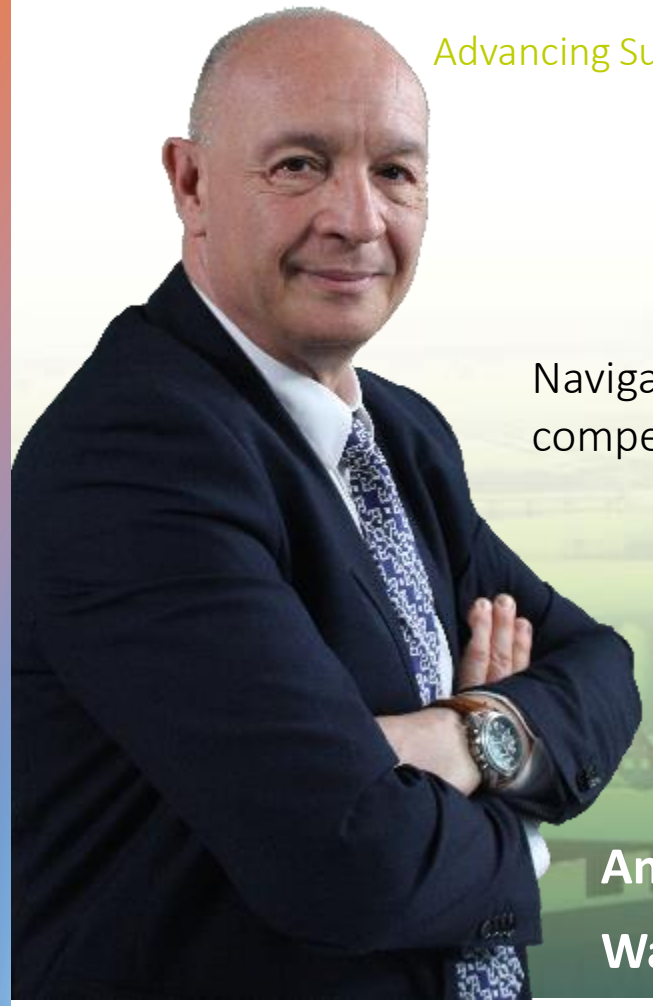
Advancing Sustainability of Process Industries through Digital and Circular Water Use Innovations

The AquaSPICEproject



Navigating towards a sustainable, pioneering horizon towards climate neutrality, circular economy and competitiveness in the European process industry for a prosperous and smart society, for water

Aqua Circular Conference October 5 2023.

Andrea Rubini, Director of Operations

Water Europe

The AquaSPICE project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 958396.

AquaSPICE

Advancing Sustainability of Process Industries through Digital and Circular Water Use Innovations

General Details

Duration:
01/12/20- 30/11/24
(4 years)

Total amount:
€11,055,248

Funding Programme:
Horizon 2020

Consortium:
29 partners, 12 countries

Coordinator:
RWTH Aachen Univ. (DE)

Partners

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Processes4Planet Partnership

A.SPIRE

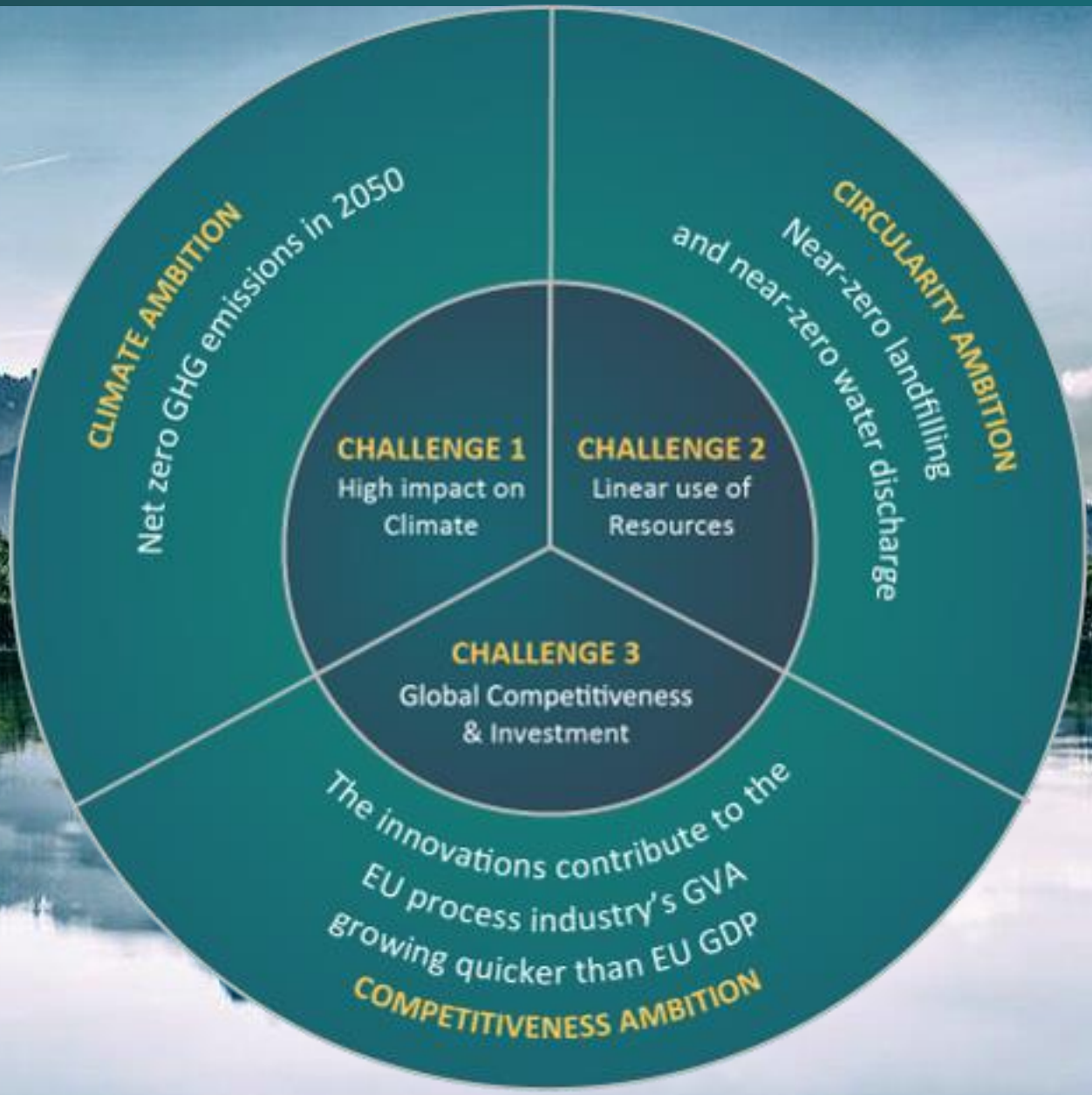
2023

ASPIRE

PROCESSES4PLANET

PROCESSES4PLANET

Ambitions and Challenges



Processes4Planet: a co-programmed Partnership in Horizon Europe

AquaSPICE

PROCESSES4PLANET

ASPIRE

10
Process Industry **Sectors**

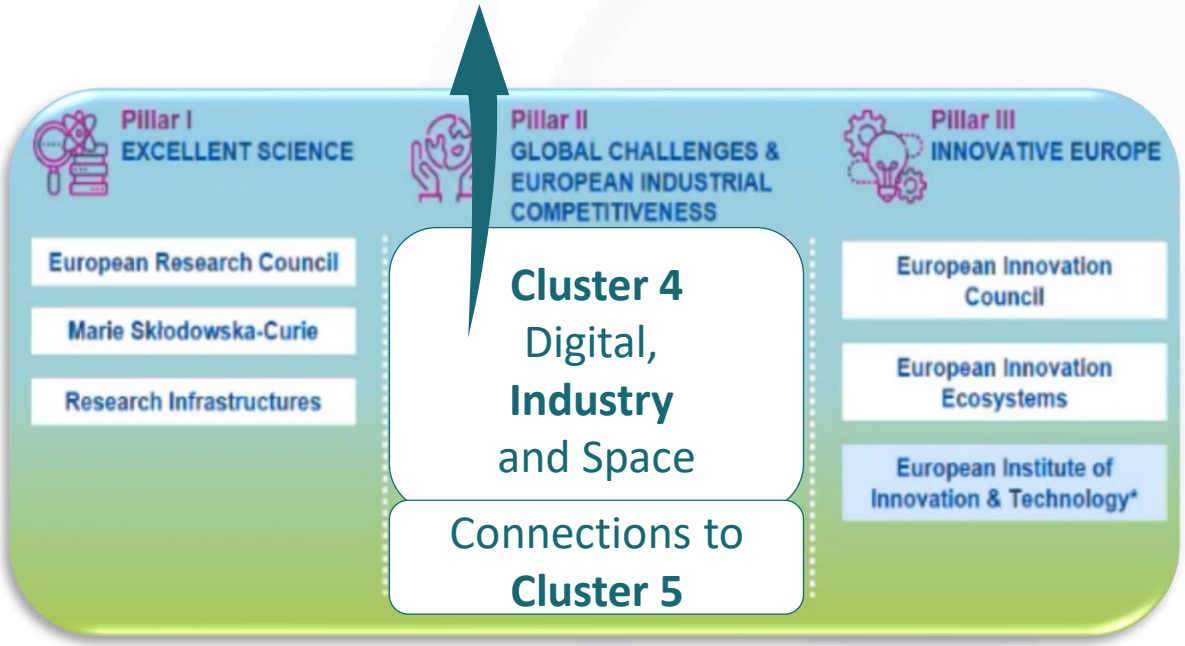
+SMEs
+ RTOs,
+ Universities
+ NGOs
+ Innovation agencies
et al…

European Commission

DG RTD
DG Grow

Co-programmed Partnership

MoU signed:
€1,3 bn exclusively for projects
27% more than in H2020



AquaSPICE at a glance

AquaSPICE aims at materializing circular water use in European Process Industries, fostering awareness in resource-efficiency and delivering compact solutions for industrial applications.

29 Partners

12 Countries

6 Case Studies

11.055.248€

3.5 years

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AquaSPICE Objectives I

The AquaSPICE overall goal is the development and validation of water efficiency management and optimization methodologies, technologies and tools that will carry

process industries forward to a near-zero water footprint target with minimum freshwater consumption and water-borne emissions.

This is pursued through a set of scientific and technical objectives, motivated by real industrial needs analysed through six case studies and a set of impact-related objectives.

AquaSPICE Objectives II

Scientific & Technical Objectives

- Deliver a methodological and technical water efficiency enhancement applications framework for the process industry.
- Deliver methodologies and tools as-a-service to support the assessment and optimal application of novel or already established best practices for water recovery and re-use.
- Deliver methodologies and tools as-a-service to support the application of advanced industrial water technologies enabling industrial water recovery/treatment.
- Deliver a monitoring platform, ensuring the continuous and uninterrupted acquisition of reliable, cybersecure and homogenized dynamic data.
- Deliver a virtualisation (digital twin) of water use-recovery-reuse processes and their relations to the production system, its value chain(s) and external connections.

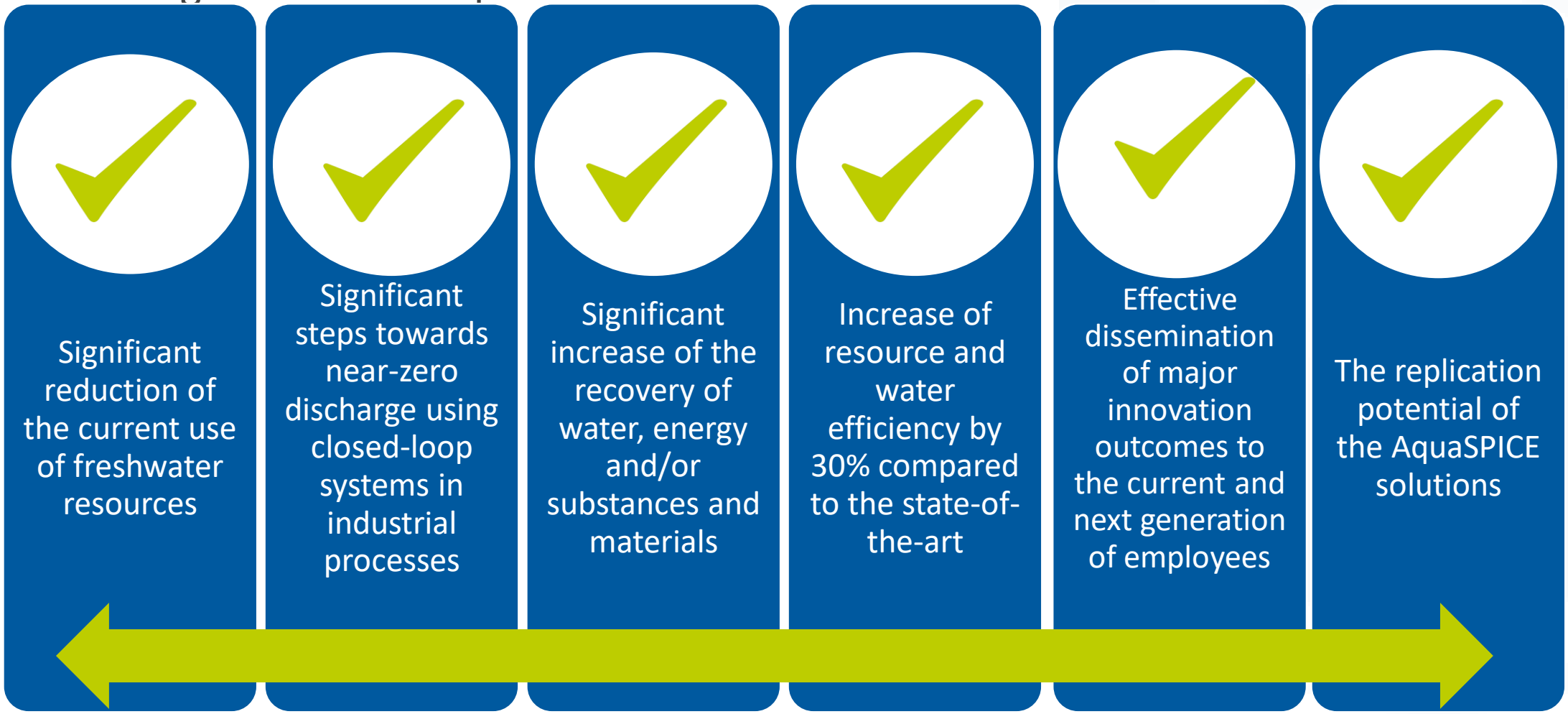
AquaSPICE Objectives II – Extended version

Impact-related objectives

- Deploy, test, demonstrate, evaluate and validate the main AquaSPICE results.
- Plan and facilitate the exploitation of project results.
- Communicate and Disseminate the project's scientific and technical results.

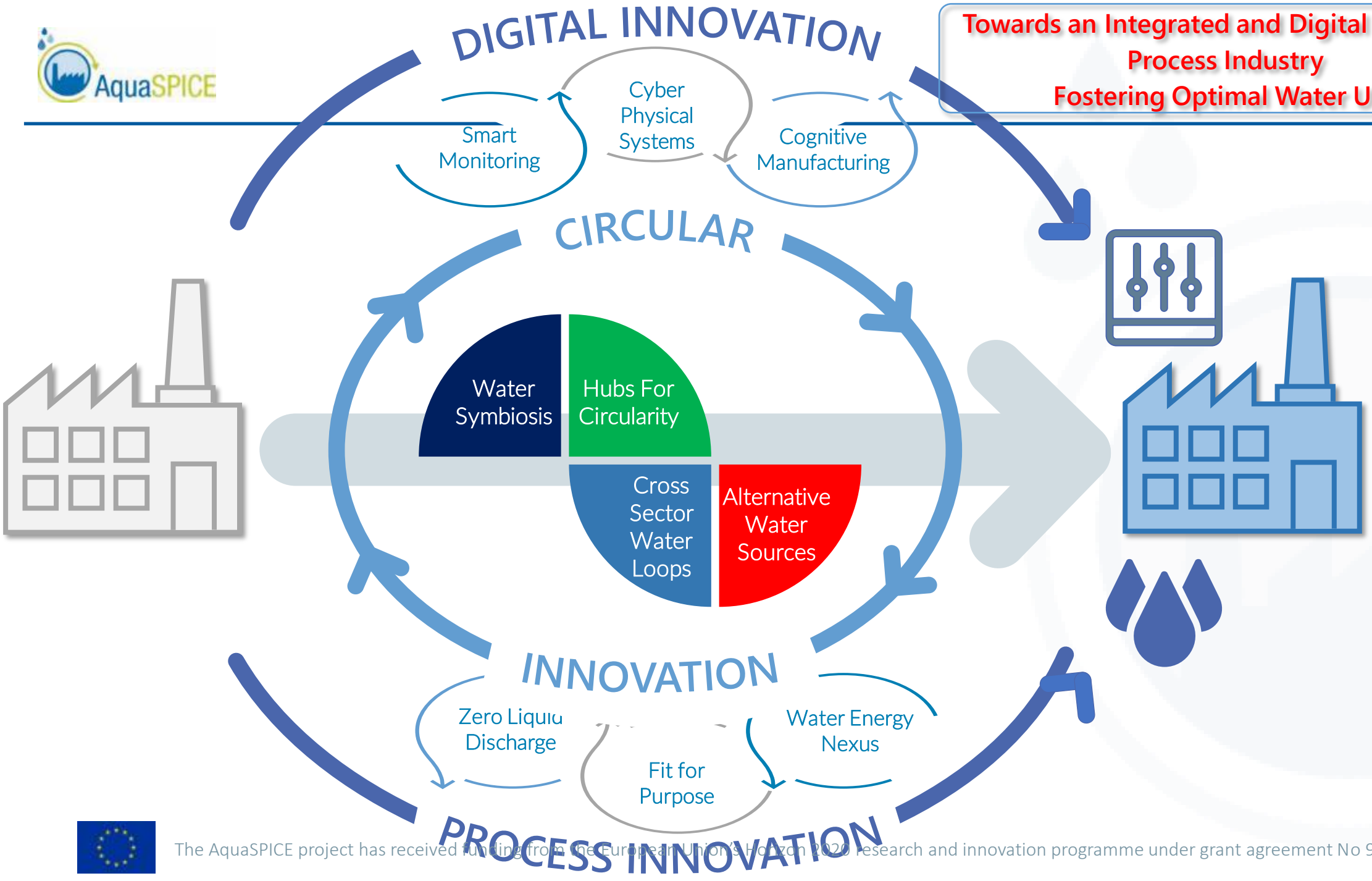
Expected Results and Impacts

AquaSPICE is expected to have an important contribution by bringing the following results and impacts:



AquaSPICE

Towards an Integrated and Digital European Process Industry Fostering Optimal Water Use



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Case Studies

Technology focus for freshwater intake reduction at DOW

Boehlen (DE), Terneuzen (NL)

Water treatment and re-use within peroxide production units at SOLVAY

Tuscany and Marche (IT)

Sustainable and robust water system for the industrial zone of Antwerp at BASF

Port of Antwerp (BE)

Sustainable water use in meat production the circular economy at AGRICOLA

Bacau (RO)

Water treatment and re-use within refinery at TUPRAS

Izmit (TU)

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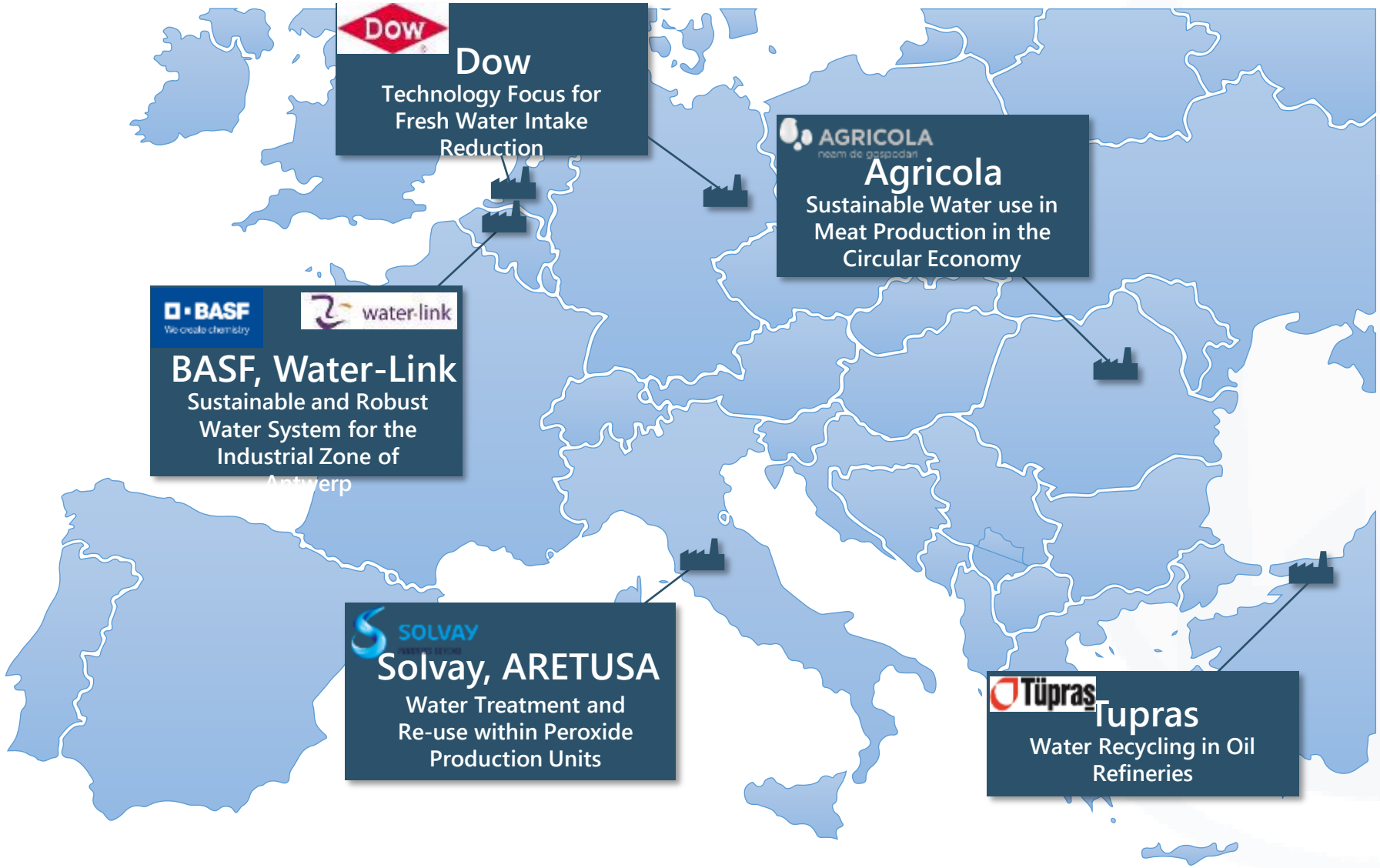
Case Studies



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AquaSPICE

OBJ 1–Water Efficiency Enhancement Framework

- Water Efficiency Framework
- Taxonomy and Ontology of Water Use

OBJ 2–Optimal Application of Circular Water Re-use Practices

- Evaluation Methodology
- Water Symbiosis Platform
- Water Recycling Schemes

OBJ 5–Virtualization System

- Process Models
- Knowledge Graph
- Cognitive Simulation Model
- Dynamic LCA
- AI Inference Tool

OBJ 3–Optimal Application of Water Treatment Technologies

- Design and Configuration Methodology
- Operational Demonstration
- Evidence Base

OBJ 4–Water Processes Real-time Monitoring Platform

- Integrated RTM Platform
- Data Fusion Middle-ware
- Data Cyber-Security & Data Integrity

OBJ 6–Water Cyber-Physical System for Water Efficiency Management

- WaterCPS
- Front-end Interfaces
- Database & Data bus

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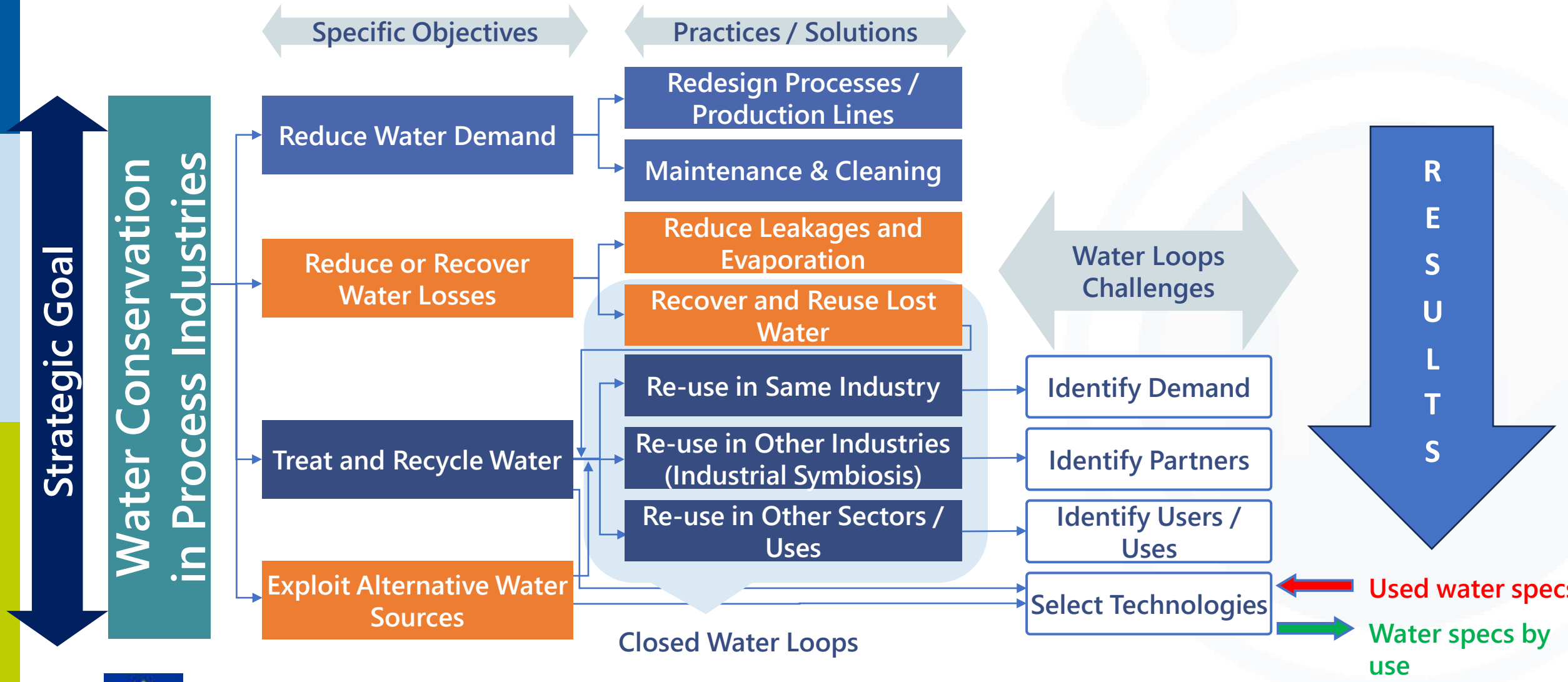
The “journey”



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THE RATIONALE

WEF
Water Efficiency Enhancement Framework

WTP
Water Technologies & Practices

WaterCPS
Water Cyber Physical System

WEP
Strategic, Business & Organizational Water Efficiency

RTM
Real Time Monitoring

DTC
Digital Twin , Smart Analytics, & Cognitive Services

Communication, Dissemination, Training and Education

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	GOAL	TARGET GROUP	AWARENESS	SUSTAINABILITY
DIRECT MODEL	• Engage industrial partners, customers, collaborators • Understand needs • Utilize existing networks • Communication/marketing activities • Create initial interest and validate delivery models and usage schemes	• Existing customers • Water and energy intensive industries • ICT companies (possible integration and new synergies)	• Existing industrial partners communication networks • AquaSPICE general communication/ marketing activities	• **Through AquaSPICE EEIG** • **Through their existing platforms (integrating AquaSPICE tools)** • **Existing marketing channels**
CLUSTER MODEL	• Engage cluster members • Understand needs • Utilize existing networks • Communication/marketing activities • Create initial interest and validate delivery models and usage schemes	• Cluster members • Water and energy intensive industries • Process industry networks (and other networks) that need to improve water management	• Cluster's communication/ marketing channels • AquaSPICE general communication/ marketing activities	• **AquaSPICE deployed at clusters** • **Marketing activities using the existing procedures** • **Existing marketing channels**
OPEN ACCESS MODEL	• Diffuse AquaSPICE to the research community • Incorporate knowledge from other SPIRE/H2020 projects into AquaSPICE	• SPIRE PPP • H2020 clusters • EU/National research projects	• Collaboration with other SPIRE PPP projects • Events organised at EU/National level • AquaSPICE general communication/ marketing activities	• **Participation in relevant committees** • **Close synergy with policy makers**

Project Duration

After the Project End

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The Work Packages

WP9: Project Management, Quality Assurance and Reporting

WP1: Water Efficiency Enhancement Applications Framework and Baseline Assessment

Use Cases, Application Scenarios, Baseline Assessment

WP3: Real-Time Water Efficiency Monitoring Platform for the Process Industry

Selection, Design & Configuration of Sensor Networks

WP6: Demonstration and Evaluation of AquaSPICE Solutions

Deployment of Technologies & Equipment

WP2: Industrial Water Saving, Recovery, Treatment and Re-use Technologies & Practices

WP5: Water Cyber Physical System: The Industrial Water Efficiency Management System

Deployment and Initialization of WaterCPS

Models, Methodologies, Tools, Applications

WP4: Digital Twin with Smart Analytics and Cognitive Services for Water Efficiency

WP7: Solution Uptake, Replication, Up-scaling and Exploitation

WP8: Communication, Dissemination, Training and Social Awareness

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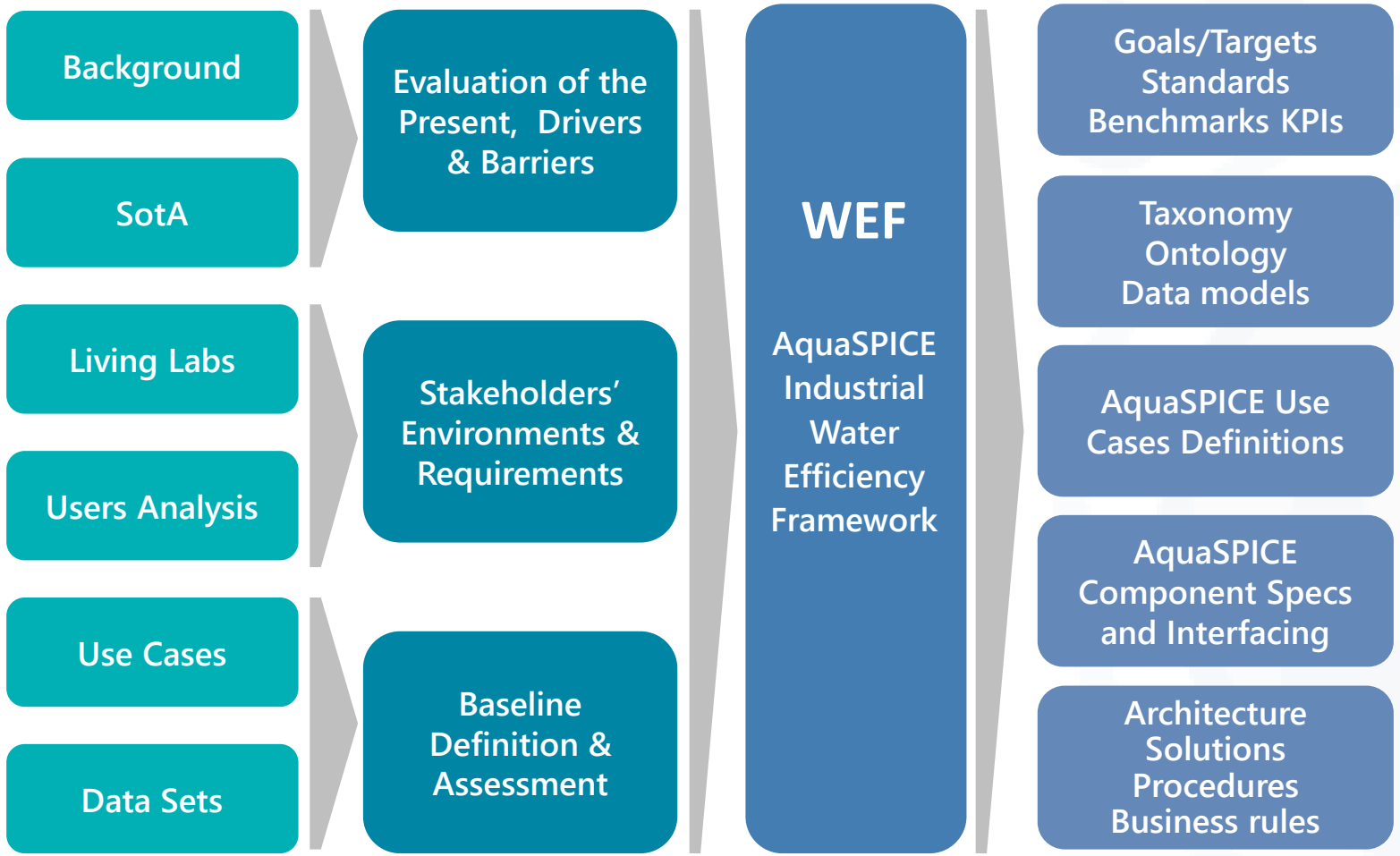
WP1 – Water Efficiency Enhancement Applications Framework and Baseline Assessment



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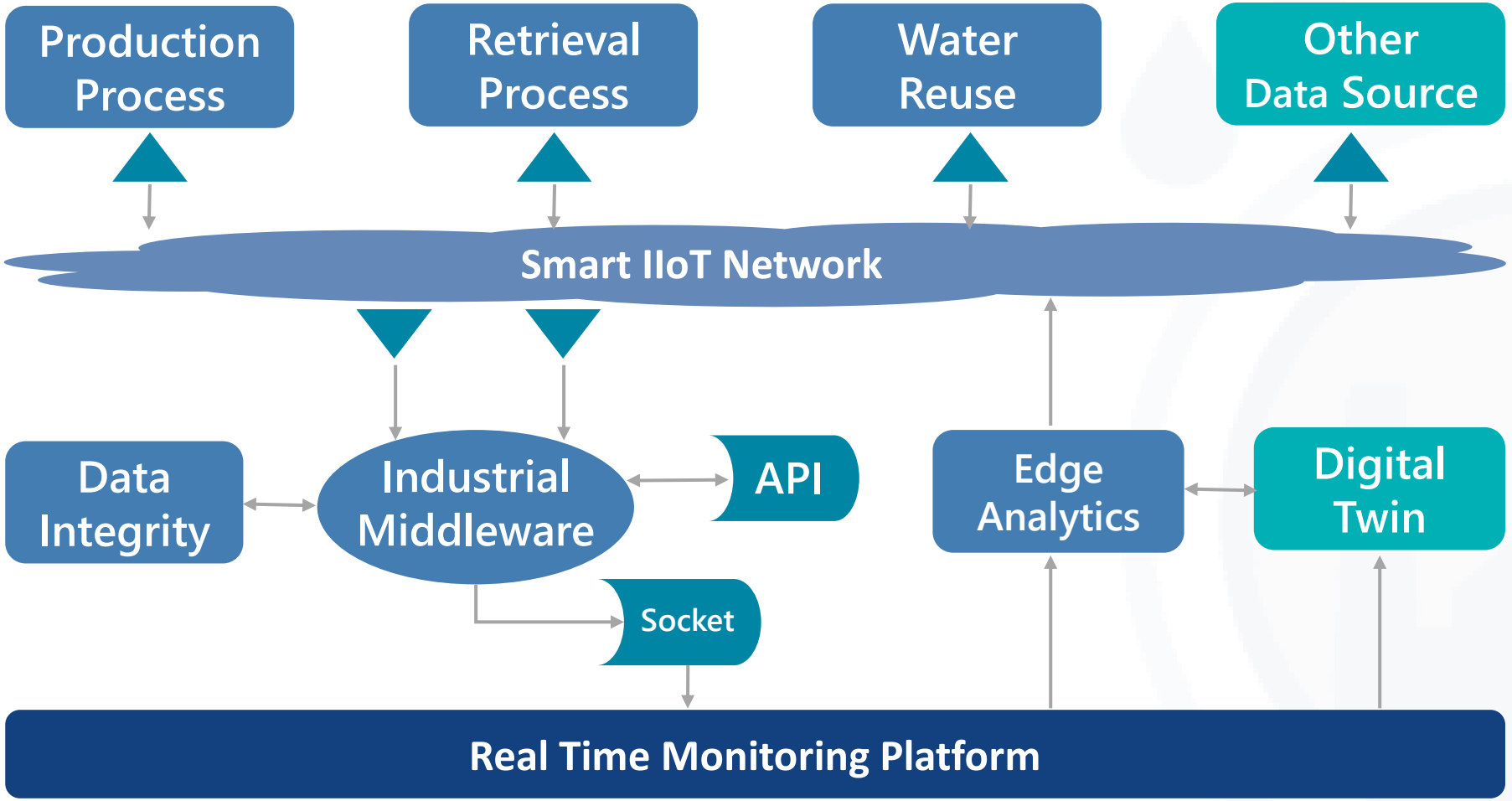
WP3 – Real-Time Water Efficiency Monitoring Platform for the Process Industry



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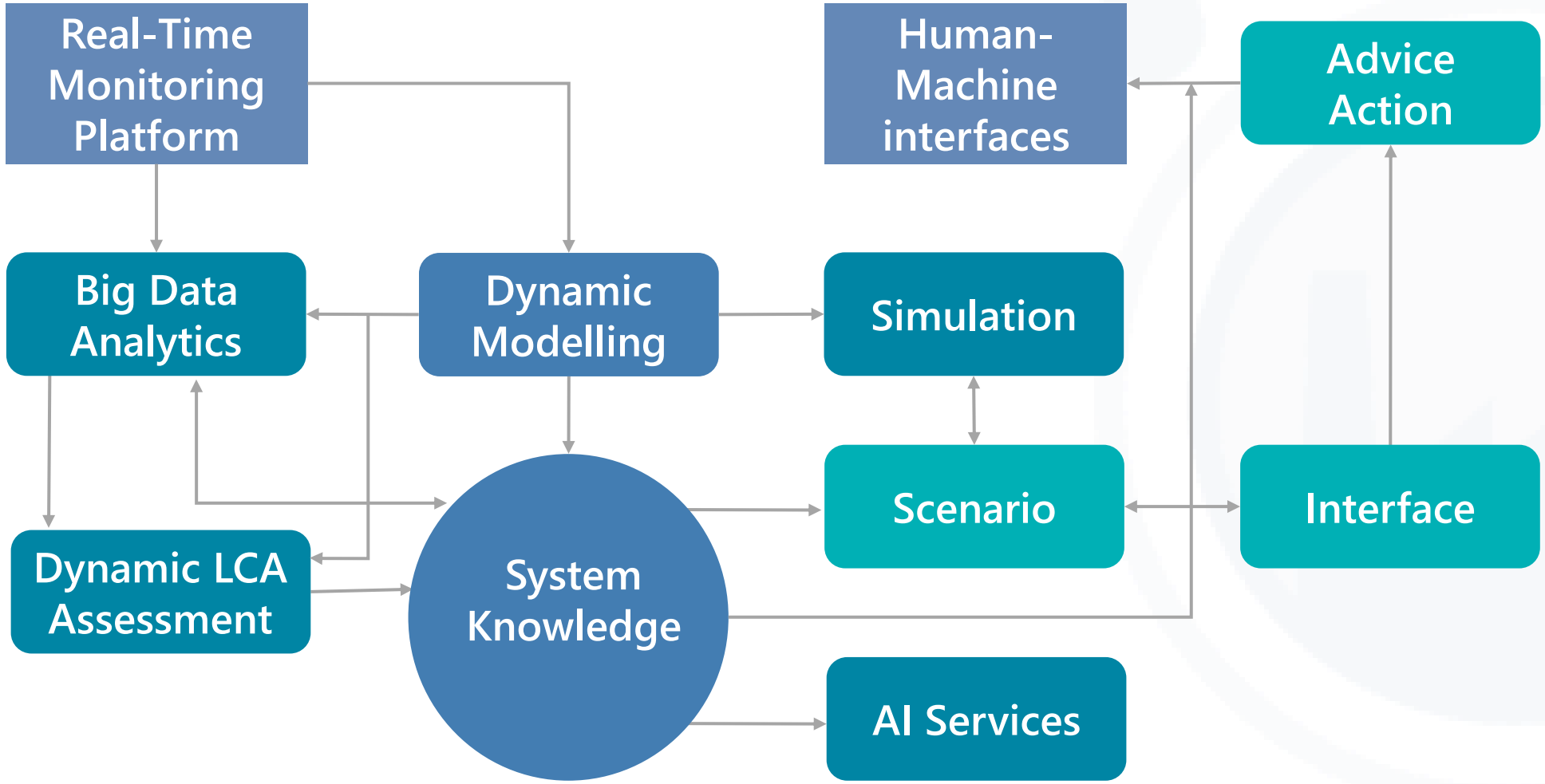
WP4 – Digital Twin with Smart Analytics and Cognitive Services for Water Efficiency



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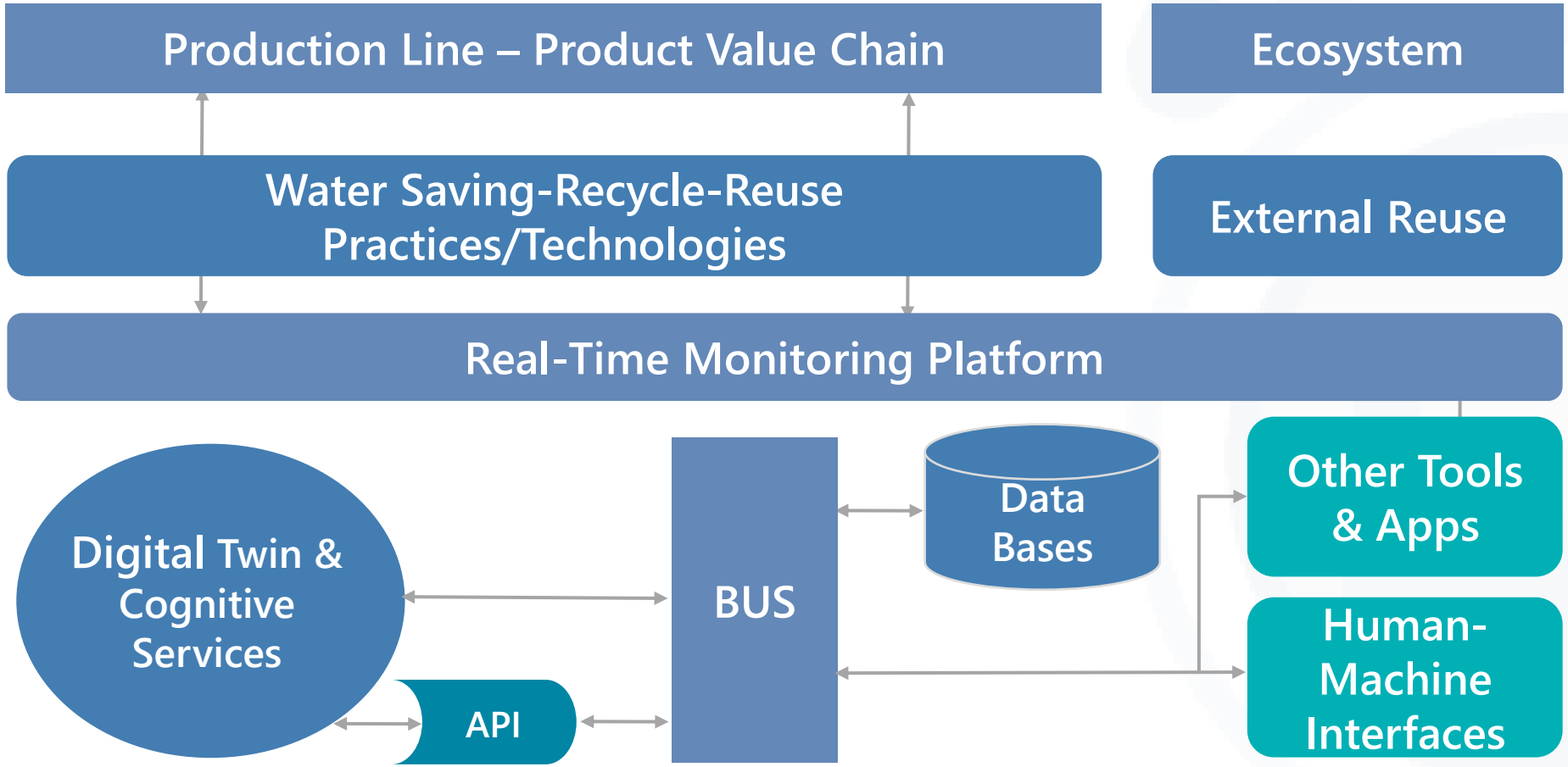
WP5 – Water Cyber Physical System: The Industrial Water Efficiency Management System



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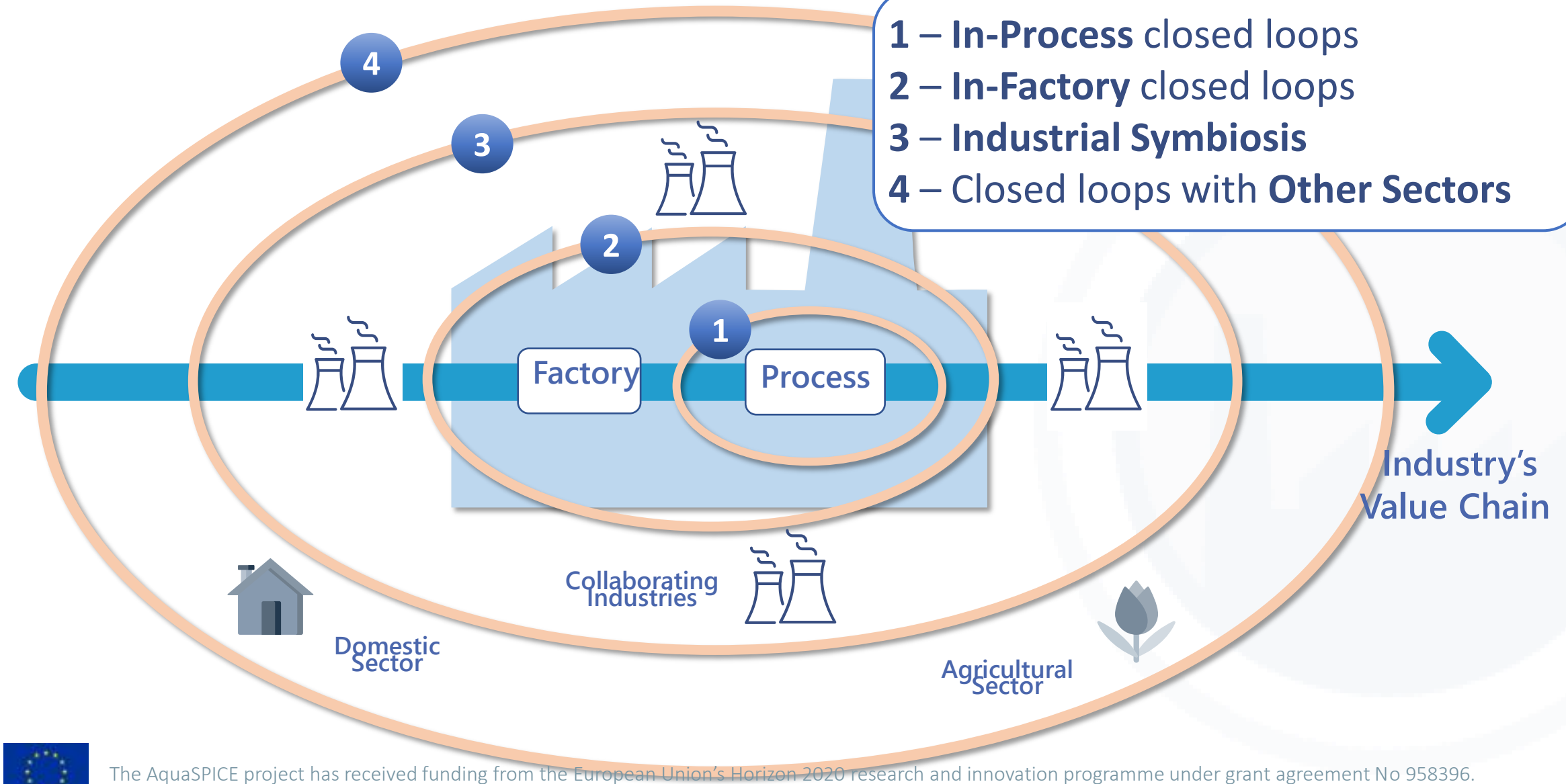
What is the way forward?



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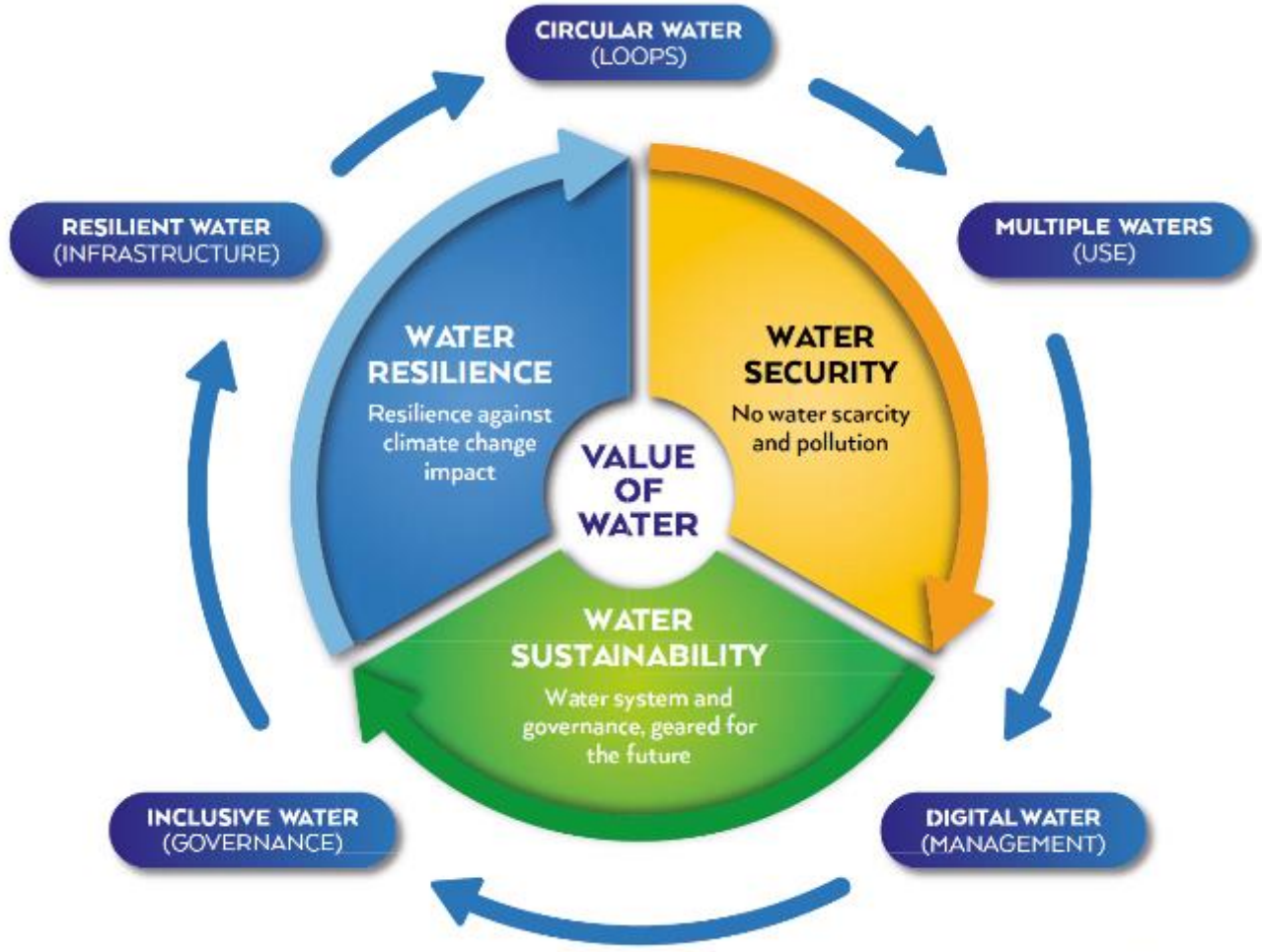
Water Vision 2023

Water-Smart Society:

- A society in which the **value of water** is recognised and realised to ensure water security, sustainability, and resilience.
- all available water sources are managed so that **water scarcity and pollution** are avoided.
- water and resource loops are largely closed to foster a **circular economy and optimal resource efficiency.**
- the water system is resilient against the **impact of climate and demographic change**.
- all relevant stakeholders are engaged in guaranteeing sustainable **water governance**.



Source: Water Europe

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