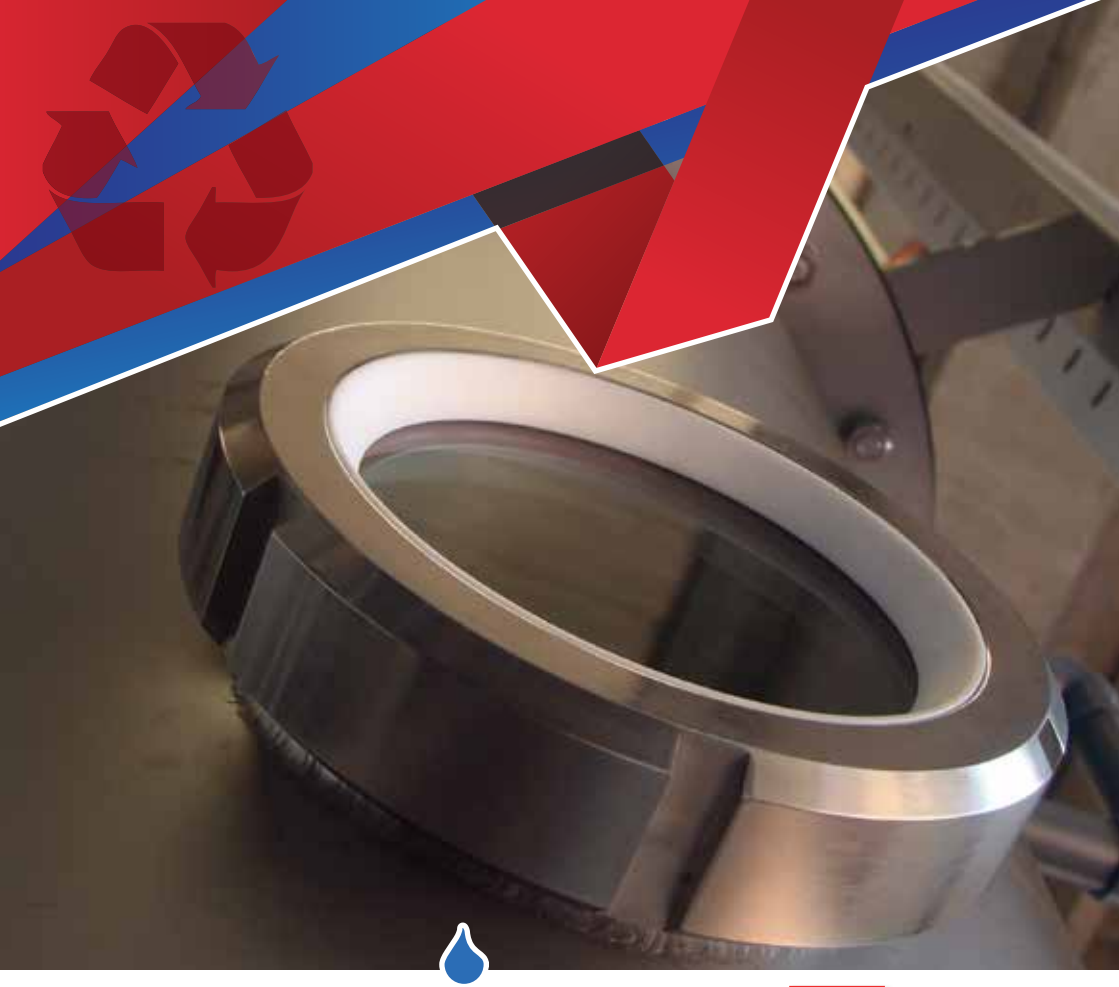

# SAVING E

Two-stage autotrophic N-removal for mainstream sewage treatment

# LAYMAN'S REPORT

## Project Information

**Project Ref.:** LIFE14 /ENV/ES/000633
**Start Date:** October 2015
**Final date:** March 2019
**Total Budget:** 1.169.068€

## Project Coordinator

UAB Universitat Autònoma de Barcelona

ENOCOV

## Project Partners

WssTP The European Water Platform

DAM Depuración de Aguas del Mediterráneo

Agència Catalana de l'Aigua

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# INTRODUCTION

## The environmental problem targeted

By 2030, the worldwide water supply-to-demand gap is likely to reach approximately 40% unless significant efficiency gains can be made, while by the year 2050, around 60% of the world's population is possible to experience severe water shortages, with 33% thought to be already under stress. In Europe, competing demands for limited and sometimes over-exploited water resources concern more than a few EU Member States; water scarcity and droughts already affect one third of the EU territory across different latitudes. Among water shortage, the pollution is a major environmental problem. In fact, the two main environmental issues Europeans are worried about are: air pollution (56%) and water pollution (50%).

In this sense, Eutrophication is a process driven by the enrichment of water by nutrients, especially compounds of nitrogen and/or phosphorus, leading to: increased growth and primary production of algae biomass; changes in the balance of organisms; and water quality degradation. Precisely, eutrophication is an indicator of the good environmental status of the Marine Directive. So, being nitrogen and phosphorous the primary inorganic nutrients responsible for the eutrophication, it is clear that in order to reduce human induced eutrophication, it is necessary to reduce the nitrogen and phosphorous load to the water bodies, especially to marine environment by implementing, for example, better sewage treatments.

For many years now, the EU has been taking steps towards the reduction of nitrogen and phosphorous loads in the environment but only 6 Member States (Denmark, Finland, Greece, Austria, Germany and the Netherlands) have an overall UWWT compliance higher than 90% for tertiary treatment, while the rest of Member States has less than 60% of implementation, including Spain. So, there is an urgent need for implementing cheap and efficient tertiary treatment but in fact, changes in the classical treatment applied for nitrogen removal are also needed, i.e. changes in the process of nitrification followed by heterotrophic denitrification, a very energy-demanding process and high emitter of greenhouse gases.

Currently, urban wastewater treatment plants (WWTPs) are net-energy-consumers systems and this consumption can be quantified in 8-16 kWh/person/year depending on the type of treatment, being the classical nitrification/denitrification the most consuming process. In EU, this means an energy consumption of 4000-8000 GWh/year for treating wastewater, which represents an emission of 3-6 Mtons $CO_2$/year. Both energy costs and greenhouse emissions are important and there is an urgent need to develop new technologies able to reduce them.

## SAVING-E Project

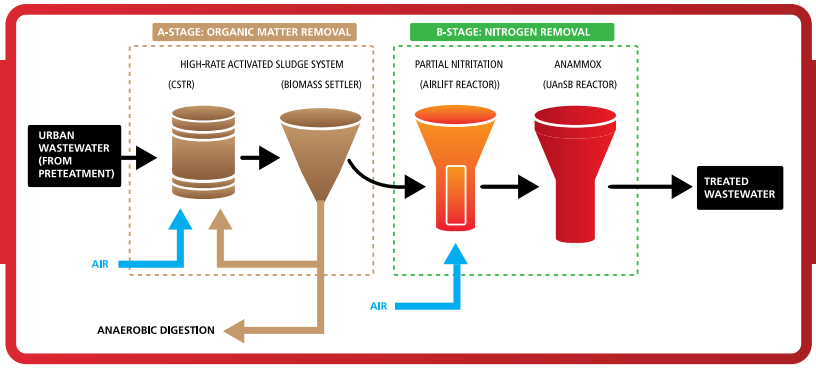
Responding to this urgent need, SAVING-E deals with the radical re-engineering of current wastewater treatment processes in order to improve energy trades and flow of materials. The development of new technologies that are able to reduce energy costs and greenhouse emissions, as the SAVING-E process, are important for the future.

## Objectives

The main objective of the SAVING-E project has been to radically redesign the urban WWTPs in a way they become energy-producers rather than energy consumers, without affecting its performance or even improving it.

SAVING-E technology uses most of the entering organic matter for biogas production purposes by designing a first biological step (the A-stage) with low oxygen consumption and high biomass production, i.e. with very low sludge residence time. The biomass produced in this step, therefore, would have a very favourable methane production potential, much greater than the achieved in the current urban WWTPs. Then, SAVING-E technology is able to biologically remove nitrogen in the mainstream without the need of organic matter (the B-stage). SAVING-E uses the autotrophic biological nitrogen removal (BNR) for this aim with a novel two-step approach. This novel approach consists of two reactors, a first aerobic partial nitritation reactor followed by a second Anammox reactor. The application of autotrophic BNR to the mainstream reduces severely the aeration costs compared with current urban WWTP.

SAVING-E aims to demonstrate a pilot scale and with real urban wastewater, both at high and low temperatures (15º C), that the energy balance of an urban wastewater treatment plant can be improved to make it a net energy producer process. It aims to demonstrate, in a relevant environment at pilot scale, the feasibility, applicability, replicability and transferability of the SAVING-E technology at local and EU level.



## Pilot plant & Installation

The SAVING-E pilot plant has been built and installed in the Rubí Wastewater Treatment Plant (WWTP).

## SAVING-E Project: 3.5 years at a glance

**October 2015**
Start of the project

**July 2016**
Installation of the SAVING-E pilot plant at the Rubí WWTP

**December 2016**
End of the start-up of the High-rate activated sludge system

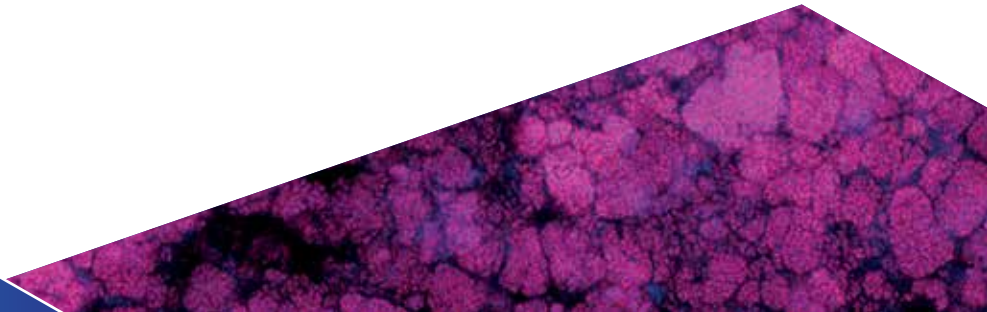
**June 2017**
End of the start-up of the anammox reactor

**December 2017**
End of the start-up of the airlift reactor

**July 2018**
Connection of the three reactors working at mild temperature

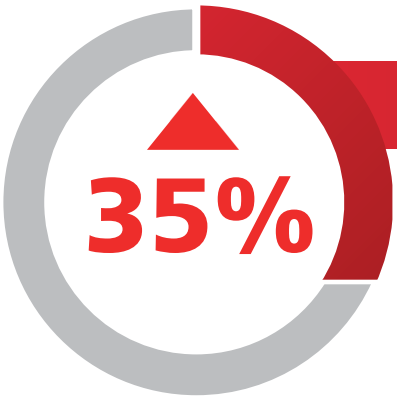
**October 2018**
Connection of th three reactors working at low temperature

**March 2019**
End of the project

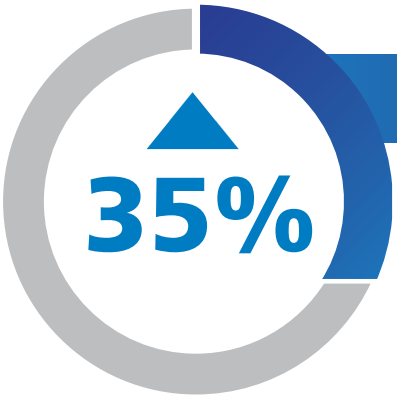


## Which are the SAVING-E Results?

The main result of the SAVING-E project is that its SAVING-E technology seems to have significant positive impacts such as: (i) energy savings and (ii) reducing operational costs. More particularly, the technical and environmental results and impacts of the application of the SAVING-E technology versus conventional technologies for treating urban wastewaters are:




**Increase of 35% of the biogas production**




**35% of Energy Saving in the Biological Treatment Process**

## What does SAVING-E project mean for society at large?

The implementation of the project's activities has resulted in bringing forward important socio-economic benefits, not only in Spain where the project got tested and implemented but also in other parts of Europe. In particular, the SAVING-E technology, as a product and a service has demonstrated a positive impact both in an economic and social context.

When it comes to the project's economic impact evaluation, the SAVING-E technology appears to be promising in the public and the private sector, with potential tenders at national and EU levels.


Boosting the development of a more advanced technology focused on energy and nutrient recovery in WWTPs, which could be implemented in existing facilities in Europe.

Focusing on the project's social impact now, SAVING-E has succeeded in boosting employment in the water and industrial sectors through the generation of technical and specialized job profiles (engineers, technicians, and operators) that are needed in granular sludge, nitrogen removal via nitrite and self-sufficient energy WWTP.

The wide range of training programmes developed over the course of this project has also left behind a stock of training courses, responding to the training needs of professionals of the wastewater market in advanced treatment solutions.

In addition to that, the children and young educational programmes offered through the project have contributed significantly to increasing the social awareness about wastewater treatment.

Equally important have also been the innovation activities of the project (Open Innovation, Hackathon: challenges in the water sector, best thesis award) that set a great example of innovative approaches in the sector and motivate water utilities and their consultants to take into account innovation in public service contracts.

# Dissemination Activities

SAVING-E Project made its presence felt in numerous events to disseminate the project's results and maximise the impact of the project.

## SAVING-E at Insitrate Workshop, 7 April 2016, Barcelona

## SAVING-E at IFAT Worldwide Munich 2018 – World´s Leading Network for environmental Technologies, 14- 18 May 2018, Munich



## SAVING-E at iWater, 13-15 November 2018, Barcelona


## SAVING-E at Smart-Water Project Workshop, 15 January, Barcelona

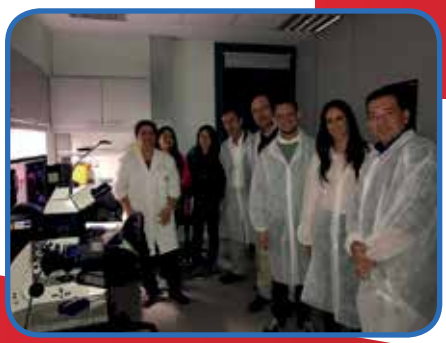
Among the events that SAVING-E project hosted are.

**Networking Meeting between LIFE SAVING-E and Rubí Brilla, 14 April 2016, Barcelona**


**Visit of Escola Emili Juncadella (Barcelona) and the Institut Públic La Romànica (Barbera Del Vallès) at SAVING-E Pilot Plant, 3 February 2017, Rubi**

## Visit of Francesc Gambús, Member of The European Parliament at Parc De Recerca UAB, 13 January 2017, Barcelona


## SAVING-E Winter school, 24-25 January 2018, Barcelona



**SAVING-E Workshop "Hacia la autosuficiencia energética en las Estaciones de Depuración de Aguas Residuales", 28 June 2018, Valencia**


**SAVING-E DAM internal innovation Workshop, 11 January 2019, Valencia**


# SAVIN

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NG E

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