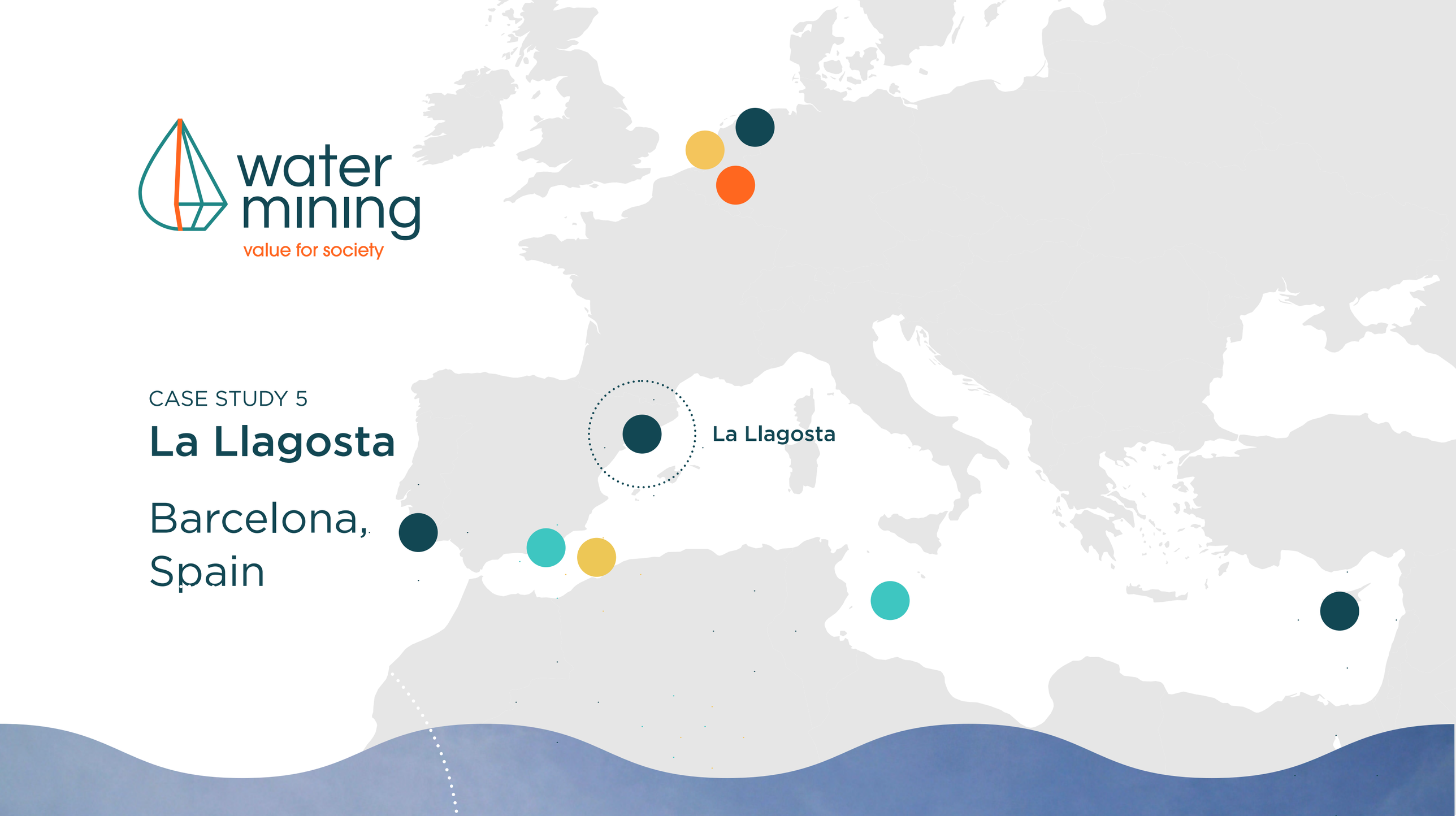
water mining

value for society

CASE STUDY 5

La Llagosta

Barcelona, Spain

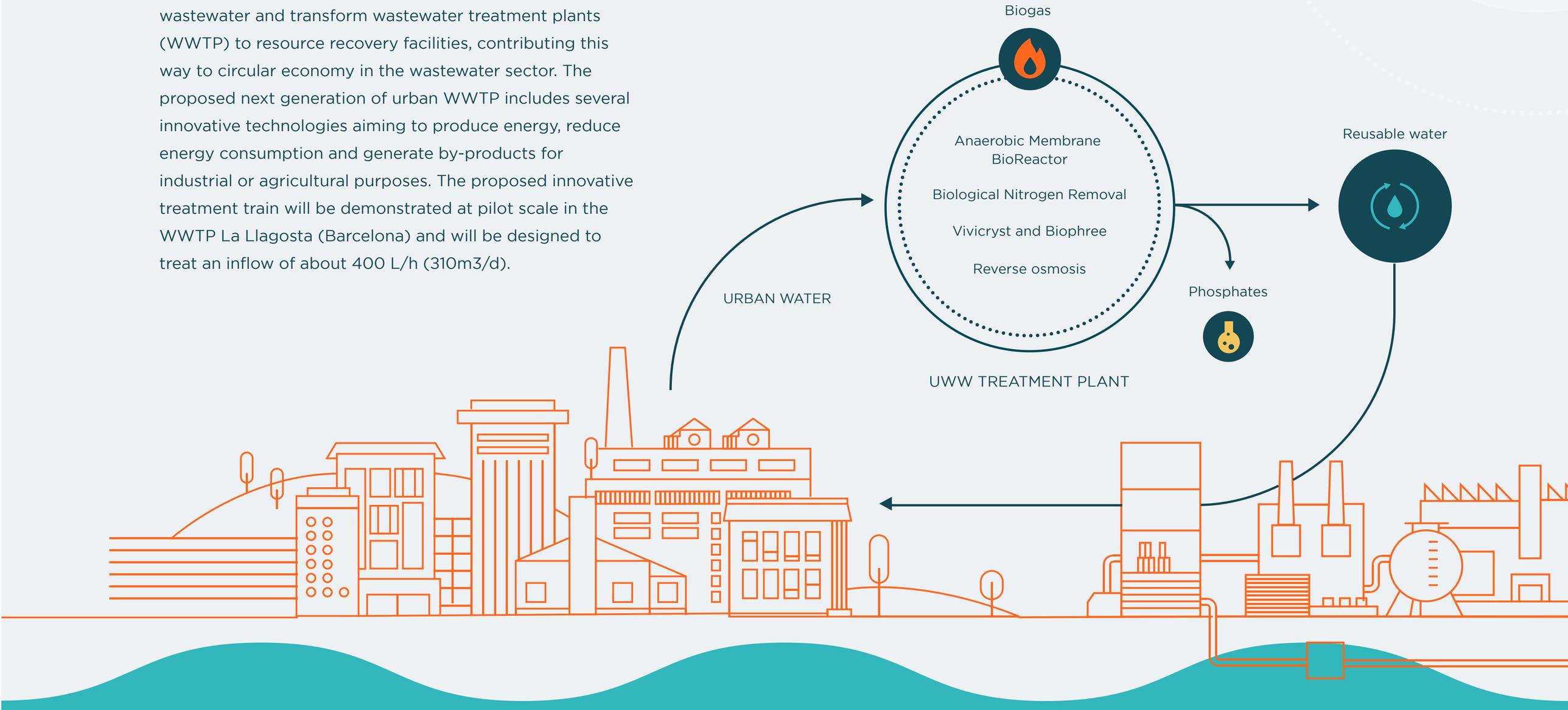


URBAN WASTEWATER

CS5 CASE STUDY 5

La Llagosta
Barcelona, Spain

The CS5 will demonstrate the feasibility of implementing innovative technologies to treat and valorize urban wastewater and transform wastewater treatment plants (WWTP) to resource recovery facilities, contributing this way to circular economy in the wastewater sector. The proposed next generation of urban WWTP includes several innovative technologies aiming to produce energy, reduce energy consumption and generate by-products for industrial or agricultural purposes. The proposed innovative treatment train will be demonstrated at pilot scale in the WWTP La Llagosta (Barcelona) and will be designed to treat an inflow of about 400 L/h (310m3/d).



Key innovations

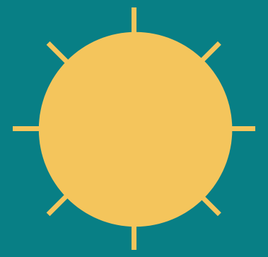
Granular Anaerobic Membrane Bioreactor (AnMBR) to convert the organic matter in urban WW into a biofuel: The granular AnMBR is a suitable way to reduce energy costs by treating organic matter from urban wastewaters, in comparison to conventional aerobic activated sludge. Also, under anaerobic conditions, biogas is produced, which is a mixture of methane and carbon dioxide and can be used as energy source.

Phosphorous recovery: Removal and recovery of phosphorus with two innovative technologies developed by WETSUS: ViviCryst and BioPhree. The effluent from the anammox reactor will be treated with ViviCryst, a technology based on the chemical precipitation of phosphorus with iron in form of vivianite crystals, which have a potential application as fertilizer. The effluent from ViviCryst will be treated with BioPhree, an adsorption process that is capable to remove phosphate to ultra-low concentrations.

Partial nitritation coupled to anammox: A suitable way to remove nitrogen from urban wastewaters is via autotrophic Biological Nitrogen Removal (BNR) processes, combining partial nitration and anammox processes. However, conventional nitrogen removal processes (nitrification followed by heterotrophic denitrification) are high energy demanding and technically limited to low loading rates. This CS proposes a two-stage approach to achieve autotrophic BNR, i.e., the removal of ammonium without the need of organic matter.

Main challenges

Operation at mainstream conditions: The combination of partial nitritation/anammox (PN/AMX) technologies have been applied successfully at sidestream. However, the implementation of PN/AMX at mainstream still faces some major challenges, that need to be resolved before its full implementation. For instance, low temperature (10-15 degrees in winter season), low nitrogen concentration and NOB outcompetition during partial nitritation. Anaerobic digestion is also challenging at mainstream conditions, and we will try to overcome this by implementing a granular AnMBR configuration.



For ViviCryst technology, the main challenges are: low solubility of produces crystals (advantage and challenge at the same time), the slow crystal growth and the low P concentration in the influent to be treated.

Outcomes

100%

Reuse of water recovered from treatment of urban WWTP (100%)

<0.05 mg L-1

Concentration of P in the heated urban WWTP effluent (<0.05 mg L-1)

>60%

Share of energy needs covered by energy recovered (>60%)

Expected impact on society

Think of wastewater as

A valuable raw product

A resource to recover water

A resource to recover nutrients

A resource to recover energy

CS5 contributes to change the perspective of urban wastewater treatment: the society should no longer think about urban wastewater as a residue that must be treated to be discharged, but as a valuable raw product that can be processed to recover valuable resources like water, nutrients, and energy.

In CS5 we will demonstrate, at pilot scale, that it is possible to implement circularity in an urban wastewater treatment plant, and we will show to the society the technical, economical, and environmental feasibility of the proposed solution. This CS (and all the project) is also aligned with the SGD 6 (sustainable development goal 6) of the UN, which aims to ensure availability and sustainable management of water and sanitation for all.

Business opportunities

The business opportunities are based on the three resources that can be recovered by implementing the proposed solution

Water

Nutrients

Energy

The recovery of these resources from urban wastewater also contribute to the circularity of the business model. Treatment plants need to be upgraded to be able to implement the proposed treatment, which requires an investment. This investment would be recovered through the revenue streams, that are: recovered water for agricultural or industrial purposes, P in form of fertilizers, stabilized sludge as fertilizer and reduction of energy costs or sale of biogas. The main barriers are related to the commercialization of the resources: in most of the countries, legal framework is not adapted for the sale of fertilizers based on recovered resources, and price of the recovered water would need to compete with the low prices of normal drinking water.

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