European Horizon 2020 Systemic Actions for Water-Smart Circular Cities, Regions and Industries

Post-conference H2020 report ECOMONDO 2021

Written by Clara Borja Barberà, Josué González Camejo, Francesco Fatone, Evdokia Achilleos (REA), Andrea Rubini
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HORIZON2020 PROJECTS

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European Horizon 2020 Systemic Actions for Water-Smart Circular Cities, Regions and Industries

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1. INTRODUCTION

The workshop on 'European Horizon2020 systemic actions for water-circular cities, regions and industries' is a joint event of Water Europe (WE) European Research Executive Agency (REA) and the Ecomondo Scientific Technical Committee organised in the frame of the 25th edition of ECOMONDO & KEY ENERGY The Circular Economy & Renewable Energy Expo 2021.

Ecomondo is the reference event in Europe for the ecological transition and the new models of circular and regenerative economy. Within the wide programme of conferences, workshops and seminars, ECOMONDO highlights a selection of international events, aimed at presenting all the key factors for the ecological transition and the new national and international trends and scenarios.

The workshop session took place on 27 October 2021 and was hosted by Andrea Rubini (WE) and Francesco Fatone (Ecomondo Scientific Technical Committee) in collaboration with Evdokia Achilleos (REA).

Water is transversal in systemic strategies for circular transition and sustainable development of cities, regions, industries and communities. Green and digital solutions, combined with proper governance and business approaches are being developed in Horizon2020 Innovation Actions and can make a crucial socio-economic impact towards the Green Deal objectives. This workshop has brought together major local and territorial innovative case studies and deliver a platform of experience to promote living lab approaches.

The main conclusions, collected in the final chapter of this repost, include considerations on the importance of digital transformation in the water sector, the circular transition of water in small and decentralized communities demonstration and in industrialized regions

2. Workshop AGENDA

The programme consisted of brief presentations from stakeholders of the water's field related to Horizon 2020 explaining their initiatives and experience and the results of ongoing Horizon 2020 projects and the impact of their actions.

The participating Horizon 2020-projects were:

- Digital-Water City (https://www.digital-water.city/)
- CIRCULAR BIOCARBON (https://circularbiocarbon.eu/)
- HYDROUSA (https://www.hydrousa.org/)
- AquaSPICE (https://aquaspice.eu/)
- ULTIMATE (https://ultimatewater.eu/)
- B-WaterSmart (https://b-watersmart.eu/)

10:00 - 13:00
Piattaforma Digitale Ecomondo
BEACON CONFERENCES
Evento Ecomondo

European Horizon2020 systemic actions for water-smart circular cities, regions and industries - VERSIONE CON STREAMING IN LINGUA ITALIANA

Lingua: inglese
Traduzione simultanea: italiano

*** RICONOSCIUTI 3 CREDITI FORMATIVI PROFESSIONALI PER L'ORDINE DEGLI INGEGNERI***

Organized by: Ecomondo Scientific Technical Committee and Water Europe

Water is transversal in systemic strategies for circular transition and sustainable development of cities, regions, industries and communities. Green, grey and digital solutions, combined with proper governance and business approaches are being developed in Horizon2020 Innovation Actions and can make a crucial socio-economic impact towards the Green Deal objectives. This workshop will bring together major local and territorial innovative case studies and deliver a platform of experience to promote living lab approaches.

Section Chairs

Evdokia Achilleos, European Commission – European Research Executive Agency – Head of Sector B3.002 - Green Europe - Biodiversity, Circular Economy and Environment
Andrea Rubini, Ecomondo's Scientific Technical Committee and Water Europe
Francesco Fatone, Ecomondo's Scientific Technical Committee and Marche Polytechnic University

Programme

10.00-10.30 *Water in Horizon 2020, Horizon Europe and National Initiatives: lessons learnt, aligning programs and synergizing efforts*

Focus on Horizon Europe - Evdokia Achilleos, European Commission
Focus on Water JPI - Giuseppina Monacelli, Chair Water JPI
Focus on Water4All - Maria Chiara Sole, Italian representative in Water4All, ISPRA

BUILDING ON RESULTS OF ONGOING PROJECTS:

10.30-11.00 *Digital Transition in Water-Smart Cities: Digital-Water City*
Chair Nicolas Caradot, Berlin Competence for Water, Germany – Project Coordinator

Contributions from case studies:

MILANO - Play with serious game and matchmaking tool
Marco Bernardi, Claudio Gandolfi, Serena Radini, Enrico Marinelli and Adriano Mancini – Gruppo CAP, UNIMI

Figure 1 H2020 Conference agenda

	Section Chairs
	Evdokia Achilleos, European Commission – European Research Executive Agency – Head of Sector B3.002 - Green Europe - Biodiversity, Circular Economy and Environment
	Andrea Rubini, Ecomondo's Scientific Technical Committee and Water Europe
	Francesco Fatone, Ecomondo's Scientific Technical Committee and Marche Polytechnic University
Timing	Agenda
10:00-10:30	Water in Horizon 2020, Horizon Europe and National Initiatives: lessons learnt, aligning programs and synergizing efforts
	Focus on Horizon Europe - Evdokia Achilleos, European Commission
	Focus on Water JPI - Giuseppina Monacelli, Chair Water JPI
	Focus on Water4All - Maria Chiara Sole, Italian representative in Water4All, ISPRA
	BUILDING ON RESULTS OF ONGOING PROJECTS:
10:30-11:00	Digital Transition in Water-Smart Cities: **Digital-Water City** |Chair Nicolas Caradot, Berlin Competence for Water, Germany – Project Coordinator
	Contributions from case studies:
	MILANO - Play with serious game and matchmaking tool | Marco Bernardi, Claudio Gandolfi, Serena Radini, Enrico Marinelli and Adriano Mancini – Gruppo CAP, UNIMI and UNIVPM
	PARIS - SIAAP - Demo of Early Warning System for bathing water | Sofia Housni, Sanitation for Greater Paris SIAAP
11:05-11:20	Circular integration of regional water and waste services: **BBI CIRCULAR BIOCARBON** flagship| Natalia Alfaro Borjabad URBASER, Spain – Project Coordinator
11:20-11:20	Break
11:30-12:05	Circular Transition in small and decentralized communities: **HYDROUSA** |Costas Noutsopulos, National Technical University of Athens, Greece – Project

	Contributions from case studies:
	LESVOS island | Fabio Masi, IRIDRA, Italy
	TINOS island |Nikos Bedau, Tinos Eco Lodge, Greece Alessandro Zecca, Planet, Italy
	MYKONOS island |Antonios Eleftheriou, Delaros, Greece
	Replication of Hydrousa circular solutions | Camillo Palermo and Giulia Cipolletta, ASA and UNIVPM, Italy
	Financial Instruments and business models | Eric Mino, SEMIDE, France
12:05-12:35	Circular Transitions in industrialized regions: **NextGen** and **ULTIMATE** and **AquaSPICE** | Gerard van den Berg and Jos Frijns Water Research Institute KWR, Netherlands – project coordinator
	ROSIGNANO case – ULTIMATE and AquaSPICE:
	Michele Del Corso and Mattia Ciampechini, ARETUSA, Italy Giovanni Cannata, WEST Systems, Italy
	Cecilia Bruni, Università Politecnica delle Marche, Italy
	Francesco Rossi, Consorzio Polo Tecnologico Magona, Italy Lorenzo Bagnoni e Gianluca Pettinello, SOLVAY, Italy
12:35-12:50	Water-smart coastal regions: B-WaterSmart. General overview and Venice case | Patrizia Ragazzo, VERITAS, Italy
12:50	Wrap up, conclusions and plans for follow-up | Evdokia Achilleos, European Commission

3. PRESENTATIONS

3.1. WATER IN HORIZON 2020, HORIZON EUROPE AND NATIONAL INITIATIVES: LESSONS LEARNT, ALIGNING PROGRAMS AND SYNERGIZING EFFORTS

3.1.1. Focus on Horizon Europe | Evdokia Achilleos, European Commission – European Research Executive Agency – Head of Sector B3.002 - Green Europe - Biodiversity, Circular Economy and Environment.

Horizon Europe (HE) (2021-2027) is the EU's key funding programme for research and innovation. It substitutes former Horizon 2020 programme and has a budget of €95.5 billion.

Horizon Europe tackles climate change, helps to achieve the UN's Sustainable Development Goals (SDGs) and boosts the EU's competitiveness and growth. The programme facilitates collaboration and strengthens the impact of research and innovation in developing, supporting and implementing EU policies while tackling global challenges. It supports creating and better dispersing of excellent knowledge and technologies. It creates jobs, fully engages the EU's talent pool, boosts economic growth, promotes industrial competitiveness and optimises investment impact within a strengthened European Research Area.

The New elements in Horizon Europe are the following:

- European Innovation Council: Support for innovations with potential breakthrough and disruptive nature with scale-up potential that may be too risky for private investors. This is 70% of the budget earmarked for SMEs.
- Missions: Sets of measures to achieve bold, inspirational and measurable goals within a set timeframe. There are 5 main mission areas as part of Horizon Europe:
    1. Adaptation to Climate Change
    2. Cancer
    3. Restore our Oceans and Waters
    4. Climate-neutral and smart cities
    5. Soil Deal for Europe
- Open science policy: Mandatory open access to publications and open science principles are applied throughout the programme.
- New approach to partnerships: Objective-driven and more ambitious partnerships with industry in support of EU policy objectives.

The structure of Horizon Europe programme is shown in Figure 2:

Figure 2. Horizon Europe programme (How Horizon Europe was developed | European Commission (europa.eu))

It must be highlighted that WATER is not a central topic in the HE Missions, but it is highly relevant in Adaptation to Climate Change Mission, Restore our Oceans and Waters Mission and Soil Deal for Europe Mission.

In HE programme, calls are divided in 6 clusters:

- Cluster 1 - Health
- Cluster 2 - Culture, Creativity & Inclusive Society
- Cluster 3 – Civil Security for Society
- Cluster 4 - Digital, Industry & Space
- Cluster 5 - Climate, Energy & Mobility
- Cluster 6 - Food, Bioeconomy, Natural Resources, Agriculture and Environment

These clusters are divided in Destinations.

WATER is specifically involved in Cluster 6. Water-related destinations can also be found in Clusters 4 and 5:

Cluster 4 - Digital, Industry & Space

- Destination 1 - Climate neutral, circular and digitised production;
- Destination 2 - Increased autonomy in key strategic value chains for resilient industry;
- Destination 3 - World leading data and computing technologies;
- Destination 3 - Digital and emerging technologies for competitiveness and fit for the Green Deal;
- Destination 5 - Open strategic autonomy in developing, deploying and using global space-based infrastructures, services, applications and data;
- Destination 6 - A human-centred and ethical development of digital and industrial technologies.

Cluster 5 - Climate, Energy & Mobility

- Destination 1 - fosters climate science and thus helps to identify effective and efficient pathways and responses to climate change.
- Destination 2 - supports different cross-cutting technologies and solutions for climate, energy and mobility applications.
- Destination 3 - is about making energy supply more sustainable, secure and competitive;
- Destination 4 - is focusing on reducing energy demand of buildings and industry and enabling their more active role in a smart energy system.
- Destination 5 - increases the competitiveness and climate/environmental performance of different transport modes;
- Destination 6 - advances mobility services and solutions at system level for passengers and goods.

Cluster 6 - Food, Bioeconomy, Natural Resources, Agriculture and Environment

- Destination 1 – Biodiversity and ecosystem services.
- Destination 2 – Fair, healthy and environment-friendly food systems from primary production to consumption.
- Destination 3 – Circular economy and bioeconomy sectors.
- Destination 4 – Clean environment and zero pollution.
- Destination 5 – Land, ocean and water for climate action.
- Destination 6 – Resilient, inclusive, healthy and green rural, coastal and urban communities.
- Destination 7 – Innovative governance, environmental observations and digital solutions in support of the Green Deal.

More information about Horizon Europe can be found at: Horizon Europe | European Commission (europa.eu).

3.1.2. Focus on Water JPI | *Giuseppina Monacelli*, Chair Water JPI.

Joint Programming Initiatives (JPIs) are an initiative of European Member States and the European Commission for tackling Current Grand Challenges with European dimension and global outreach through:

- Identification of common research, development and innovation priorities.
- Launch of Joint multilateral activities e.g. calls for projects, networks of experts, technology transfer.
- Reinforcement of links to various international initiatives.

There exists 10 JPIs since 2008, including WATER JPI.

JPI on “Water challenges for a changing world” aims to tackle the ambitious grand challenge of “Achieving sustainable water systems for a sustainable economy in Europe and abroad”. Water is vital and essential for a smart, sustainable and inclusive growth. Better results and optimization of public funds are obtained through the alignment of water research agendas and programmes at European and international”.

Water JPI partners (Figure 3) currently represent 88% of the European National Public RDI investment on Water.

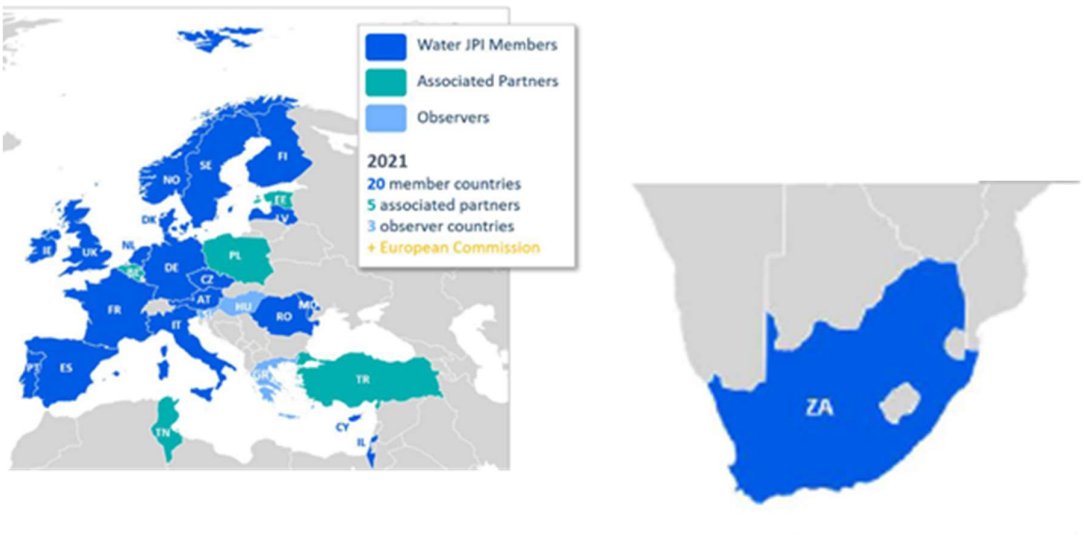

Figure 3. Map of WATER JPI members, partners and observer countries.

Figure 4. Description of Water JPI activities.

Water JPI has elaborated two documents describing their vision and strategic agenda (updated in April 2020):

1. WATER JPI VISION 2030 (waterjpi_vision2030_web.pdf).

2. WATER JPI STRATEGIC RESEARCH AND INNOVATION AGENDA 2025 (waterjpi_sria2025_web.pdf).

Seven Joint Calls have been launched (2013, 2015, 2016, 2017, 2018, 2020,2020-21) including five calls with support of the European Commission as part of the Horizon 2020 ERA-NETs Cofund WaterWorks2014, WaterWorks2015, WaterWorks2017, ERA-NETs Cofund AquaticPollutants & BioDiversa and two calls implemented within the CSAs WatEUr and IC4Water.

2013 Pilot Call: “Emerging Water Contaminants” (budget 9.7M€, 7 projects funded).

2015 Joint Call: “Developing technological solutions for services for water distribution and measurement, wastewater treatment and reuse, desalination, floods and droughts” (budget 15.2 M€, 16 projects funded).

2016 Joint Call: with the FACCE JPI “Improving water use efficiency and reducing soil and water pollution for a sustainable agriculture” (budget 18 M€, 21 projects funded).

2017 Joint Call: “Water resource management in support of the United Nations Sustainable Development Goals (UN SDGs)” (budget 6.8 M€, 8 projects funded).

2018 Joint Call: “Closing the water cycle gap - improving sustainable water resources management” (budget 15.2 M€, 18 projects funded).

2020 Joint Call: with the Oceans and AMR JPIs on “Risks posed to human health and the environment by pollutants and pathogens present in the water resources” (budget 24 M€, 18 projects funded).

2020 Joint Call: with the BiodivERsA JPI on “Conservation and restoration of degraded ecosystems and their biodiversity, including a focus on aquatic systems”.

WATER JPI has also organised 2 Knowledge Hubs: The first one (2018) on Contaminants of emerging concerns (http://www.waterjpi.eu/implementation/thematic-activities/water-jpi-knowledge-hub-1).

The second one (2019) on UN SDGs: WATER4SDGs"New Water under Water Scarcity“. (http://www.waterjpi.eu/implementation/thematic-activities/water-jpi-knowledge-hub-1/knowledge-hub-on-un-sdgs).

WATER JPI is also involved in the Thematic Annual Programming action (TAP) (http://www.waterjpi.eu/implementation/thematic-activities/water-jpi-tap-action), a cluster of R&I projects for a common research priority on Ecosystem Services. It is a network of national projects focused on specific research needs.

It relies on the establishment of a network or cluster of excellence, creating a critical mass of research and technological excellence, the integration and sharing of knowledge, infrastructure, data and modelling tools, training and capacity building, as well as improved communication and networking with stakeholders and the scientific community.

The first Water JPI TAP action on “Developing Approaches for Assessing and Optimising the value of Ecosystem Services” run from June 2019 until June 2021.

Water JPI has also participated in the organisation of the 2021 Water JPI Conference on “Pollutants, pathogens, and antimicrobial resistances in the water cycle”, which took place in Mülheim a.d.R, Germany, on 17-18 November 2021.

Water JPI is also an associated partner in European partnership Water4All – Water Security for the Planet (see next presentation).

Water JPI Contact:

www.waterjpi.eu

waterjpisecretariat@agencerecherche.fr

3.1.3. Focus on Water JPI | *Maria Chiara Sole*, Italian representative in Water4All, ISPRA.

Water4All is a co-funded European Partnership (under Horizon Europe programme) composed of 77 partners, including R&I funders, sectoral ministries, local authorities, EU networks, national associations, clusters, RPOs. It has been launched in November 2021 and will last until 2027, although some activities can be lengthened until 2032.

Phase I will take place in 2022-2023, which budget accounts for 90 M€ including 26 M€ from EC funding.

The aim of the partnership:

- Concentrating research and innovation and the funding landscape of water in Europe and beyond.
- Enabling water security for all on the long term by boosting systemic transformations and changes across the entire water research and innovation pipeline, fostering the matchmaking between problem owners and solution providers.Destination 3 – Circular economy and bioeconomy sectors.
    - cross-sectoral approach, encompassing policy, environmental, economic, technological and societal considerations.
    - continuum from knowledge development to the transfer and practice to the actors of policy, operators and society.

The R&D&I themes, drivers and enablers of Water4All are shown in Figure 5:

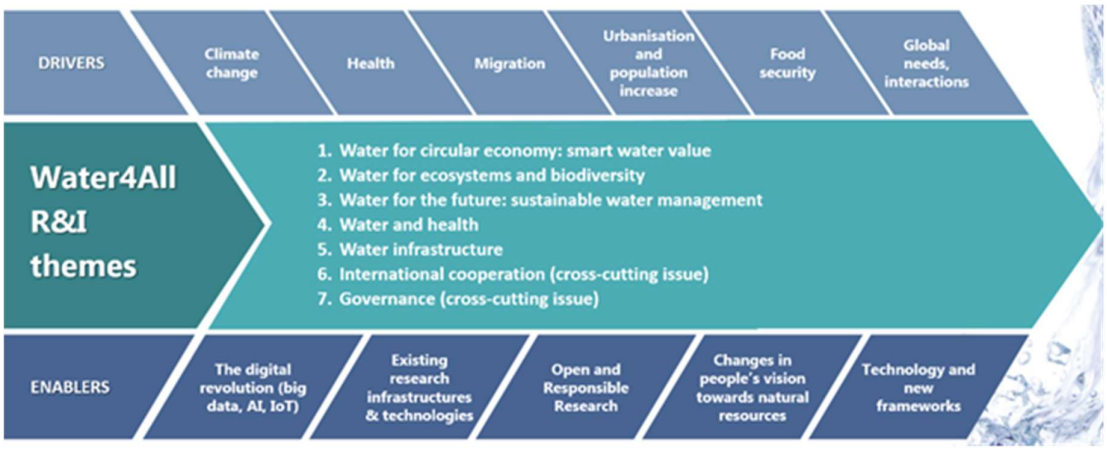

Figure 5. R&D&I themes, drivers and enablers of Water4All.

The themes and sub-themes of Water4All Strategic Research and Innovation Agenda (SRIA) are displayed in Figure 6, while the Water4All strategic plan is shown in Figure 7:

Themes	I. Water for circular economy: smart water value	II. Water for ecosystems and biodiversity	III. Water for the future: sustainable water management	IV. Water and health	V. Infrastructures for water	VI. International cooperation	VII. Governance
Sub-themes	• Water supplies for socio-economic development and activities. • Circular economy. • Empowering the public, water users and stakeholders in valuing water.	• Functioning and biodiversity. • Resilience, mitigation and adaptation of aquatic ecosystems and ecosystem services to global changes. • Developing and applying ecological engineering and ecohydrology for ecosystems restoration. • Integrating ecosystem services into the management of water resources.	• Water Resources Management. • River basin management. • Groundwater management. • Resilience, adaptation and mitigation to hydroclimatic extreme events. • Tools for water management.	• Behaviour and effects of contaminants of emerging concern, plastics, endocrine disruptors. • Water dimension in antimicrobial resistance. • Innovative water tools and technologies for water quality monitoring and water treatment, remediation and disinfection. • Risk Assessment.	• Adaptation of existing water infrastructures to new challenges • Water infrastructure resilience. • Water infrastructure security (including cyber and terrorism security).	• Water diplomacy. • Establishing tools for trans-boundary cooperation • Developing integrated, fair and adaptive water resource management systems.	• Developing methods for more efficient citizen and wider stakeholder engagement • Strengthening policy integration, alignment, coherence and water policy coordination in order to exert a real change in society. • Enhancing the regulatory framework.

Figure 6. Themes and sub-themes of Water4All Strategic Research and Innovation Agenda (SRIA).

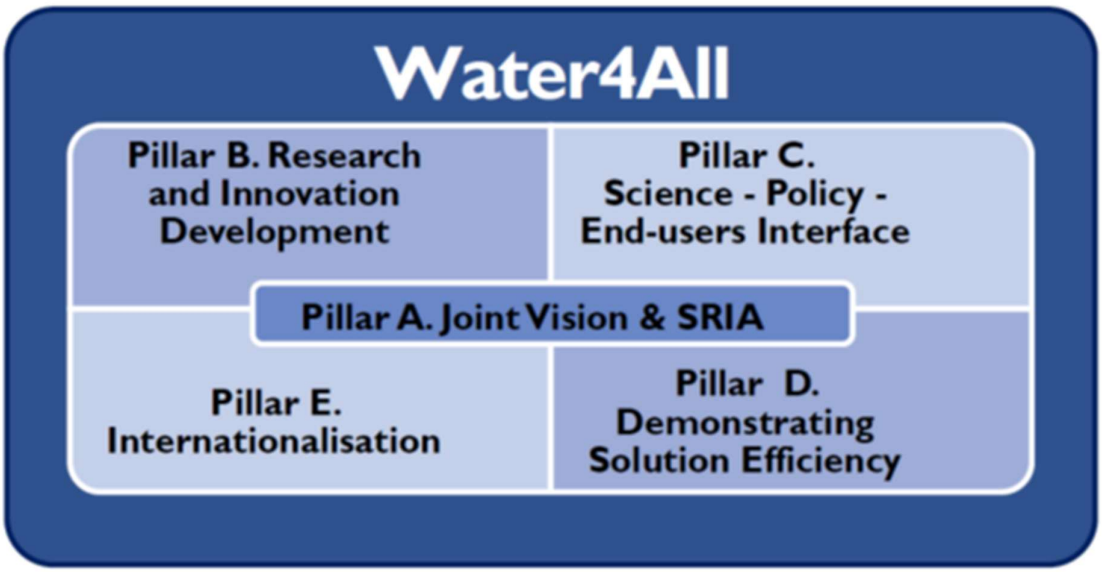

Figure 7. The Water4All strategic plan is divided in 5 pillars: Pillar A, B, C, D and E.

Contacts:

Commision services: Panagiotis Balabanis.

Coordinator: Agence Nationale de la Recherche (ANR): Olivier Bouc (Water4all@agencerecherche.fr).

Partner: ISPRA: Maria Chiara Sole (mariachiara.sole@isparambiente.it).

3.2. BUILDING ON RESULTS OF ONGOING PROJECTS

3.2.1. Digital Transition in Water-Smart Cities: **Digital-Water City** | Chair *Nicolas Caradot*, Berlin Competence for Water, Germany – Project Coordinator

European cities face major challenges to achieve sustainable management of urban water systems with:

- The over-exploitation of groundwater and surface water bodies by the agricultural industry and citizens.
- And the effects of climate change competing with growing demand for liveable and resilient cities.

Digital technologies can help. Mobile devices, real-time sensors, machine learning, artificial intelligence and cloud solutions can significantly improve the management of water infrastructures. They can boost the quality of services provided to citizens, as well as the level of awareness and collaboration between utilities, authorities and citizens. DWC creates new linkages between the digital and the physical world by developing, assessing and bringing to the market a panel of 15 advanced tailor-made data and digital technologies for integrated water management. DWC digital solutions are being deployed in five major European urban and peri-urban areas, Berlin, Milan, Copenhagen, Paris and Sofia, representing about 30 million inhabitants, i.e. 6% of Europe's population, facing common issues concerning water and wastewater management and digitization, and linked to important events such as the 2024 Olympic Games in Paris.

DWC partners consider that the large-scale assessment and communication of the benefits provided by the digital solutions in five major cities will serve as lighthouse, raising the awareness of other European cities, including smaller urban areas, and opening new market opportunities for DWC partners and European providers of digital solutions. DWC takes the challenge of developing a large number of solutions (15 DS, TRL 3-7 toward TRL 7-9) that address a wide panel of digital techniques for all the water value chain instead of focusing only on few isolated solutions. DWC considers that this approach is essential to unleash the full potential obtained through the interactions of single digital technologies such as real-time monitoring data empowered by artificial intelligence and mobile visualisation tools. DWC solutions have been selected based on their level of maturity, on their market potential and on their high relevance to address current and future water-related issues, namely the protection of human health, the technical, environmental and economic performance and return on

investment of water infrastructures as well as the public and end-user awareness on water management.

DWC solutions are developed in close collaboration with municipalities, utilities, research institutes and innovation players from both the digital and physical sphere. Digital-water.city integrates the development of digital solutions in a dedicated guiding protocol to cover existing gaps in governance, interoperability and cybersecurity. I will take place in 2022-2023, which budget accounts for 90 M€ including 26 M€ from EC funding.

Figure 8. Contributions from case studies: DIGITAL WATER CITY H2020.

MILANO - Play with serious game and match making tool | Marco Bernardi, Claudio Gandolfi, Serena Radini, Enrico Marinelli and Adriano Mancini – Gruppo CAP, UNIMI and UNIVPM.

Milano case is developed in Peschiera Borromeo WasteWater Treatment Plant (WWTP) (Figure 9):

Figure 9. Peschiera Borromeo WWTP. Milano case study (Italy).

Match Making Tool

The water and nutrient needs in the areas near the WWTP are wanted to be estimated. Different technologies are wanted to be integrated to support decisions about irrigation.

The match-making tool (Figure 10) aims to enhance the reuse of water in agriculture by promoting "smart" irrigation that takes into account real needs; supports the decisions of various stakeholders to find the match between quality and quantity and integrates data from multiple "sources" in order to have an updated vision to support different stakeholders.

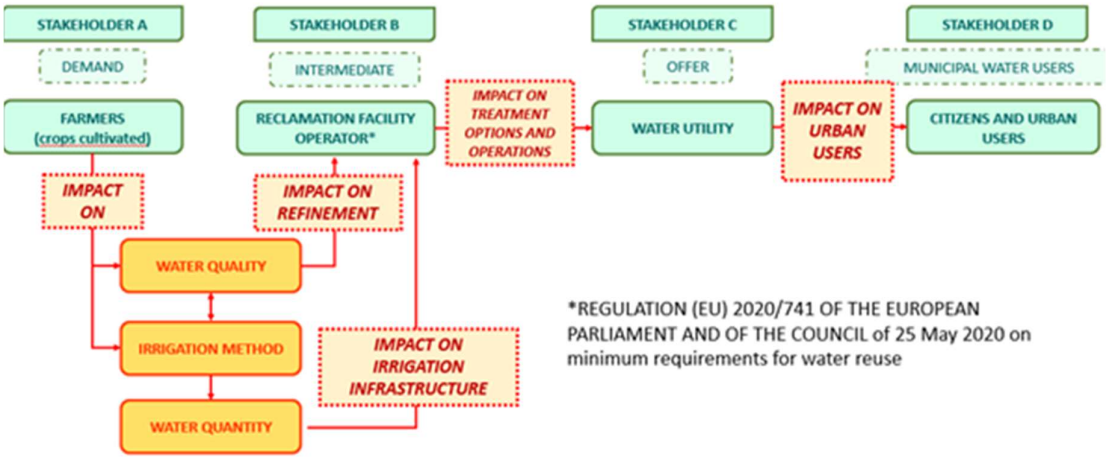

Figure 10. Scheme of the Match Making tool from the Milano case.

Using Satellite data over fields, it is possible to derive time-series and check the status also evaluating different ripening growths.

Serious Game

The serious game is based on a scientifically sound validated integrated model to evaluate water reuse-carbon-energy-food-climatic Nexus. It is focused on water reuse practice and uses

local real-time data to validate the evaluation of the scenarios. It provides a cross-domain real-time data flow and foot printing for a range of scenarios such as different climatic conditions, water availability, irrigated / fertigated crops, water demand and population, treatment performances and related greenhouse gas emissions. The player of the serious game will play the role of those who manage the resources that potentially can be recovered from urban wastewater for a SAFE AND SUSTAINABLE REUSE IN PERIURBAN AGRICULTURE. It can be thus used to raise stakeholders and public awareness about sustainability of water reuse and to improve public perception of water reuse in agriculture. It can also be used as a decision support tool for planning, providing results based on real data and calibrated models.

Every choice is accompanied by informative mirrors with curiosity and suggestions to continue the game. The player will have the opportunity to choose to irrigate different crops by using different irrigation methods. They will compare the relative benefits in terms of NEXUS, PRODUCTIVITY AND EFFICIENCY in the decision making.

The serious game is currently in a beta version. Figure 11 shows a screenshot of its display during one of the simulations:

Figure 11. Screenshot during the simulation of the Serious Game.

Contact:

PARIS - SIAAP - Demo of Early Warning System for bathing water | Sofia Housni, Sanitation for Greater Paris SIAAP.

There is an increasing social demand from citizens to reduce environmental impacts in urban rivers and to benefit from urban bathing areas. Several cities like Berlin have achieved excellent water quality levels for their urban rivers and propose swimming areas at the heart of the city.

A major challenge regarding bathing water management, however, is that concentrations of faecal bacteria may show spatial and temporal variability. In urban rivers, discharges from combined sewer overflow (CSO) and stormwater may contain high amounts of faecal bacteria and contaminant bathing water quality.

In many cases, even with sufficient water quality, bathing can be forbidden as current monitoring protocols are not sufficient to protect human health. Even modern rapid monitoring approaches still need up to 12-14 hours before results are available, and traditional grab sampling does not allow tracking of pollution variability since events may occur between sampling intervals or cannot be collected for logistical reasons (e.g. if events happen at night or during weekends).

If bathing waters are subject to short-term pollution, the current European Bathing Water Directive (BWD Article 12(c)) explicitly demands the implementation of early warning systems in order to prevent bathers from being exposed to contaminated water. However, the BWD neither provides guidance on how to implement early warning systems in practice nor defines water quality alert thresholds. Bathing water quality is assessed only in the long term by estimating parametric 90th and 95th percentiles based on monitoring data of the previous four years. The lack of specified thresholds makes it difficult for the responsible authorities to justify and defend short-term decisions about closures of or warnings on bathing sites.

The early warning system developed in the Paris case study is based on an innovative probabilistic approach. The tool translates the current approach of long-term classification according to the European BWD into real-time management for early warning, making it possible to close a major gap in current European bathing water legislation. The availability of online water quality prediction significantly improves microbial safety and reduces the risk of contamination at bathing waters. This can make it possible to establish bathing waters in challenging locations that are subject to short-term pollution (e.g. urban agglomerations). It also enables management of nothing authorisation considering modelling uncertainty and strengthening of bathing water profiles. The tool provides users with a free, user-friendly software that can be easily implemented at new bathing waters. A mobile application is proposed to inform key decision makers and citizens of bathing water contamination risks.

Machine-learning based Early Warning System for bathing water quality

This early warning system is an open-source software interface that enables real-time bathing water quality assessment. Based on machine learning and/or statistical modelling, it predicts bacterial concentration in specific river sections using a set of local data such as rainfall, river flow, temperature and water quality.

The system helps to (1) manage bathing authorisations in urban bathing sites, (2) monitor the efficiency of the sanitation policy and (3) improve the real-time management of the sewer

network and urban bathing sites. The daily functioning of the Early Warning system is shown in Figure 12, while the prediction tool is displayed in Figure 13:

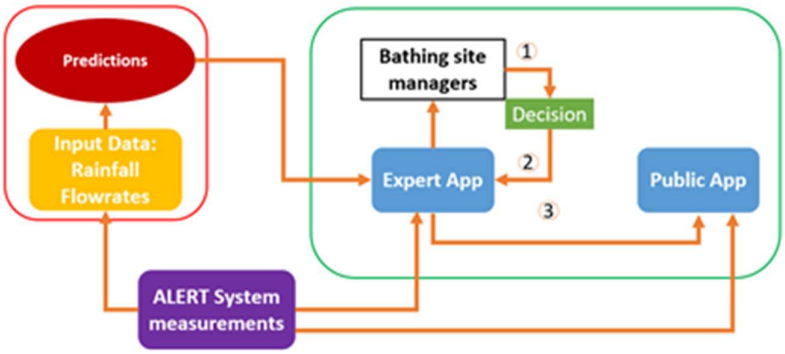

Figure 12. Daily functioning of the Early Warning System.

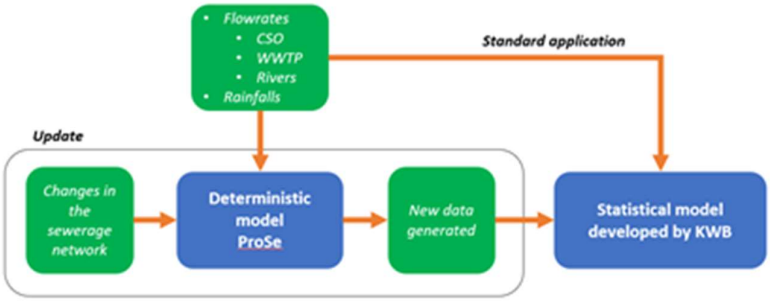

Figure 13. Prediction tool of the Early Warning System.

Two different kind of apps are being developed, according to the end-user (Figure 12) to which it is aimed:

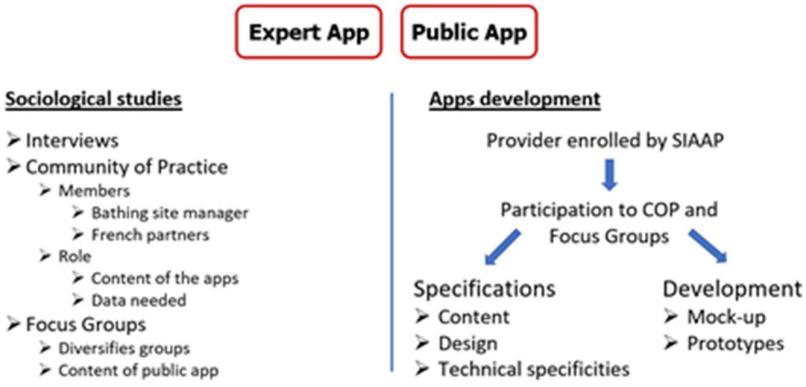

Figure 14. Mobile applications to communicate bathing water quality.

Contacts:

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SIAAP Sofia Housni : Sofia.HOUSNI@siaap.fr

3.2.2. Contributions from case studies: **CIRCULAR BIOCARBON** H2020

Circular integration of regional water and waste services: BBI CIRCULAR BIOCARBON flagship | Natalia Alfaro Borjabad, URBASER, Spain – Project Coordinator

1300 M Ton of urban solid wastes are produced annually in Europe (Eurostat, 2019). This amount is expected to increase up to 271 kg of solid wastes per capita by 2025, 46% of which refers to organic content (The World Bank, 2012). 91 kg per capita of organic waste comes from wastewater treatment (sewage sludge) to be added to the urban solid waste produced (calculated from data of Eurostat, 2019). Even though the recycling of these wastes has improved in the past decades, municipal solid waste still contains a large part of organic fraction that is not used efficiently. Hence there a necessity and gap to be filled.

Traditionally, the solid residues from urban wastes and wastewater have been managed separately. This management scheme can be improved by joining both treatments in a biorefinery scheme. Through the concept of a biorefinery, OFMSW can be managed more efficiently in terms of circular economy. This implies:

- Reduction of investments costs.
- Closing the cycle of materials (nutrients, organic matter, etc.).
- Increase in profitability.
- Zero waste.

CIRCULAR BIOCARBON (Figure 15) is a first-of-its-kind flagship biorefinery conceived to valorise organic fraction of municipal solid waste (OFMSW) into value-added products: diamond-like-carbon coatings, green graphene, tailor-made bio-based fertilisers, or bio-plastic, as well as a variety of intermediate products. To maximise replicability and boost potential penetration in the market, the biorefinery will be operated for three years in Spain and Italy, and consistent business and exploitation strategies will be put in place. The CIRCULAR BIOCARBON biorefinery, organised through a pool of cascading technologies, starting from anaerobic process steps (after proper pre-treatment) of mixed urban waste streams, of which OFMSW is the main one, in order to treat all the biowaste produced by a medium-size city (at the end of the project, a commercial scale biorefinery will be fully operative). The fundamental objective of the CIRCULAR BIOCARBON project is to open up new business frameworks based on a new circular vision of waste treatment in a city towards a sustainable bioeconomy, to which actors leading the territorial waste management schemes and policies will be brought to maximize impact on the market, on policy makers and on society.

Figure 15. Partners of Circular Biocarbon.

Locations: Zaragoza (Spain) and Sesto San Giovanni (Italy) (Figure 16).

1. Zaragoza (Spain) is a province in the autonomous community of Aragon, northeastern Spain. The biorefinery will be built in the facilities of “Alfonso Maíllo” Innovation Center (CIAM, one of the most important facilities in Spain for research applied to waste management) and in the Center for Urban Waste Treatment of Zaragoza (CTRUZ), owned by the Municipality of Zaragoza and located in the Technological Park for Recycling (PTR). Both facilities are managed by CIRCULAR BIOCARBON coordinator URBASER.

2. Located in the suburbs of Milan, in the Lombardia region, northern Italy, Sesto San Giovanni is a town with a long-standing industrial tradition that has left its mark on the territory. Italian partner Group CAP will manage the CIRCULAR BIOCARBON biorefinery in the city. Following public consultations which started in 2016, construction of the biorefinery in Italy will start in 2022 with the reconversion of two biodigesters in the already existing thermal-valorisation plant and the wastewater treatment plant, in Sesto San Giovanni and managed by CAP.

Figure 16. Map of the locations.

Through CIRCULAR BIOCARBON is still in its first year (from a total of 5 years). Its main impacts at the end of the project are:

- Reduction of 100% of Organic Fraction of Municipal Solid Waste (OFMSW) sent to landfill.
- 4 new bio-based materials.
- Reduction 400 t/year of Greenhouse emissions.
- 100% reduction of the incineration of the Sewage Sludge (SS).
- 4 new bio-based value chains from the Organic Fraction of Municipal Solid Waste (OFMSW) and Sewage Sludge (SS).
- More than 7000 jobs created by 2030.
- 7 new cross-sector interconnections between waste management, water utilities, coating, electronics, chemical, bioplastics and agriculture sectors.

3.2.3. Contributions from case studies: HYDROUSA H2020.

Circular Transition in small and decentralized communities: HYDROUSA|Costas Noutsopulos, National Technical University of Athens, Greece – Project Coordinator.

HYDROUSA (www.hydrousa.org) aims to setup and demonstrate on-site nature-based solutions for the management of a variety of water streams including rainwater, sewage, groundwater and seawater to produce valuable resources, which can then be valorised to increase agricultural production and boost the economic activities of Mediterranean areas. The demonstration systems (Figure 15) will be applied at full scale on three Greek islands (Lesvos, Mykonos and Tinos). The implemented solutions will be complemented with innovative services based on the formation of new value chains, involving farmer associations and water producers. The transferability of the solutions will then be demonstrated in 10 other Mediterranean and water stressed places.

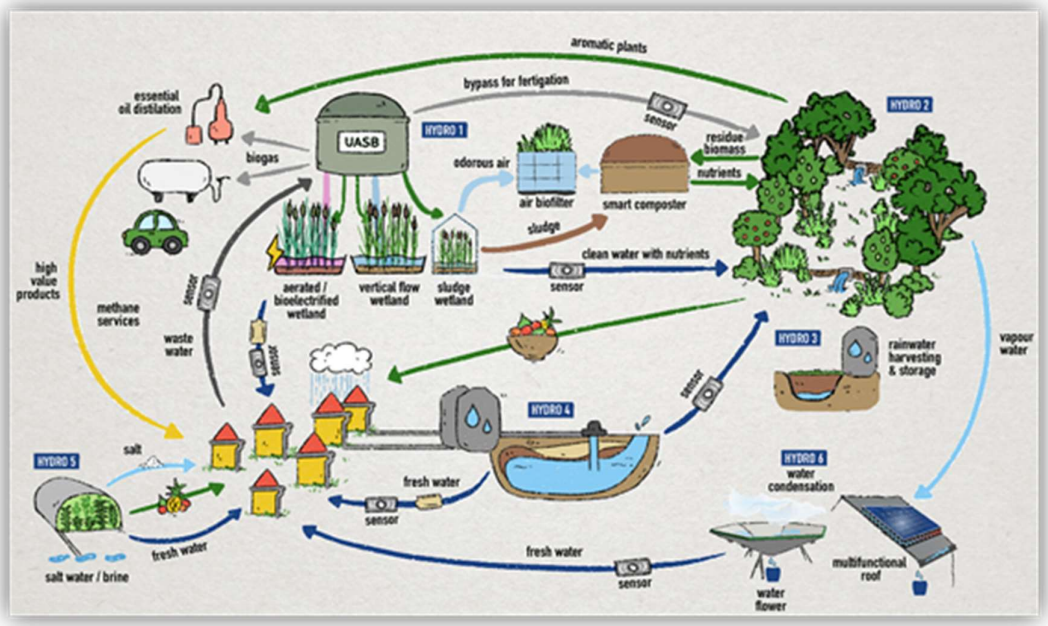

Figure 17. Schematic representation of the HYDROUSA case studies.

Impacts and Dissemination activities

AWARDS:

- Award on “Preservation of ecosystems and NBS” in the Mediterranean Climate Change Adaptation Awards.
- WEFE Nexus Award of the PRIMA foundation, Awarded by EC Director of DG Research and Innovation.

PUBLICATIONS:

- Policy Briefs: HYDROUSA water loops in the context of the EU and international policy / Evidence matrix of circular economy facts and policy brief www.hydrousa.org
- WEF Scientific Publications: Cipolletta et al. 2021, on policy and legislative barriers (UWWTD; Water Reuse; SSD and other) https://doi.org/10.1016/j.jclepro.2020.12560

KEY CONTRIBUTOR TO EU CLIMATE ADAPTATION STRATEGY:

Institute for European Environmental Policy (IEEP) on HYDROUSA case studies.

Figure 18. Description of Case study 2.

BUILD AN ACTIVE COMMUNITY AROUND CIRCULAR WATER SOLUTIONS:

- >100 citizens participating in co-creation activities.
- 22 job opportunities from locals directly contributing to HYDRO development.
- 4 Synergies applied between HYDROUSA and local organisations for the co-production of activities on dissemination & community activities.
- Ethnobotanical study based on locals input: >60% of the citizens suggestions on crops are applied to the agroforestry (Co-creation, Lesbos).
- Salinity, pH and microbial contamination identified by locals as main water quality parameters to monitor (Co-creation, Tinos).

HYDROUSA REPLICATION SITES:

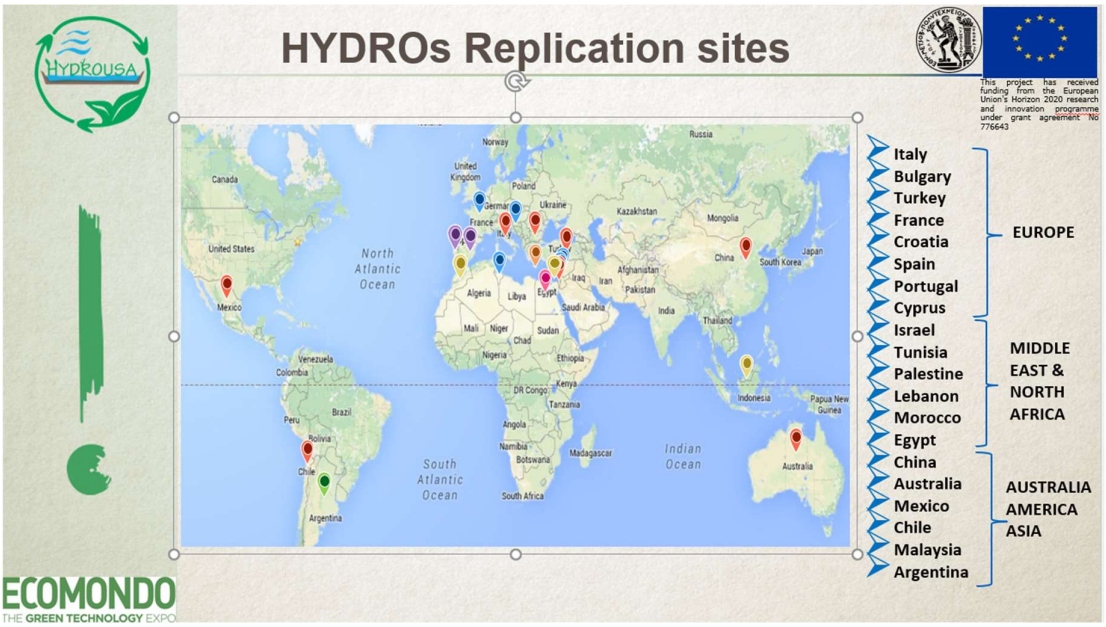

Figure 19. HYDROUSA replication sites map.

HYDROUSA SOLUTIONS APPLIED IN OTHER PROJECTS:

- AccelWater Horizon2020.
- WATER-MINING Horizon2020.
- DIVAGRI Horizon2020.
- FIT4REUSE PRIMA.
- DECOST ENI CBCMED.
- CIRC4Food, Greek National Funds.
- Redirri Greek National Funds.
- Sustainable islands replication Saint Honorat (France) and in Kerkennah (Tunisia), Region Sud (France).
- UKWIR Tender - What does a circular economy water industry look like? Jacobs, Brunel.

HYDROUSA SOCIAL MEDIA:

- 330 Dissemination activities of HYDROUSA.
- 615 k reach from reported activities so far.
- 128 offline and online features in media outlets, journals, magazines, news portals & references to the project.
- 20 k visits to www.hydrousa.org

- 4,250 followers on social media @HydrousaProject.
- 4,500 animation video views on YouTube and on HYDROUSA channel videos in total.

LESVOS island CASE: HYDROUSA | Fabio Masi, IRIDRA, Italy.

HYDRO 1 consists of a natural-bases Wastewater management system (Figure 16). Monitoring is based on the measurement of COD, TSS, VSS, NH4+, NO3-, NO2-, PO43- , pH, Conductivity and turbidity. Turbidity is able to be measured regularly (1 – 2 times/week). The rest of the parameters are measured 1 – 2 times/month, while e.g. VFAs, Micropollutants, Heavy Metals (2 – 4 times/year) or Na, Ca, Mg etc. (1 – 2 times/month).

Figure 20. Pictures from HYDRO 1.

HYDRO 2 consists of an agroforestry system (Figure 21) where there were cultivated:

- 18 species of trees.
- 15 species of bushes.
- 10 species of herbs.
- 7 species of annual crops.

Figure 21. Overview of the plantation design in HYDRO 2.

The total products obtained so far are shown in Figure 22:

Plant	***Production (kg)***
Raspberry	2,2
Blackberry	2,4
Aronia	5,6
Physalis	5,4
Goji berry	3,1
Lavender	5
Oregano	2,6
Mint	4,3
Basil	2,2
Sage	3,5
Corn	35
Pumpkin	82
Watermelon	488,6
Melon	110,2
Tomato	226
Cucumber	42
Eggplant	128,2
Zucchini	206,9
Pepper	49
Lettuce	12,2
Onion	3,5
Total	**1419,9**

Figure 22. Production of vegetables and plants in HYDRO 2.

It consists of freshwater production, collection, storage and supply from seawater desalination (Figure 23). It currently produces:

- 70 m3/year freshwater production.
- 700 kg/year recovered salt.
- 1.5 tons tropical fruits.

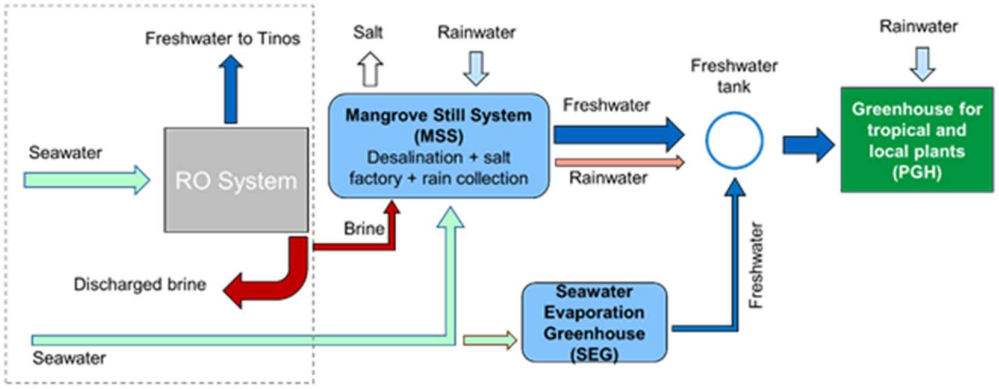

Figure 23. Water loop scheme.

TINOS ECOLODGE

Tinos Ecolodge is a self-sustainable hotel placed in Tynos Island (Greece). Its eco-innovative designed allows:

- 100% energy produced from renewable sources.
- To harvest and storage rainwater.
- Sewage treatment by constructed wetlands.
- Local material traditional craftsmanship.
- Local food production (organic garden).

HYDRO 6: It consists of a rainwater harvesting system that enables to produce water for:

- Organic vegetable production from farm to table (0 km products).
- Organic herb production for essential oils and seminars.
- Unconventional water resources.

MYKONOS island CASE: HYDROUSA| Antonios Eleftheriou, Delaros, Greece.

HYDRO 3: It consists of a pilot innovative, nature-inspired, sub-surface rainwater harvesting system, which is composed by a 280-m2 sub-surface collector and 2 water storage tanks of 30 m3 each.

The rainwater harvesting system has been successfully tried. It has collected water of 2 hydrological periods (wet seasons) and reached its full capacity for the 2nd year in a row. From this water, 10000 seedling were ordered and planted in December 2019. 50 kg of oregano were harvested from them; 15 kg were given to local agro-touristic units and greengrocers, while 35 kg were left to dry and used for essential oil production. nth).

HYDRO 4: is a novel decentralised rainwater harvesting and aquifer storage and recovery system which intends to store excess water during the winter months to reuse it in summer, with the goal to maximise the use of this resource and increase water management efficiency in water scarce areas. More than 200 m3/year of rainwater are expected to be harvested.

The system has been installed, tested and operated from February 2021. It is remotely controlled and monitored.

Financial Instruments and business models | Eric Mino, SEMIDE, France.

A financial analysis has been also carried out in HYDROUSA projects (Figure 24). More than 50 financing instruments have been identified, including direct funding; co-funding; lending / venture capital; guarantee / securitisation; equity and bonds; blended instrument; advising, etc.

HYDRO	Volume of water (m3/year)	Payback period (years)	Water productivity (€/m3)
1	19 418	9	2
1+2	19 418	5	3
3	66	3	78
4	259	3	26
5	60	7	165
6	201	5	110

Figure 24. Revenue streams/economic savings from HYDROUSA case studies.

Replication of Hydrousa circular solutions: Gorgona Case study | Camillo Palermo and Giulia Cipolletta, ASA and UNIVPM, Italy.

HYDRO 1 and HYDRO 2 solutions were replicated in the small island of Gorgona (Italy). Here, about 15 ha on a total area of 2.2 km2 are exploited for agriculture, but it was necessary to improve the wastewater treatment capacity of the island.

The main water related issues of Gorgona Island are:

- Limited water resources
- Preservation of the natural resources from pollution
- Sludge management
- Lack of a circular resource management (e.g. water, sludge, crops, plants, etc.)

For this replication, factors related to social, legislative, technical and economic feasibility were considered, giving the following Weight Scale:

- Social feasibility 30%
- Legislative feasibility 30%
- Technical feasibility 20%
- Economic feasibility 20%

Also were considered the local enabling environment in terms of:

a) Policies
b) Legal framework
c) Investments and financing structures

And the local institutional arrangements in terms of:

B1 – Regulation and Compliance

B2 – Water Supply and Sanitation Services

B3- Coordination and Facilitation

B4 – Capacity Building

About the dissemination, in HYDRO 1 the engagement (Figure 25) has been energized through 2 key meetings:

1. Meeting with Tuscany Water Authority to evaluate replicability of HYDROUSA solutions on the island
2. Meeting with Gorgona Island (Italy) stakeholders to replicate HYDRO solutions. Local people and inmates engaged in delivering sustainable water management.

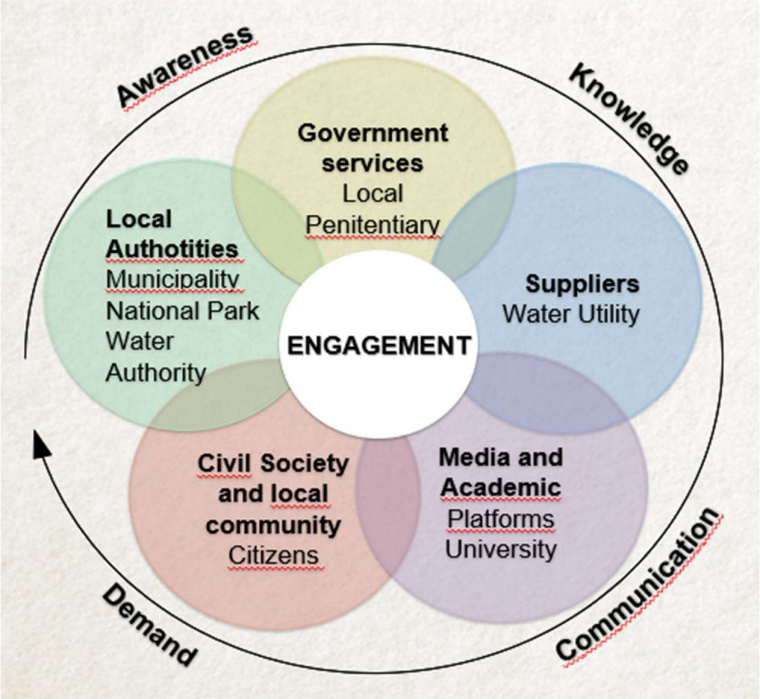

Figure 25. Figure explaining the engagement task of HYDRO 1.

3.2.4. Contributions from case studies: **NextGen**, **ULTIMATE** and **AquaSPICE** H2020.

Circular Transitions in industrialized regions: NextGen, ULTIMATE and AquaSPICE | Gerard van den Berg and Jos Frijns, Water Research Institute KWR, Netherlands.

These projects are based on the application of circular economy principles and industrial symbiosis in the water sector.

Circular Economy (CE) aims to design waste and pollution management systems with new value chains, by keeping products and materials in re-use and regenerating natural systems (Ellen MacArthur Foundation).

Industrial Symbiosis (IS) aims to bring together companies from different industrial sectors in order to improve the resource efficiency and sustainability by sharing and reusing resources (NISP UK).

Water Smart Industrial Symbiosis (WSIS) aims to create economic value and increased sustainability by introducing circular symbiotic arrangements between industry and water service providers.

WSIS applies technologies for:

- Water reclamation and reuse (recovery, refining, and reuse of municipal and industrial wastewater.

- Exploitation of energy and heat (extraction of energy, combined water-energy management, water enabled heat transfer, storage and recovery of heat).
- Nutrient and material recovery/reuse (nutrient mining, extraction/reuse of high-added value exploitable compounds) and assesses the impact with life cycle (LCA, LCCs) and risk based (QMRA, QCRA) tools.

ULTIMATE project (www.ultimatewater.eu) aims to be a catalyst of WSIS, in which water plays a key role as a reusable resource, and as a vector for energy and materials to be extracted and reused. ULTIMATE aims to create economic value and increase sustainability by valorising resources within the water cycle. Wastewater is not only a reusable resource but also a carrier for energy and components that can be extracted, treated, stored, and reused. Drawing on "Water Smart Industrial Symbiosis", wastewater recycling in various industrial settings is promoted.

ULTIMATE brings together 9 WSIS cases (8 in the EU and 1 in Lebanon) where it develops, tests and demonstrates multi-layered water-energy-materials reuse approaches, complying with strict health and safety requirements while showcasing novel governance arrangements and business models. All cases build on direct industrial interest and investment, with ULTIMATE providing added-value through additional expertise, novel technological ideas, software (process models and control optimisation analytics, whole system models, IS matchmaking algorithms and digital marketplaces), hardware (e.g. advanced treatment technologies, sensors), as well as business intelligence and market analysis. We facilitate the design, deployment, monitoring and control of these symbiotic systems and co-develop with the main stakeholders (from the industry and water service provision sides of the symbiosis) the business models required to make them profitable – ensuring wide transferability and uptake. The project also leverages years of experience and millions in investment in industrial symbiosis, by learning from additional mature high-profile cases (incl. cases in the UK and China). All demonstrations place emphasis on the valorisation of resources, addressing key challenges in scale of production, quality and costs.

Kalundborg industrial symbiosis plant

Kalundborg industrial symbiosis plant (Figure 26) is the first industrial symbiosis plant worldwide (since 1972). The cooperation between the companies in the symbiosis provides mutual benefits, economical as well as environmental. The main principle is that a residue from one company becomes a resource in another.

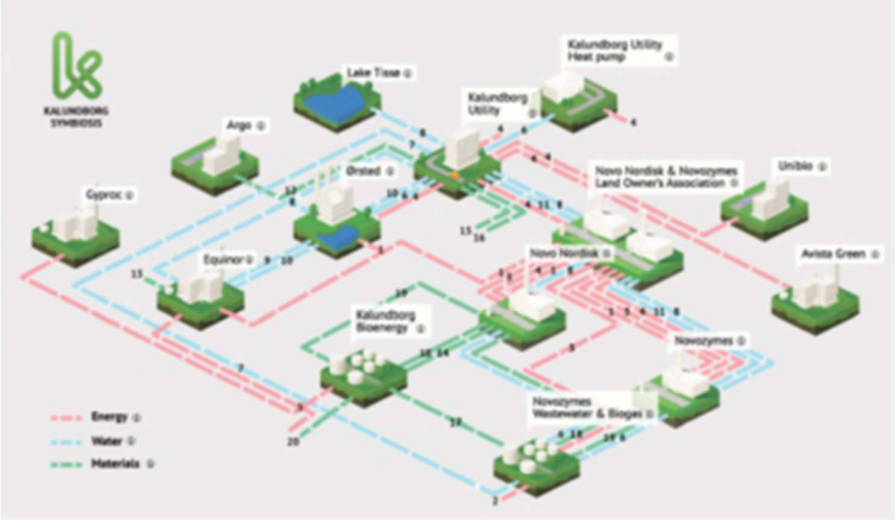

Figure 26. Kalundborg industrial symbiosis plant.

Nieuw Prinsenland (NL): matching demand and supply.

This case study focuses on wastewater treatment to reliably remove pesticides and plant pathogens for water reuse in Horticulture and looks into heat recovery for greenhouse heating.

The Nieuw-Prinsenland area is a modern agro- and food cluster aiming at maximum symbiosis among different industries with regards to water, energy, and waste. Maximized reuse is attained between a sugar factory and the industries.

Solutions for water and nutrient reuse are demonstrated at De Vlot, a cooperative wastewater treatment facility treating wastewater from 160 ha of greenhouses. Exploring water and nutrient reuse opportunities for their facility, the system for internal and external symbiosis with neighbouring greenhouses and industries is optimized.

The use of high temperature aquifer thermal energy storage is assessed for heating of greenhouses.

Further information at www.subsol.org

Industrial symbiosis in Italy

Figure 27 shows 5 Italian research pilots regarding Industrial Symbiosis:

Project	Italian research pilot	Main research activity
ULTIMATE	Rosignano Solvay industrial site	Use of by-products of local industries for wastewater treatment
B-WaterSmart	Venice lagoon	Water reuse for different (industrial/urban and agricultural) purposes in coastal regions
water mining	Lampedusa	Zero-liquid discharge seawater destillation combined with recovery of waste heat (SEA-MINING).
wider uptake	Sicily (Corleone and Marineo WWTPs)	Reuse of wastewater for irrigation and production of slow-release fertilizers in agricultural industry
AquaSPICE	Rosignano Solvay industrial site	Treatment of industrial wastewater up to levels suited to discharge in municipal sewers

Figure 27. Industrial Symbiosis research pilots in Italy.

Important to note:

- Water Smart Industrial Symbiosis is a special type of Industrial Symbiosis in which water, energy and materials from municipal and industrial wastewater are recovered and reused.
- Successful circular transitions in urbanised industrialised regions depends on systematically addressing technological, digital, socio-economic, governance and business systems interdependencies.
- Transformation of linear production-consumption-disposal chains in industrial processes to circular systems may reduce the vulnerability to climatic changes and environmental degradation and contribute to a more competitive industry.
- Showcasing WSIS cases (in living labs) with emphasis on cross synergies, transferability and applicability of the concept may contribute to a further acceptance and understanding.
- WSIS application contributes to e.g. the Circular Water 2050 goals (in e.g. The Netherlands) and the Green and Digital 'twin' transition promoted by the EC in the EU and beyond.

ROSIGNANO case – ULTIMATE | Michele Del Corso and Mattia Ciampechini, ARETUSA, Italy / Giovanni Cannata, WEST Systems, Italy / Cecilia Bruni, Università Politecnica delle Marche, Italy.

The Italian case study in ULTIMATE (www.ultimate.eu); i.e., ARETUSA, is based on a successful example of an already established industrial symbiosis, which is to be optimised in ULTIMATE.

The Rosignano Solvay industrial site (Figure 28) is one of the oldest and largest in Italy. It produces sodium carbonate, sodium bicarbonate (also for pharmaceutical use), calcium chloride, chlorine, hydrochloric acid, chloromethane, plastic materials, peracetic acid and hydrogen peroxide. In order to deliver more sustainable water management, Consorzio ARETUSA was established in 2001 as PPP among water utility (ASA Livorno), industry (Solvay Chimica Italia) and tech provider (Termomeccanica). Thanks to ARETUSA, since more than 15 years the Solvay chemical plant is implementing a utility-industry (public-private) symbiosis

system for optimising the regional water cycle, by reusing about 3 million cubic meters per year of urban wastewater treated in the ARETUSA reclamation plant. The existing WasteWater Reuse Plant (WWRP) contains flocculation, sedimentation, filtration, activated carbon filter (GAC), and UV disinfection.

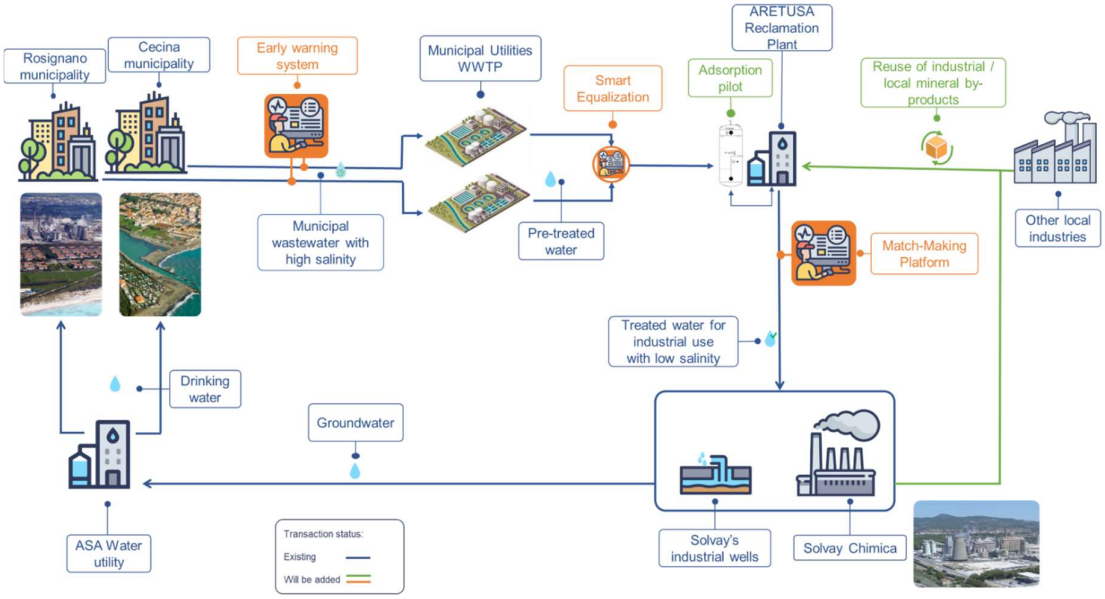

Figure 28. Technical implementation of Rosignano case.

Work packages approach of Rosignano Case Study

WP1:

- Monitoring system to avoid high chloride concentrations in reuse water in Rosignano (IT);
- Testing of possible reuse of by-products locally available.

WP2:

- Cost assessment (LCC).
- Risks assessment on human health (screening).
- Technical risks assessment.
- Legal risks assessment.

WP3:

- Community of practice (CoP).
- Living labs.
- Co-creation.
- Playbook.

WP4:

- Analyse the socio-political, regulatory and governance aspects of the WSIS to identify opportunities and challenges.

WP5:

- Maximise the impact of the project through action on business models, with identification of synergies.

WP6:

- Bottom-up activism from local demo cases to build hubs for circularity and sweet spot replication at a regional level.

ROSIGNANO case – AquaSPICE | Francesco Rossi, Consorzio Polo Tecnologico Magona, Italy / Gianluca Pettinello, SOLVAY, Italy.

The goal of the Rosignano Case Study in AquaSPICE is to treat the wastewater coming from the hydrogen peroxide production department inside the Solvay facility in order to reuse it. In particular, the pilot plant will be integrating (1) chemical pre-treatment for pH control, (2) filtration in an Iron Oxide-Coated Gravel/Sand Fixed Bed Column or Iron oxide (geothide) filled bed to remove H_2O_2 and metals, (3) high-loaded biological denitrification in a membrane bioreactor. The effluent from the pilot plant will be tested for impact and tertiary treatment within processes operated in ARETUSA reclamation plant to increase the water to be re-used in Solvay industrial site.

Digitalisation of the water reuse scheme will include the design for full digital smart control and integration in the existing water grid for current operations. Digital solutions will be applied for:

- Process control in the WAPERUSE processes.
- The internal re-use of cooling tower blowdown streams;
- The treatment and direct reuse of slightly polluted process water and dilution steam blowdown streams.

Three different options are tested in this case study (Figure 29):

1. Wastewater is discharged to the municipal sewer network to be treated in the ROSIGNANO WWTP and in the ARETUSA WRP before its reuse in the Solvay cooling tower system

2. Wastewater is sent to ARETUSA WRP to be treated before its reuse in the Solvay cooling tower system

3. Wastewater is reused DIRECTLY by the Solvay cooling tower system.

The target parameters to be controlled are COD, nitrates, hydrogen peroxide, sulphates.

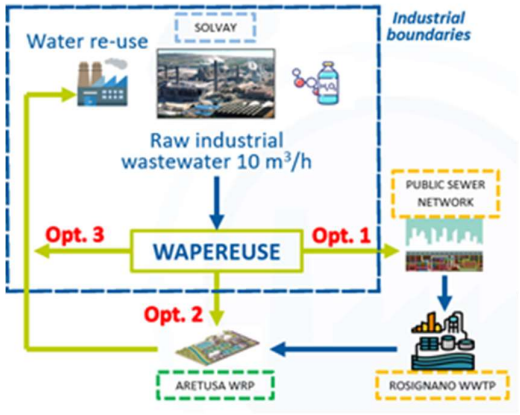

Figure 29. Representation of the 3 options of Rosignano Case Study.

3.2.5. Contributions from case studies: **B-WaterSmart** H2020

ROSIGNANO case – ULTIMATE | Michele Del Corso and Mattia Ciampechini, ARETUSA, Italy / Giovanni Cannata, WEST Systems, Italy / Cecilia Bruni, Università Politecnica delle Marche, Italy.

B-WaterSmart (Figure 30) aims to be a lighthouse project to enable water-smart societies and economies by building stronger links between the technological, societal and governance dimensions. This is done through a systemic innovation approach in Living Labs that includes but goes far beyond technology. The new water-smartness concept and assessment framework will pave the way for water services towards more sustainable and resilient systems. This approach is currently unique in the water sector and no similar solution is currently available which supports water utilities to do:

- A comprehensive diagnosis.
- Solutions prioritisation.
- Assessment of alternatives scenarios.
- Monitoring of performances.

All is based on participatory co-creation of solutions by Communities of Practices (CoP's) and collaborative work with stakeholders to develop solutions for societal, regulatory and governance issues. Local CoPs in six Living Labs: Alicante (Spain), Bodo (Norwey), East Frisia (Germany), Flanders (Belgium), Lisbon (Portugal), Venice (Italy). They will implement a co-developed water-smartness agenda with a perspective until 2040. They will start to implement their strategy through technology, IT, business models & policy/governance solutions and will receive training and capacity building on joint challenges, solutions and ambitions through an innovation alliance.

Figure 30. Key data of the project, partners and contact details.

Venice Case study

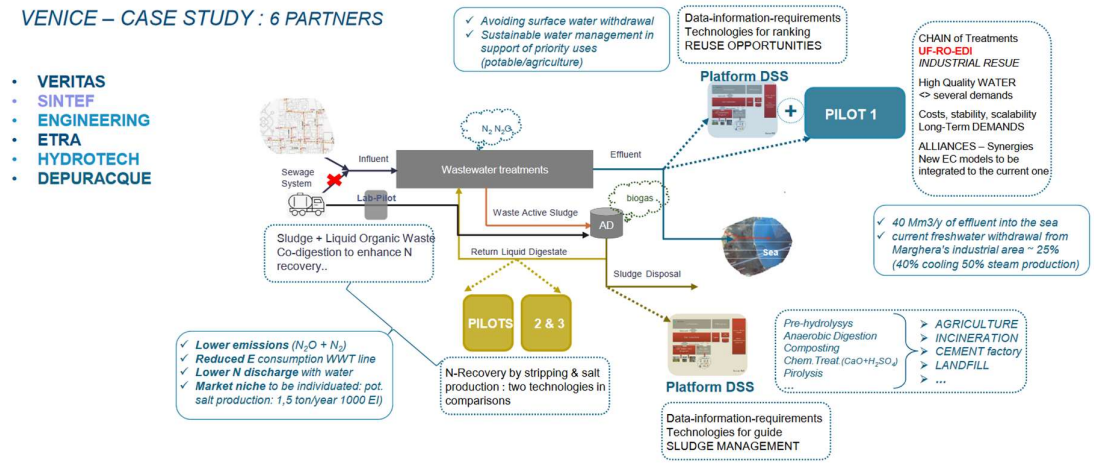

Figure 31. Representation of the Venice Case Study.

The objectives, working steps and targets of the Venice Case Study are shown in Figure 32:

STRATEGIC OBJECTIVES		WORKING STEPS & TARGETS
Raising and creating awareness among stakeholders on water smartness opportunities in a circular context	GOVERN.	1. Scientific evidence for objective evaluation; 2. Objective risk assessment; 3. Easy and synergic model for *competences sharing*; 4. Regulation revision; 5. Unlock circularity.
Extracting value from water by transforming water systems from passive to active and adaptive.	TECHNICAL	6. Technical feasibility and risks implication; 7. Technical sustainability (costs related).
Identifying business models to promote the extraction of value from water (circular economy) and fostering/sustaining policies revision.	ECONOMIC	8. Quality characterization (comparison among several products on the market); 9. Model for market creation.
Achieving social acceptance.	SOCIAL	10. Ordered and planned increase of knowledge on RR and CE opportunities and implications.

Figure 32. Objectives, working steps and targets of the Venice Case Study.

4. CONCLUSIONS

Concluding Remarks from Evdokia Achilleos, co-chair representing the European Commission.

Congratulations to the organisers and all of you who participated in today's meeting.

Water is high on the agenda of EU and EU policies and EU funding because it was and remains a big societal challenge. This was evidenced also by the EEA report that just came out stating that water stress affects at least 30 % of Europeans.

Water R&I projects have been contributing to address the water related challenges, vulnerabilities and risks. Water R&I will have a significant impact on EU priorities supporting Green Deal and related policies. Significant funding went to Water R&I in H2020 and this will continue with HE, with the different Grant Instruments (RIA, IA, CSA) but also with new European Partnership and funding under the HE Missions.

Today we heard the results from the ongoing H2020 projects with big innovation demonstrations and case studies at large scale, real life, on field, paving the way for the transition to sustainable water management.

- We heard how Digital Transformation of the Water Sector can support and optimise water management in cities and greater regions, improve the circularity of the sector and be key for health & flood risk management, smart irrigation, safe water reuse, and early warning systems (e.g. for bathing water quality).
- We heard also about the circular transition of water in small and decentralized communities, which is supported by innovative solutions that combine green, grey, and digital infrastructure to support adapting to climate change and addressing

water scarcity, as well as supporting policy priorities (for example implementation of UWWTD).

- Finally, we also heard about Circular Transitions in industrialized regions and how symbiosis within industry and with UWTPs and agricultural sector can lead to optimising the resources and tackling several problems at same time.

Some keys take away messages from today's presentations:

- There is an abundance of innovative Digital technologies and solutions, which have great potential to help to address the challenges of the water sector, in reliable way. They use scientific knowledge and vast data, support decision making and smart water management, tackling health and environmental risks, and they are also key to bringing stakeholders together. Nevertheless, there is still a low uptake from the end users and still there are steps to be taken. These may include making the business case and proving or improving the Return on Investments, which will be required from a digital transformation, the supporting the digital infrastructure for open data and interoperability, and the addressing IPR challenges that arise with new approaches
- For addressing the challenges of the water sector, we need flexible solutions that can be tailored to scale, conditions, and needs of different geographical/climatic areas.
- To enable the developed solutions, ensure replicability and uptake of water innovation we need:
    - to have the stakeholders on board to reach the market including for example industry, farmers, municipalities & the public- we need to have Active communities around water solutions
    - innovative business models that include appropriate considerations for end-users and stakeholders
    - knowledge on the variety of Financial instruments that can support investments and analysis on the most effective ones.
- Utility – industry symbiosis has very good potential and strong technological basis as it relies on industrial approach.
- Important enables for ensuring the success of symbiosis include not only technologies and digital support but also stakeholder engagement, political governance context, and exploitation and valorisation plans. Improving and innovating on the governance aspects and focusing on exploitation of state of art symbiosis models will be key to expanding the approach.
- These new symbiosis models for which we now have evidence form the IAs results, need to be consider in the planning /design phase for new or updated infrastructure & water management practices.

Overall, from the discussion today we can also conclude that:

- There is a need to move to **greener solutions**, combining grey infrastructure with green infrastructure in a balanced way, which ensures both financial viability and leads to sustainability and achieving the environmental targets and addressing risks. The sustainable taxonomy can be an enabler to follow up on Innovation Actions with large scale investments.
- We need systemic solutions and strategies to ensure circularity of the water sector and across sectors and ensure sustainability. This means that we need solutions for the different scales (cities, regions, river basins), we need all actors and communities on board (in co-creation – living lab approach), we need new business models and most importantly we need innovative governance models.

- Water legislation at EU and correspondingly at National level has very good provisions to foster this change (e.g. WFD), and is under continuous update (e.g. with reuse regulation and UWWTD revision). Beyond any updates, what is needed is not more legislation but improved implementation of existing directives, for example WFD (which has provisions for many of the concepts discussed today). The solutions presented from the projects today can definitely lead to improved implementation of legislation, thus enabling the exploitation and further uptake of the projects outputs and results is important.

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