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Sustainable, secure and competitive energy supply

Di-Hydro

Digital maintenance for sustainable and flexible operation of HYDROpower plant

Grant Agreement No. 101122311

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Deliverable D6.1
Di-Hydro project website

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REVISIONS			
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1.1	18.12.2023	Marta Cecconi (DBL)	Consolidation of input from reviewers
FINAL VERSION			
2.0	22.12.2023	Debora Zanatto, Marta Cecconi (DBL)	Format review, version ready for submission

SHORT ABSTRACT FOR DISSEMINATION PURPOSES

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Abstract

This document represents a comprehensive description of the project's website structure, content, and digital identity elements. It will outline the architecture and layout of the web pages, detailing its various sections and functionalities.

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LIST OF PARTNERS

N.	Logo	Name	Short Name	Country
1	CERTH CENTRE FOR RESEARCH & TECHNOLOGY HELLAS	CENTRE FOR RESEARCH AND TECHNOLOGY HELLAS CERTH	CERTH	Greece
2	WATERJADE value in every drop	MOBYGIS SRL	MobyGIS	Italy
3	Institut Mines-Télécom	INSTITUT MINES-TELECOM	IMT	France
4	ACCELIGENCE	ACCELIGENCE LTD	ACCELI	Cyprus
5	deepblue CONSULTING & RESEARCH	DEEP BLUE SRL	DBL	Italy
6	ATLANTIS ENGINEERING	ATLANTIS ENGINEERING SA	ATLANTIS	Greece
7	MAS	MAS CONSULTING SRL	MAS	Italy
8	INOSENS	INOSENS DOO NOVI SAD	INO	Serbia
9	ACCENT PRO 2000	ACCENT PRO 2000 SRL	AP2K	Romania
10	a2a LIFE COMPANY	A2A SPA - A2A	A2A	Italy
11	ΔΕΗ	PUBLIC POWER CORPORATION SA	PPC	Greece
12	ЕЛЕКТРОПРИВРЕДА СРБИЈЕ	JOINT STOCK COMPANY ELEKTROPRIVREDA SRBIJE BELGRADE	EPS	Serbia
13	aimen TECHNOLOGY CENTRE	ASOCIACION DE INVESTIGACION METALURGICA DEL NOROESTE	AIMEN	Spain

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ABBREVIATIONS

Acronym	Description
AB	Advisory Board
BIEO	Business, Innovation and Exploitation Objectives
DT	Digital Twin
EC	European Commission
ER	Expected Results
EU	European Union
GDPR	General Data Protection Regulation
HP	Hydropower
HPP	Hydropower plant
KPI	Key Performance Indicator
LCA	Life Cycle Assessment
OBJ	Objective
O&M	Operations and Maintenance
STO	Scientific and Technical Objectives
W3C	World wide web consortium
WCAG	Web Content Accessibility Guidelines
WP	Work Package

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LIST OF FIGURES

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EXECUTIVE SUMMARY

This document provides an overview of the Di-Hydro project's website structure and contents. The website serves as a hub for all information regarding the objectives and planned activities of Di-Hydro. It presents a view of the entire project, introduces the consortium partners, showcases key results, provides references to related and sister projects, and serves as an easily accessible platform for citizens and stakeholders to access all project-related information.

The website will undergo regular updates and will serve as the primary communication and dissemination channel. News, milestones, events, planned workshops, and any other announcements will be published through its dedicated news section. Project partners will contribute to its functionality by sharing updates on research progress, scientific publications, reports, public deliverables, conferences, and project outcomes.

Not only will interested visitors find valuable information, but the general audience will also have the opportunity to explore content, download resources, and engage through the newsletter form and social media links.

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1. Di-Hydro WEBSITE

1.1 General information

The website will guide the user through the project's content, thanks to its designed layout and its simple and user-friendly architecture, graphically displayed in the **Errore. L'origine riferimento non è stata trovata.** below. It provides a clear overview of the project's context, methodology, and objectives while delving into details about the technologies and scientific innovations involved.

Initially, content was extracted and, in some instances, rephrased from the project's proposal to enhance clarity, ease of understanding, and alignment with dissemination and communication objectives. A framework structure and graphical layout were then proposed to partners to better satisfy the information needs of the project's target audience.

The drafted texts underwent a thorough peer review by the consortium and received approval from the project coordinator, CERTH. Font types, styles, and the overall identity, including the logo, were selected based on consortium preferences gathered during the kick-off meeting in Thessaloniki, October 2023.

The official website address is www.dihydro-project.eu. It is hosted on DBL servers and operates through the WordPress content management system. The website adheres to the latest General Data Protection Regulation (EU) 2016/679 and complies with the Web Content Accessibility Guidelines (WCAG) (version 2.0) issued by the World Wide Web Consortium (W3C).

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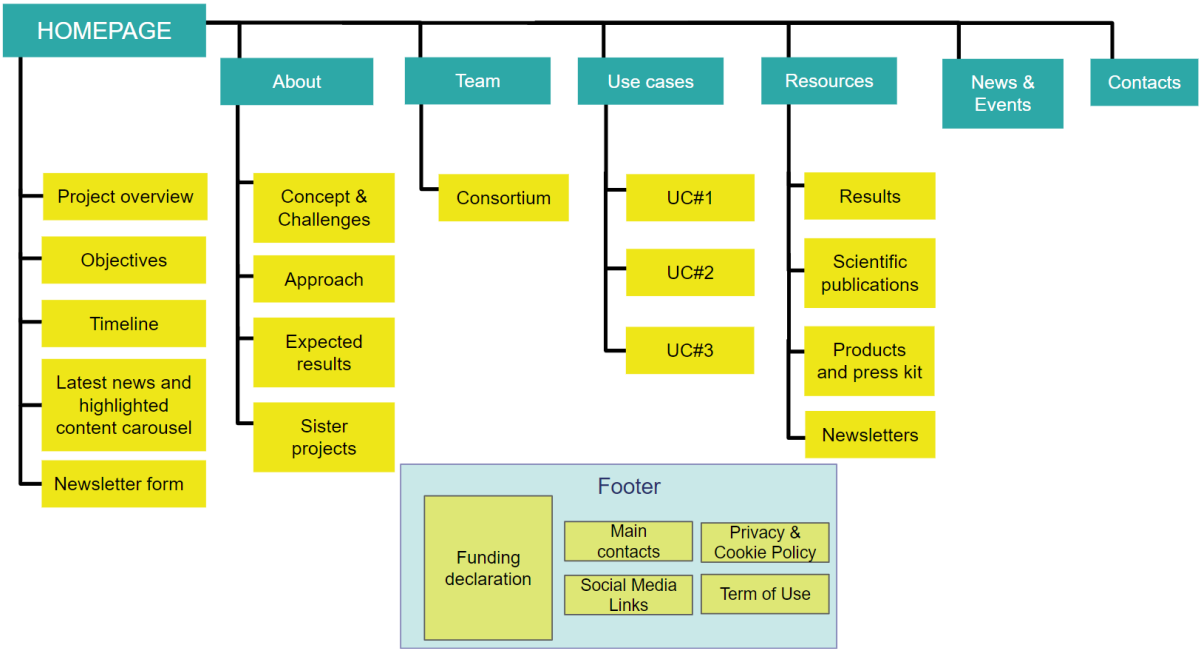

Figure 1 - Website Architecture

2. WEBSITE PAGES CONTENT

2.1 Homepage

2.1.1 Project's overview

Di-Hydro is a European-funded project committed to advancing the potential of hydropower (HP) plants and clusters in alignment with the ambitious goals of the European Green Deal and the Paris Agreement. The mission is to revolutionise the way hydropower plants operate, making them smarter, more efficient, and environmentally conscious.

At Di-Hydro, our vision is to empower sustainable energy production through the development of cutting-edge digital and smart decision-making tools for hydropower plants, regardless of their digitisation level, ensuring they play a pivotal role in a greener future.

[READ MORE button linking to About page]

2.1.2 Objectives

[The five (5) main objectives of the project will be shortly presented. Every objective will be identified with a dedicated pictogram.]

Objectives

1: Develop innovative sensors and data technologies for hydropower plants

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2: Digitise maintenance and operation of hydropower plants for sustainability
3: Reliable and robust hydropower data solutions as transparent as needed
4: Facilitate decision-making for the operations and maintenance of hydropower plants and clusters in contemporary power markets
5: Assess the socio-economic and environmental impact of hydropower sector digital transition

2.1.3 Timeline

[A graphical timeline will show the significant milestones and key processes for a collective view of the 3 years of Di-Hydro]

2.1.4 Latest news and highlighted content carousel

[A selection of the latest/top news will appear here]

2.1.5 Newsletter form

[Form to submit/subscribe to the Newsletter]

2.2 About

2.2.1 Concept & Challenges

Di-Hydro's innovative concept involves introducing a Decision-Making Platform and Digital Twin technology to the hydropower sector. Our primary goal is to address the digital divide among hydropower plants and clusters while enhancing their operational performance and environmental sustainability.

Digital Twin for Clusters: Di-Hydro will create a Digital Twin platform for use case hydropower plants, as well as forming a cluster for collaborative operations and maintenance.

Advanced Technology: Our approach utilises federated architecture, decentralised storage, AI technologies, and Reinforcement Learning for resilience and robustness.

Data Integration: We analyse historical data, implement advanced sensors, and integrate market forecasting to optimise operations and participation in wholesale markets.

Competitiveness: Our solution reduces maintenance costs, increasing competitiveness and sustainability, aligning with the European Green Deal's goals.

[A concept image will be developed to effectively communicates the project's concept]

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2.2.2 Approach

Di-Hydro's approach centres on the following key areas:

1. Structural Health Monitoring: development of a real-time, low-cost monitoring system for assessing the structural health of hydropower structures. It provides Damage Tolerance assessments and supports automatic decision-making.

2. Condition Monitoring: the solution proposed will use wireless sensors for vibration, pressure, temperature, and oil conditions. It issues intelligent reports and early maintenance warnings, enabling continuous updates in condition monitoring of critical HP machinery.

3. Biofouling Prevention: Di-Hydro will introduce a novel solution using ultrasonic technology to prevent and clean biofouling in hydropower heat exchangers, reducing economic impact and downtime.

4. Unmanned Underwater Inspection: Advanced unmanned underwater vehicles visually inspect water reservoirs and pipelines, enhancing maintenance and safety.

5. Environmental and biodiversity monitoring, modelling and forecasting: Di-Hydro will develop water quality sensors for monitoring environmental and biodiversity parameters for upstream and downstream locations of the HPP catchment. Parameters such as pH, dissolved oxygen, oxidation reduction potential (ORP), total dissolved solids (TDS), salinity, turbidity, electrical conductivity (EC), ammonium, nitrate, residual chlorine, temperature, concentration of including pathogens and toxins. The monitoring data will be combined with historical data to provide biodiversity and environmental forecasting.

6. Weather and flow monitoring / Forecasting models: weather and water flow monitoring will be combined with historical and satellite data to develop AI prediction models for short, medium and long forecasting to assist HPPs in decision-making.

2.2.3 Expected results

[The eight (8) expected results of the project will be shortly presented. Every result will be identified with a dedicated symbol]

1. Innovative sensors for hydropower machinery operation.
2. Hydropower structural health monitoring and prediction.
3. Hydropower inspection and automatic defect detection using underwater unmanned vehicle.
4. Monitoring and predictive models for biodiversity and environmental effects of hydropower operations and maintenance.
5. Forecasting models for weather and water flow of hydropower plants.

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6. Digital twin of hydropower plants and cluster connectivity.
7. AI-based decision support platform for hydropower plants and clusters.
8. Advanced encryption algorithms for hydropower data collection, exchange and storage.

2.2.4 Sister projects

[Sister projects logos with link to their websites and short abstract]

2.3 Team

2.3.1 Consortium

[Partners logos and access to their company websites]

2.4 Use cases

The technologies developed in Di-Hydro will be studied and applied in three distinct use cases. Each site represents a unique facet of our exploration: through field research, the project aims to unravel the potential, challenges, and innovations associated with hydroelectric power generation. Explore the pages dedicated to each use case to gain insights into their specific focus areas.

[Below the descriptions of the three pilot use cases that will take place within Di-Hydro, a map indicating the different locations of these hydropower plants will be inserted. Each use case will be accompanied by images of the sites, provided by the partners.]

2.4.1 UC#1: PPC

Application of stand-alone Di-Hydro DT and integration in hydropower digital cluster. Calibration of Di-Hydro Decision Making Platform for hydropower plants and cluster.

Locations:
1. Ilarionas Kozanis
2. Thisauros Dramas
3. Pournari Artas

Partner:
PPC, or Public Power Corporation S.A., is Greece's leading electricity company, holding a crucial position in the nation's energy sector. PPC manages a diverse portfolio of hydroelectric power plants that serve essential roles in water reserve management, encompassing activities from flood control and irrigation to energy generation and environmental preservation.

Challenges:

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PPC's hydropower plants manage a significant portion of Greece's water reserves and serve various purposes such as flood control, irrigation, water supply, and recreation. The PPC faces the challenge of optimising operations in the face of changing weather conditions, flood control needs, irrigation demands and energy requirements.

To address this complexity, the Di-Hydro Digital Twin introduces innovative tools, methodologies, and sensors coupled with digital solutions. The use of DTs, an emerging technology in hydropower, allows engineers to collect real-time data through sensors, continuously access an up-to-date replica of the plant, and experiment with solutions and scenarios at no cost. This digital approach aims to facilitate optimal operation by accommodating the diverse needs of the system while ensuring cost-efficient operations and mitigating environmental effects on biodiversity.

Objectives:

- Introduce innovative digital tools and methodologies to enhance operations & maintenance and address the different needs and challenges.
- Enable engineers to collect real-time data through sensors, facilitating informed decision-making.
- Continuously access an up-to-date replica of the plant for better monitoring and management.
- Allow engineers to experiment with various solutions and scenarios at minimal cost, improving operational efficiency and adaptability.

2.4.2 UC#2: A2A

Inflow forecasts at flexible lead-times according to meteorological evolution in the upstream catchment.

Locations:

1. Sauris Lake
2. Verzegnis Lake
3. Novarza Dam

Partner:

A2A S.p.A. is a leading Italian multi-utility company with expertise in energy, environmental, and water services, emphasising digital innovation and sustainability. The company encounters challenges in accurately forecasting water inflow for its hydroelectric plants, particularly during unpredictable events like droughts.

Challenges:

Water inflow forecasting is a complex task influenced by various catchment-scale factors such as weather changes and water abstraction by third parties. Despite this complexity, accurate forecasts are crucial for effective plant management at different time levels. In the short term, precise forecasts enhance safety and optimise dispatching to energy markets,

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while in the medium and long term, they provide valuable insights for budgeting energy production.

The conventional approach, relying on historical averages and local observations, proves insufficient. To address these challenges, a robust hydrological model is essential. Such a model can significantly improve water flow forecasts, contributing to better safety, optimal energy dispatching, and precise budgeting for current and future energy production.

Objectives:

- Enhance the accuracy of water inflow predictions for hydropower plants, considering upstream influences and meteorological variations.
- Enable precise short-term forecasting to boost safety and market dispatch efficiency.
- Provide reliable data for budgeting and long-term energy production planning.
- Develop a robust hydrological model to improve water flow forecasts.

2.4.3 UC#3: EPS

Development and implementation of a digital sensor-based real-time water quality monitoring system (with early warning)

Location:
Međuvršje, Zapadna Morava basin

Partner:
EPS, Elektroprivreda Srbije, is a key player in Serbia's energy sector, responsible for generating, transmitting, and distributing electricity. Operating various power plants, EPS ensures a stable power supply for the country.

Challenges:
The Ovčar-Kablar gorge, designated as an area of exceptional characteristics, houses concrete dams that have created the Ovčar Banja and Međuvršje reservoirs, significantly altering ambient conditions for aquatic life. Unfortunately, measurements indicate that the Međuvršje reservoir is highly polluted, impacting its intended uses for drinking water, agricultural irrigation, and recreational purposes. To address this issue and enhance the socio-economic potential of Međuvršje hydropower plant, a solution involving robust sensors is necessary.

By integrating automated monitoring of biochemical and physical water properties, coupled with understanding and modelling of collected data, a real-time water quality monitoring system will be developed. This system, equipped with early warning capabilities, aims to provide detailed insights into water quality dynamics (both upstream and downstream of the water catchment area). Collaborating with existing monitoring data, it will support decision-making processes for the hydropower plant, fostering more efficient and timely management. This use case represents a significant step in advancing

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the understanding of environmental and socio-economic aspects related to the Međuvršje hydropower plant.

Objectives:

- Develop a robust real-time water quality monitoring system with early warning capabilities to assess and understand the dynamics of water quality.
- Enable informed decision-making processes by providing reliable, up-to-date information on environmental impact and socio-economic sustainability.
- Enhance the management of the hydropower plant by integrating the digital sensor-based monitoring system with existing data sources to improve efficiency and expedience.

2.5 Resources

[Contents will made available for download and uploaded when available. The different resources will be presented with drop-down menus.]

2.5.1 Results

[List of the published deliverables]

2.5.2 Scientific publications

[Links to the site/journal/magazine where the scientific articles have been published]

2.5.3 Products and press kit

[Downloadable graphic materials and press materials]

2.5.4 Newsletters

[Repository of newsletter issues]

2.6 News & Events

[Latest news in grid visualisation]

2.7 Contacts

[Form to submit inquiries and contact the project team, plus additional relevant contacts]

2.8 Standard pages

[Set of standard pages and features normally accessed through the header or footer bar]:

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- Funding declaration
- Privacy policy and Cookie Settings
- Terms of use
- Social media links
- Search bar

3. WEBSITE BACK-END FUNCTIONALITIES

The Di-Hydro website will represent the main dissemination channel for the project, providing a comprehensive overview of the project objectives, its planned activities, and its results. The website will be updated constantly with news about the project, progress, organisation or participation in events, incoming workshops and any other announcement related to Di-Hydro. It will also serve as a repository of relevant documents, public deliverables, publications, and dissemination materials. The project partners will support this task by sharing relevant updates whenever possible.

The website will undergo continuous updates to ensure compliance with the latest standards, including regular updates for plugins. Deep Blue is responsible for the design, realisation, maintenance, and update of the website and the social network profiles. Other partners are encouraged to contribute through content creation such as articles, news, and blog posts, designated as authors to prevent potential breaches in the system by limiting access to a select number of users.

Both the structure and the external appearance of the website are developed considering the highest usability standards, ensuring a clear and easy navigation for all kinds of users and from all devices thanks to responsive design.

3.1 Project Infrastructure

From a technical point of view, to develop a secure, reliable and dynamic website, a professional hosting service providing a database service (MySQL) and backup features was chosen.

The domain and hosting have been procured through the vHosting[1] platform, which is also linked to the project's dedicated email service and mailing lists. These resources serve as essential tools for WP leaders and the coordination team to facilitate effective communication within the project. The integration of the vHosting platform ensures a streamlined and secure environment for hosting, email services, and collaborative communication.

[1] www.vhosting-it.com/

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The website has been developed using a Content Management System (CMS) technical platform that allows for an easy management of the contents and the sections of the website. Among the CMSs available, we selected the one considered the most reliable, supported from a documentation point of view and flexible, Wordpress[2]. In order to improve the Di-Hydro website positioning on the major search engine, Search Engine Optimisation (SEO) functionalities were enabled. This functionality increases the possibility of being correctly identified and proposed to users by search engines.

3.2 Analytics and data protection

Matomo[3] Analytics tools will be used to monitor the website usage and accesses. It provides statistical information about the website: visitors, traffic sources, most viewed content, etc. It is a helpful tool to identify possible issues, increase efficiency, and evaluate the website's impact and effectiveness.

Concerning GDPR (EU regulation 2016/679) compliance, the website will refer to Iubenda[4], a leading platform in the online compliance industry, providing intuitive and comprehensive solutions for privacy and cookie management. It enables businesses to effectively and transparently comply with data protection regulations. Deep Blue will act as data controller. Among the types of personal data that this application collects there are: email addresses; first name; last name; usage data and cookies. The website only collects the personal data strictly necessary, freely provided by the users, or, in case of usage data, collected automatically when navigating the website.

4. NEXT STEPS

The project website functions as a dynamic content management platform, allowing for ongoing updates to the mentioned content and potential modifications to its initial structure according to communication and dissemination needs over time. Furthermore, the texts and contents on the website serve as official references for public sharing of project advancements and results.

[2] www.wordpress.org
[3] https://matomo.org/
[4] www.iubenda.com

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