



Digital maintenance for sustainable and flexible
operation of HYDROpower plant

PROJECT OVERVIEW

Alkiviadis Tromaras

CERTH, 21/05/2024, ETIP Hydropower “Boosting
Hydropower, best practices for research” webinar



This project has received funding by the European Union’s Horizon Europe research and innovation programme under Grant Agreement N° 101122311



GENERAL PROJECT INFORMATION

PROJECT DURATION

36 months - from 1/10/2023 to 30/09/2026

GA NUMBER

101122311

HORIZON-CL5-2022-D3-03-08

BUDGET

~ 4.5 M€ (4. 498. 761.00) €

GRANT TYPE

Lump sum

PARTNERS

13 partners

WORK PACKAGES

7 WPs (5 Technical & 2 horizontal)

20 Deliverables



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MAIN THEME

Digitisation of O&M for hydropower plants & clusters

MAIN OBJECTIVES

1. Develop practical solutions, for HP plants and clusters across the EU, regardless of their digitization level
2. Combine innovative sensor technologies and digital adaption for energy production
3. Create Digital Twins and a decision-making tool for HPPs by combining :
 - Historical data
 - Sensory data
 - AI based weather and/ water flow, environmental, biodiversity modelling and forecasting
 - socioeconomic parameters
4. Optimize O&M practices based on cutting-edge information technologies
5. Assist HP companies to strategize and manage production, based on foreseen needs and their intended commercial strategy



Innovative sensors for HP machinery operation

- Novel structural health and condition monitoring sensor-unit
- Biofouling ultrasonic probes
- TRL 6



HP Structural Health Monitoring and prediction

- Create and execute novel predictive algorithms for HP O&M based on historical and currently obtained HP datasets
- TRL 5



Mounting sensor units on underwater drone for HPP inspection

- Usage of unmanned and remote vehicles
- M/L for defect identification
- TRL 5



Monitoring and predictive models for biodiversity and environmental effects of HP O&M

- Novel sensors for water quality /enviro monitoring
- Database with digitised historical environmental data
- Early warning system for water quality
- TRL 6



Forecasting models for weather and water flow of HPPs

- Combining weather and water flow predictive AI-based algorithms
- Use of water flow and level sensor
- TRL 6



DT of HPPs and cluster connectivity

- Di-Hydro DT tool and pilots
- TRL 6



AI based Decision Support platform for HPPs and clusters

- Di-Hydro Decision Making Platform for holistic optimized decision-making and visualization of HP plants and clusters
- TRL 6



Advanced encryption algorithms for HP data collection, exchange and storage

- Data protocols for secure, reliable, and as open as needed HP data transfer, storage and access
- TRL 5

Use Case 1 – PPC- Greece

*Application of Di-Hydro DT and integration in HP digital cluster.
Calibration of Di- Hydro Decision Making Platform for HPPs and cluster*

- Structural Health Monitoring- Condition Monitoring of machinery:
Creation and installation of sensors nodes
- Predictive algorithms for HP O&M
- Creation of plant replica and display of real time data from sensors and existing digitised equipment and telemetry
- Biofouling prevention using ultrasonic probes
- Unmanned underwater drone inspection and M/L for automatic detection.
- Creation of HPP communication cluster



LOCATIONS:



Pournari Artas
Epirus, Greece



Ilarionas Kozanis
Western Macedonia, Greece



Thisauros Dramas
Central Macedonia, Greece

Use Case 1 – PPC- Greece

*Application of Di-Hydro DT and integration in HP digital cluster.
Calibration of Di- Hydro Decision Making Platform for HPPs and cluster*

Ilarionas HPP



Capacity: 155 MW
Turbines: 2x Francis

Thisavros HPP



Capacity: 375 MW
Turbines: 3x Francis
Pumped storage type plant

Pournari I HPP



Capacity: 300 MW
Turbines: 3x Francis



LOCATIONS:



Pournari Artas
Epirus, Greece



Ilarionas Kozanis
Western Macedonia, Greece



Thisavros Dramas
Central Macedonia, Greece

Use Case 2 – A2A- *Italy*

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

- Collection of historical data
- Installation of flow meter sensors
- Weather and water flow predictive AI-based modelling and forecasting

Ampezzo and Somplago HPPs



Total capacity: 235 MW
Turbines: 3x Pelton -Ampezzo,
3x Francis - Somplago



LOCATIONS:



Novarza Dam
Udine, Italy



Sauris Lake
Udine, Italy



Verzegnis Lake
Udine, Italy

Use Case 3 – EPS-Serbia

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

- Collection of historical data
- Development of sensors for biodiversity and environmental monitoring

Međuvršje HP HPP



Capacity: ~10 MW
Turbines: 2x Kaplan,
1x Francis



LOCATIONS:



Međuvršje HP plant
Serbia

DIGITAL USER
MANAGEMENT
LEVEL



Di-Hydro DECISION MAKING PLATFORM

HPP DIGITAL
TWIN LEVEL

HPP DIGITAL
INFRASTRUCTURE
LEVEL

HPP PHYSICAL
INFRASTRUCTURE
LEVEL

DT
Data

Ilarrionas
Kozani Digital
Twin

Thissavros
Dramas
Digital Twin

Pournari Artas
Digital Twin

Sauris Lake
Digital Twin

Verzegnis Lake
Digital Twin

Novarza Dam
Digital Twin

ML
Results

Međuvršje HPP
Digital Twin

Raw
Data

ML
Models

HPP Cluster



Ilarionas HPP
Kozani,
Greece



Thissavros HPP
Drama,
Greece



Pournari HPP
Arta,
Greece



Ampezzo HPP
Sauris Lake,
Italy



Somplago HPP
Verzegnis
Lake, Italy



Novarza Dam,
Italy



Međuvršje HPP
Međuvršje,
Serbia

BioFouling
prevention
probes

SHM/CM
sensors

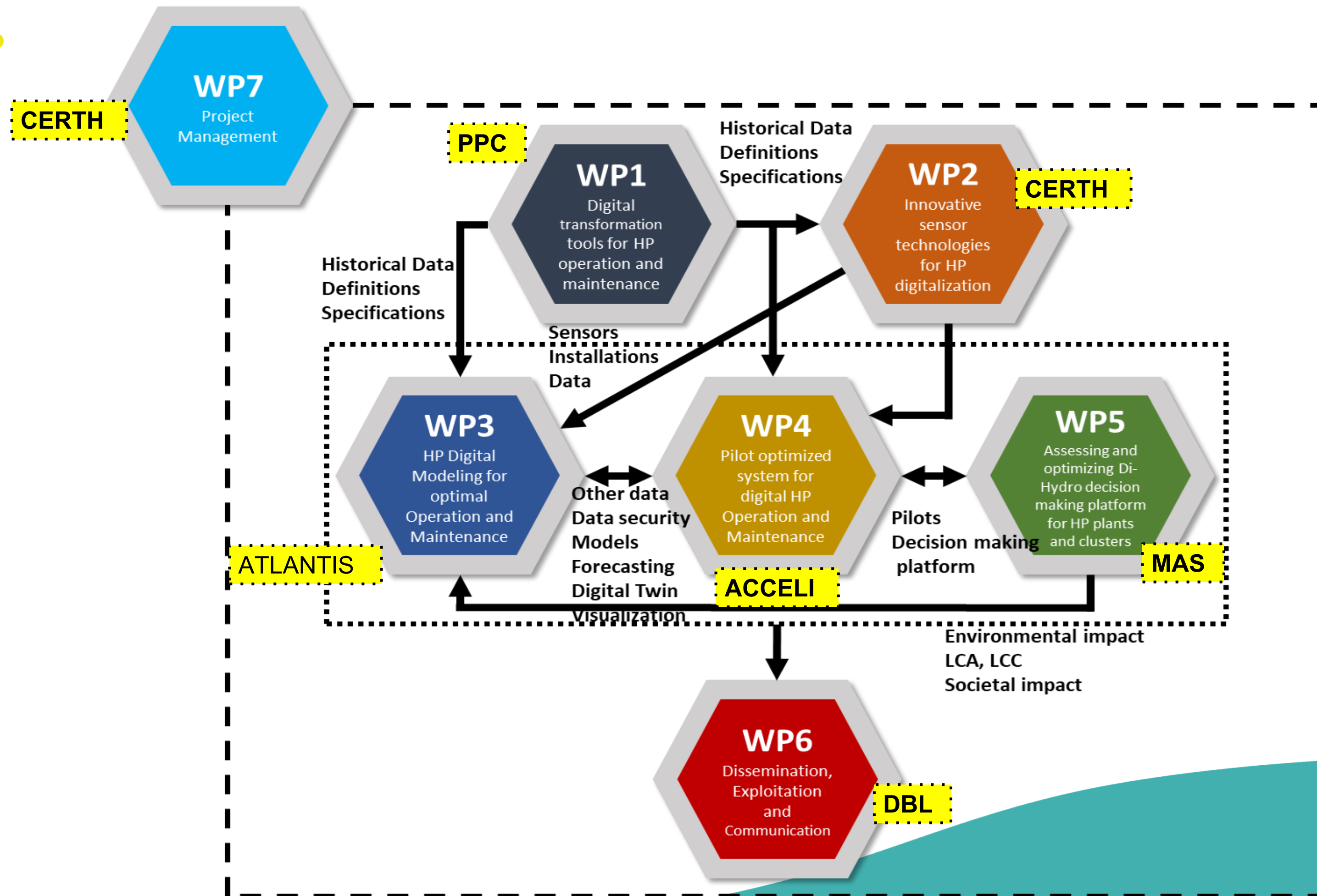
Underwater
inspection
drone

Water Flow
and Level
sensors

Environmental
and
Biodiversity
sensors



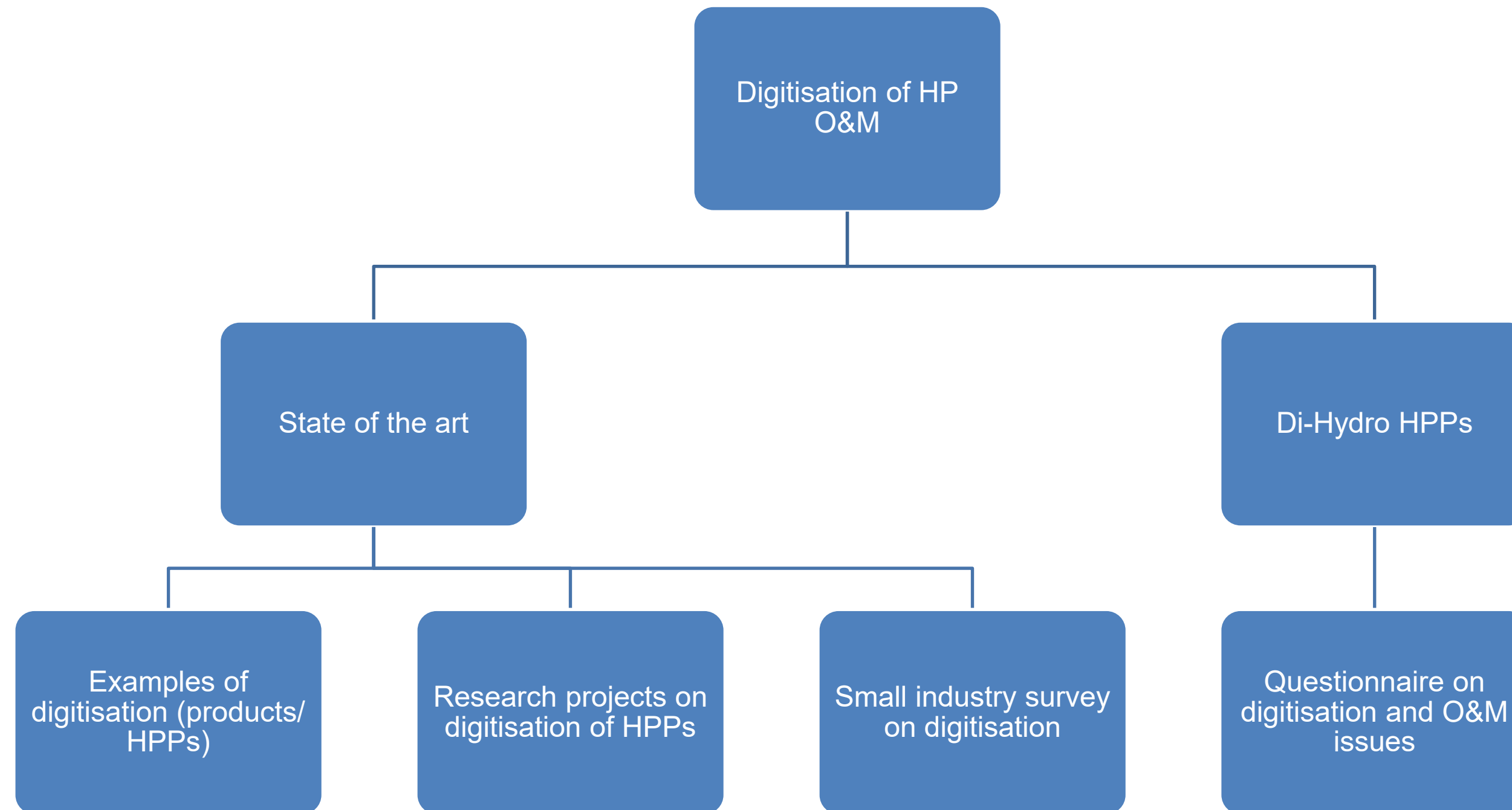
STRUCTURE OF THE PROJECT





CURRENT WORK

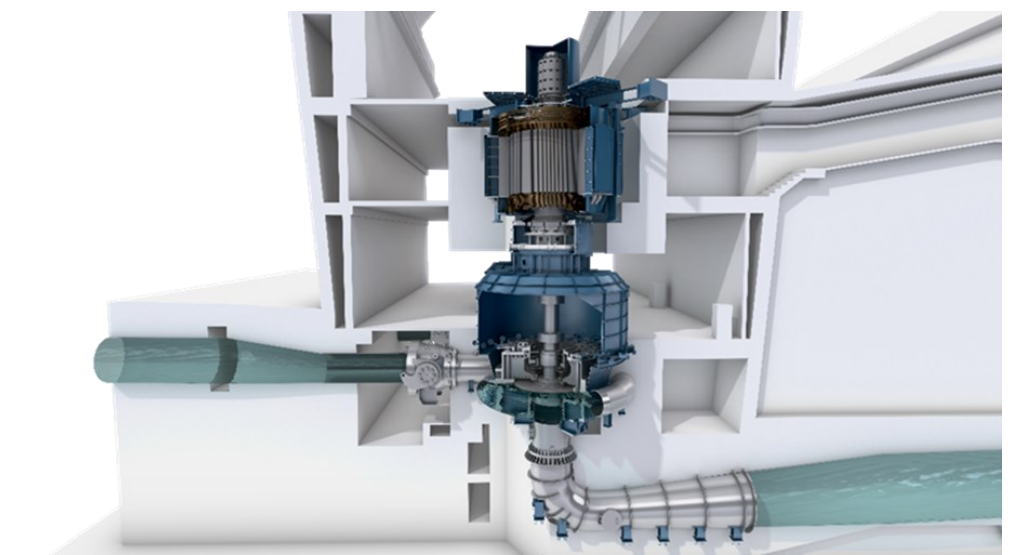
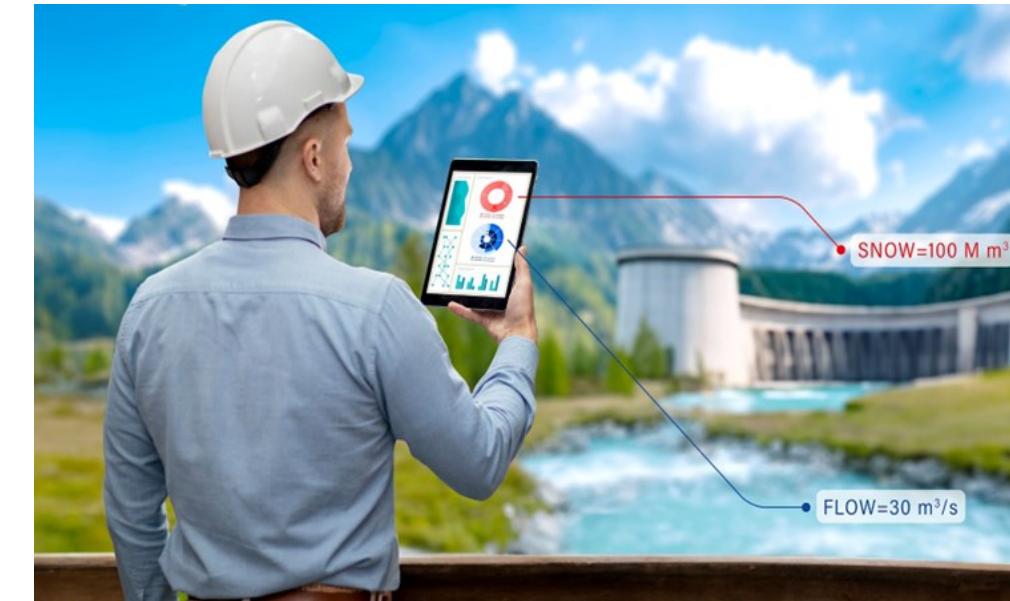
D 1.1- Digital transformation of the HP sector- Methodology



D 1.1- Digital transformation of the HP sector- What is digitisation of O&M?

1. Digital twins
2. Forecast modelling
3. Predictive maintenance
4. Real time KPI monitoring
5. Digital workforce management

6. Augmented and virtual reality
7. Unmanned vehicles and robots
8. Environmental monitoring
9. Fish monitoring
10. Cybersecurity



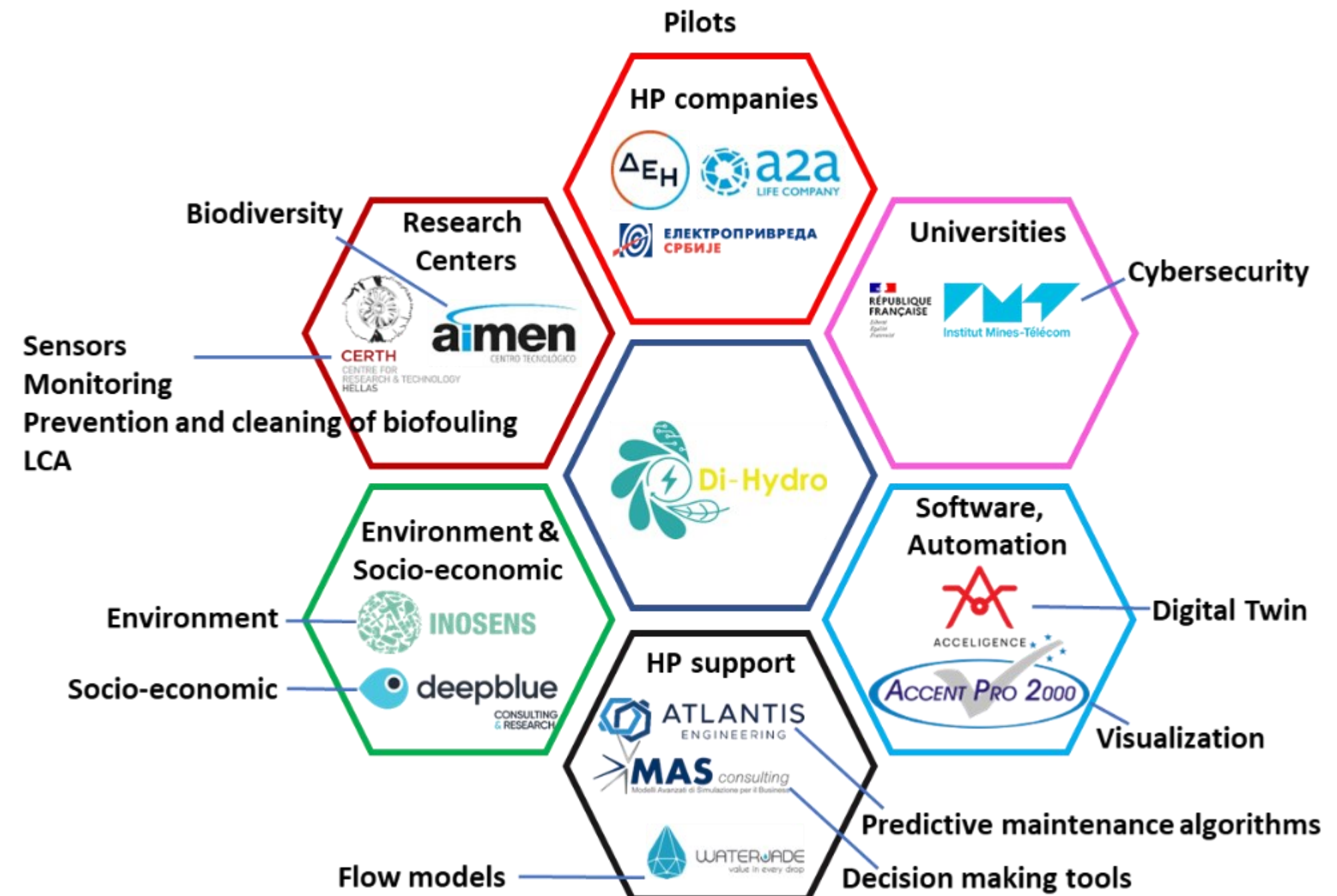
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Horizon

CONSORTIUM

8 Countries:

Greece (GR)
 France (FR)
 Italy (IT)
 Cyprus (CY)
 Serbia (RS)
 Romania (RO)
 Spain (ES)





**Dimosia Epicheirisi
Ilektrismou Anonymi
Etaireia (PPC)**

Partner

Greece (GR)



**Javno Preduzece
Elektroprivreda Srbije
Beograd (EPS)**

Partner

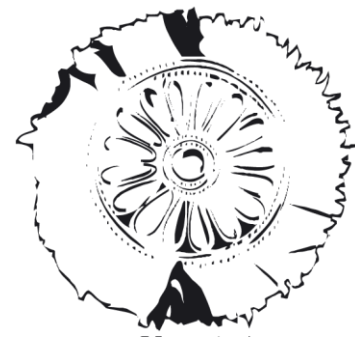
Serbia (RS)



A2A spa (A2A)

Partner

Italy (IT)



CERTH
CENTRE
FOR RESEARCH
& TECHNOLOGY
HELLAS

**The Centre for Research
& Technology Hellas
(CERTH)**

Coordinator
Greece (GR)



**Asociacion de
Investigacion Metalurgica
del Noroeste (AIMEN)**

Partner
Spain (ES)



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**Institut Mines-Telecom
(IMT)**

Partner

France (FR)



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**WATERJADE
(WATERJADE)**

Partner
Italy (IT)



**MAS Consulting
SRL (MAS)**

Partner
Italy (IT)



**Atlantis
Engineering AE
(ATLANTIS)**

Partner
Greece (GR)



**InoSens Doo
Novi Sad (INO)**

Partner
Serbia (RS)



**Accent Pro 2000
srl (AP2K)**

Partner
Romania (RO)



Deep Blue srl (DBL)

Partner
Italy (IT)



Accelience Ltd (ACCELI)

Partner
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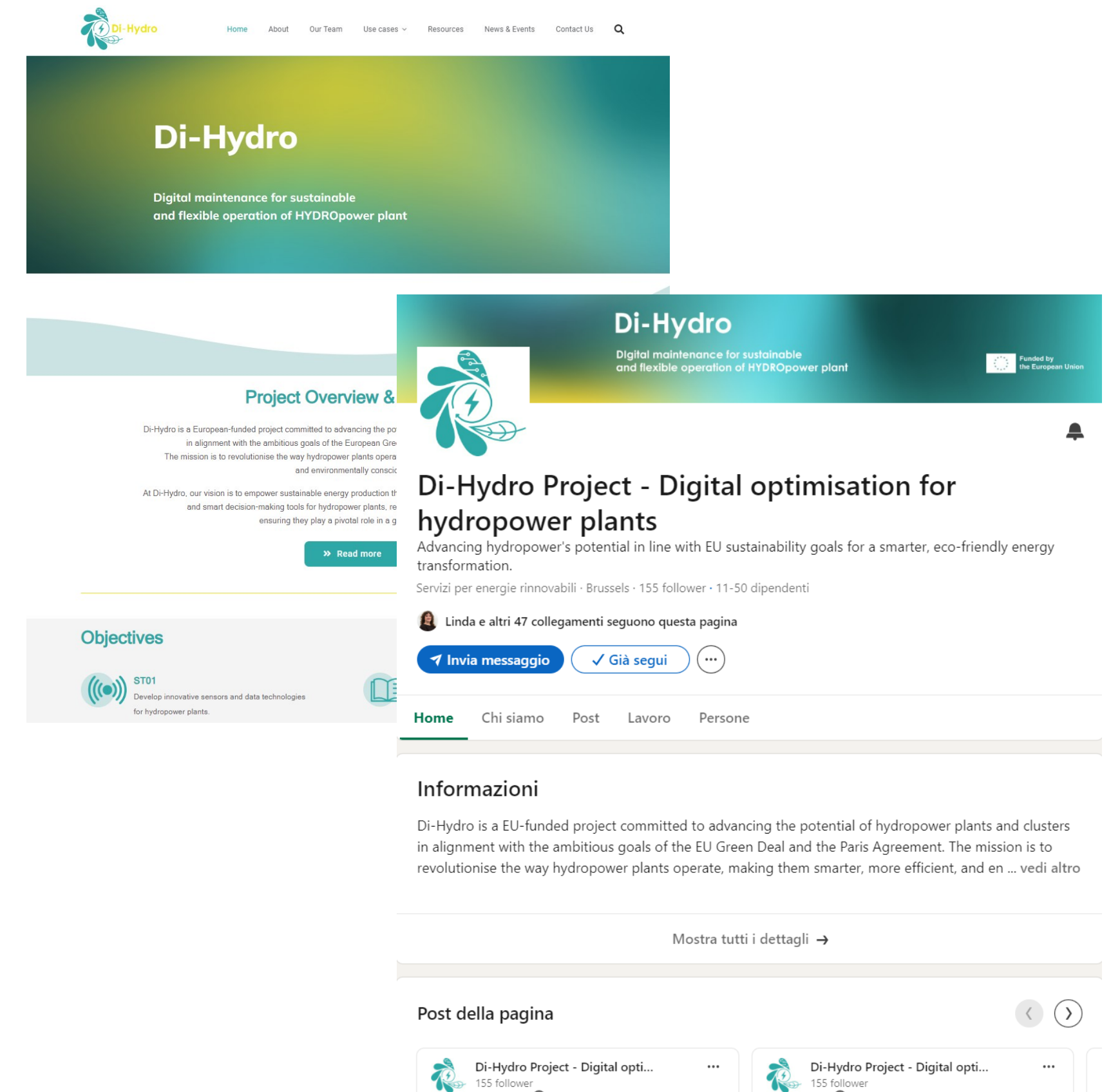
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Thank you.

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