HYDROUSA project Recovering water, materials and energy from non-conventional water sources through nature-based technologies

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INTRODUCTION

The Mediterranean (MED) basin is one of the most vulnerable regions of the planet, in terms of water scarcity; it is characterized by the unequal distribution between water demand and supply, both spatially and temporally (UNEP/MAP, 2016). Several MED countries have water reserves less than 500 m^3/capita/year, ('structural shortage'), and many areas have less than 1000 m^3/capita/year (UN water stress level) (GWP, 2012). Industrialization, population growth, climate change, tourism and the intensification of production in some water- demanding sectors, are the main factors that have deteriorated the availability of water resources (Scoullos & Feggarina, 2010). Agriculture is the most water intensive activity, as it accounts for 72% of the total freshwater consumption in the MED region (Masia et al., 2018). Moreover, the need for fresh water production from unconventional sources (seawater), has led to the development of desalination plants that severely stress the energy grid and result in the production of large quantities of brine, which are not valorized, as they are disposed into the sea (Lattemann & Höpner, 2008). In many MED regions wastewater is discharged into marine ecosystems, without adequate treatment. Wastewater treatment plants (WWTPs), are often too overloaded to cope with the high seasonal loads, while some regions are not serviced at all. The implementation of a sustainable water management approach in MED area is necessary more than ever, through the valorization of non-conventional water sources.

HYDROUSA PROJECT

The HYDROUSA Horizon2020 project aims to setup, demonstrate and optimise on-site, innovative nature based solutions (NBS) for the management of a variety of water streams, including **wastewater**, **rainwater**, **groundwater**, atmospheric **vapour water** and **seawater** to produce valuable resources, which can then be treated to enrich the domestic water supply and valorised **to increase agricultural production** and **boost the economic activities** of water-scarce Mediterranean areas. HYDROUSA aims at closing all water loops at local level, taking advantage of local resources, promoting the concept of decentralized on-site water, materials and energy conservation, treatment and reuse.

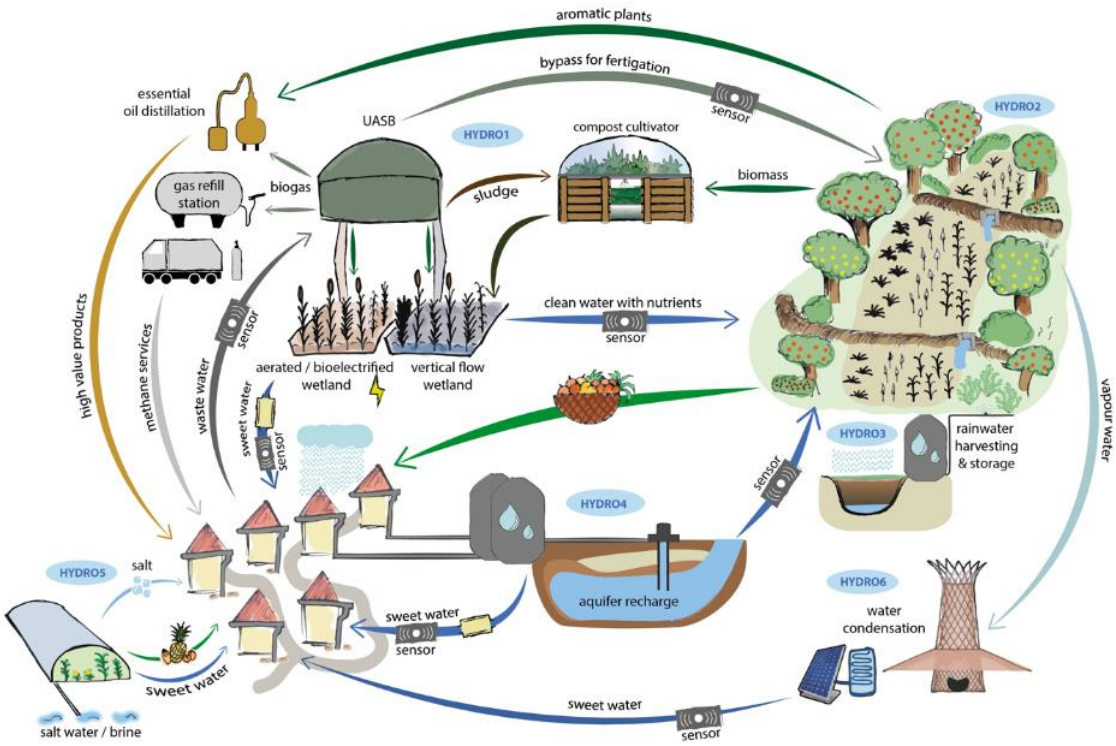

Figure 1. HYDROUSA water loops

The HYDROUSA concept will be materialized by implementing **13 innovations in six demonstration sites**:

- Upflow anaerobic sludge blanket (UASB), biodiverse constructed wetland (CW) and biogas upgrade for wastewater reuse and energy recovery
- UASB and bio-electrified wetland for wastewater reuse and energy recovery
- In-vessel composting system with integrated odour abatement to manage sewage sludge
- Tropical greenhouse for seawater desalination and production of edible salt
- Water vapour condensation with passive systems to recover vapour water
- Rainwater harvesting and treatment coupled with aquifer storage

HYDROUSA technologies will start directly at TRL 5-6 (validated in relevant environment) and will reach TRL 7 (system prototype demonstration in operational environment).

The demonstration sites will achieve a high level of automation, real-time monitoring and control, through ICT integration. Open source/low cost sensors/actuators for monitoring and controlling water loops will result in net water savings. The whole water supply chain developed within HYDROUSA will be evaluated in environmental, social and economic terms. Transferability of HYDROUSA solutions will then be demonstrated in 25 early adopter cases of coastal areas and islands. Institutional pathways, policy drivers, barriers and opportunities for the market deployment of the project technologies and services and for the use of the recovered resources will be analysed. Dissemination activities shall be targeted to stakeholders and include workshops, publications and presentations, clustering with other initiatives, opening events, etc. HYDROUSA will also foresee strong interaction with citizens, including gamification strategies for citizen science, info points, summer schools, hackathons, artists' and researchers' residencies, etc.

Table 1: HYDROUSA demonstration sites

Site	Specification	Issue Solved
HYDRO1	Anaerobic treatment, sludge composting, water reuse, biogas upgrade	No wastewater discharge into sea; cheaper production of reclaimed water; recycling nutrients
HYDRO2	Irrigation of agroforestry system with nutrient-rich water	Wastewater use for fertigation; no fertilizer import; product diversity; creating resilient ecosystems
HYDRO3	Remote rainwater harvesting system and irrigation of oregano	Cheap water supply in remote areas; create business case with little input
HYDRO4	Domestic rainwater harvesting, aquifer storage, watering of local crops	Increase water supply; production of drinking water; aquifer recharge to reduce saltwater intrusion
HYDRO5	Seawater and brine treatment to recover salt and water, produce tropical fruits	Produce sweet water from saltwater/brine; decrease import of tropical fruits; salt production
HYDRO6	Water loops in eco-tourist facility	Ecotourist facilities which are self-sufficient in terms of water, energy and food production

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