AccelWater

Accelerating Water Circularity in Food and Beverage Industrial Areas around Europe

This project has received funding from the European Union's Horizon 2020
research and innovation programme under grant agreement No 958266

Project Information

Project Title	**Accelerating Water Circularity in Food and Beverage Industrial Areas around Europe**
Acronym	AccelWater
Grant Agreement ID	958266
Start Date	November 1st 2020
Overall Budget	9,429,670.00€
EU contribution	8,115,787.38€
Coordinator	AGENSO
Duration	48 months (54 with a 6-month extension)

Why Accelwater?

Food and beverage industry is one of the most water and energy intensive industries worldwide while it produces a lot of wastes

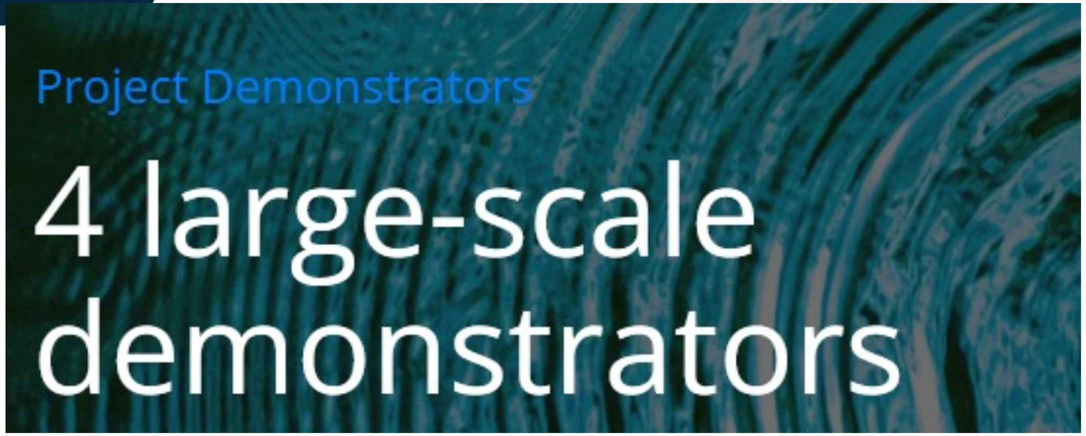
15,500 liters of water

24,000 liters of water

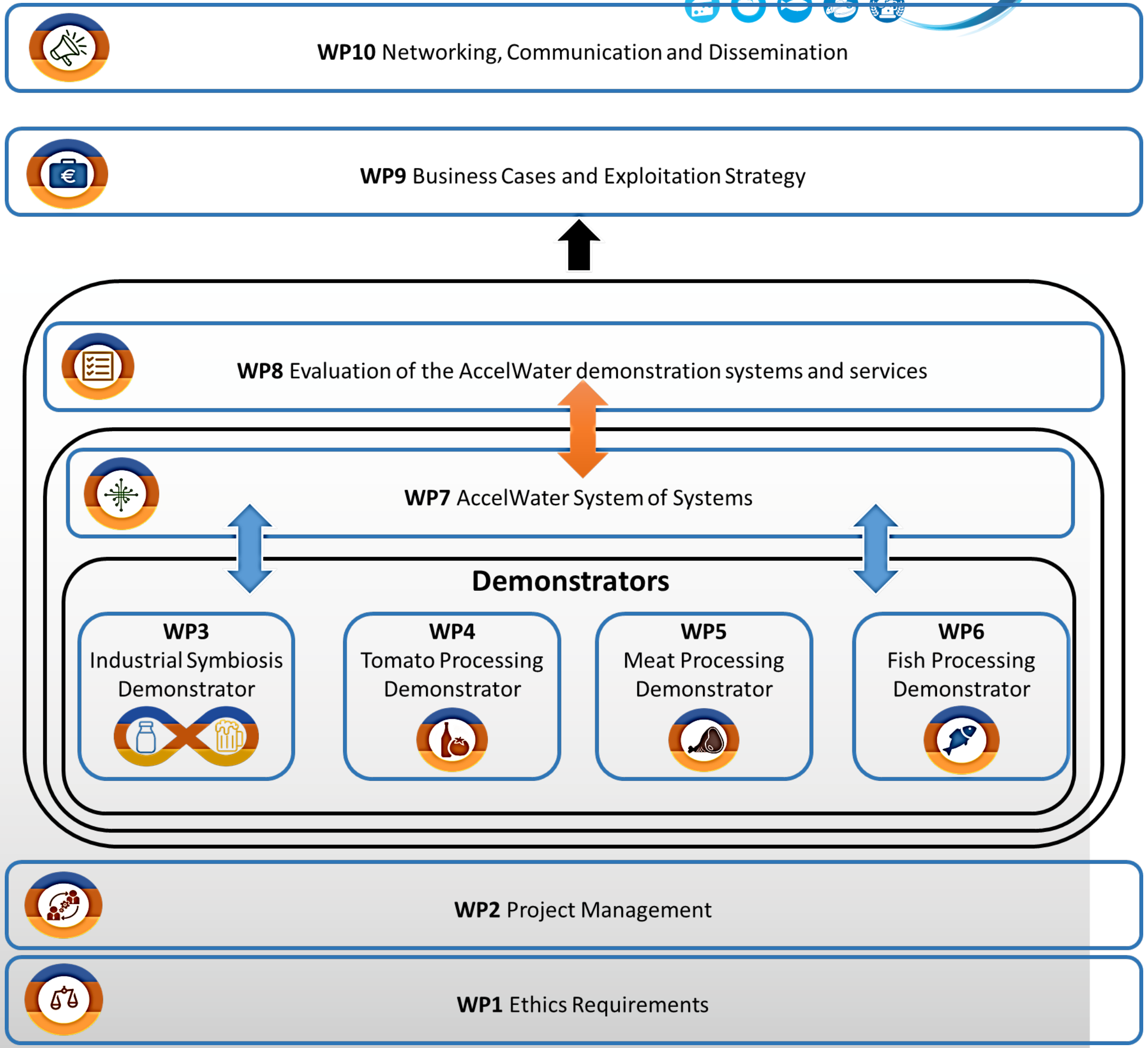
5,000 liters of water

700 liters of water

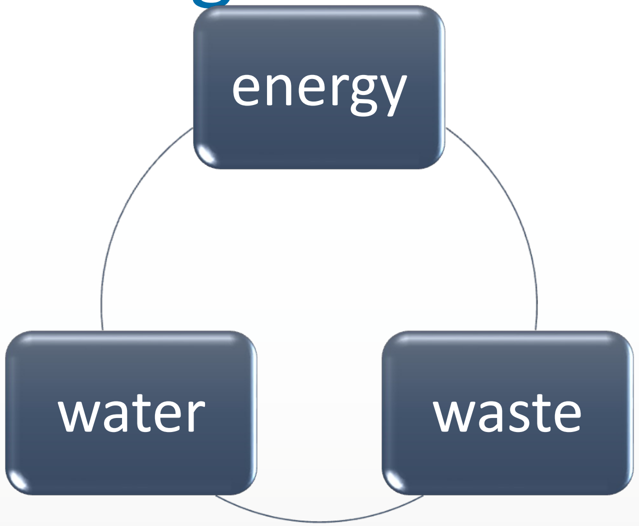
High water consumption in industrial areas → increased production costs



Four large scale demonstrators representing **five different sectors** of the food and beverage industry



AccelWater Demonstrators' Targets



For achieving the desired circularity, the demonstrator's targets include:

- Water and energy saving
- Reducing the environmental footprint
- Reducing the amount of resources wasted
- Reuse of water, energy and by-products
- Production of new ingredients/products

a **holistic food and beverage production framework**, which will be **demonstrated in industrial environments**, able to contribute to **the reduction of the use of freshwater in the food and beverage industry,** resulting in **a reduced and more cost-effective use of resources (water, raw materials and energy), lower waste and reduced environmental impacts.**

AccelWater Demonstrators

Industrial Symbiosis Demonstrator

Meat Processing Demonstrator

Tomato Processing Demonstrator

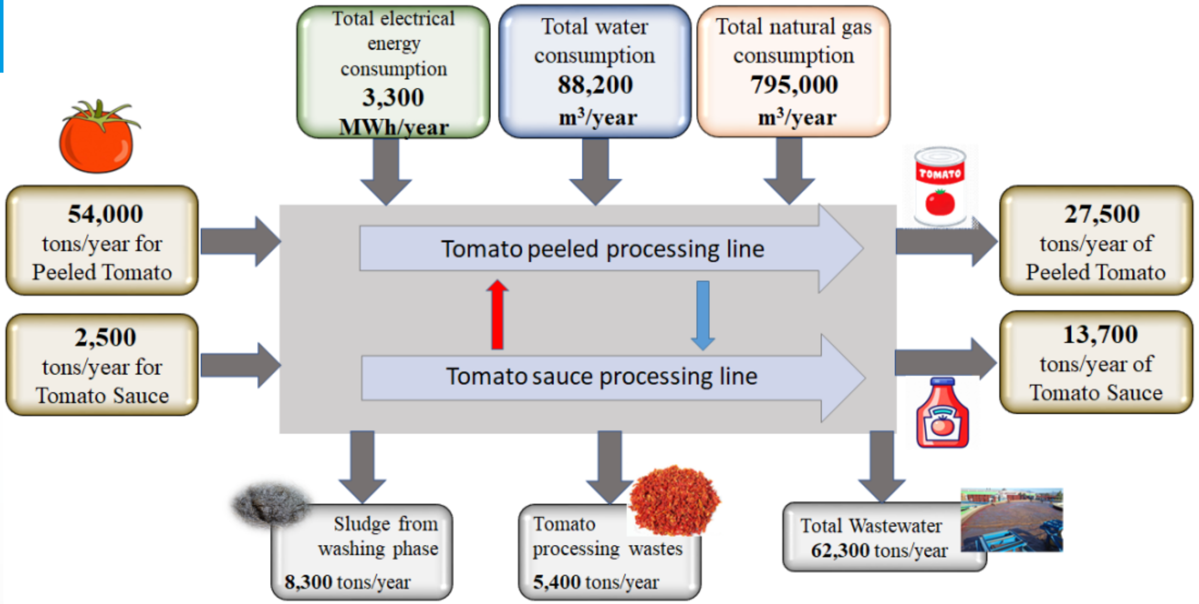
Fish Processing Demonstrator

Tomato Processing

Industrial Area Overview

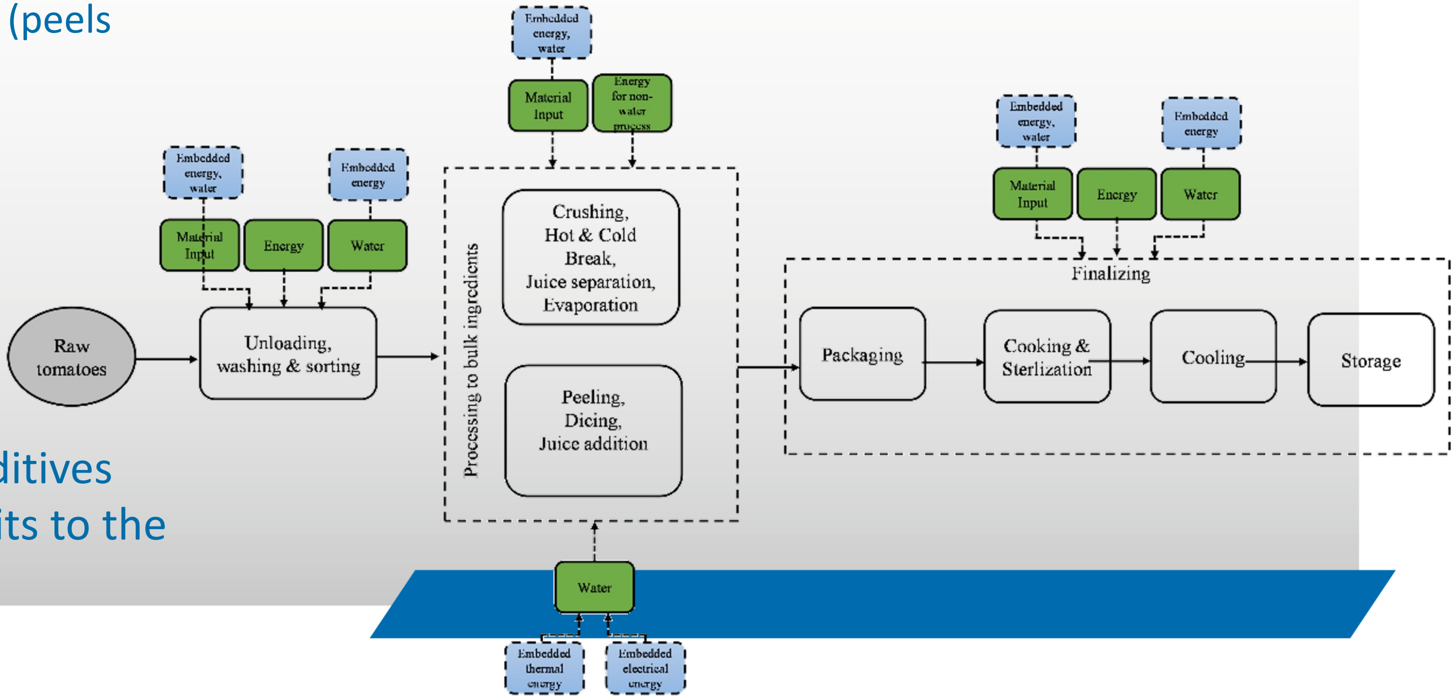
<u>Location:</u> Castel San Giorgio, Italy
<u>Sectors Involved:</u> Tomato processing industry
<u>Involved Partners:</u> PRODAL, CALISPA, ANICAV
<u>Main resources and by-products available:</u>

- Wastewater
- Tomato processing wastes such as tomato pomace (peels and seeds)



Demonstrator Targets

- Reduction of water and energy footprint
- Reduction of energy costs
- Water saving
- Reduction of tomato processing wastes
- Production of new food ingredients and additives that could bring additional economic benefits to the companies



Meat Processing Demonstrator

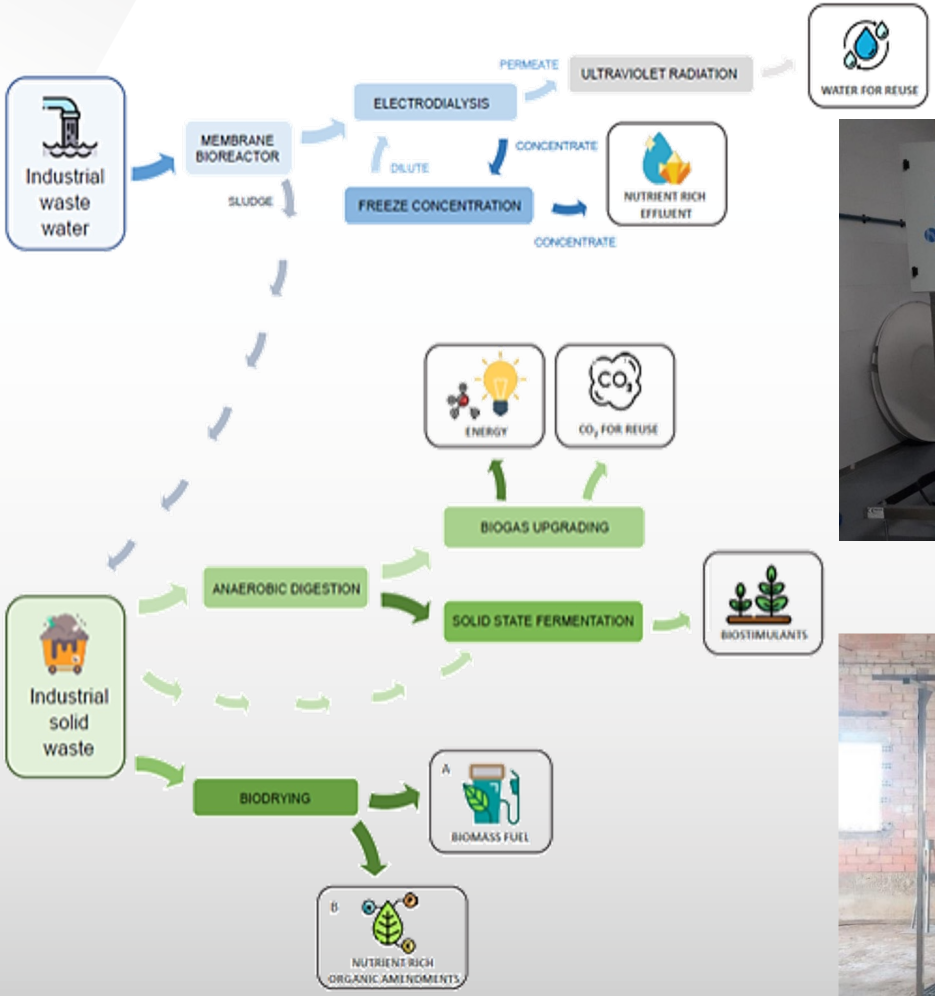
Industrial Area Overview

Location: Sant Joan de Vilatorrada, Spain
Sectors Involved: Meat processing industry
Involved Partners: BETA TC – MAFRICA
Main resources and by-products available:

- Wastewater
- Solid waste

Demonstrator Targets

- Reduction of water and energy footprint
- Water saving and reuse in MAFRICA's installations
- Reduction of meat processing wastes
- Production of products with a high agronomic value that could bring additional economic benefits to the companies
- Energy recovery



Fish Processing Demonstrator

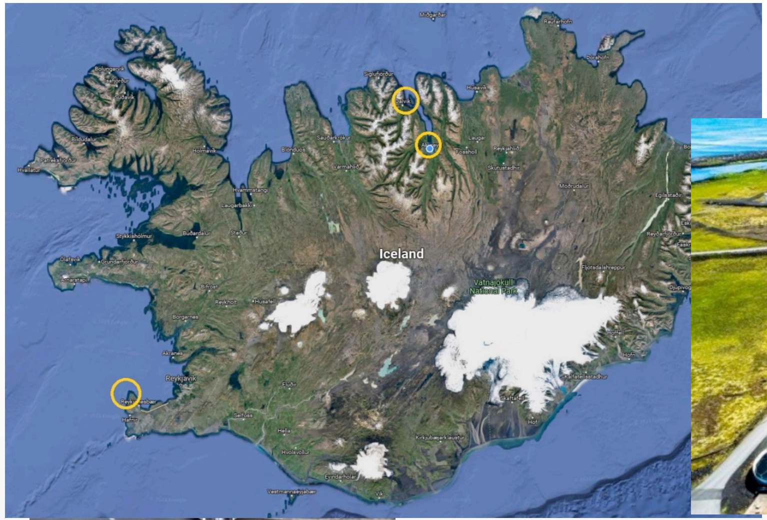
Industrial Area Overview

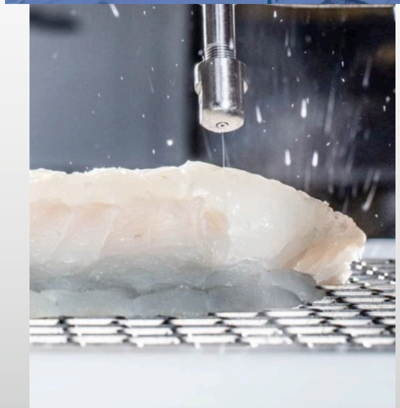
Location: Akureyri, Iceland
Sectors Involved: Fish processing industry
Involved Partners: MATIS, UoI, SAMHERJI
Main resources and by-products available:

- Side raw material and residual ingredients from processing water and recirculation systems

Demonstrator Targets

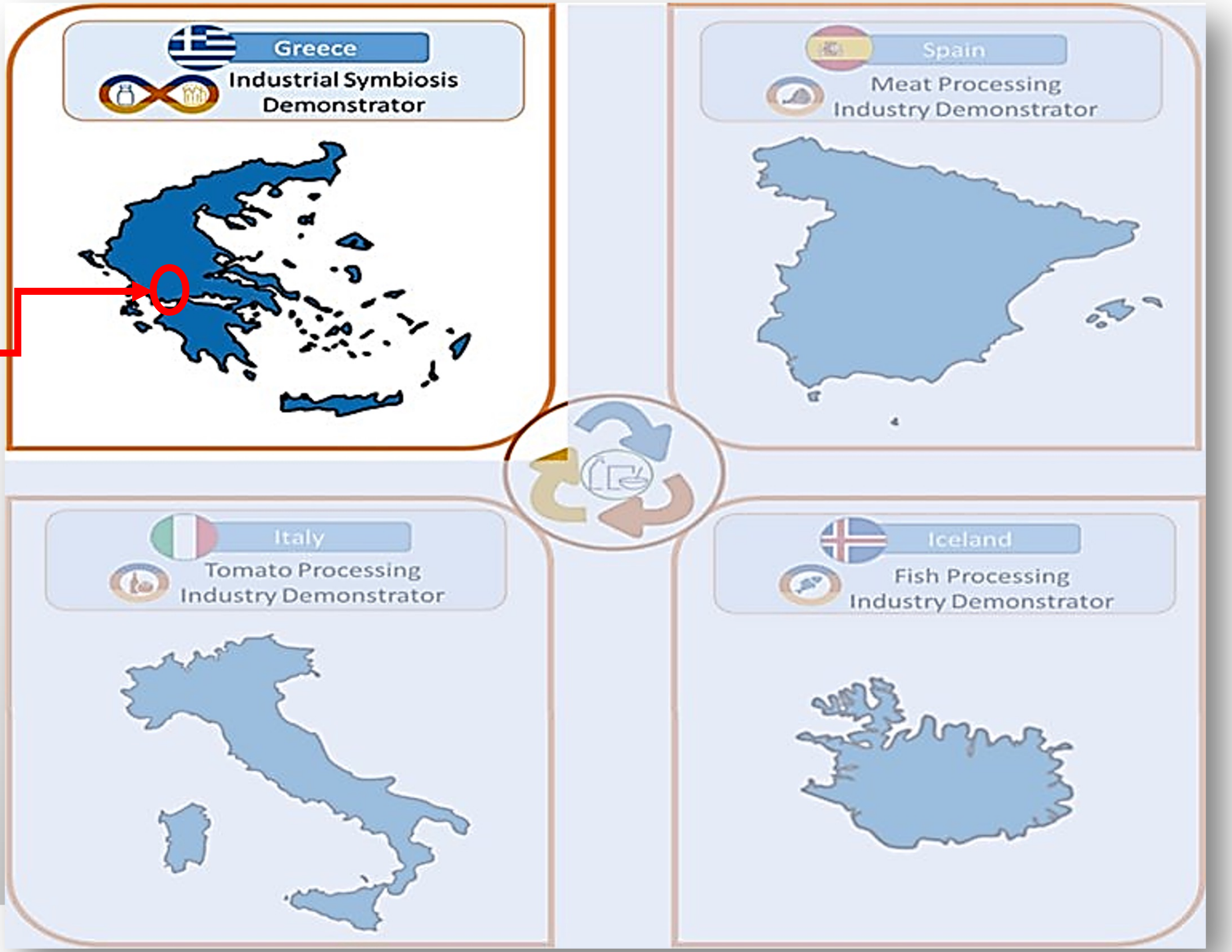
- Reduction of water and energy footprint
- Increase of reuse water and energy
- Reduction of fish processing wastes
- Production of products with a high value that could bring additional economic benefits to the companies





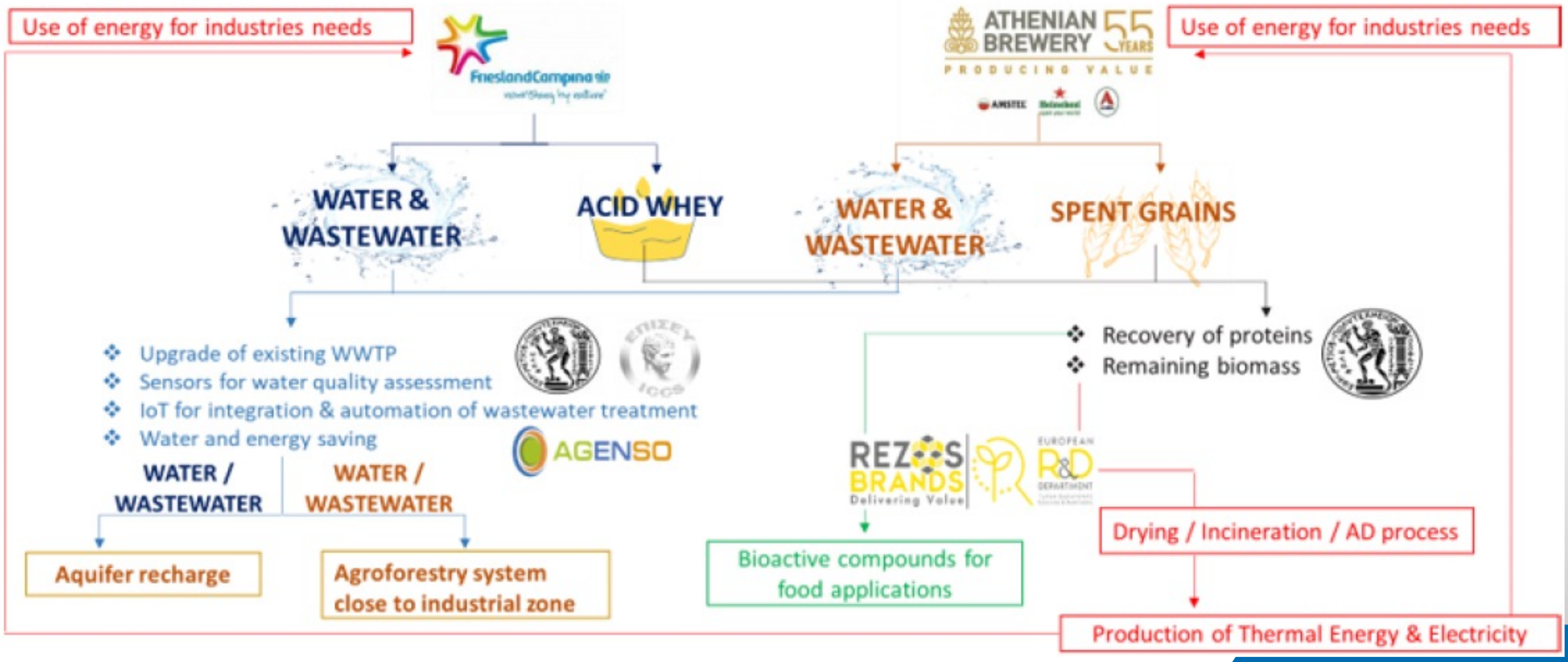
Industrial Symbiosis Demonstrator

Industrial area overview
Location: Industrial area of Patras, Greece **Sectors involved:** • Brewery • Dairy industry • Food processing industry



Industrial Symbiosis Demonstrator

✓ Initial scheme



✓ Main resources and by-products available

- Wastewater
- Acid whey from dairy industry
- Spent grains from brewery

Before Accelwater- Main WWTP

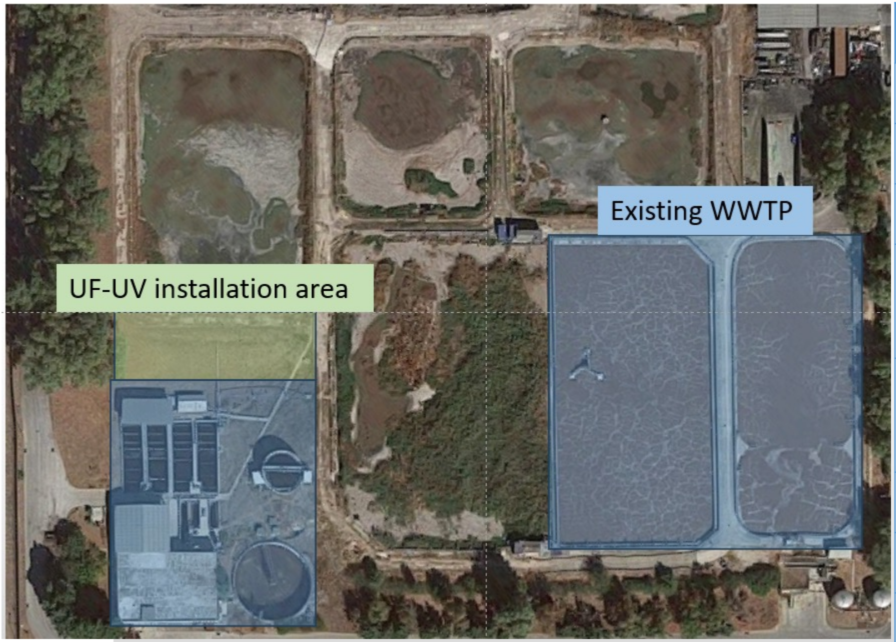
- average COD influent value is 5,000 mg/L, mean effluent value is 200-250 mg/L.
- 640,000 m3 /year of wastewater is discharged in the WWTP
- the effluent from the WWTP is discharged into the sewerage network of the Patra Industrial Area
- The fee for the disposal of wastewater into the Patra Industrial Area WWTP depends on the COD and BOD content
- water consumption ranges from 4 to 11 L of water, per L of beer produced.

Panoramic view of the Main Wastewater treatment plant

Aeration tank

Outlet tank

Pilot UF/UV system (1)

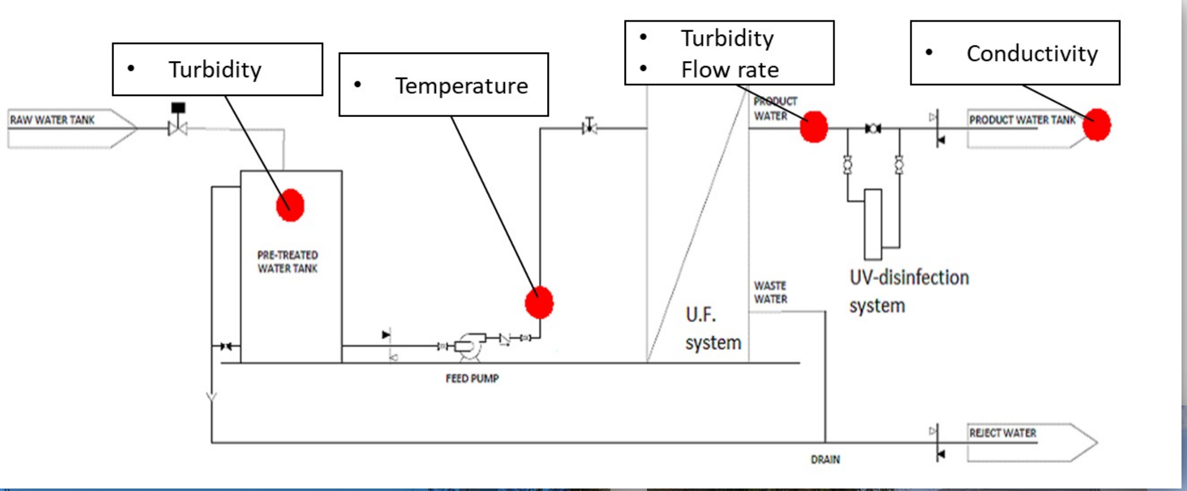


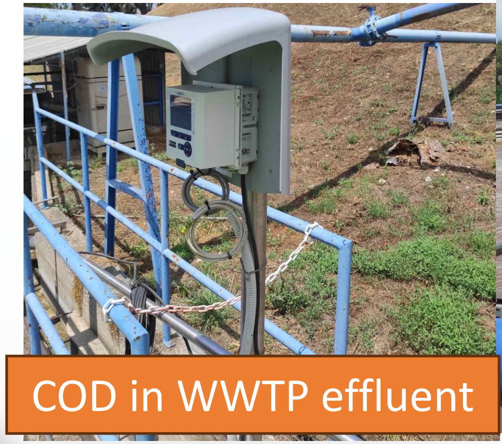
Top view of the AB's WWTP highlighted in blue and the installation area of the UF-UV system.

Parameter	Value
Container size	20 ft
Treatment capacity	5 m^3/h
System recovery	95.7%
Operation and Control	Fully automated through PLC
Membrane specifications	PVDF 0.04 microns
Membrane code	UF-1015ET
Membrane type	Outside-In
Average net flux	31 $L/m^2/h$
Membrane Cleaning	Air and Chemical

Pilot UF/UV system (2)

➢ Extra sensors for AB' main WWTP monitoring





COD in WWTP effluent

COD in aeration tank

constructing a concrete slab

System delivered

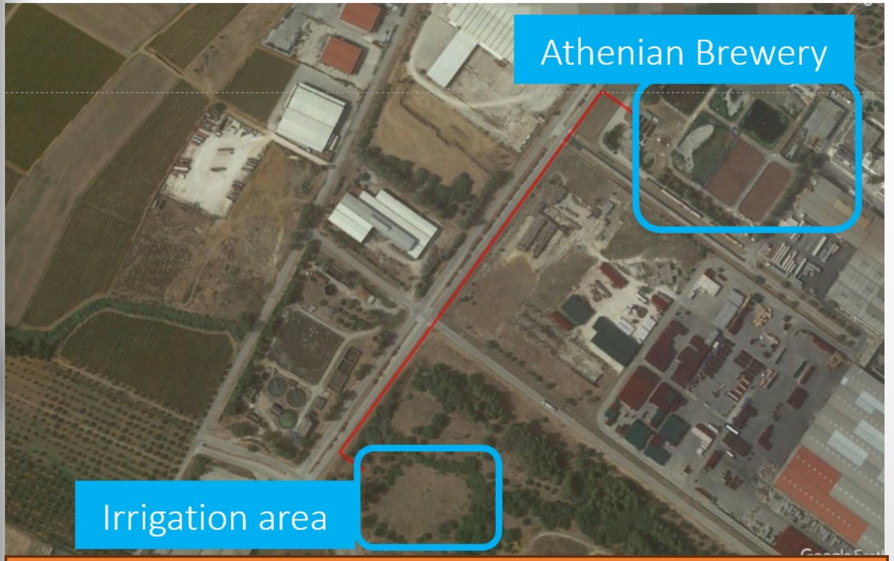
PLC of the system

System membranes

ΑΘΗΝΑΪΚΗ ΖΥΘΟΠΟΙΙΑ

Pilot UF/UV system (3)

Irrigation area: 5,002.46 m^2



Construction of the irrigation pipeline

Results from soil sample analysis

- ✓ 3m^3/d of reclaimed water will be used for irrigation purposes

Pilot UF/UV system (4)

Excavation of an irrigation conduit within the premises of the Athenian Brewery facility.

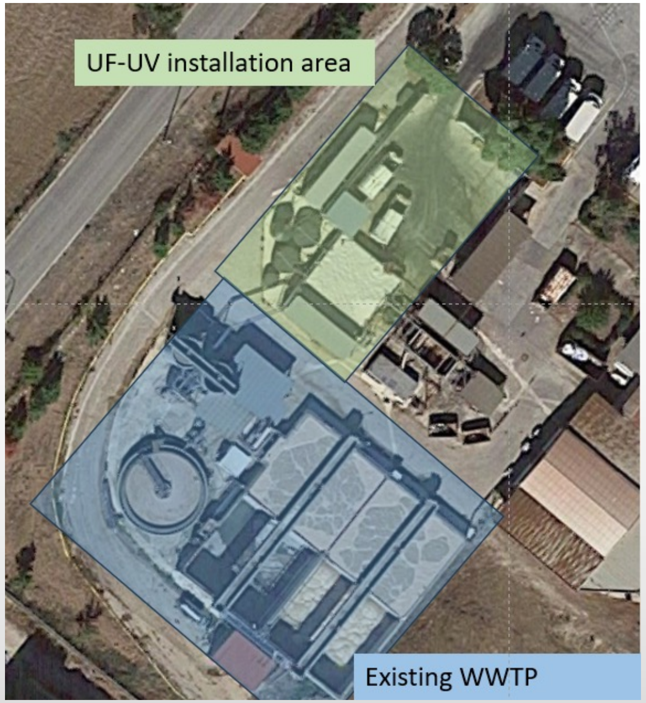
Reclaimed water in the irrigation zone

- ✓ The construction of the irrigation pipeline has been completed
- ✓ Soil samples were taken from four different points in the irrigation area

Before Accelwater- Main WWTP

- ✓ average inflow is 20-25 m3/h
- ✓ 1 - 2 m^3 of wastewater is produced for each ton of milk
- ✓ COD influent value is approximately 2,500-3,000 mg/L
- ✓ output ranged between 40 and 100 mg/L.
- ✓ The industry produces about 2,500 L /d of effluent water which could be reused for for cooling purposes by utilizing about 6-7% of the secondary treated wastewater.
- ✓ the effluent from the WWTP is discharged into the sewerage network of the Patra Industrial Area
- ✓ The fee for the disposal of wastewater into the Patra Industrial Area WWTP depends on the COD and BOD content

Pilot UF/UV system (1)



Top view of FCH WWTP and installation area

Side view of the installation area

- RO Unit (red)
- UF-UV system space (green)
- Treated effluent tank (orange)

Pilot UF/UV system (2)

UF-UV Online Monitoring

- ✓ Fully automated operation and control through PLC monitor
- ✓ Online sensors : turbidity (inlet), conductivity (outlet), temperature (inlet)

PLC monitor


Membrane modules

Characteristics of UF-UV system

Parameter	Value
Container size	20 ft
Treatment capacity	5 m^3/h
System recovery	95.7%
Operation and Control	Fully automated through PLC
Membrane specifications	PVDF 0.04 microns
Membrane code	UF-1015ET
Membrane type	Outside-In
Average net flux	31 $L/m^2/h$
Membrane Cleaning	Air and Chemical

Pilot UF/UV system (3)

GA amendment

✗ aquifer recharge has been prohibited

✓ on-site applications (e.g. cooling purposes, washing purposes etc.)

FCH – Cooling towers

- ✓ Capacity increased from 20 to 40 m^3/d
- ✓ The UF-UV system was connected to the RO unit
- ✓ The reclaimed water can cover over 75% of annual water demand in the Cooling towers

AccelWater

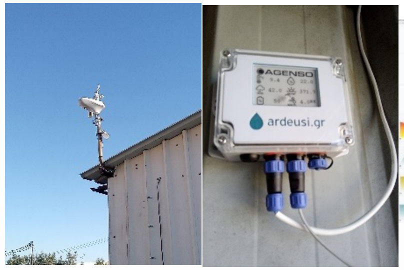
REZOS BRANDS
Delivering Value

Rainwater harvesting and use

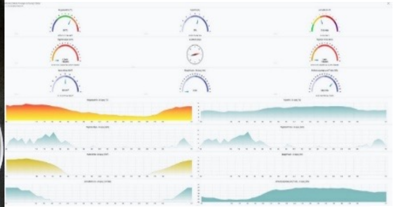
- *Installation of a weather station (provided by AGENSO)*

✓ Weather station information is accessible on the **Temperature.gr** website.

Data included are temperature, humidity, wind speed/direction, rainfall.



Weather station



Data illustration

- *Rainwater harvesting system*

✓ The system currently collects rainwater from the roofs of the Rezos premises (4000m2)into the storage tank.

✓ The harvested water is currently being used for:

a) Watering trees in the adjacent area of Rezos.
b) Washing trucks, machines, tools and bins.

✓ Rezos has installed an additional piping that connects the tank to the factory's fire safety system.

Fire sprinkler water supply line.

storage capacity 50 m^3

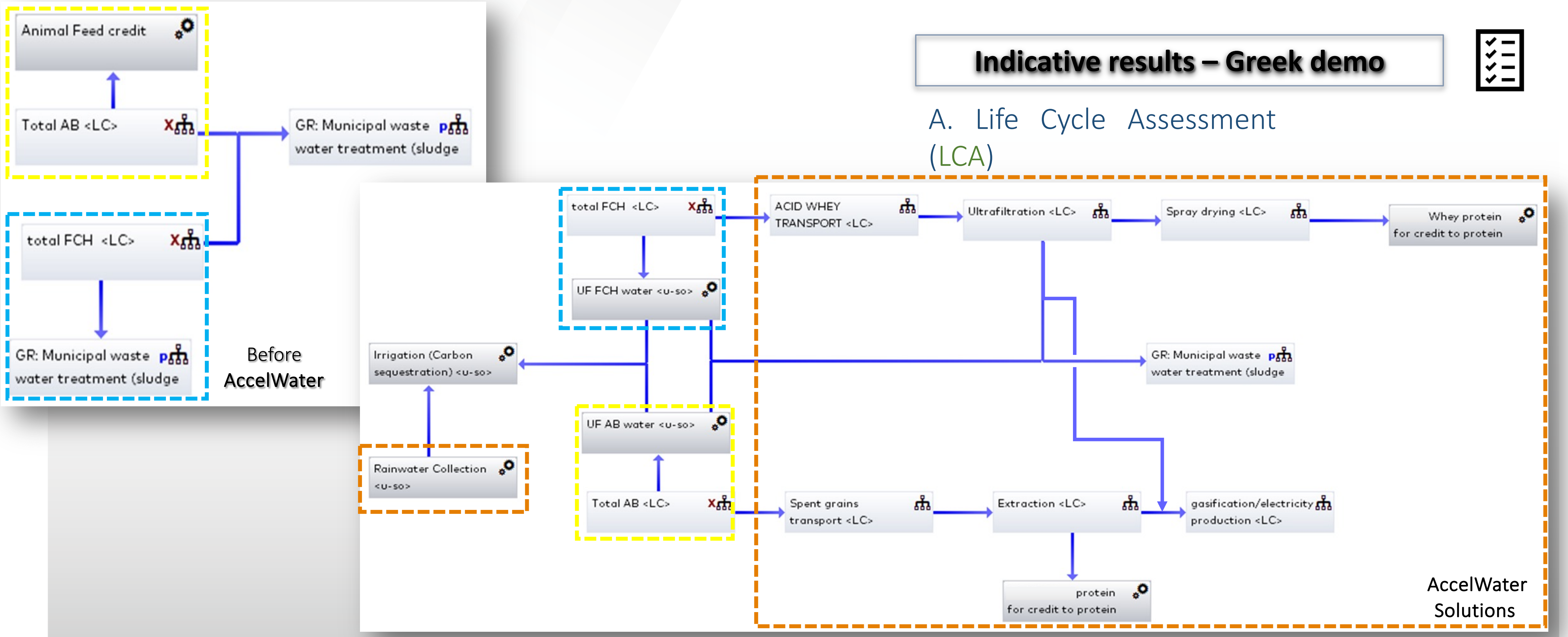
Storage tank

Evaluation of the AccelWater demonstration Systems and Services

Environmental, Economic and Nexus assessment methodology – (Task 8.1, 8.3)

Indicative results – Greek demo

A. Life Cycle Assessment (LCA)



Life Cycle Assessment of the Greek Use Case

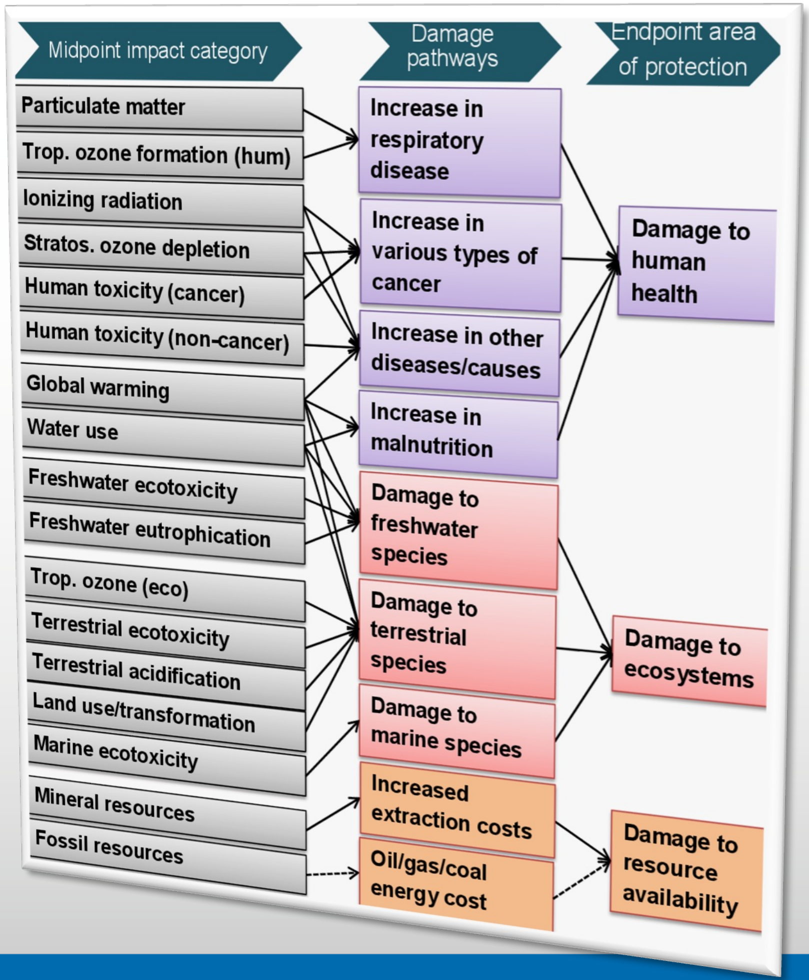
…& Scope

Assumptions:

For the new systems: Data (processes and material credit system were **calculated** through literature's models
(For the existing systems: Data have been collected)

Environmental impact assessment methodology:

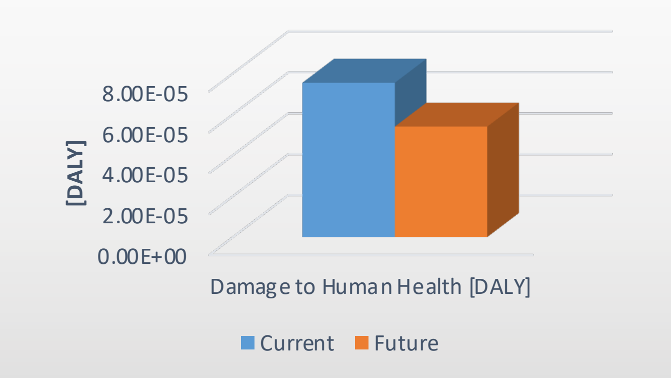
ReCiPe 2016 (Hierarchist) with 18 midpoints, 3 endpoints

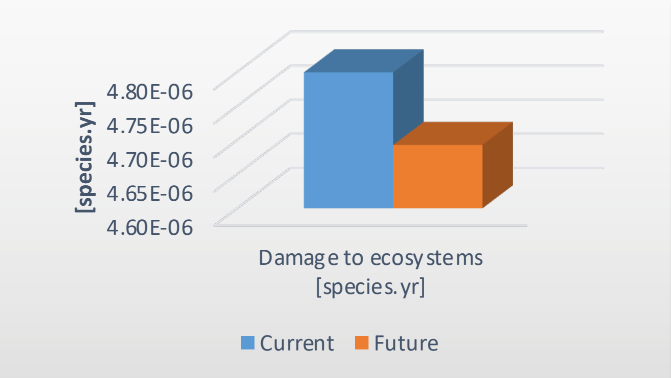


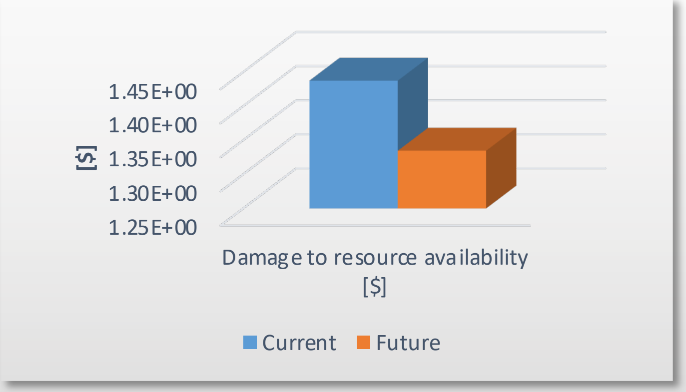
Life Cycle Assessment of the Greek Use Case

Life Cycle Impact Assessment (LCIA)

Environmental Impact Categories (Endpoint)	Current	Future	Change Rate (%)
Damage to Human Health [DALY]	7,54E-05	5,40E-05	-28,40%
Damage to ecosystems [species.yr]	4,80E-06	4,69E-06	-2,22%
Damage to resource availability [$]	1,44E+00	1,33E+00	-7,15%







Environmental, Economic and Nexus assessment methodology – (Task 8.1, 8.3)

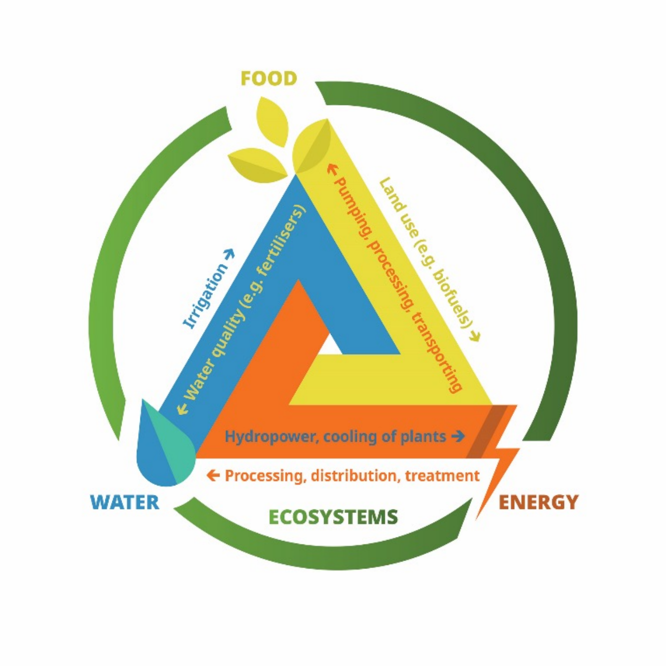
Water-Waste-Energy Nexus approach (WWEN)

WWEN examine the interconnection and potential synergy between wastewater treatment processes and energy generation/conservation, water saving and nutrient recovery.

The **methodology** employs a "systems-thinking" approach, recognizing that water, energy, and material systems are interconnected and influence each other.

Data Collection and Analysis: It involves gathering relevant data on water resources, energy generation and consumption, material recovery. Advanced analytical tools and modeling techniques are often employed to analyze the data and assess the nexus interactions.

- Boundaries definition
- Process identification
- Process modelling
- Mass and Energy balance analysis
- System(s) modelling



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Environmental, Economic and Nexus assessment methodology – (Task 8.1, 8.3)

Water-Waste-Energy nexus approach (WWEN)

Nexus Approach

Category	Resource (i)	Equation
Basic Indicators	Water Loop	$n_{water} = \frac{w_i - w_{save}}{w_i}$
	Circular Energy	$n_{energy} = \frac{e_i - e_{save}}{e_i}$
	Waste, Nutrients and Valuable Material	$n_{waste} = \frac{c_{ww/oav} + c_{ww/av} + c_{processing} - c_{av} - c_w}{c_{ww/oav} + c_{ww/av}}$
Economic	Damage to Resource Availability	$n_{resource} = \frac{DRA_i}{DRA_1}$
Social	Damage to Human Health	$n_{health} = \frac{DHH_i}{DHH_1}$
Environmental	Climate Change (CO_2 Emissions)	$n_{climate\ change} = \frac{GHG_i}{GHG_1}$
	Damage to Ecosystems	$n_{ecosystems} = \frac{DE_i}{DE_1}$

Nexus Strenght Indicator:

$$NS_j = p_i d_{ij}$$

i: resource

p_i: weighting factor

j: industrial system (current, future)

$$d_{ij} = \frac{q_i}{max_j(q_i)}$$

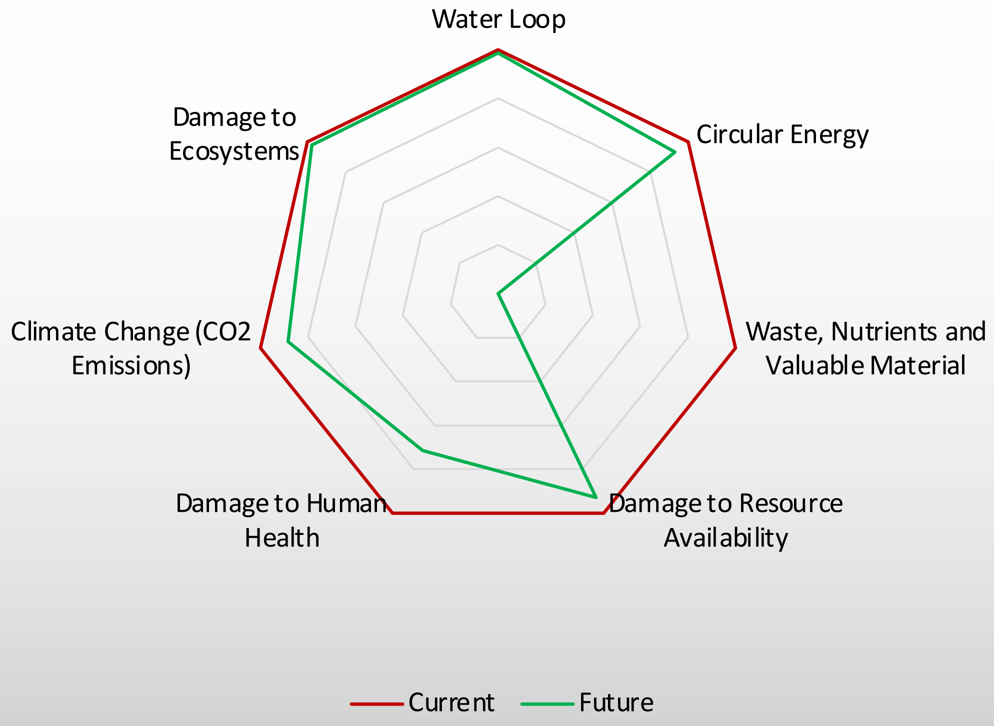
q_i: quantity of resource i in j case study

Environmental, Economic and Nexus assessment methodology – (Task 8.1, 8.3)

Water-Waste-Energy nexus approach (WWEN)

Results of Greek Demonstrator

Nexus Indicators



Would you help us to measure the impact of AccelWater project?
It'll only take 5 minutes

AccelWater

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Thank you for your attention

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