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Designing Urban Nature-Based Solutions for Greywater Reuse e-TWS

March 1, 2020

Designing an eco-innovative NBS system for municipal wastewater treatment and reuse: case studies presentation

Konstantinos Plakas
AQUACYCLE Project Manager
Centre for Research and Technology-Hellas

AQUACYCLE

CERTH
CENTRE FOR RESEARCH & TECHNOLOGY HELLAS

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- Emerging statistics
- Intro to AQUACYCLE
- The APOC technology
- APOC demo plants

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"The value of water remains too often under the radar, and this situation locks the hidden potential of this sector such as the valorisation and reuse of waste water"

Pernille Weiss

MEP Water Group

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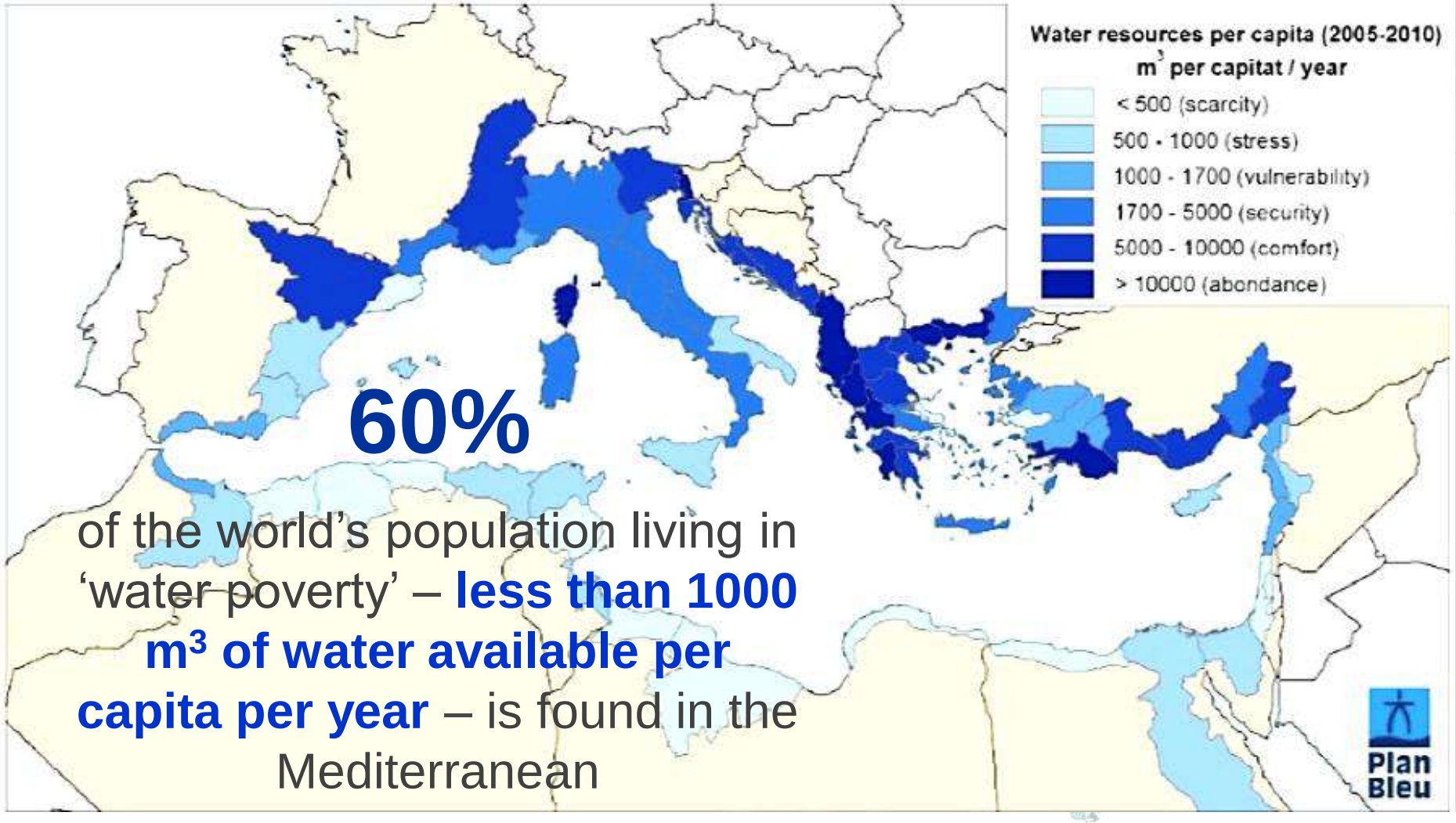
Did you know



60%

of the world's population living in 'water poverty' – **less than 1000 m³ of water available per capita per year** – is found in the Mediterranean

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Did you know

20,000,000

of Mediterraneans don't have access to drinking water

47,000,000

of Mediterraneans don't have access to adequate sanitation

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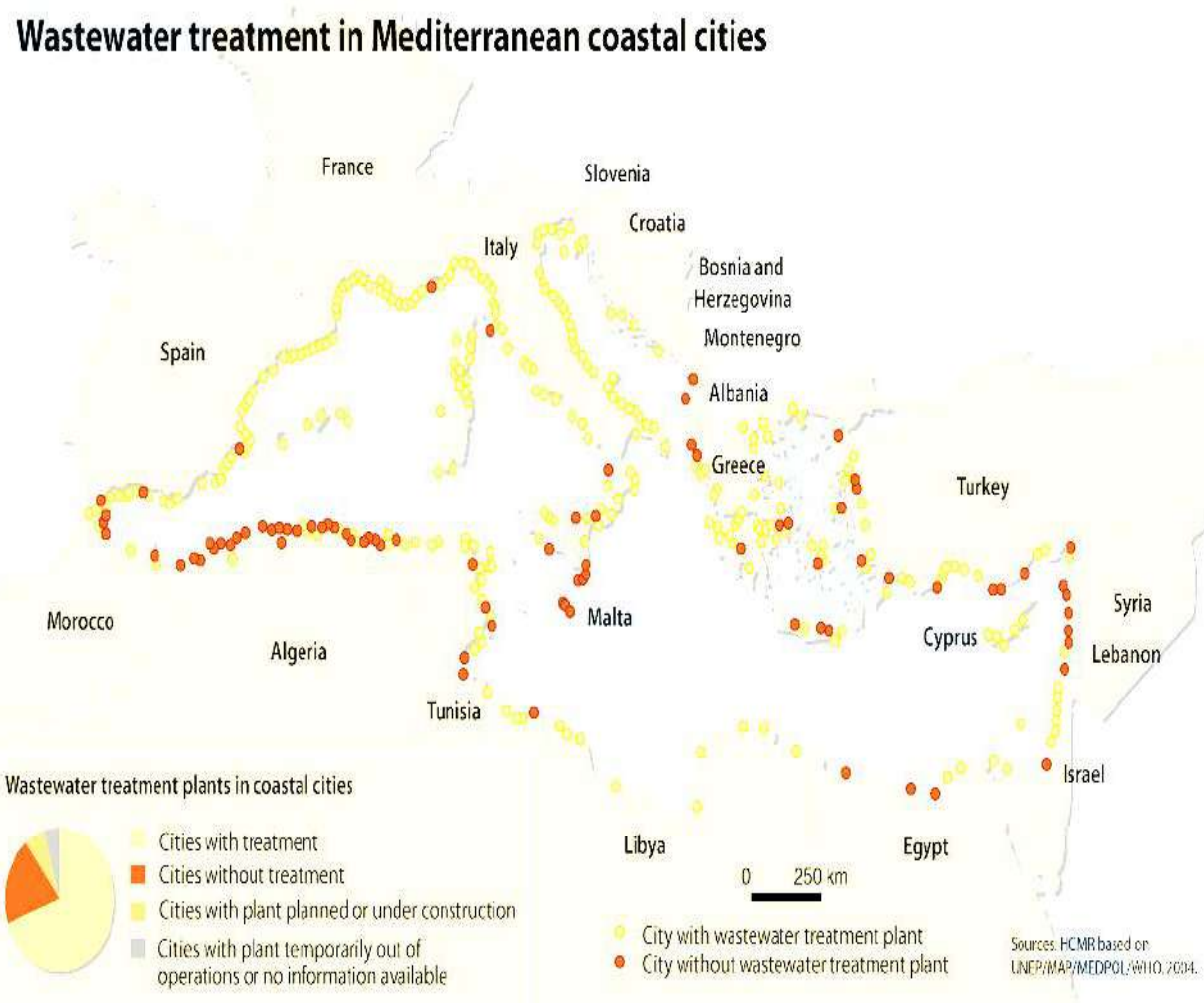

37 %

of coastal settlements with more than 2.000 inhabitants **DO NOT operate** a wastewater treatment plant

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Did you know

Urban WWTPs are the largest emitters of:

Nitrogen (45%) ; 1,5–4,5 million tonnes per year

Phosphorous (13%) ; 0,1–0,4 million tonnes per year

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Did you know

40 %

of the energy expenditures in small to medium-sized municipalities **go to pumping-moving-treating** of the urban water needed

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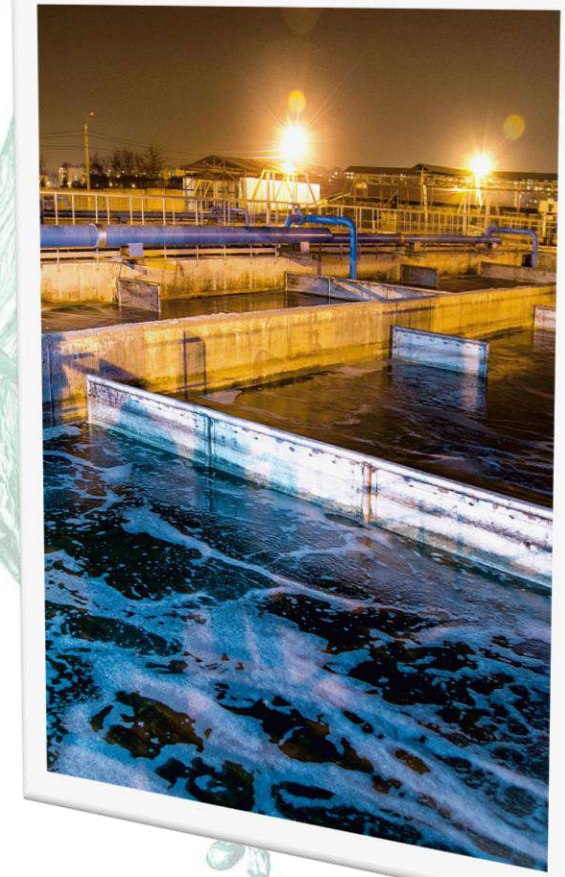
Did you know

211.3 Billion $

is expected to reach by 2025 the global Water and Wastewater Treatment Market



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Priority B.4.1 Water Efficiency

Support sustainable initiatives targeting innovative and technological solutions to increase water efficiency and encourage use of non-conventional water supply

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Target

150

hectares of land irrigated with non-conventional water

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Target

2,700,000

m³/year of non-conventional water supply used for domestic purposes

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5 Projects funded under the Priority B.4.1 Water Efficiency

- **AQUACYCLE** Towards Sustainable Treatment and Reuse of Wastewater in the Mediterranean Region
- **MEDISS** Mediterranean Integrated System for Water Supply
- **MENAWARA** Non Conventional WAter Re-use in Agriculture in MEditerranean countries
- **NAWAMED** Nature Based Solutions for Domestic Water Reuse in Mediterranean Countries
- **PROSIM** Promoting Sustainable Irrigation Management and non-conventional water use in the Mediterranean

Sharing the same logo

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AQUACYCLE partnership

	**Centre for Research & Technology, Hellas** **CERTH**
	Plataforma Solar de Almería **PSA-CIEMAT**
	Integrated Resources Management Company Ltd. **IRMCo**
	Lebanese University, Doctoral School in Sciences and Technology **UL**
	Water Research and Technologies Centre **CERTE**
	Tunis International Center for Environmental Technologies **CITET**
	Regional Entity for Wastewater Sanitation and Treatment in Murcia **ESAMUR**

CERTH
CENTRE FOR RESEARCH & TECHNOLOGY HELLAS

Ciemat
Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas

PSA Ciemat

I R M
INTEGRATED RESOURCES MANAGEMENT

الجامعة اللبنانية
UNIVERSITE LIBANAISE

CERTE

Centre International des Technologies de l'Environnement de Tunis

esamur
Entidad de Saneamiento y Depuración de la Región de Murcia

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AQUACYCLE partnership

- Public Power Company Renewables S.A. (**PPCR**)
- French National Centre for Scientific Research (**CNRS**)
- Association of Teachers of Life Sciences and Earth of Morocco (**AESVT**)
- Water and Sanitation Society of Algiers (**SEAAL**)

PPC Renewables
Innovation • Development • Environment

cnrs

A.E.S.V.T

سيال
SEAAL

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The AQUACYCLE contribution

Sustainable technology

Promote the operational application of an **eco-innovative wastewater treatment system** which is based on **natural processes** and **renewable solar energy**

Clean water

Promote the water circular economy by providing an **alternative, supplementary water resource** that is readily available all year-round

Water governance

Improve water governance through the active involvement of the local communities in the development of **waste water treatment and reuse action plans**

Investments & Employment

Prepare the ground for **investment in the new technology**, increase **employment opportunities** and stimulate the long-term **endogenous economic growth**

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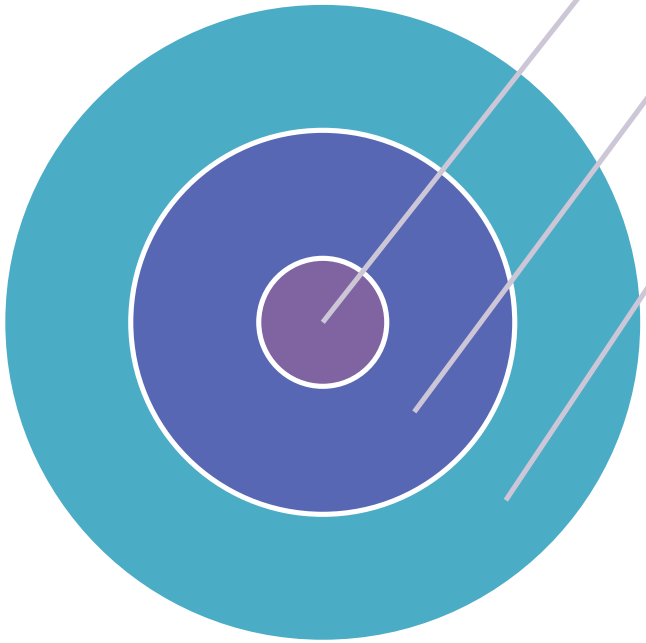
AQUACYCLE target values



1 new technology

10 support measures

900000 m^3 of reuse

PROGRAMME EXPECTED RESULT

Support research and development for locally applicable and low-cost technologies for the use of non-conventional water resources for domestic purposes

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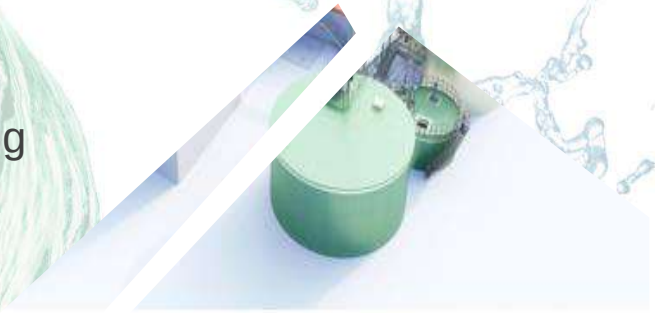
The APOC technology

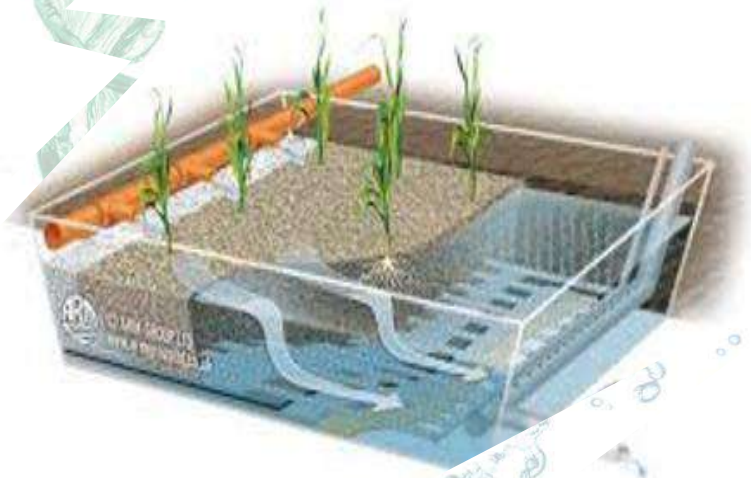
Anaerobic Digestion (AD)

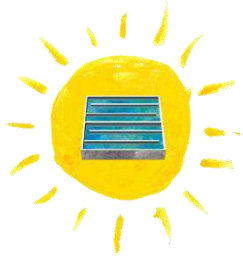
Secondary treatment of domestic wastewater based on the anaerobic digestion process focusing on **energy efficiency of biogas production** and **utilisation of the nutrient-rich by-product** generated (solid digestate).



Constructed Wetland (CW)

Tertiary treatment by a natural-based solution to **improve the quality** of the AD effluent, to **produce biomass** for valorization, and provide an alternative **habitant**.





Photocatalytic Oxidation (PO)

Post treatment of the CW effluent in a novel solar Raceway Pond Reactor (RPR) for high **disinfection** and **contaminants of emerging concern** removal efficiency.

Main benefits

Production of a clean water (final effluent) that is reusable and safe for the environment

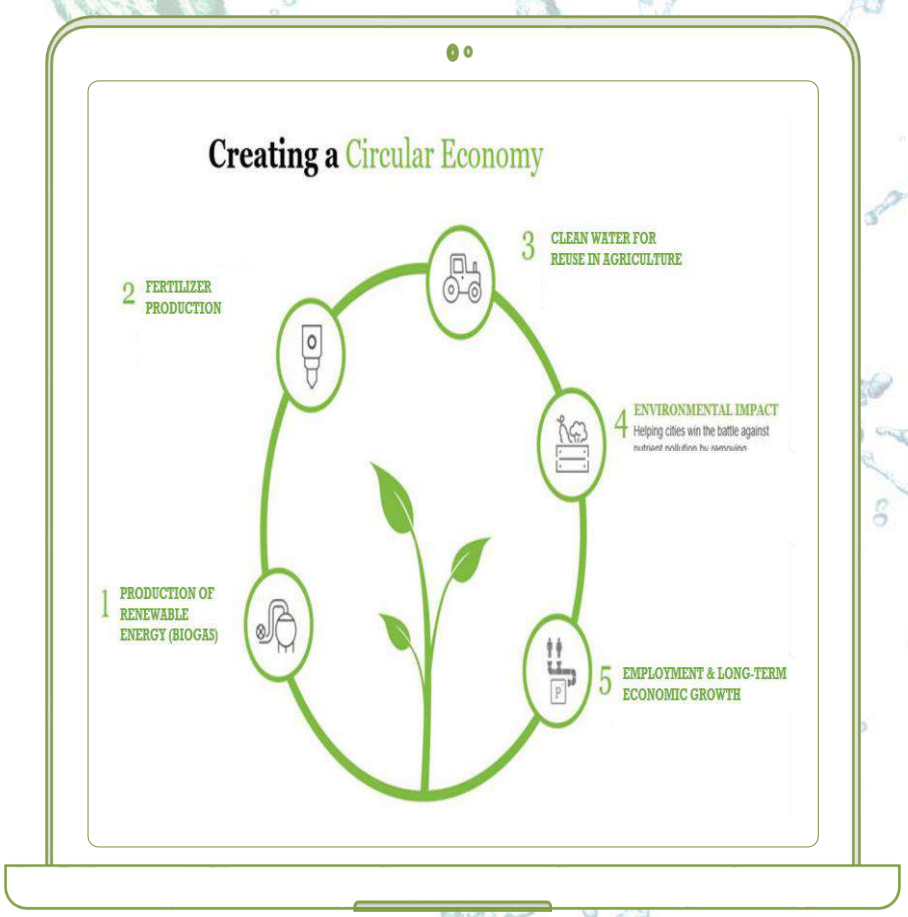
Other benefits include

- ✓ **utilization of solar energy**, which is an abundant resource in the Mediterranean region, for the effective disinfection and non-selective photocatalytic oxidation of persistent organic pollutants exiting the wetland,
- ✓ depending on the demand, technical modifications can be made and **biogas can be generated** by the anaerobic digestion of the organic content to supply energy,
- ✓ **minimization of the excess secondary sludge** and production of a solid byproduct (anaerobic solid digestate) that can be used for **land fertilization**,
- ✓ APOC can be implemented using **local skills and know-how** to provide context-specific sanitation services and get optimum efficiency of the system

Main attributes

APOC presents salient attributes in relation to

- **cost**,
- **cultural acceptability**,
- **simplicity of design and construction**,
- **operation and maintenance**,
- **hydrogeological conditions** and
- **local availability of materials and skills**



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Administrative geolocation of 3 APOC demonstrations units

North Governorate of Lebanon

Murcia Region of Spain

Zaghouan Governorate of Tunisia

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Maloule Saki Al-Chimali demo unit location, Lebanon

Bent Saidane demo unit location, Tunisia

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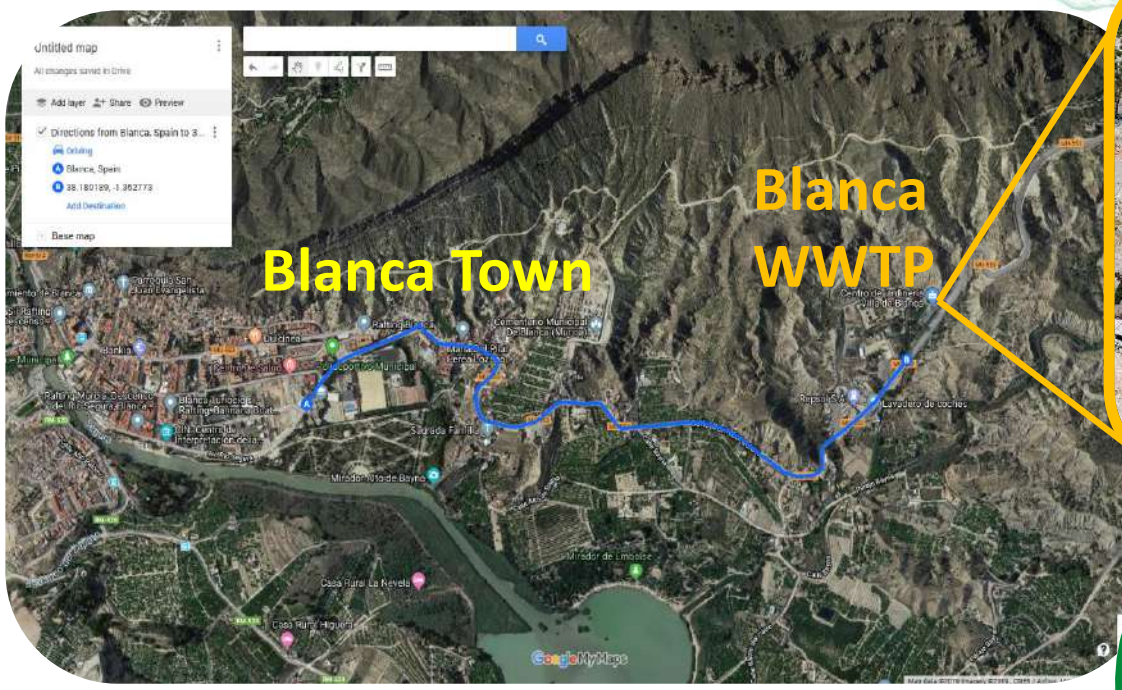

Planned constructed wetland

Blanca demo unit location, Spain

The case of Blanca demo unit, Spain

Actions implemented

- Definition of demo plant location
- Collection of necessary permits (plot owner, environmental authoritation)
- Collection of information related to the characteristics of the treated water in the anaerobic reactor of Blanca
- Determination of treatment targets to comply the Spanish and European regulation
- Discharge maximum values : BOD_5: 25 mg/l; COD: 125 mg/l; SS: 35 mg/l
- Selection of vertical subsurface wetland for optimum organic matter removal and subsurface horizontal wetland for the nitrification of the organic nitrogen and ammonia with minimum surface requirements
- Preparation and launch of public tender

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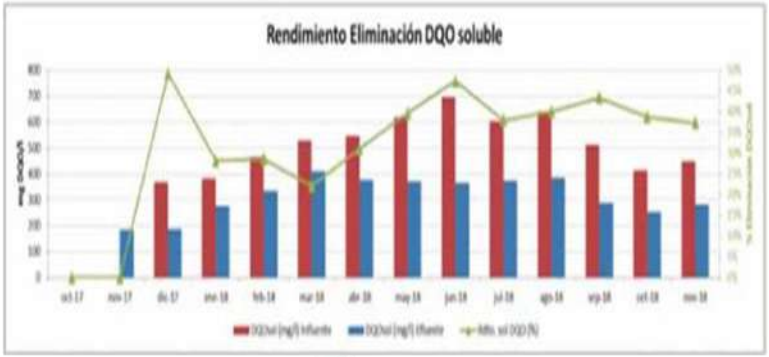
UASB

- Working since January 2018
- Design capacity 700 m^3/day
- COD influent average 1010 mg/l
- COD effluent average 428 mg/l
- COD average efficiency removal 57,6%
- SS influent average 347 mg/l
- SS effluent average 122 mg/l
- SS average efficiency removal 65,0%



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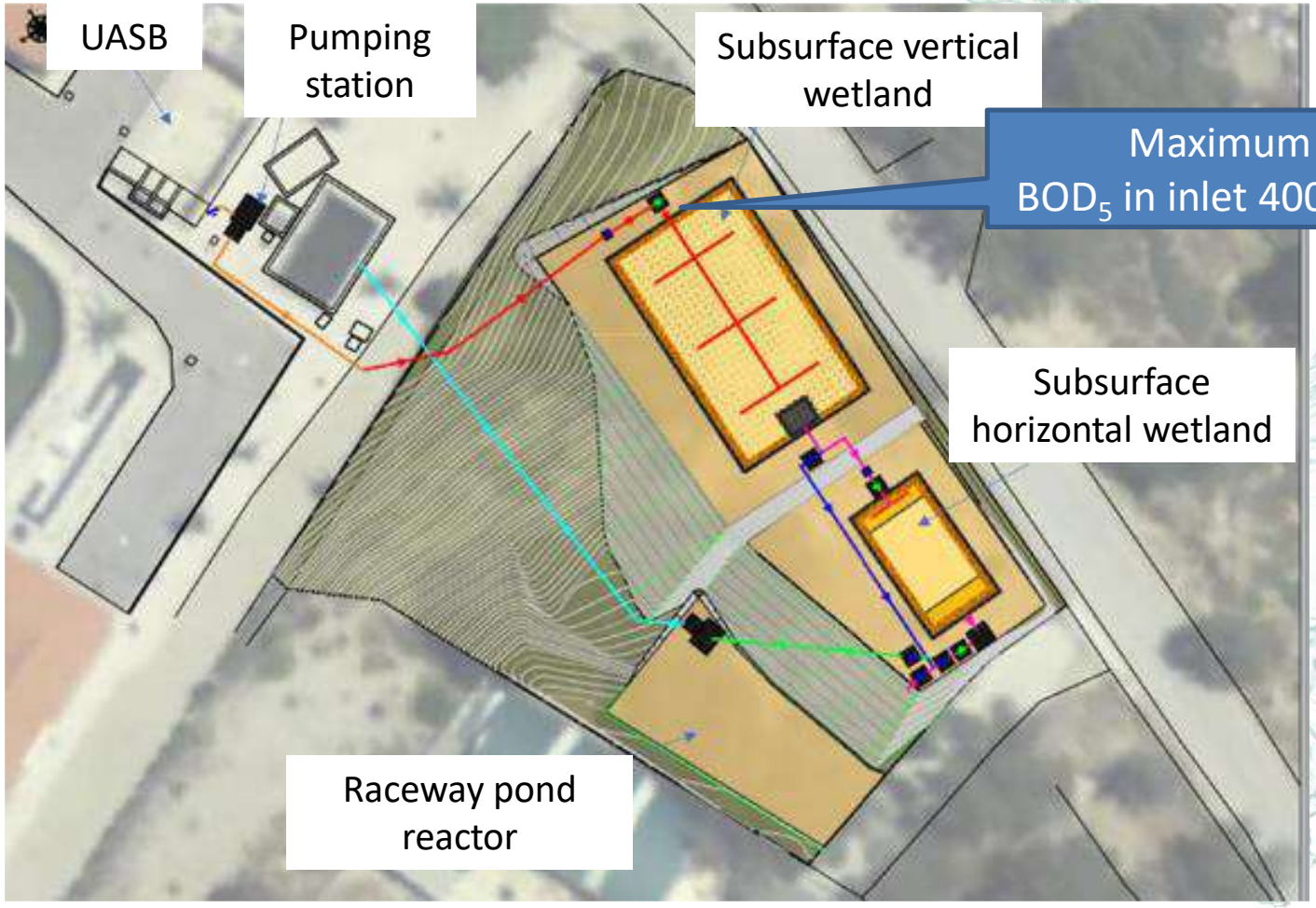
Design flowrate for the pilot plant : 5 m^3/day



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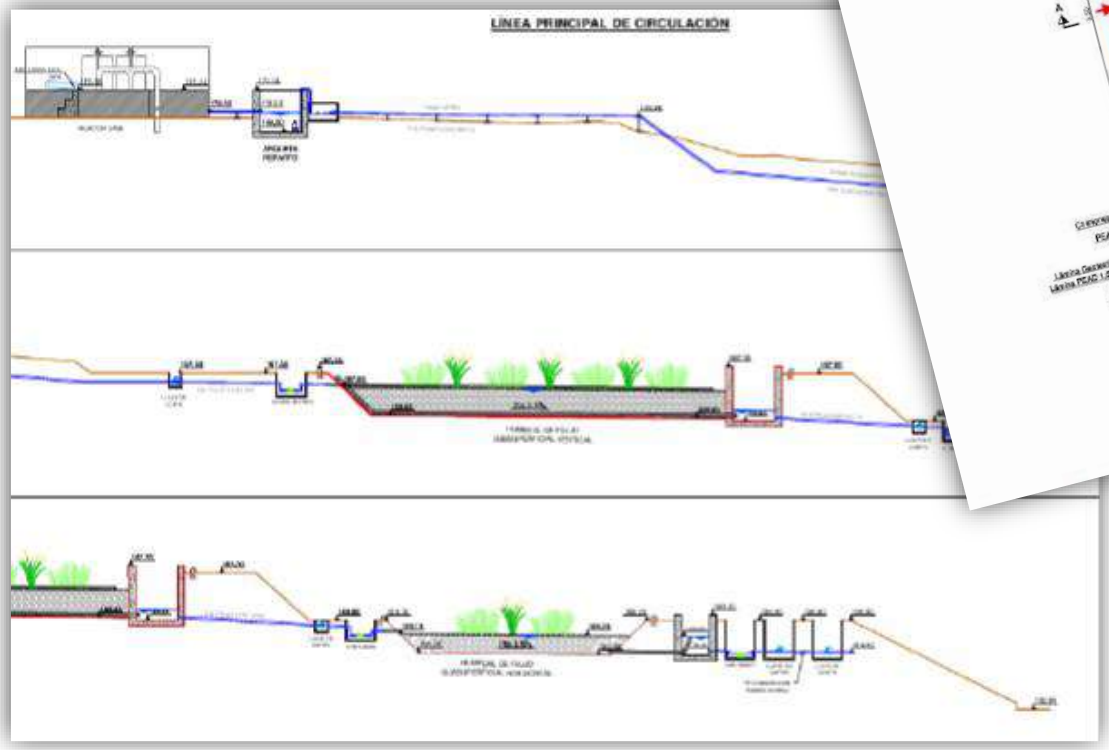
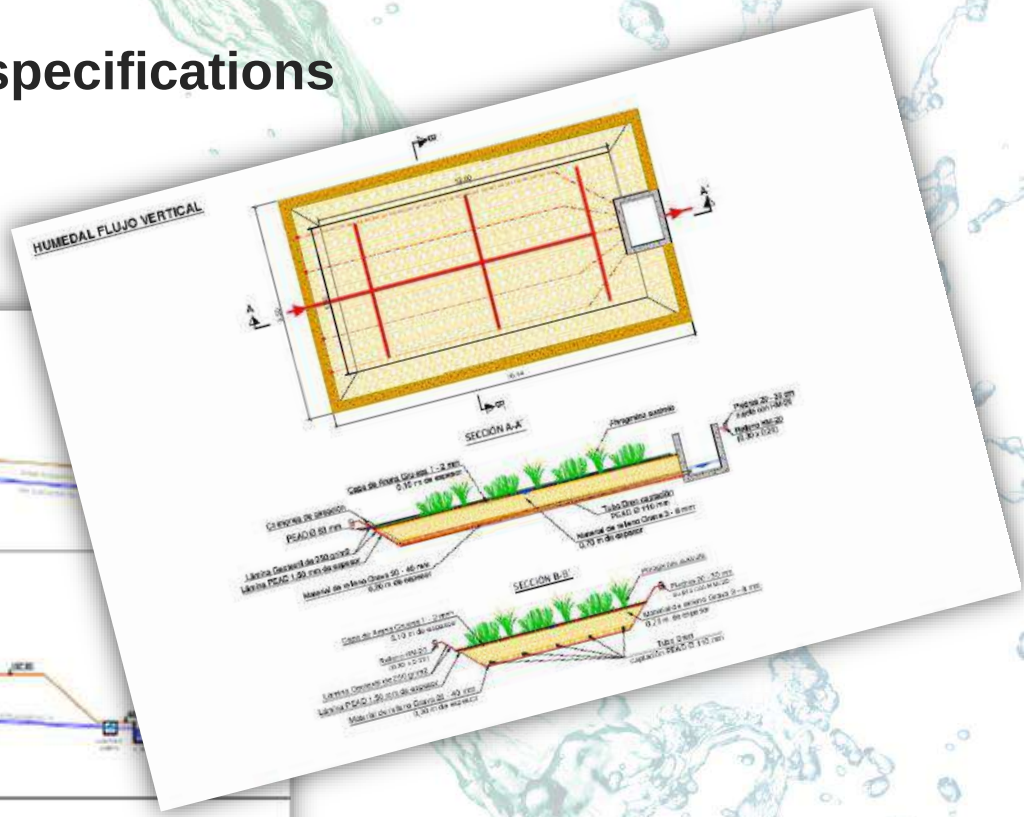
Detailed designs and technical specifications





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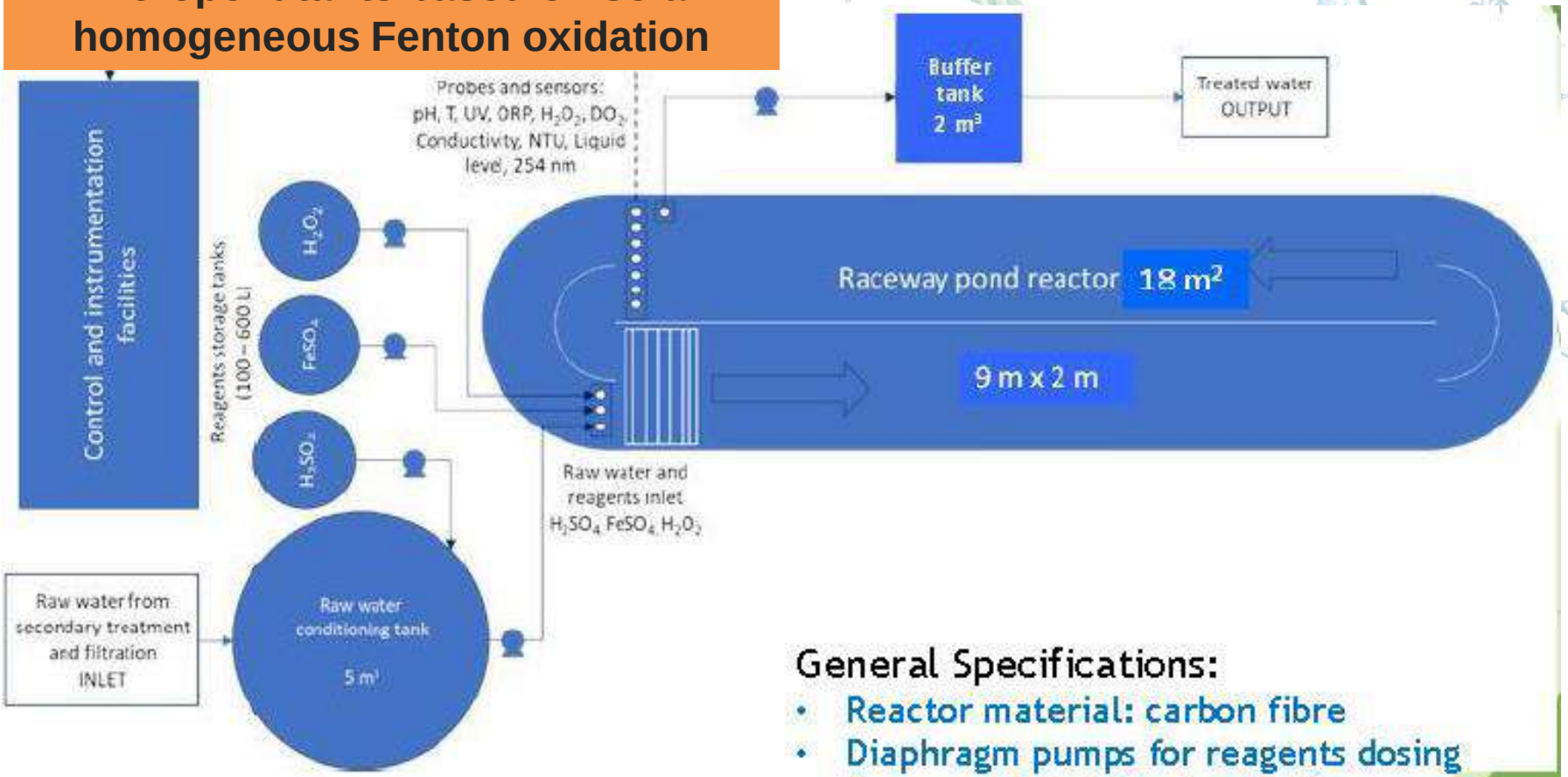
Solar raceway pond reactor (RPR)

Disinfection and removal of organic micropollutants based on solar homogeneous Fenton oxidation



General Specifications:

- Reactor material: carbon fibre
- Diaphragm pumps for reagents dosing
- Sensors: pH, T, UV, dissolved oxygen

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By end of 2021 all 3 demo plants are expected to be constructed & fully operated

Stay tuned for new developments through AQUACYCLE website, newsletters and follow us on social media

http://www.enicbcmed.eu/projects/aquacycle

Acknowledgment

The **AQUACYCLE** project is funded and supported by the European Union through the **ENI CBC Mediterranean Sea Basin Programme** under the Grant Contract A_B41_0027_AQUACYCLE.
Project duration: 36 months (September 2019 – August 2022)

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