster presentation at HydroFlex Workshop 1. Trondheim, May 27, 2019.

Felicetti, R, Abrahamsson J & Lundin, U: *Experimentally validated model of a fast switched salient pole rotor winding*. Presented at IEEE WEMDCD 19. Athens, April 22, 2019.

Foti, P: *Evaluation of the Strain Energy Density value with volume free FE model*. Poster presentation at HydroFlex Workshop 1. Trondheim, May 27, 2019.

Foti, P & Berto, F: *Evaluation of the strain energy density value for welded joints typical of turbine runner blades*. Presented at Francis-99 workshop 3. Trondheim, May 28-29, 2019.

Joy, J & Cervantes, M: *Study of pressure pulsations and mitigation of RVR in Francis-99 Hydro Turbine*. Poster presentation at HydroFlex Workshop 1. Trondheim, May 27, 2019.

Joy, J: *Study of Flow Characteristics inside Francis Turbine Draft Tube with Adjustable Guide Vanes* Presented at 15th Asian International Conference on Fluid Machinery, Busan, South Korea. September 25-28, 2019

Joy, J: *Numerical Study on Reduced Francis-99 Turbine Model during Part Load Operation*. Digital presentation on 30th IAHR Symposium on Hydraulic Machinery and Systems (IAHR 2020), Lausanne, Switzerland, 21-26 March 2021.

Juarez, A & Alfredsen, K: *Hydraulic model for evaluation of peaking operation in Nidelva*. Poster presentation at HydroFlex Workshop 1. Trondheim, May 27, 2019.

Juarez, A.: Assessing the impact of hydropeaking utilizing a 2D hydraulic model. Presented at The 6th Biennial Symposium of the International Society for River Science (ISRS) in Vienna.

September 9-13, 2019.

Khanzadeh, B., Tang, C., & Thiringer T., (2020): *A Study on the Lifetime of Q2L-MMC-DAB's Switches for Wind Turbine Applications*. Presented on Fifteenth International Conference on Ecological Vehicles and Renewable Energies (EVER). Monte-Carlo, Monaco, 10-12 September 2020.

Lazarevikj, M: *Influence of the guide vanes structural parameters on variable speed Francis turbine performance*. Poster presentation at HydroFlex Workshop 1. Trondheim, May 27, 2019.

Lazarevikj, M., Stojkovski, F., Iliev, I & Markov, Z. (2019) *Influence of the guide vanes design on stress parameters of Francis-99 turbine*. Presented at Francis-99 workshop 3. Trondheim, May 28-29, 2019.

Markov, Z, Stojkovski, F, Lazarevikj, M & Iliev, I: *Investigation of the possibilities for development of a variable speed hydraulic turbine*. Presented at Energetics. Ohrid, October 04-06, 2018.

Sargazi, R: *The effect of Static Converters on Field Grading Materials in Rotating Machines*. Poster presentation at HydroFlex Workshop 1. Trondheim, May 27, 2019.

Schönefeld, M & Hüllenkremer, J: *Dynamic frequency stability analysis*. Poster presentation at HydroFlex Workshop 1. Trondheim, May 27, 2019.

Siemonsmeier, M: *Hydropower and flexibility - Defining Three European energy scenarios*. Presented at Post COP-24 How to unlock clean and flexible hydropower in Europe. Norway House. Brussels. December 18, 2018.

Siemonsmeier, M: Investigating the Flexibilization of Hydraulic Storage Power Plants in the Nordics Presented at IEEE Electric Power and Energy Conference (EPEC), Edmonton, Canada, 9-10 November 2020

Stojkovski, F: *Mathematical and numerical modeling in order to optimize the hydrodynamic and geometrical parameters of guide vanes in Francis turbines with variable speed*. Poster presentation at HydroFlex Workshop 1. Trondheim, May 27, 2019.

Stojkovski, F: *Parametric Design Tool for Development of a Radial Guide Vane Cascade for a variable Speed Francis Turbine*. Digital presentation on 30th IAHR Symposium on Hydraulic Machinery and Systems (IAHR 2020), Lausanne, Switzerland, 21-26 March 2021.

Tang, C: *Converter design for pumped-storage hydro power unit with large number of start-stops*. Poster presentation at HydroFlex Workshop 1. Trondheim, May 27, 2019.

Tang, C. & Thiringer, T: Thermal modelling of a multichip IGBT power module. Presented at 21st European Conference on Power Electronics and Applications (EPE '19 ECCE Europe)

Genua, Italy. September 3-5, 2019.

Tørklep, A: Presentation of HydroFlex at RENEXPO INTERHYDRO, Salzburg, Austria. November 28, 2019.

Wirtz, P: *Two-step Approach Simulating the Unit Commitment of Highly Complex Hydraulic Systems in the Future European Power System*. Presented on 17th International Conference on the European Energy Market (EEM), Stockholm, Sweden, 16-18 September 2020.

INEA (Innovation and Networks Executive Agency) in European Commission organized an workshop on 20th Novemeber 2020 on the policy context: Hydropower and its role in the future energy system and Hydropower and its environmental impact- latest trends in legislation. Ole Gunnar Dahlhaug (Co-ordinator of HydroFlex project) presented about the HydroFlex project and its expected technological impact and major challenges and barriers in the forum.

3 Workshops/seminars arranged by HydroFlex

HydroFlex Webinar 1: Hydropower and Flexibility "Defining three European Energy Scenarios"

The first HydroFlex webinar is based on the WP2 report "Three European Energy Scenarios". HydroFlex researcher Marius Siemonsmeier (RWTH Aachen) presents three different future scenarios for the European energy system and the role of hydropower within them. The webinar is available on the HydroFlex YouTube channel.

HydroFlex Webinar 2: Hydropower and Flexibility "Overvoltage phenomena in the field winding of a hydropower generator".

Operational flexibility of hydropower stations is among the highest goal of the Hydroflex project. Faster and at the same time more efficient start-stop transients of generators and pumped–storage units are challenging a more than a century old technology. In particular, the coupling of faster and faster switching power electronics drives to the generator/motor windings needs to be carefully assessed, in order to avoid the insurgence of prejudicial electric stress to the insulation. After introducing the reasons for the increased use of power electronics in the excitation system of synchronous machines, this webinar by Roberto Felicetti, Uppsala University, presents how WP4 is facing the issue of predicting and assessing overvoltage in the unit field winding.

HydroFlex Webinar 3: Hydraulic models in Nidelva and Ume Rivers

In HydroFlex webinar #3, HydroFlex researchers Ana Juárez (NTNU) and Anton Burman (LTU) present Hydraulic Models in Nidelva and Ume rivers in Norway and Sweden. These models will help to evaluate different scenarios for the operation of hydropower plants, including 30 starts and stops per day, to be able to assess environmental impacts.

HydroFlex Webinar 4: Flexibility of Hydraulic Turbines – A Parametric Design Tool

The future electricity market will have large contributions from renewable energy sources such as solar and wind. The intermittent nature of these energy sources creates a need for highly flexible operation of hydropower stations, and challenges the structural integrity of the turbines of the future.

In this webinar, Erik Tengs and Maria Rolstad Jordal from EDRMedeso present a framework for variable-speed Francis turbine design. To ensure that the turbine is less prone to fatigue, even at off-design operation, it must be optimized from a hydraulic point of view, as well as considering the structural integrity.

The presented process is fully automated, with no need for human interaction. A MATLAB design code and ANSYS simulation processes are coupled using the optimization software optiSLang

HydroFlex plenary meeting 1

On May 27, 2019 more than 45 people gathered in Trondheim, Norway for the HydroFlex plenary meeting. The plenary meeting was an opportunity for all the research teams to update each other on the progress of the various work packages and an important social and scientific meeting place to ensure collaboration across teams and work packages.

A common language and a common understanding of key challenges for the different teams is important for enabling a good collaboration between the teams. Thus, in addition to the mandatory presentation on the progress for each work package, the program for the day included a number of popular science presentations of HydroFlex results. Futher, a poster session with HydroFlex PhD projects was organized.

A public summary of the workshop and an online poster exhibition is available on the HydroFlex website.

Third Francis-99 workshop: Fluid Structure Interactions

HydroFlex was co-organizer of the Third Francis-99 workshop, which took place in Trondheim on May 28-29, 2019. The scope of the workshop was fluid structure analysis under steady state operating conditions. In particular, parameters such as study of mode-shape, nodal- diameter, deformation, fatigue loading, estimation of fatigue life, individual/combined natural frequencies, hydrodynamic damping, harmonic response, etc. were investigated.

The workshop was chaired by HydroFlex WP3 lead Chirag Trivedi and several HydroFlex researchers participated in the workshop. First results from WP3 were presented by Marija Lazarevikj (UKIM) and Pietro Foti (NTNU).

Third Public workshop of HydroFlex: Flexibility needs in the Nordic power systemtowards 2030

The third HydroFlex workshop took place on April 21, 2021. Due to covid-19 and travel restrictions, the event, which was planned to be arranged at Luleå Technical University (LTU), Sweden had to be converted to a digital workshop. More than 80 speakers and participants joined the 3.5 hours long workshop.

The theme of the workshop was “Flexibility needs in the Nordic power system towards 2030”. More specifically, the workshop aimed at answering the following questions: With emphasis on the changes towards 2030:

• How will Nordic hydropower as part of the European power supply system be operated?

• What are the main drivers for change in flexibility provision by hydropower plants in Nordics?

• What benefits does an increased flexibilization of hydropower have in the Nordic power market?

• To what extent is flexibility provision from the Nordics possible for North- and CentralEurope? What are the necessary conditions for this to happen?

EU Green Week 2021: European hydropower is important for the Green deal

HydroFlex organized the EU Green week partner event entitled “European hydropower is important for the Green Deal”. This online webcast was held on May 26, 2021.In this short event, participants from different parts of Europe presented various important aspects of hydropower. This included facts and numbers about hydropower, the historical relation between industrialization and hydropower development, public perception of hydropower as well as the importance of hydropower in the power system. In closing, three Horizon 2020 projects, XFLEX HYDRO, AFC4Hydro and HydroFlex came together and each gave a short introduction to their projects.

Fourth public workshop of HydroFlex: The role of flexible hydropower in the future energy system

The fourth/ final HydroFlex workshop took place on March 23, 2022. Due to slightly reduced travel restrictions, the event was organized in a hybrid mode. The physical event was held in Trondheim, Norway with the participation of more than 40 people. More than 40 digital participants joined the 5 hours long workshop.

The theme of the workshop was “The role of flexible hydropower in the future energy system”. In this public workshop, some of the key results from the project were presented. The workshop presented the scenarios the project had been working with and addressed the following questions:

- How flexible can a Francis turbine be operated?
- How to increase flexibility of the generator?
- Can we analyze and understand the trade-off between increased flexibility and environmental impact? and
- What is the public acceptance for more flexible operation?

After a winter with unprecedented price peaks and high volatility, the question of the role of highly flexible hydropower is more pertinent than ever.

4 Submitted for publication

WP	Title	Authors	Journal/Proceedings/Books series/Book	Remarks
3	Draft Tube Guide Vane System to Mitigate Pressure Pulsations	Jesline Joy, Mehrdad Raisee and Michel Cervantes	IAHR 2022	Submission in progress
3	Analysis of the Influence of Francis Turbine Guide Vane Axis Location on Its Structural Parameters	Marija Lazarevikj, Zoran Markov	39th IAHR World Congress in Granada	Submitted
3	Non-Uniform Design of Guide Vanes for Variable Speed Francis Turbines	Filip Stojkovski, Zoran Markov	39th IAHR World Congress in Granada	Submitted
3	Optimization of Guide Vanes for Variable Speed Francis Turbines – Human Controlled vs. Automated Approach	Filip Stojkovski, Zoran Markov	31st Symposium on Hydraulic Machinery and Systems in Trondheim	Submitted
3	Automated hydraulic design procedure for a Francis turbine spiral casing	Marija Lazarevikj, Zoran Markov	31st Symposium on Hydraulic Machinery and Systems in Trondheim	Submitted