EU Green Week

PARTNER EVENT

Circular water vision within the context of new EU directives

On-line webinar

25 June 2024

#WaterWiseEU

IWA the International water association RESOURCE RECOVERY FROM WATER CLUSTER

Water Europe Technology & Innovation

UNIVERSITÀ POLITECNICA DELLE MARCHE

EU Green Week

PARTNER EVENT

Water-smart Urban Industrial Symbiosis: 15 years of successful implementation in Aretusa and the horizon2020 ULTIMATE innovations

- Chiara Cusenza, Camillo Palermo (Consorzio Aretusa)
- Joep van den Broeke, Gerard van den Berg (KWR Water Research Insitute)

Indice

1. **Intro to the Ultimate project**

2. **WATER-SMART URBAN INDUSTRIAL SYMBIOSIS – Consorzio Aretusa and Case Study 3 (Italy)**

3. **Governance of a industrial symbiosis for wastewater reuse**

ULTIMATE indUstry water-utiLiTy symblosis for a sMarter wATer society

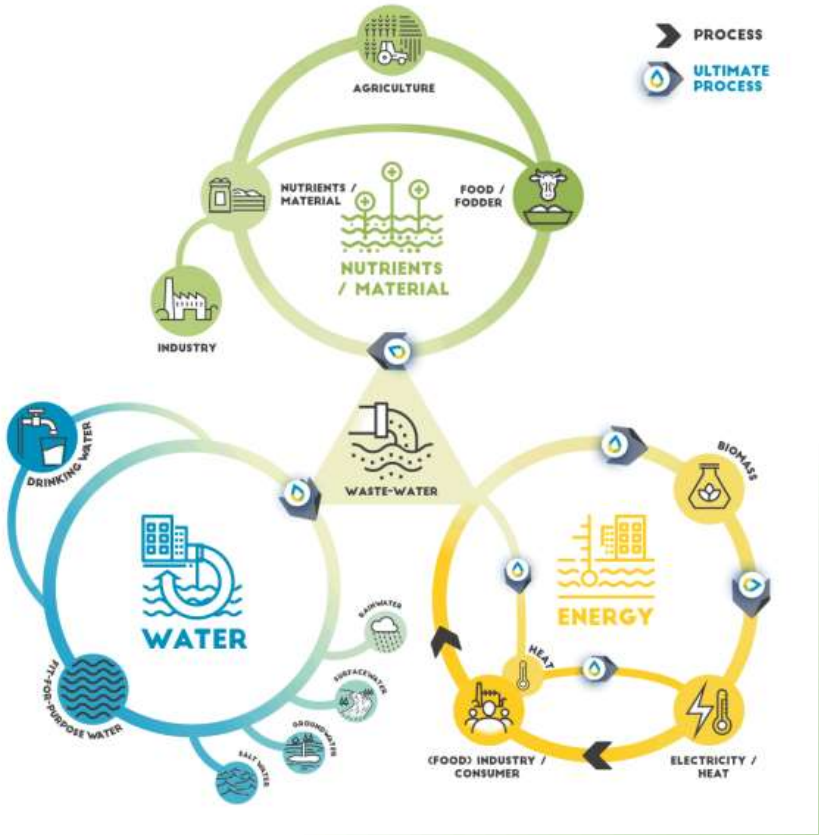
Funding program and call identifier: *H2020_CE-SC5-04-2019 Building a water-smart economy and society*
Project period: May 2020 - October 2024
Website: www.ultimatewater.eu

Introducing ULTIMATE indUstry water-utiLiTy symblosis for a sMarter wATer society

Develop, optimize, and demonstrate ***Water-Smart Industrial Symbiosis*** technologies and solutions for:

- **Water reclamation and reuse** (recovery, refining, and reuse of municipal and industrial wastewater)
- **Exploitation of energy and heat** (extraction of energy, combined water-energy management, water enabled heat transfer, storage and recovery of heat)
- **Nutrient and material recovery/reuse** (nutrient mining, extraction/reuse of high-added value exploitable compounds)

- Technological innovations are made available and shared through the **Water Europe MarketPlace**

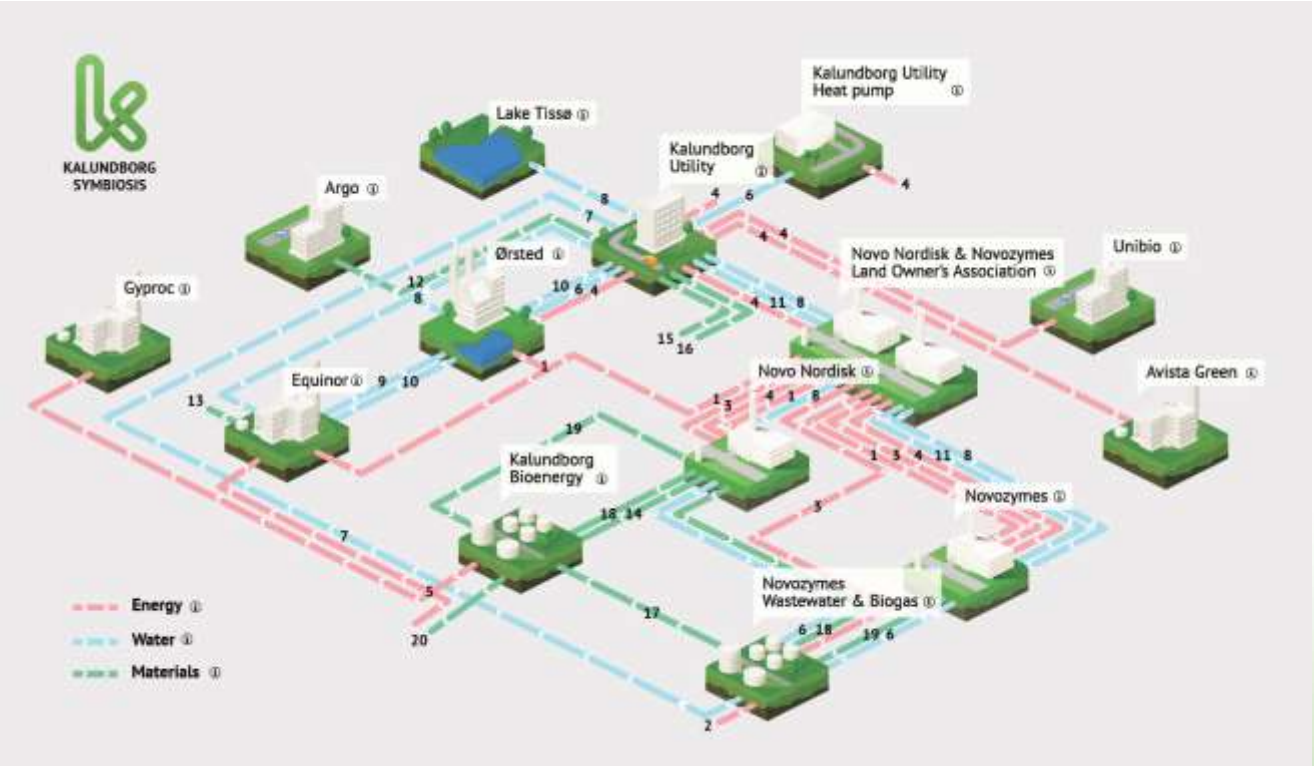


Industrial symbiosis

First industrial symbiosis plant worldwide in Kalundborg (since 1972).

The cooperation between the companies in the symbiosis provides mutual benefits, economical as well as environmental.

The main principle is that a residue from one company becomes a resource in another.



From: http://www.symbiosis.dk/

Water Smart Industrial Symbiosis (WSIS) aims to create economic value and increased sustainability by introducing circular symbiotic arrangements between industry and water service provider.

We leverage <u>much</u> more than “just” technologies to achieve these objectives!

DEMONSTRATING WIN-WIN SYMBIOTIC OPPORTUNITIES ...

... FOR WATER-SMART INDUSTRIAL SYMBIOSIS (WSIS)

ENABLING TECHNOLOGIES

Demonstrating novel (TRL 5-7) technologies at meaningful scales achieving quantifiable impacts (economic, environmental, social)

SYMBIOTIC PARADIGMS

Showcasing 9 WSIS ‘modes’ between water providers (municipal or industry owned utilities, service-providing SMEs) and key industries

SMART TOOLS

Leveraging the power of Ontologies, Hybrid Modelling and Simulation, Gamified Visualisation and immersive Mixed Reality Storytelling

WATER-ENERGY-MATERIALS

Demonstrating circular solutions for water as both resource and vector of energy and materials with millions invested and decades of experience

INNOVATOR ECOSYSTEM

Open Innovation and co-creation with industry and the public meets start-ups and established players in B2B, B2G, B2C CoPs and Living Labs

WSIS MARKET BUILDING

WSIS matchmaking supported by start-ups, ontologies and financial engineering linking investments to KPIs for business innovation

GLOBAL OUTREACH

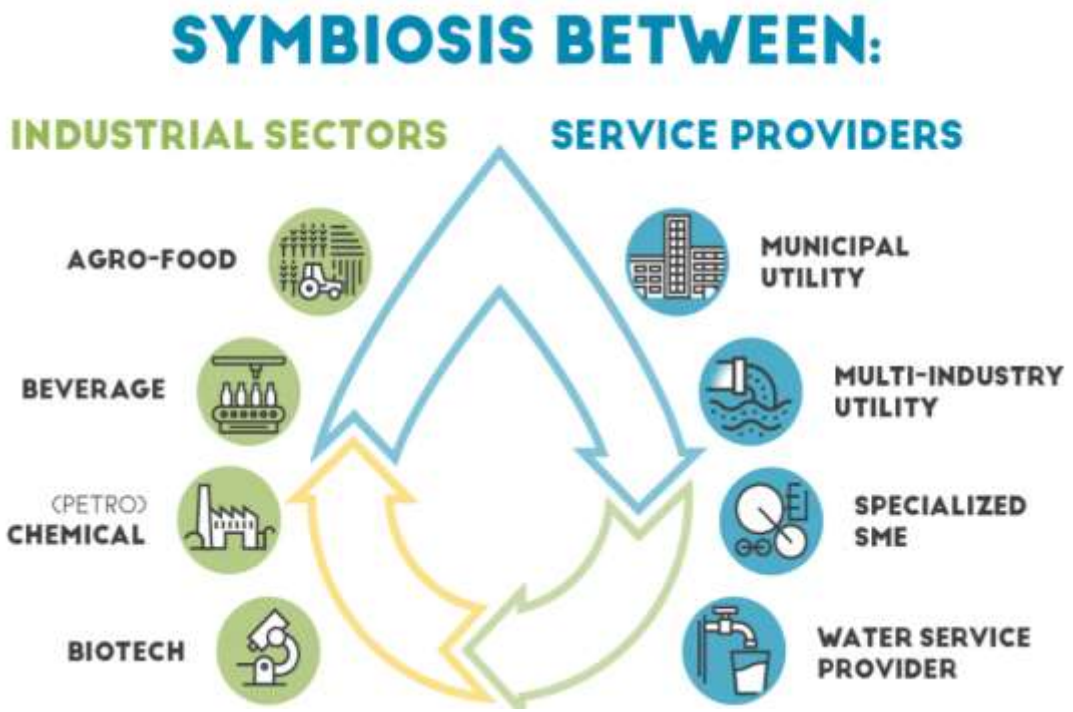
Engaging EU and global networks of industries, water companies, SMEs, business innovators and media to disseminate, influence, broker, transfer

STRONG PARTNERSHIP

A team of 8 technology & service providers (of which 6 SMEs), 8 utilities (incl. 2 multinationals), 4 industries, 9 Research Centres and Water Europe

The core of ULTIMATE – integrated case studies

Concepts are developed for and validated in 9 case studies across Europe



Stakeholder Engagement

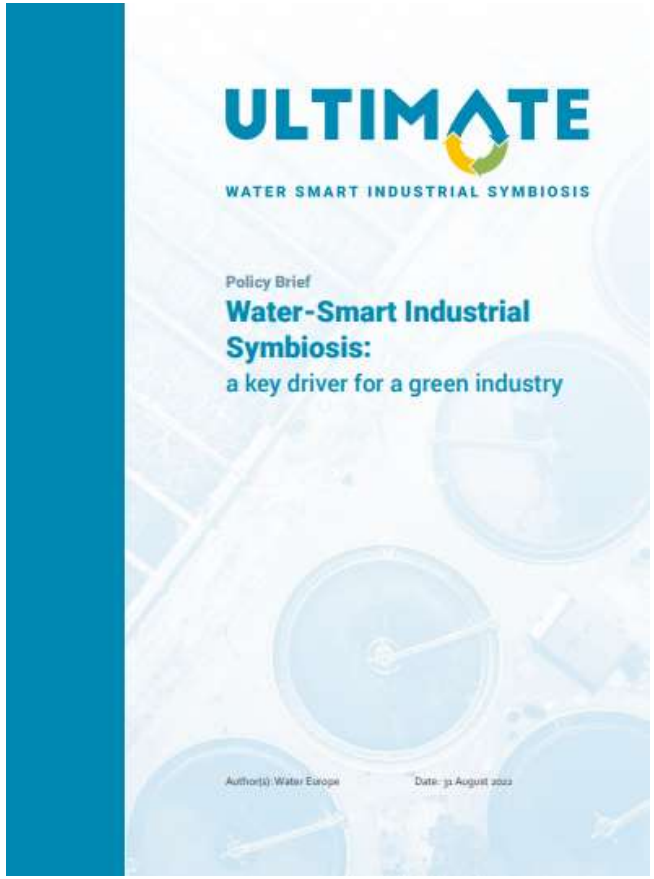
Promote active stakeholder engagement, innovation, co-creation and public awareness **to accelerate socio-economic and business transformation** towards a WSIS

Novel approaches include a.o.:

- Communities of Practice (COPs)\
- Co-creation
- Living labs
- Multi-use playspaces

[ULTIMATE stakeholder approaches]

Policy support for



Main Recommendations

- Adopt a risk-based approach for reused water and recovered materials in Europe.
- Encourage financial incentive for circular economy systems.
- Consider the opportunities of digital tools within the revision of the directive to support water-smart industrial symbiosis.
- Familiarise citizens with circular economy systems.
- Companies may provide a more transparent overview also of their non-circular activities.

Ultimate solutions involve circular economy technologies

- Membrane technologies
- Adsorption technologies
- Electrostimulated systems

- Biogas technologies
- Heat recovery
- Digitalization

- 22 pilot plants
- 3 control and/or early warning systems
- 6 concept studies

WATER-SMART URBAN INDUSTRIAL SYMBIOSIS

Consorzio Aretusa and Case Study 3 (Italy)

AZIENDA SERVIZI AMBIENTALI SPA

Water Utility

SOLVAY

Chemical Industry

Termomeccanica Ecologia

Termomeccanica Group

Technology Provider

Since 2001

ARETUSA WATER RECYCLING

From **ARETUSA** WRP to **Solvay** Industry

3.8 M m3/y

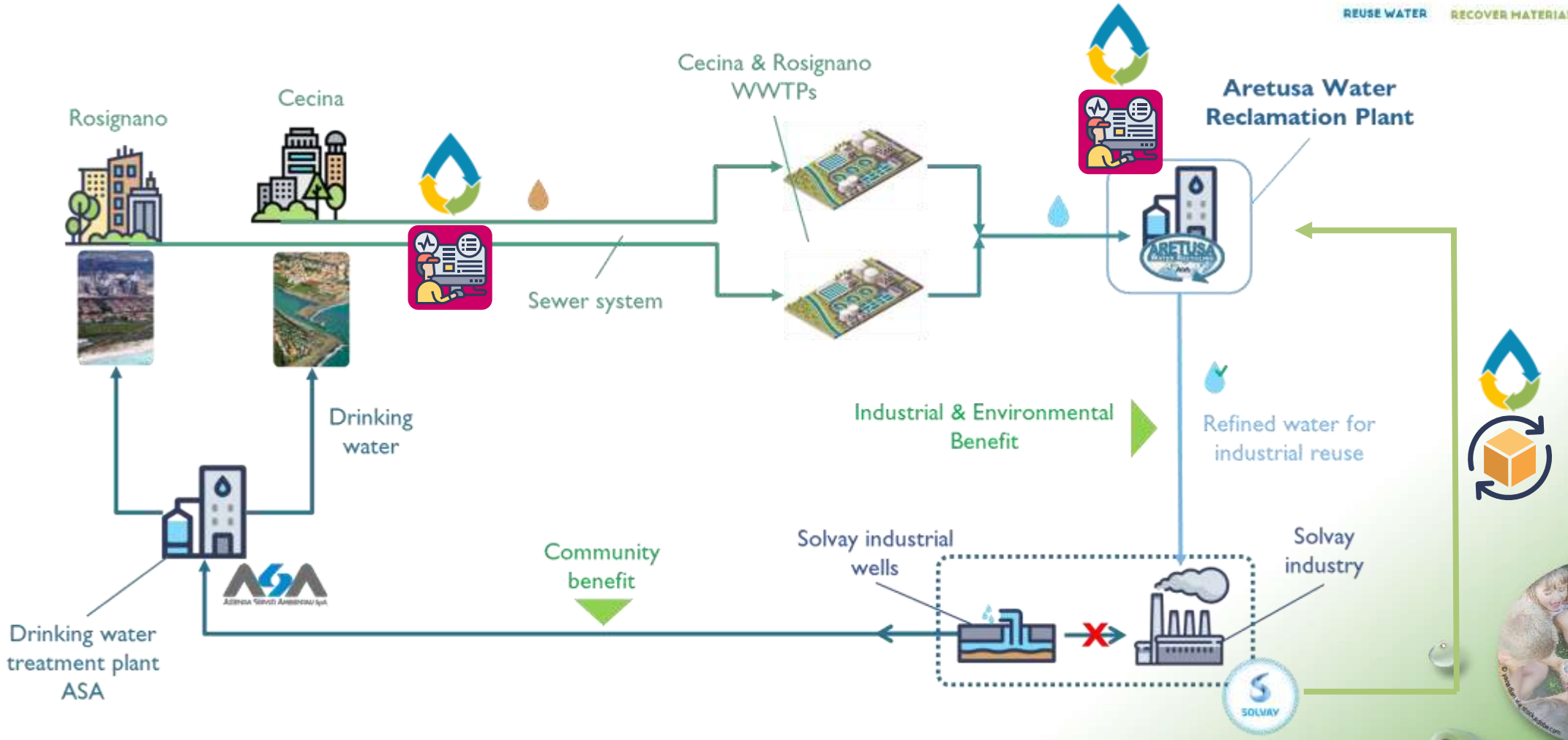
ARETUSA is a successful example of already established water-smart industrial symbiosis, optimized with ULTIMATE project

Case Study 3 - Rosignano (Italy)

Wastewater industrial reuse

ULTIMATE Innovations

REUSE WATER RECOVER MATERIALS

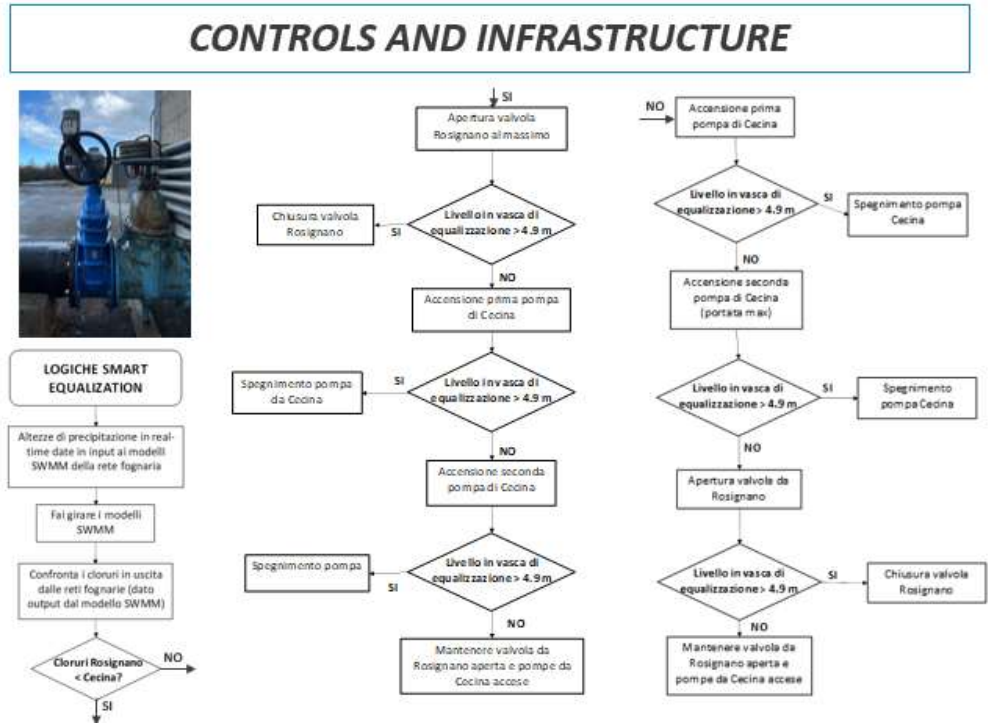


Case Study 3 - Rosignano (Italy): Ultimate Innovations

Early warning system and smart equalization

Objectives:

1. Energy- and carbon - efficient prevention of chlorides peaks and other critical parameters in the WWRP influent;
2. Optimization of wastewater reuse;



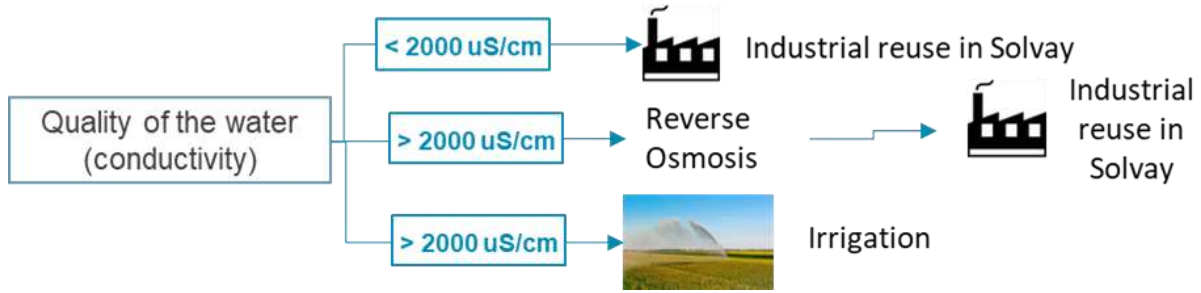
Ultimate innovations:

- Real-time driven data process control for salinity management in order to get an **Early Warning System and a Smart equalization system.**

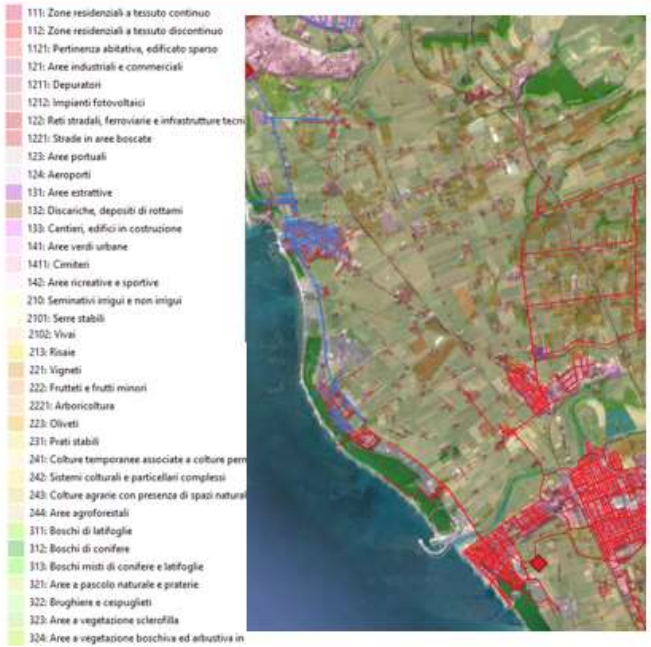
Case Study 3 - Rosignano (Italy): Ultimate Innovations

Matchmaking platform

Depending on the water quality (conductivity), water will be used for industrial reuse rather than for irrigation propouses



REGIONAL REUSE OPTIONS

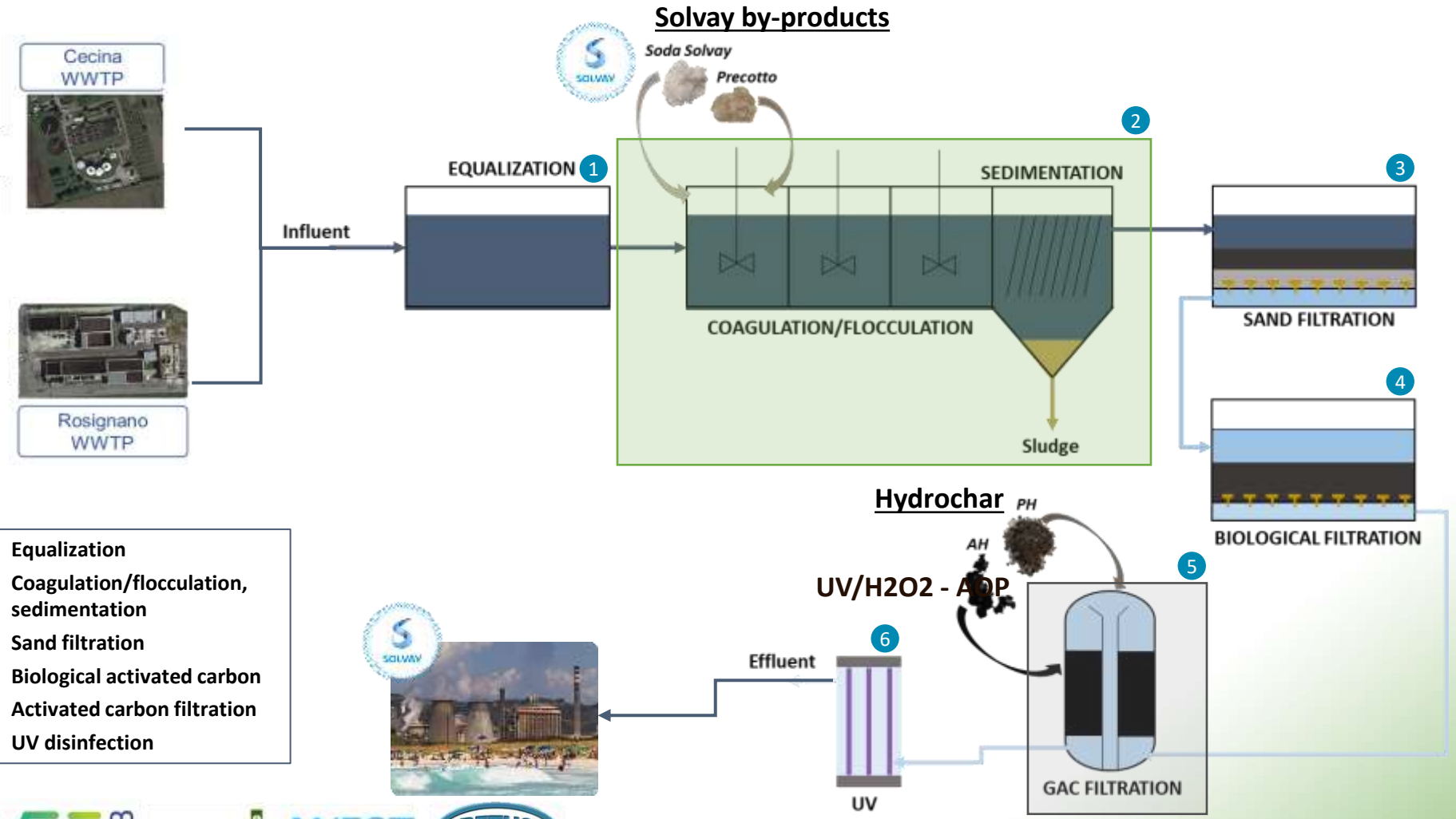


Salinity tolerance of crops	
Crop	**Value (µS/cm)**
Bean; Carrot; Strawberry	1000
Onion	1200
Lettuce	1300
Vine; Almond; Plum; Pepper	1500
Apricot; Broad bean	1600
Peach; Orange; Lemon; Apple tree; Potato	1700
Grapefruit	1800
Watermelon; Spinach	2000
Melon	2200
Broccoli	2300
Tomato; Cucumber	2500
Olive tree	2700

Other parameters of Aretusa water quality		
Parameter	Unit measure	Value
pH	-	7 - 8
COD	mgO2/l	<10
N-NH4	mgNH3/l	<15
Ptot	Mg/l	<1
Metals	Mg/l	<3
E.Coli	UFC/100ml	<10

Case Study 3 - Rosignano (Italy): Ultimate Innovations

By products reuse in advanced treatment processes for water reuse in industries



1. Equalization
2. Coagulation/flocculation, sedimentation
3. Sand filtration
4. Biological activated carbon
5. Activated carbon filtration
6. UV disinfection

Case Study 3 - Rosignano (Italy): Ultimate Innovations

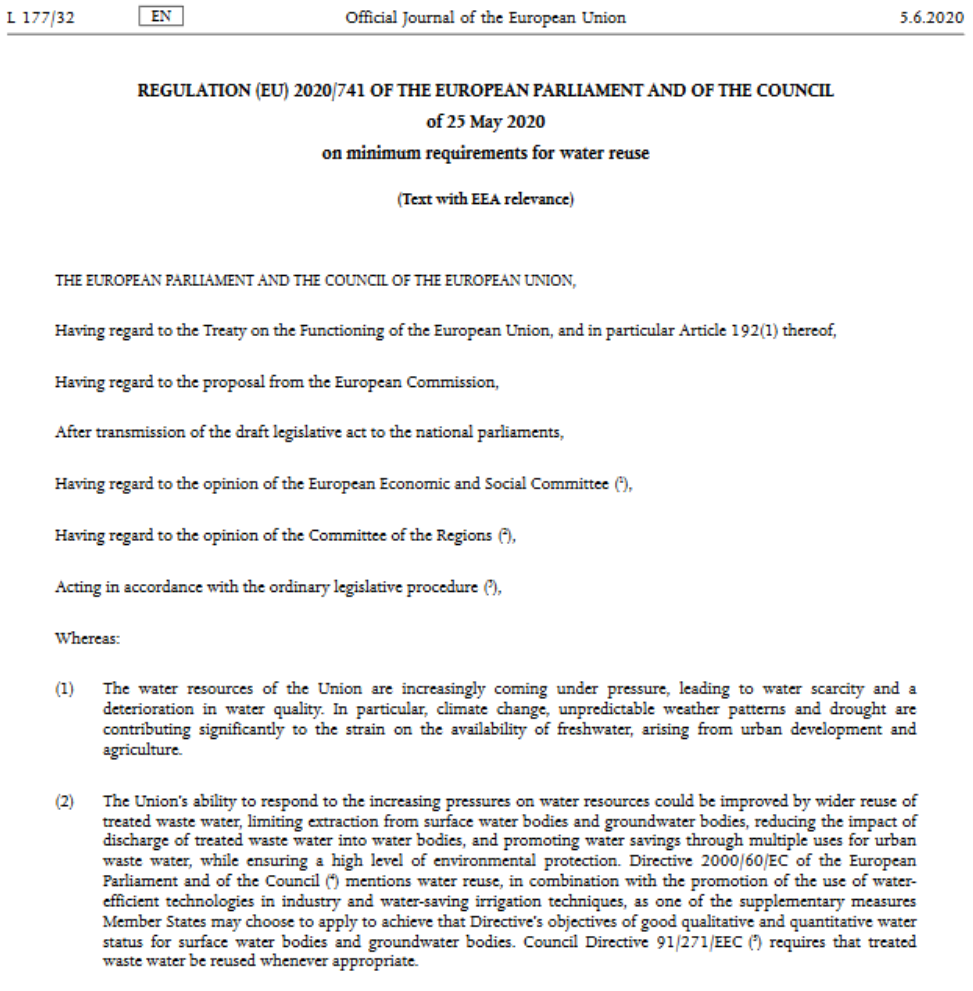
By products reuse in advanced treatment processes for water reuse in industries

New pilotes plants to test:

- Hydrochar for **Adsorbption process**;
- By-products for **softening process** (Soda Solvay and Precotto);
- **UV/H2O2 process** – upgrade of treatment process;
- **Reverse osmosis** to reduce chloride concentration in Aretusa effluent.

Regulation (EU) 2020/741 of the European Parliament and of The Council on minimum requirements for water reuse

"**Cooperation and interaction** between the various parties involved in the **water reclamation process** should be a precondition for setting up reclamation treatment procedures in accordance with the requirements for specific uses, and in order to be able to plan the supply of reclaimed water in line with demand from end-users."



L 177/32 EN Official Journal of the European Union 5.6.2020

REGULATION (EU) 2020/741 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL
of 25 May 2020
on minimum requirements for water reuse

(Text with EEA relevance)

THE EUROPEAN PARLIAMENT AND THE COUNCIL OF THE EUROPEAN UNION,

Having regard to the Treaty on the Functioning of the European Union, and in particular Article 192(1) thereof,

Having regard to the proposal from the European Commission,

After transmission of the draft legislative act to the national parliaments,

Having regard to the opinion of the European Economic and Social Committee [1],

Having regard to the opinion of the Committee of the Regions [2],

Acting in accordance with the ordinary legislative procedure [3],

Whereas:

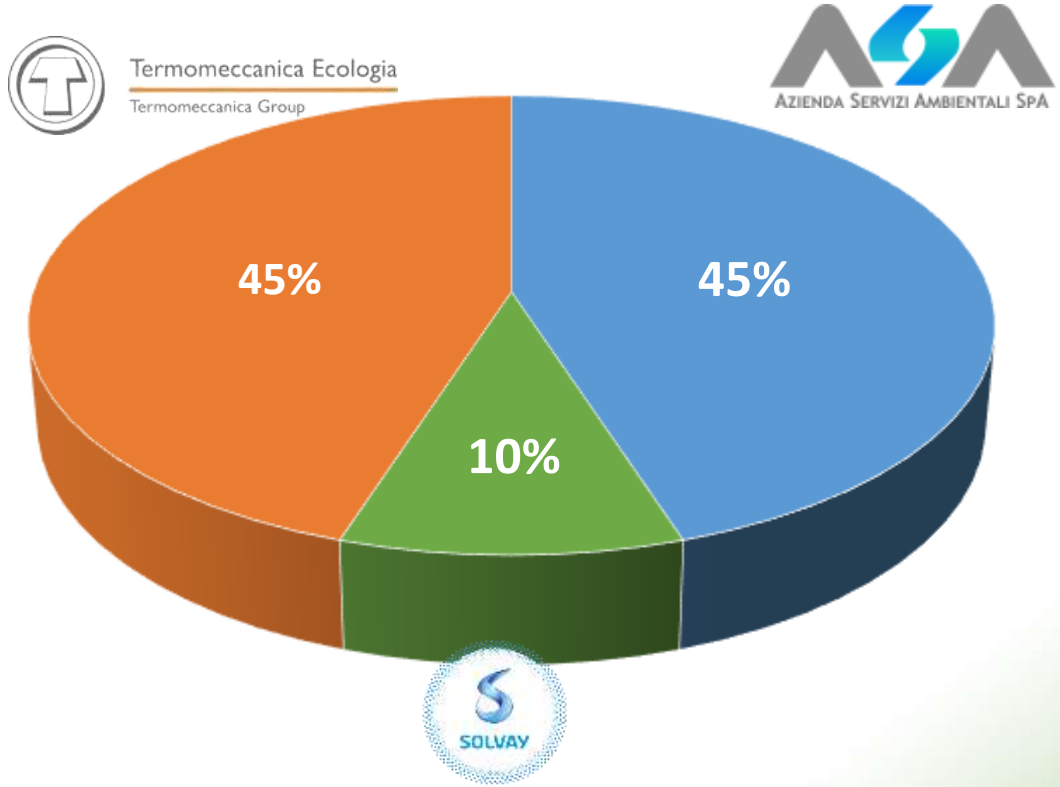
(1) The water resources of the Union are increasingly coming under pressure, leading to water scarcity and a deterioration in water quality. In particular, climate change, unpredictable weather patterns and drought are contributing significantly to the strain on the availability of freshwater, arising from urban development and agriculture.

(2) The Union's ability to respond to the increasing pressures on water resources could be improved by wider reuse of treated waste water, limiting extraction from surface water bodies and groundwater bodies, reducing the impact of discharge of treated waste water into water bodies, and promoting water savings through multiple uses for urban waste water, while ensuring a high level of environmental protection. Directive 2000/60/EC of the European Parliament and of the Council [4] mentions water reuse, in combination with the promotion of the use of water-efficient technologies in industry and water-saving irrigation techniques, as one of the supplementary measures Member States may choose to apply to achieve that Directive's objectives of good qualitative and quantitative water status for surface water bodies and groundwater bodies. Council Directive 91/271/EEC [5] requires that treated waste water be reused whenever appropriate.

Consorzio Aretusa

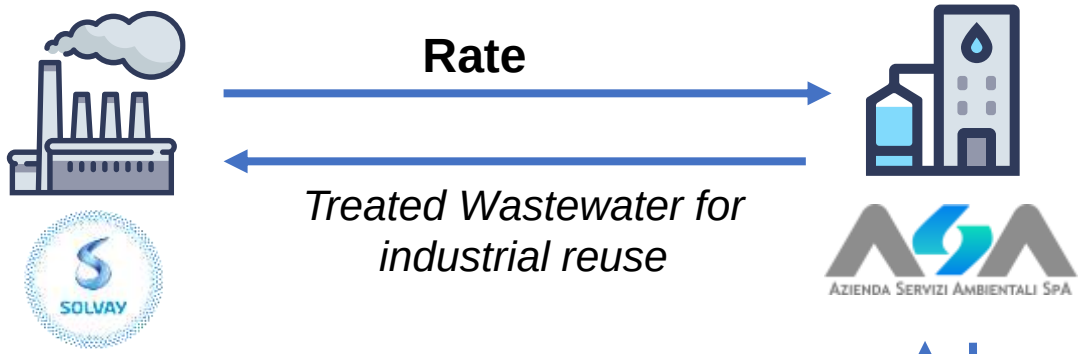
Aretusa Consortium is a non-profit organization. It was founded in **2001** to build and manage water treatment plants from municipal WWTP in order to produce reclaimed water for industrial reuse or other activities.

Partners



Governance of a industrial symbiosis for wastewater reuse

Consorzio Aretusa



PPP Governance Model

Public Private Partnership

Main Contracts:

- **Bank loan**
- Supply of Treated Wastewater Contract (**Rate**)
- **Rent** contract ASA-Aretusa

Governance of a industrial symbiosis for wastewater reuse

Replication of Aretusa Governance Model

Bank

Mortgage to build the plant	
Share capital	€ xxxx
Grace period	xx years
Grace period interest costs	€ xxxx
Repayment	xx years
Annual installments	€ xxxxx
Interest rate	x%
Total interest cost	€ xxxxx

Treatment plant

Rental plant contract		
Years	xx	
Average annual rent linked to the mortgage	€	xxx
Annual rent linked to management costs	€	xxx

Water Utility

	Annual Plant Management Costs
Rental cost	€ xxxx
Electric Energy	€ xxxx
Reagents	€ xxxx
Ordinary maintenance	€ xxxx
Extraordinary maintenance	€ xxxx
Staff costs	€ xxxx
Work equipment	€ xxxx
Chemical analyses	€ xxxx
Sludge disposal	€ xxxx
Indirect costs	€ xxxx
TOTAL ANNUAL COSTS	€ xxxxxxxxxx

	Rate of treated waste water supplied
m3/y	xxxxxx
Total annual costs	€ xxxxxxxx
Rate	€ /m³ xxxxxx

Industry

EU Green Week
PARTNER EVENT

Thank you!

#WaterWiseEU

IWA the International water association
RESOURCE RECOVERY FROM WATER CLUSTER

Water Europe
Technology & Innovation

UNIVERSITÀ POLITECNICA DELLE MARCHE