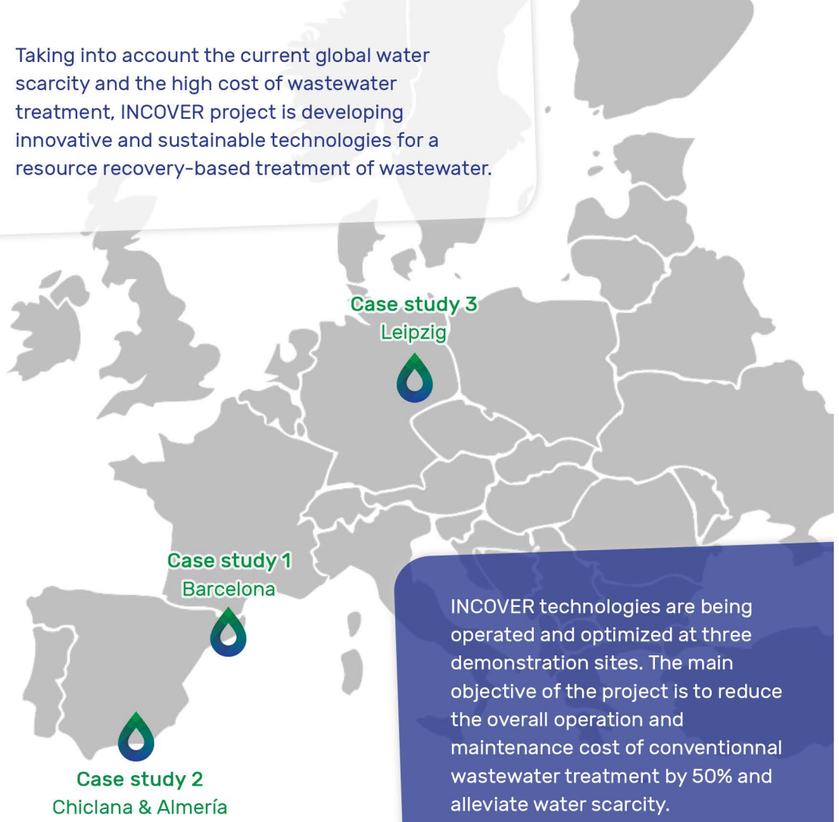
Taking into account the current global water scarcity and the high cost of wastewater treatment, INCOVER project is developing innovative and sustainable technologies for a resource recovery-based treatment of wastewater.



INCOVER technologies are being operated and optimized at three demonstration sites. The main objective of the project is to reduce the overall operation and maintenance cost of conventionnal wastewater treatment by 50% and alleviate water scarcity.

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Evaporative system - © Recilnu

Total funding:
7.2 millions €

Dates:
June 2016 - May 2019

Coordination:
AIMEN Technology Centre

Smart irrigation system - © Fint

INCOVER consortium

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FIN Future Intelligence Telecom Engineering Company
Office International de l'Eau

Realisation: OIEau - February 2019

Front page photo: *From left to right: samples of agricultural wastewater, PBR effluent, settler effluent, and final postreatments effluent © UPC*

INCOVER

Innovative Eco-Technologies for Resource Recovery from Wastewater

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Case study 1 - Barcelona, Spain

Tubular horizontal semi-closed photobioreactors located in Agròpolis (Viladecans, Barcelona) © GEMMA Research Group, UPC

35 m^3
PBR volume

Production of biomass
21 gVS/m^2d

94-99% CH_4
Biomethane composition

At the demonstrative plant in Barcelona, **a microalgae based system** is tested for wastewater treatment and resource recovery. The plant consists of 3 semi-closed horizontal tubular **photobioreactors (PBRs)** using agricultural runoff and urban wastewater as feedstock. The operational conditions are adjusted in order to select cyanobacteria, microalgae able to accumulate polyhydroxybutyrates, which can be used for **bioplastics production**. The biomass is harvested and used for biogas production by means of anaerobic co-digestion (AcoD) with secondary sludge. The biogas is upgraded in an **absorption column to increase methane concentration**. The digestate from the AcoD is further stabilized and dewatered in a **sludge wetland**, producing a **biofertilizer**. On the other hand, wastewater is post-treated in a **solar driven ultrafiltration and disinfection system**, and in **nutrients recovery columns** filled with an adsorptive material. Eventually, the reclaimed water is applied in an agricultural field to grow crops by means of a **smart irrigation system**.

Case study 2 - Chiclana & Almería, Spain

In Almería, wastewater is treated by a 3000m² **High Rate Algae Pond** (HRAP) and tertiary treatment composed of 250m² **planted filter** with natural material for enhancing **phosphorus recovery**. Irrigation water is finally obtained and reused with a **solar anodic oxidation disinfection** and smart irrigation system. The biomass obtained is anaerobically digested and biomethane is produced by an **innovative biogas upgrading system**.

In Chiclana, **PHA production** is through a two-stage anaerobic phototrophic purple bacteria pond (PPBPonds) system, obtaining up to 25 g PHA/m²day. Two 500 m² HRAPs treat wastewater and the algae biomass used is harvested and transformed into biogas through thermal pre-treatment and anaerobic co-digestion. A 250m² evaporative system is used for the digestate stabilization and nutrient recovery, with zero liquid discharge.

300 m^3/day
Wastewater reused

25g PHA/m^2d
Bioplastics production

High Rate Algae Pond - © *Aqualia*

Case study 3 - Leipzig, Germany

At the demo plant in Leipzig, wastewater and bio-wastes from the food industry are treated by a three-step process:

1) **Up to 170 kg/m³ Citric Acid (CA) is produced** by the non-conventional yeast *Yarrowia lipolytica* under non-sterile condition from waste frying oil as carbon rich source and a kitchen cleaning WW from canteen operating. This **yeast based bioprocess** is performed in a modified conventional 1 m³ container system. The produced CA solutions will be used for cleaning or descaling purposes.

2) The residual yeast biomass from the CA bioprocess in combination with waste frying oil are the substrates for mesophilic anaerobic co-digestion (AcoD) to produce **biogas** in a range of 0.85 – 1.0 $m^3/kg_{VolatileSolid}$.

3) In the final step anaerobic digestate is treated by **hydro-thermal carbonization** transforming the AcoD residuals into **valuable carbonized products** (bio-coal, carbon black, bio-fertilizer) applicable both for **fertilizing** and **energy purposes**.

Production of Citric Acid
100-170 kg/m^3

Production of biogas
0.85-1.0 $m^3/kg_{Volatile\ Solid}$

IBC container bioreactor system for yeast based citric acid production - © *UFZ*