July 2025 # PRESS RELEASE #6

D-HYDROFLEX

#MeetTheD-HYDROFLEXDemos_No 1

Efficiency Optimization and Predictive Maintenance

How to fully utilize the energy potential of the water and reduce unplanned outages.

Wrocław, POLAND – July 2025 — As part of the EU-funded **D-HYDROFLEX** project, the HPP Wały Śląskie demo is showcasing how digital technologies can transform traditional hydropower infrastructure into a flexible, secure, and sustainable pillar of Europe's energy transition.

Demo Case at a Glance

Location: Odra River, Wały Śląskie, Lower Silesia, Poland

Lead Partners: Tauron Ekoenergia (TEE)

Wroclaw University of Science and Technology (PWR)

Demo Goals:

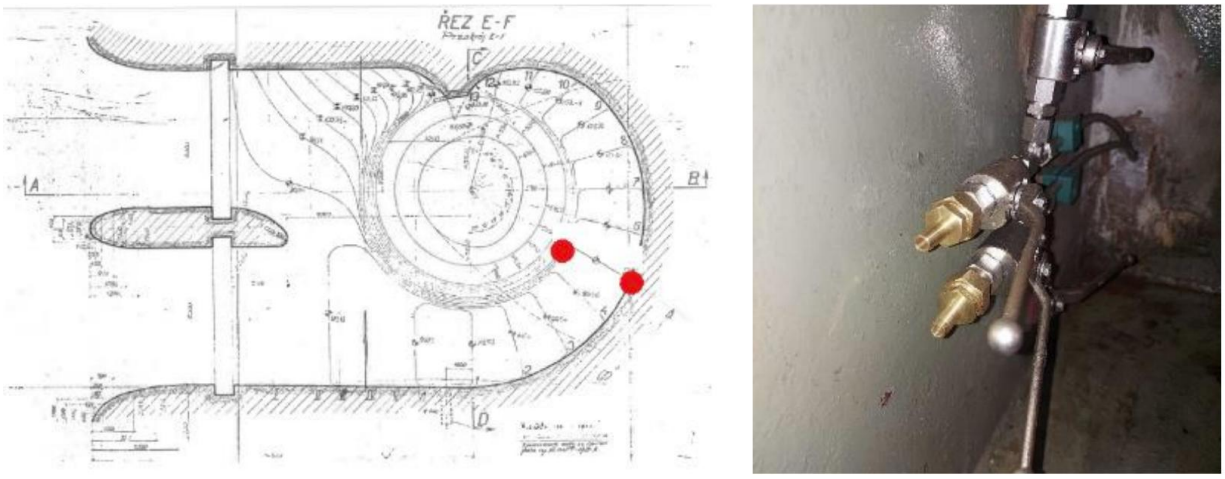
- **Operational Efficiency Maximization**
- **Predictive Maintenance Support**

Hydropower plays an important role in transition to decarbonized power systems and needs modernization. This particular demo addresses the digitalization of hydropower assets by means of a digital twin. Business related objectives and operational needs are the driving forces of the concept for digital twin helping in the maximisation of profitability of a hydro-system in the HPP Waly Slaskie.

Funded by the European Union

D-HYDROFLEX project has received funding from the European Union's HORIZON Research and Innovation Action under Grant agreement No 101122357

HPP Wały Śląskie Kaplan turbine 3d scan



HPP Wały Śląskie pressure differential measurement points (for Winter-Kennedy flow measurement)

Challenges Faced

The demo tackled key barriers such as:

- **Lack of Kaplan turbine CAD documentation** – At the early stage of the project, detailed turbine geometry was unavailable, and turbine dewatering was scheduled for a later date. However, CFD modeling and tool development had to start without delay.
- **Absence of flow measurement system -** The plant was not equipped with a flow measurement method, which limited efficiency analysis and turbine diagnostics.
- **Missing additional instrumentation and data acquisition system** – Several operational parameters, such as upstream and downstream water levels, were not being recorded, limiting the accuracy of performance assessment.

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Innovative Solutions Delivered

To overcome these, the team:

- Created an initial virtual model of the Kaplan turbine based on known dimensions and parameters. Once the turbine was dewatered, a 3D scan was performed to obtain high-resolution geometry, which was used to validate and refine the model.
- Proposed the Winter-Kennedy method for indirect flow estimation – A set of propeller-type velocity meters mounted on a custom frame will be used to measure flow velocity at the turbine inlet. These measurements will be conducted to calibrate the differential pressure (Δp) values obtained from the Winter-Kennedy taps. Once calibration is complete, the system will enable continuous flow estimation based solely on pressure readings, ensuring non-intrusive and reliable monitoring during normal plant operation.
- Installation of new water level sensors and a dedicated data acquisition system – To enhance monitoring capabilities, the project includes the planned installation of sensors for key parameters such as upstream and downstream water levels. These sensors will be integrated with a dedicated data acquisition (DAQ) system, designed to collect, synchronize, and store measurement data in real time. The system will connect to an industrial PC, enabling local data processing and remote access. This setup will provide the necessary infrastructure for improved operational awareness and seamless integration with the digital twin.

Impact & Future Outlook

Early results show:

- A 3D scan enables accurate CFD (Computational Fluid Dynamics) modeling of the Kaplan turbine and the entire hydraulic system.
- A scalable approach to flow estimation and efficiency analysis, using cost-effective pressure-based methods calibrated through targeted on-site measurements.
- A replicable digitalization pathway for small and medium-sized hydropower plants, demonstrating how legacy infrastructure can be upgraded without full system replacement.
- Increased data availability and reliability, laying the foundation for predictive maintenance strategies and long-term performance tracking.

Voices from the Demo

"We successfully performed the 3D scan of the Kaplan turbine during a scheduled maintenance shutdown. This allowed us to obtain precise geometry without incurring additional downtime or operational costs, and ensured the accuracy of our CFD models used in the digital twin",
said Artur Machalski, Researcher, Wroclaw University of Science and Technology.

"The use of the Winter-Kennedy method, combined with calibration using propeller-type velocity meters, will enable reliable flow measurement - a task that is often challenging in hydropower due to the large size of water conduits", said Przemysław Janik, R&D department, Tauron Ekoenergia.

To learn more, please visit https://d-hydroflex.eu/ to explore all demonstration sites and stay updated on the project's progress. Follow us on LinkedIn and Twitter for the latest news and insights.

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About us:

The D-HYDROFLEX is a project funded by the European Union's HORIZON Research and Innovation Action under the topic HORIZON-CL5-2022-D3-03-08/Development of digital solutions for existing hydropower operation and maintenance and responds to the Call HORIZON-CL5-2022-D3-03/Sustainable, secure and competitive energy supply. The Consortium consists of 18 partners, bringing together 5 power plant operators/energy producers (EDF, TEE, PPC, INTEX, TASGA), 6 European research institutes and universities (CARTIF, PWR, UCL, UOC, UoA, ENERGYLAB) and 7 technology providers (UBI, NOVA, UBE, MINDS, FASADA, IDEA, CINT). D-HYDROFLEX will carry out 5 demonstration campaigns in 7 hydropower plants. D-HYDROFLEX is a 36-month long project started in September 2023.

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D-HYDROFLEX Consortium

	PARTICIPANT NAME	SHORT NAME	COUNTRY CODE	LOGO
1	GIOUMPITEK MELETI SCHEDIASMOS YLOPOIISI KAI POLISI ERGON PLIROFORIKIS ETAIREIA PERIORISMENIS EFTHYNIS	UBI	EL	
2	UBITECH ENERGY	UBE	BE	
3	FUNDACION CARTIF	CARTIF	ES	
4	TASGA RENOVABLES S.L.	TASGA	ES	
5	FUNDACION CENTRO TECNOLOXICO DE EFICIENCIA E SOSTENIBILIDADE ENERXETICA	ENERGYLAB	ES	
6	ELECTRICITE DE FRANCE	EDF	FR	
7	TAURON EKOENERGIA SPOLKA Z OGRANICZONA ODPOWIEDZIALNOSCIA	TEE	PL	
8	POLITECHNIKA WROCLAWSKA	PWR	PL	
9	PRZEDSIEBIORSTWO ROBOT ELEWACYJNYCHFASADA SP ZOO	FASADA	PL	
10	ASOCIATIA INOVARE SI DEZVOLTARE IN ENERGIE - IDEA	IDEA	RO	
11	INTEX PRIM GREEN ENERGY SRL	INTEX	RO	
12	ETHNIKO KAI KAPODISTRIAKO PANEPISTIMIO ATHINON	UoA	EL	
13	DIMOSIA EPICHEIRISI ILEKTRISMOU ANONYMI ETAIREIA	PPC	EL	
14	METAMIND INNOVATIONS IKE	MINDS	EL	
15	CINTECH SOLUTIONS LTD	CINT	CY	
16	NOVA TELECOMMUNICATIONS & MEDIA SINGLE MEMBER SA	NOVA	EL	
17	THE CHANCELLOR MASTERS AND SCHOLARS OF THE UNIVERSITY OF CAMBRIDGE	UOC	UK	
18	UNIVERSITY COLLEGE LONDON	UCL	UK	

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