Project: Increasing the value of Hydropower through increased Flexibilty – HydroFlex

The HydroFlex project is financed by The European Commission and the Innovation and Networks Executive Agency (INEA) which recognized the potential for integration of variable speed operation of hydropower systems. The idea for a project that will develop a variable speed Francis turbine was born from the extensive experience that the lead institution, the Norwegian University of Science and Technology, Trondheim, Norway has in the field of hydropower.

Project aim

The HydroFlex project aims to meet the challenge of increasing the flexibility of hydropower in order to utilize the power and storage capability. The project tends to create the basis for successful future industrial developments by performing well-focused research and innovation actions on the key bottlenecks of hydropower plants that restrict their operating range and ability to have many start-stops and high ramping rates. Technical solutions to overcome the main barriers and factors influencing more flexible operation will be developed and tested in laboratory.

Taking into account that Francis turbine is the most common turbine type in Europe, the emphasis on the research is on the flexibility of Francis turbines and the configuration of synchronous generators and frequency converters that allow for variable speed operation.

The project specific objectives are:

- Identifying and describing the demands that hydropower will be confronted in future systems, such as dynamic loads resulting from providing high ramping rates and frequent start-stop cycles
- Developing a parametric design tool needed for assuring optimal geometry suitable for turbines operating with variable speed, focusing on the geometry of stay/guide vanes cascade and runner

- Numerical optimization of the design of the variable speed Francis turbine using FSI analysis in ANSYS software in order to provide optimal hydraulic design and structural integrity of the developed design solution
- Validation of the turbine design through model turbine experiments in laboratory
- Developing new power station electrical layouts, generator rotor and magnetization systems and power electronic converter control for increased flexibility and strong grid support
- Assessing social acceptance and testing innovative methods to mitigate social impact and environmental impacts
- Promoting research results to the hydropower industry, the scientific community and the public by presenting results in workshops, conferences, scientific journals, newspapers and social media.

Participating institutions

1 NORGES TEKNISKNATURVITENSKAPELIGE UNIVERSITET (NTNU) Norway - coordinator

2 LULEA TEKNISKA UNIVERSITET (LTU) Sweden

3 UPPSALA UNIVERSITET (UU) Sweden

4 CHALMERS TEKNISKA HOEGSKOLA AB (CHALMERS) Sweden

5 SINTEF ENERGI AS (SINTEF) Norway

6 Lyse Produksjon AS (Lyse) Norway

7 RAINPOWER NORGE AS (RP) Norway

8 VATTENFALL AB (VATTENFALL) Sweden

9 STATKRAFT ENERGI AS (Statkraft) Norway

10 STIFTELSEN NORSK INSTITUTT FOR NATURFORSKNING (NINA) Norway

11 UNIVERSITY OF STRATHCLYDE (USTRAT) United Kingdom

12 SS. CYRIL AND METHODIUS UNIVERSITY IN SKOPJE (UKiM) Macedonia

13 ABB AS (ABB AS) Norway

14 RHEINISCH-WESTFAELISCHE

TECHNISCHE HOCHSCHULE AACHEN (RWTH) Germany

15 MULTICONSULT NORGE AS (MC) Norway

16 EDR & MEDESO AS (EDR) Norway

More details about the HydroFlex project can be found on the official website:

www.h2020hydroflex.eu

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