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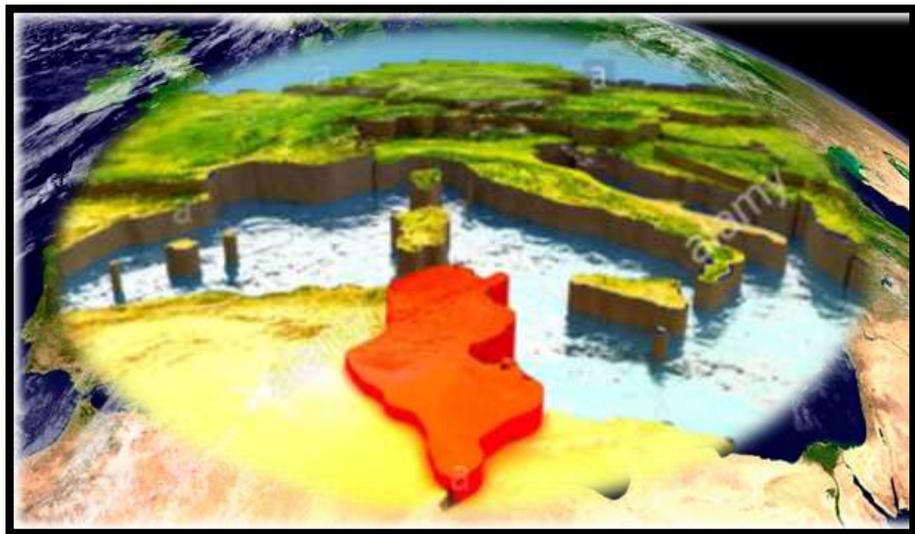
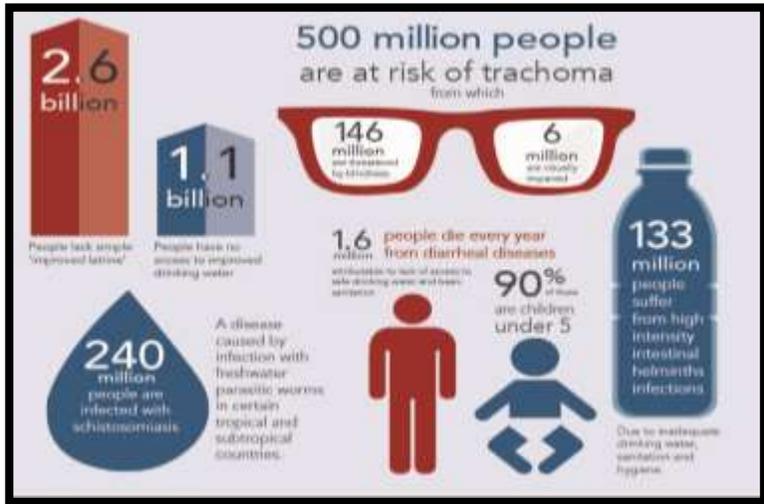
# APOC technology as an eco-innovative decentralized sanitation system for wastewater treatment and reuse facilities in the rural locality of Bent Saidane-NE Tunisia

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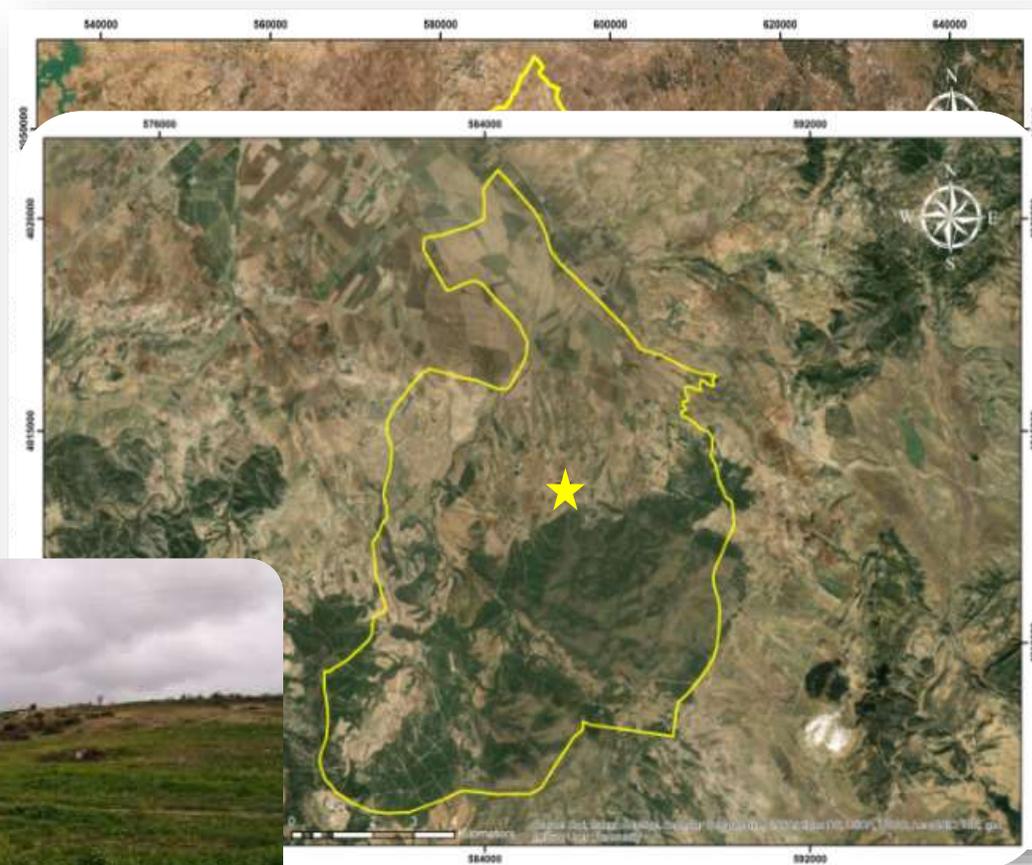
# Background / Opening



THE GLOBAL GOALS



# Geographic localization of Bent Saidane locality & the APOC System



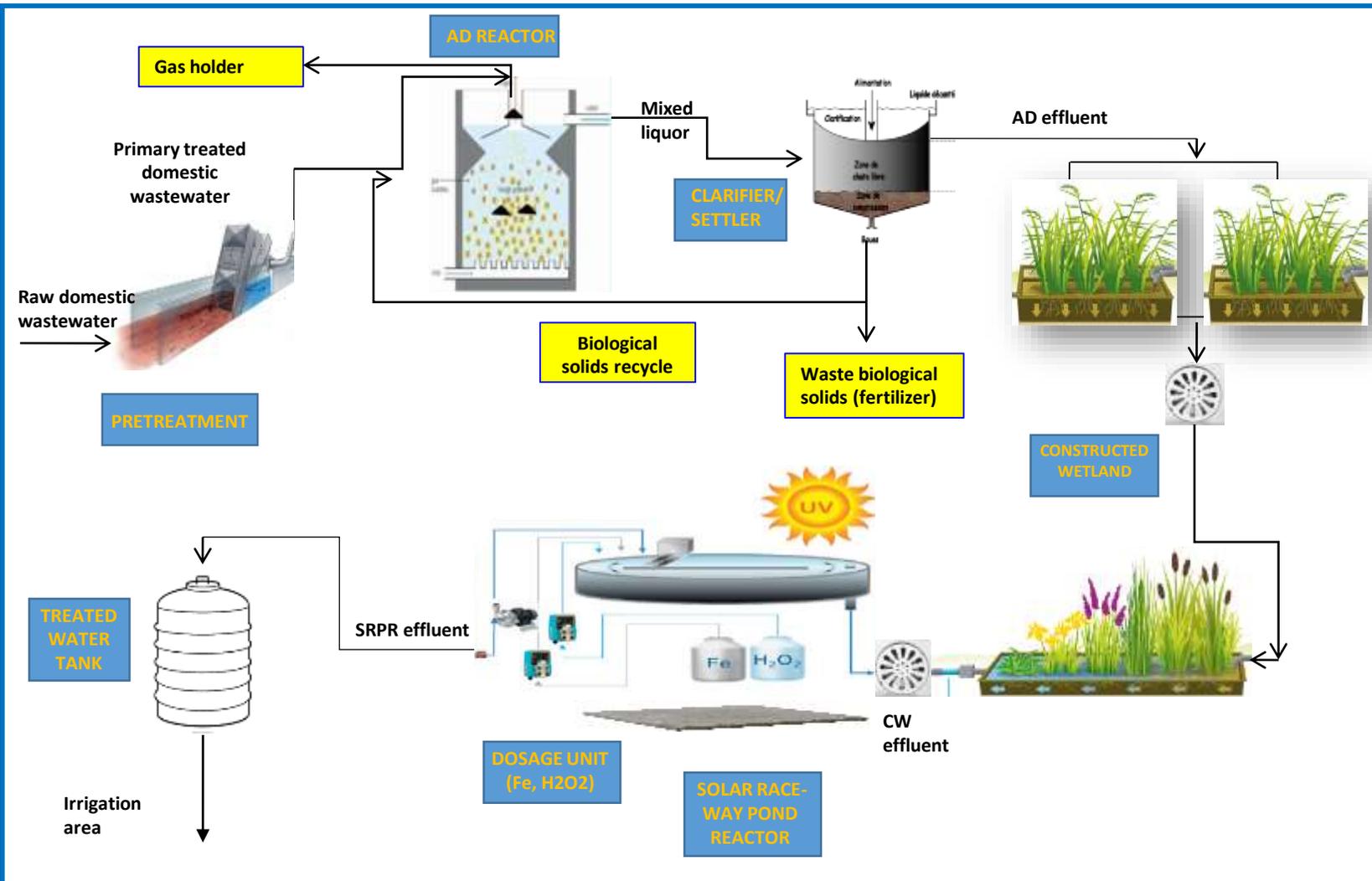
## BENT SAIDANE locality

### APOC System

- ❖ Latitude:  $9^{\circ}57'24.6''$
- ❖ Longitude:  $36^{\circ}15'52.6''$
- ❖ Surface area of APOC:  $1000 \text{ m}^2$
- ❖ Surface area for TWW reuse tests: 1 ha
- ❖ 160 houses connected to the unit sewerage network



# Description of an eco-innovative APOC system



- ❑ **The APOC system** is set to improved **water governance socio-economic**, and **environmental sustainability** through the active involvement of the local communities.
- ❑ A good example in relation to the transition to the **circular economy**.
- ❑ It will be established with a capacity of **5 to 25 m<sup>3</sup>/day**.
- ❑ An estimated surface area of APOC installation is about **1000 m<sup>2</sup>**.
- ❑ The selected area of **1 ha** will be planned for **TWW irrigation** purposes.
- ❑ **3000 m<sup>3</sup>/year** of non conventional water supply used for domestic purposes.
- ❑ An extended area of **86 ha** present the proposed irrigation area with non conventional water.

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## Thank you for your attention!



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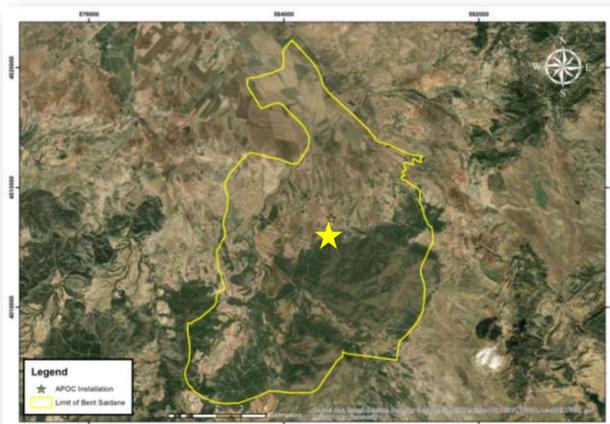


## INTRODUCTION

Water resources in the Mediterranean countries, are subjected to many pressures related to water quality pollution, anthropogenic activities, urbanization and climate change. These pressures reached the UN-Sustainable Development Goal 6 (SDG 6) and Goal 13 (SDG 13) to strengthen the rural sanitation in improving clean water and sanitation management. Water resources in Tunisia are subjected to many pressures related to urbanization and anthropogenic activities which will be exacerbated by climate change. DEWATS can provide a smart green alternative solution for small communities to tackle climate change impact on water resource, if properly designed, maintained, and operated to provide optimum benefits of sustainability. The main objective of the AquaCycle project is to provide research and development support for sustainable non-conventional water resources management (NCWR) through participatory governance and low-cost eco-innovative technology to enhance rural sanitation in the Mediterranean's Regions especially for Tunisian rural localities. The eco-innovative APOC System stands for "AD", "PO" and "CW" for sustainable WWTR in the rural locality of Bent Saidane. The attributes of the implementation of the WWTP demonstration unit in Bent Saidane case study, would support decentralized sanitation facilities to achieve equitable and sustainable sanitation in Tunisian rural areas.

The locality of Bent Saidane is a rural community belonging to the delegation of El Fahs, Governorate of Zaghouan. It is an agricultural area located in the North East of Tunisia. It lies between latitudes 36° 11' 42.774" N to 36° 19' 53.956" N and longitudes 9° 53' 21.322" E to 9° 59' 53.997" E. The total area is approximately 90.12 km<sup>2</sup>. This area is mountainous with heights between 186 and 932 m above sea level and majority of the slope is lower than 15°. It is crossed by temporary Wadi El Gouissate where the wastewater is discharged. The bioclimate of Bent Saidane locality is Mediterranean semi arid.

## GEOGRAPHIC LOCALIZATION OF THE APOC SYSTEM



The surface area of APOC installation, located in degrees, minutes seconds (WGS84) Latitude (9°57'24.6"), Longitude (36°15'52.6") is about 863 m<sup>2</sup>. The area of one hectare will be planned for TWW reuse tests.



## RAW WASTEWATER QUALITY CHARACTERISTICS

The COD/BOD ratio with a value of 2 to 2.5 with nutrients, confirms the type spontaneous biodegradability of domestic wastewater. The character of this wastewater is slightly stronger in terms of organic content reflected by the concentrations of Total Kjeldahl Nitrogen (TNK) and concentrations of Total phosphorus (Pt). The up-scaling values of Pt and TKN suggest that agricultural activities and the use of fertilizers influence their concentrations in raw wastewater polluted

PARAMETER	VALUE	TUNISIAN STANDARDS (DPH)
T (°C)	16	25
pH	7.5	6.5 – 8.5
SS (mg/l)	400-500	40
COD (mgO <sub>2</sub> /l)	1000-1500	160
BOD <sub>5</sub> (mgO <sub>2</sub> /l)	500-600	40
COD/BOD <sub>5</sub>	2-2.5	-
Chlorides (mg/l)	220	700
Sulphate (mg/l)	300	600
Nitrates (mg/l)	< 0.5	50
Nitrites (mg/l)	0.12	0.5
TNK (mg/l)	70-200	5
Phosphorous (mg/l)	10-30	2
Total coliforms /100 ml	1-3×10 <sup>7</sup>	-
Feecal coliforms /100 ml	5-9×10 <sup>6</sup>	2000
Feecal strep. /100 ml	2-3×10 <sup>6</sup>	1000

## DESCRIPTION OF AN ECO-INNOVATIVE APOC SYSTEM

The acronym APOC stands for "AD", "SPO" and "CW", the three components of the eco-innovative wastewater treatment system (WWTS) proposed by the AquaCycle project. In order to solve the problems of obstruction of pipes and mixing systems, a good pretreatment with a screen will be used to remove all large objects and control the dry matter content of the reactor.

The secondary treatment is based on the AD process composed by two delivery pumps with timer, an AD reactor with a flow capacity of 5 to 25 m<sup>3</sup>/d and a settling tank at the outlet of the digester with the possibility of recycling or extraction. Anaerobic treatment will reduce organic matter in the wastewater, but the quality of the effluent is not sufficient to meet the requirements for discharge or reuse. Therefore, two basins of sub-surface vertical flow CW followed by one basin sub-surface horizontal flow CW and two manholes is the system chosen to improve the quality of the effluent from the anaerobic reactor. The post treatment of the CW effluent in a novel solar Raceway Pond Reactor (RPR) consists a feasible option for treating substantial amount of wastewaters by the Solar Photo-Fenton (SPF) process and a distinctive feature of the APOC system. The phase of storage and recovery of the by-products of the APOC WWTP requires a storage basin for TWW with a volume of approximately 50 m<sup>3</sup>, a basin for drying and treating sludge, a delivery pump to the irrigation network with a drip network, a technical room and a fence for the irrigation area.

## CONCLUSION

The main objective of the AquaCycle project is to provide research and development support for sustainable NCWR management through participatory governance and low-cost eco-innovative technology to enhance rural sanitation in Tunisia. Bent Saidane WWTP case study was selected to support rural decentralized sanitation facilities in Tunisia. Results demonstrate an estimated surface area of APOC installation of 863 m<sup>2</sup>. The APOC system will be established with a capacity of 5 to 25 m<sup>3</sup>/day. The selected area of 1 ha will be planned for TWW irrigation purposes. As the APOC technology will permit the recovery of valuable substances from the TWW such as fertilizer and biogas, sustainable WWTR in Bent Saidane rural locality is set to show a good example in relation to the transition to the circular economy.

## GEOGRAPHIC LOCALIZATION OF BENT SAIDANE LOCALITY

