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**EQUITABLE AND SUSTAINABLE WASH SERVICES:  
FUTURE CHALLENGES IN A RAPIDLY CHANGING WORLD**

**Non-conventional water reuse in agriculture:  
MENAWARA project in Palestine**

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**Summary**

Water reuse, according to the intended use and in compliance with the required qualities, constitutes one of the basic strategies to manage the imbalances between the availability of water and the demand, as well as one of the key measures for the application of the concept of Circular Economy. The EU funded project “MENAWARA - Non-Conventional Water Re-use in Agriculture in Mediterranean countries (ENI CBC Med programme)” is designed to enhance access to water through the treatment of wastewater to be reused as complementary irrigation and to strengthen the operational capacity of stakeholders of the quadruple helix. In the specific intervention in Palestine, the action is foreseen to turn into an open living lab; innovative and technological solutions to encourage the end-use application of treated wastewater for agricultural irrigation and increase water efficiency and availability are being implemented, strengthening the promotion of synergies and the transfer of knowledge and innovation between the different stakeholders involved in the water governance.

**Introduction**

Across the world, improved, innovative and sustainable management and reuse of treated wastewater have begun to be considered as an urgent priority, to cope with the demand growth of freshwater, especially in the contexts where limited water resources are stressed by over-abstraction, pollution, political constraints and climate change. In this regard, the agricultural sector, is responsible for 70% of water abstractions worldwide, and a large increase in water demand are predicted for industry and energy production as well. Unfortunately, according to UNESCO, it is estimated that well over 80 percent of wastewater worldwide (over 95 percent in some developing countries) is released into the environment without treatment[1]. In this context, Mediterranean Countries are still torn between old and new water policies, facing water shortage experience not related only to the increasing demand, but also to poor infrastructure and management practices. Concerning this, Palestine represents a so-called water-scarce territory, whose vulnerability is exacerbated by its unstable geopolitical setting, facing a significant and growing shortage in water supply. The actual Palestinians’ share from the three regional groundwater aquifers should be 118 Mm<sup>3</sup>/year, while the current utilization is 87 Mm<sup>3</sup>/year. This quantity is insufficient to meet the WB’s 2.65 million inhabitants’ demand for water. Additionally, the Palestinian wastewater treatment sector is characterized by inadequate management due to insufficient and outdated infrastructures, unsafe disposal of untreated or partially treated effluents. According to the Palestinian Water Authority (PWA), in 2005 about 66 Mm<sup>3</sup>/year of wastewater (WW) was generated in Palestine, of which 36 Mm<sup>3</sup> was produced in the West Bank (WB) and 30 Mm<sup>3</sup> in the Gaza Strip[2]. Moreover, in the WB the current treatment capacity of wastewater treatment plants (WWTP) amounts just to 4.5 Mm<sup>3</sup>/year. In this regard, the PWA National Water and Wastewater Strategy for Palestine, aimed at deal with water shortage, increasing treatment and reuse of WW to reach 80% of produced sewage water by the year 2032. Under this umbrella and in line with the national priorities, the EU funded

project "MENAWARA" is considered by PWA as a framework to experiment innovative and sustainable technologies for water reclamation and reuse in Palestine, contributing to increase the percentage of treated and reused water in Nablus Governorate, by the rehabilitation of a Conventional activated sludge (CAS) WWTP located in the farmer community of Beit Dajan, with the aim of rationalizing water use practices and setting operational optimal water governance. The project was designed to enhance access to water for agricultural use through the treatment of WW to be reused as complementary irrigation, parallelly strengthening the management and technical capacity of governmental institutions, non-state actors operating in the sector, technicians and farmers. The initiative aims to reduce the stress on freshwater sources from the agriculture sector, improving the quality of treated wastewater (TWW) for irrigation use. In this regard, several sustainable technological, managerial and operational innovations will be applied.

### **Wastewater treatment innovation in Beit Dajan**

Beit Dajan WWTP is considered a CAS, whose main components of the existing electro-mechanical system are: a) Manual Screen, b) Influent pumping station, c) Conventional Preliminary treatment, d) Activated sludge tank, e) Secondary clarifier, f) Chlorination unit. The current technical status of the plant does not allow the production of TWW according to national parameters and thus, it required multiple interventions to sustain its operativity. First, the installation of an innovative pre-treatment compact system for screening, sand removal, and degreasing of WW, that thanks to the modular structure, will be assembled directly on site. The machine can be runned manually or automatically and presents easy maintenance. Secondly, for water reclamation, according to the principle "fit for purpose", is foreseen a post-treatment train based on a filtration process using pressure sand filters and a subsequent disinfection stage by application of hypochlorite as a disinfecting agent. The reclaimed water will meet the quality required for irrigation of target crops, according to Palestine Standard PS 742-2015 on TWW effluent for agricultural irrigation. The irrigation systems supplied will enhance local agriculture practices, allowing to build upon a water governance model around the establishment of a farmer water users association with high replicability for neighboring farming communities. Positive impacts are expected on the livelihood of all community members, towards the concept of the living lab.

### **Living lab for co-creation and interchange of experiences**

Living labs are defined as "user-centered, open innovation ecosystems based on a systematic user co-creation approach in public-private-people partnerships, integrating research and innovation processes in real-life communities and settings" [3], [4]. Beit Dajan community is foreseen to turn in an open living lab, a peer-to-peer learning space where youths, technicians, water users' associations and local authorities will be trained on capitalizing on innovative and user-oriented wastewater treatment, reuse and irrigation technologies. The engagement of stakeholders, based on a model of the quadruple helix [5] will facilitate knowledge transfer regarding sustainable use of water resource and circular economy, fostering the dialogue, and developing national planning more responsive to the community's needs. Finally, MENAWARA project is expected to provide a "field lab" to develop, test, and validate a combination of solutions for sustainable wastewater treatment and management, which include technologies, their integration as well as a combination with new business models and innovative policies based on the value of water.

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