

# ULTIMATE



WATER SMART INDUSTRIAL SYMBIOSIS

## ULTIMATE promoting water smart industrial symbiosis



Joep van den Broeke & Gerard van den Berg | KWR Water Research Institute, NL

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# ULTIMATE indUstry water-utiLiTy symbiosis 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](http://www.ultimatewater.eu)





# Introducing **ULTIMATE** indUstry water-utiLiTy symbiosis 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**



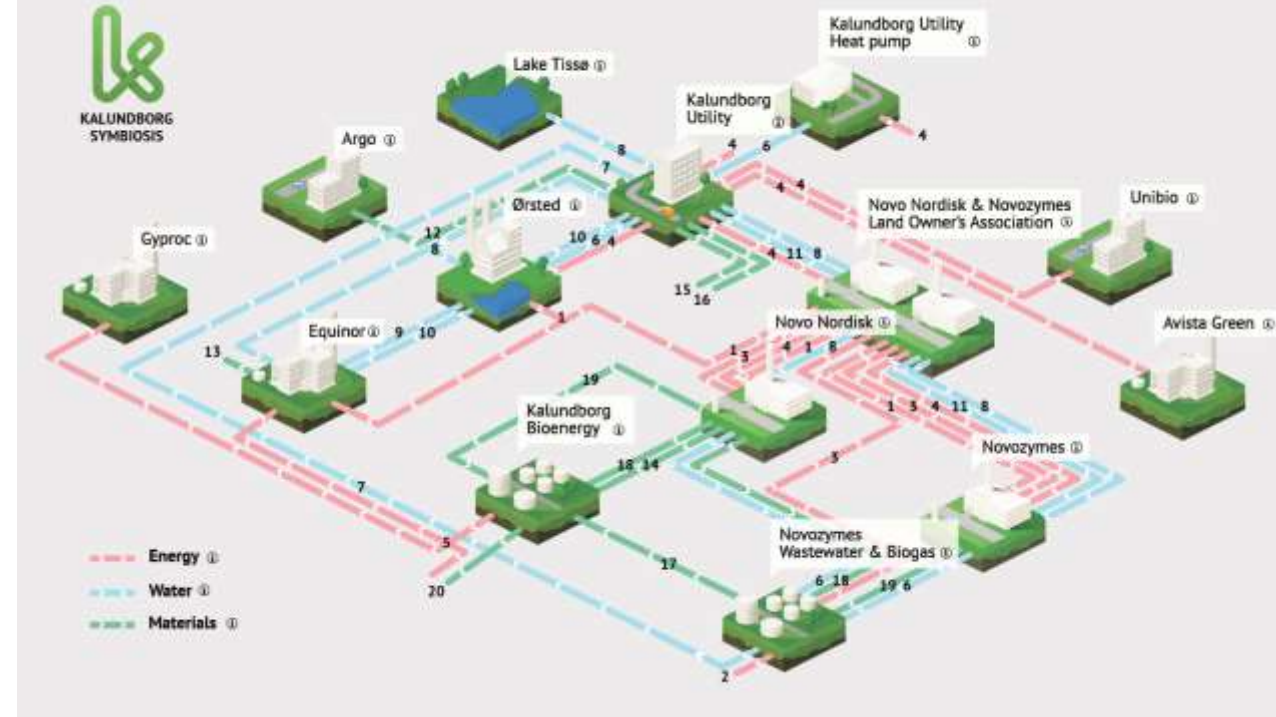


# Industrial symbiosis

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 much more than “just” technologies to achieve these objectives!

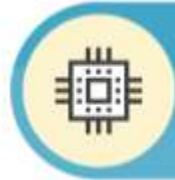
## DEMONSTRATING WIN-WIN SYMBIOTIC OPPORTUNITIES ...

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



### ENABLING TECHNOLOGIES

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



### SMART TOOLS

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



### 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



### GLOBAL OUTREACH

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

### SYMBIOTIC PARADIGMS

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



### WATER-ENERGY-MATERIALS

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



### WSIS MARKET BUILDING

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



### STRONG PARTNERSHIP

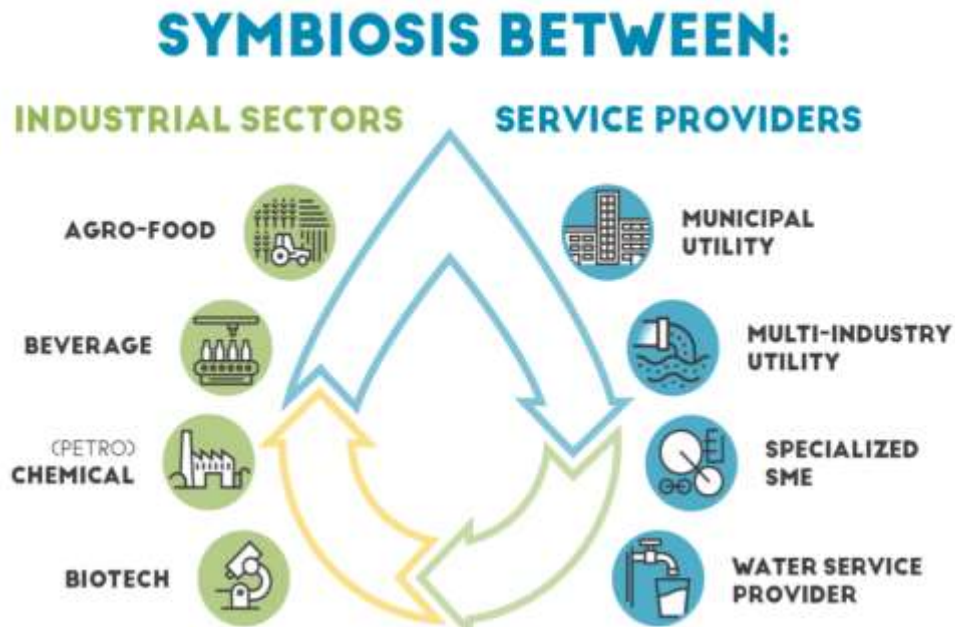
A team of 8 technology & service providers (of which 6 SMEs), 8 utilities (incl. 2 multinationals), 4 industries, 9 Research Centres and Water Europe





# The core of ULTIMATE – integrated case studies

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



The project leading to this application has received funding from the Horizon 2020 research and innovation programme under grant agreement



# Exploitation / valorisation schemes

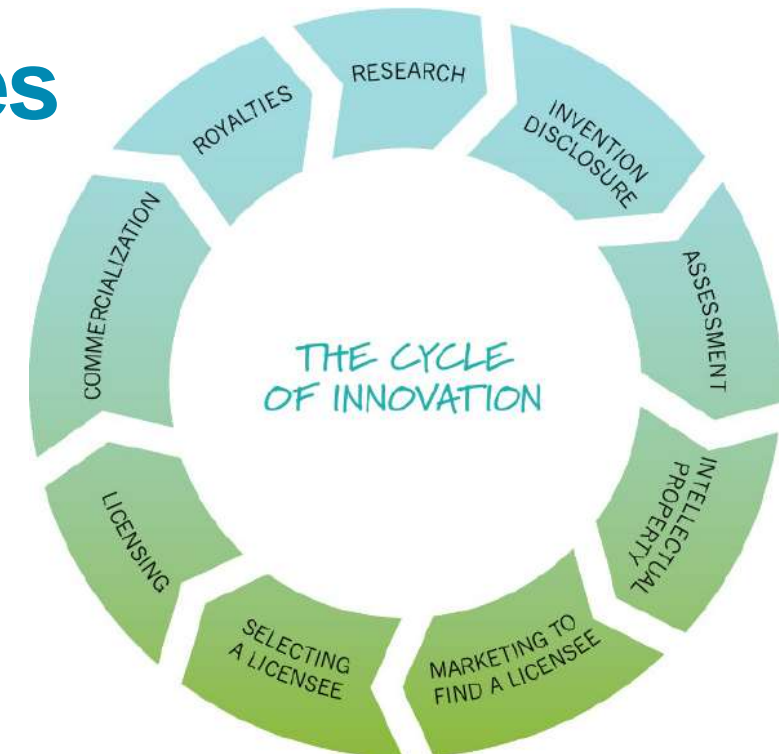
Develop new exploitation and valorisation schemes based on business models and services tailored to WSIS

**Value chains** for recovered resources are exploited by symbiotic arrangements between industries and water service providers:

- **Partnerships** between industries and municipal water utilities looking for symbiotic gains
- **Co-ownership** of water service providers by co-located industries to catalyse symbiosis
- **WSIS service provision** to industries by commercial companies of various scales: from niche SMEs to multinational corporations

Supported by:

- assessing the impact with life cycle (LCA, LCCs) and risk (QMRA, QCRA) analysis
- performance validation and certification schemes







# 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







# Ultimate solutions involve circular economy technologies



- Membrane technologies
- Adsorption technologies
- Electrostimulated systems

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

- Biogas technologies
- Heat recovery
- Digitalization





# CS1 Tarragona (ES)

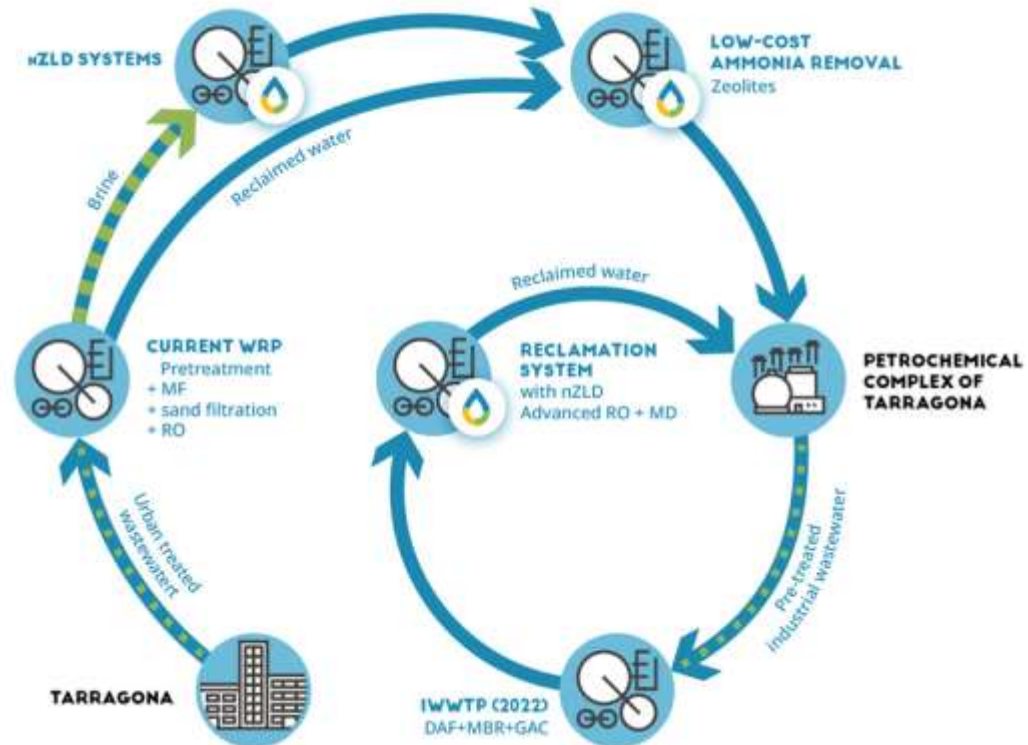
Membrane distillation



- Petrochemical complex (> 100 chemical companies) & municipal WWTPs
- Fit-for-purpose water for industrial reuse
- Long experience with water reuse



Ultrafiltration &  
Reverse osmosis



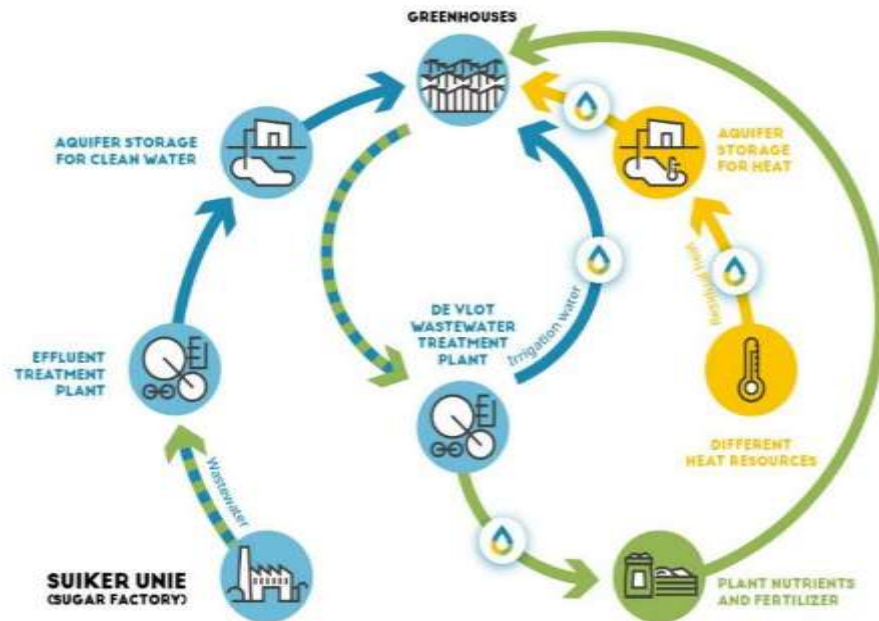
Zeolite column for  
NH<sub>4</sub> removal





# CS2 Nieuw Prinsenland (NL)

- Greenhouses
- Feasibility study: Heat management via high temperature aquifer thermal energy storage
- Fit-for-purpose water for irrigation incl. nutrients



Electrodialysis to remove salts





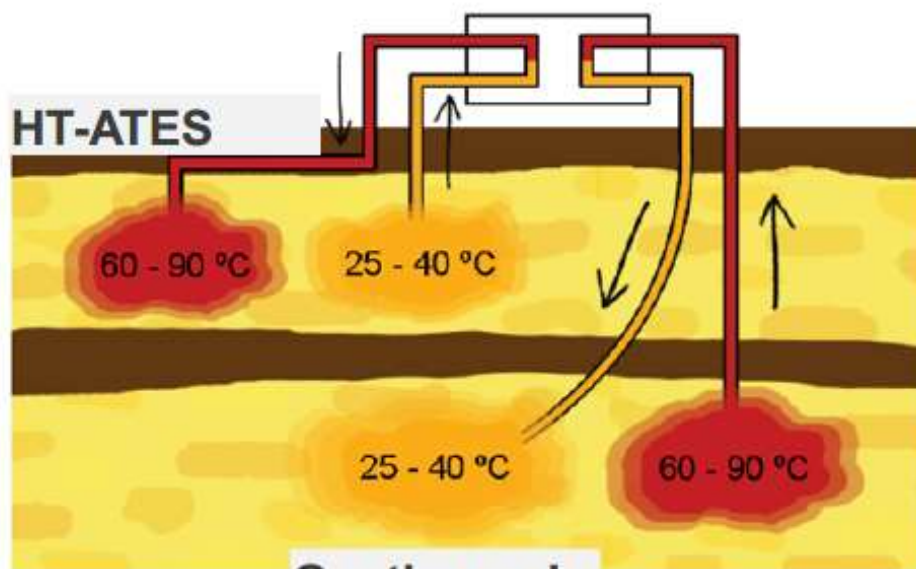


# High Temperature Aquifer Thermal Energy Storage (HT-ATES)



Summer

Available heat is stored in the HT-ATES

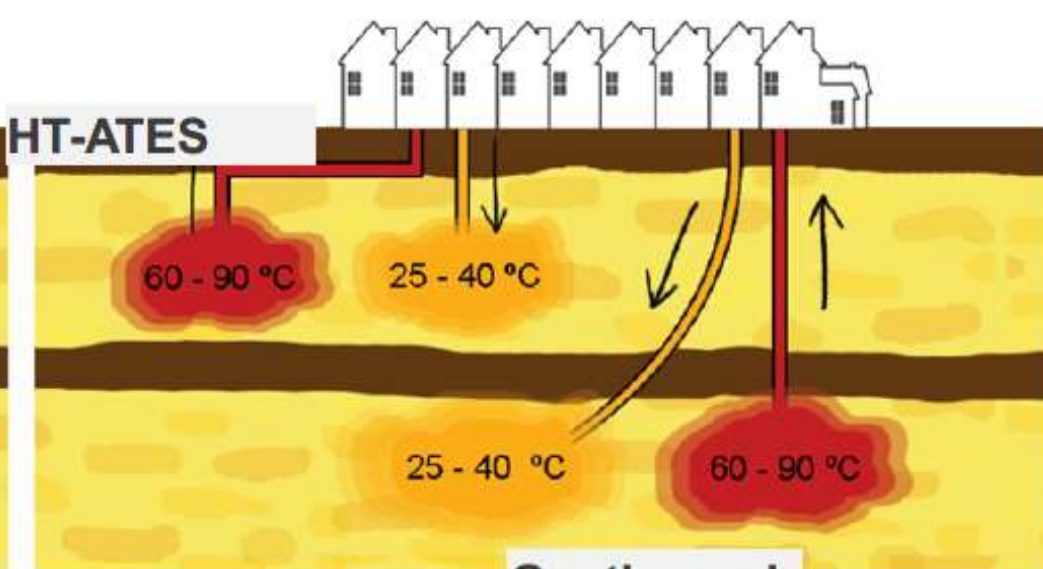


Geothermal well



Winter

HT-ATES delivers heat



Geothermal well

The project leading to Horizon 2020 research

funding from the European Union's under grant agreement No 869318





# CS5 Lleida (ES)

- Brewery
- Biogas production
- Heat & electricity production
- Fit-for-purpose water for industrial reuse and irrigation

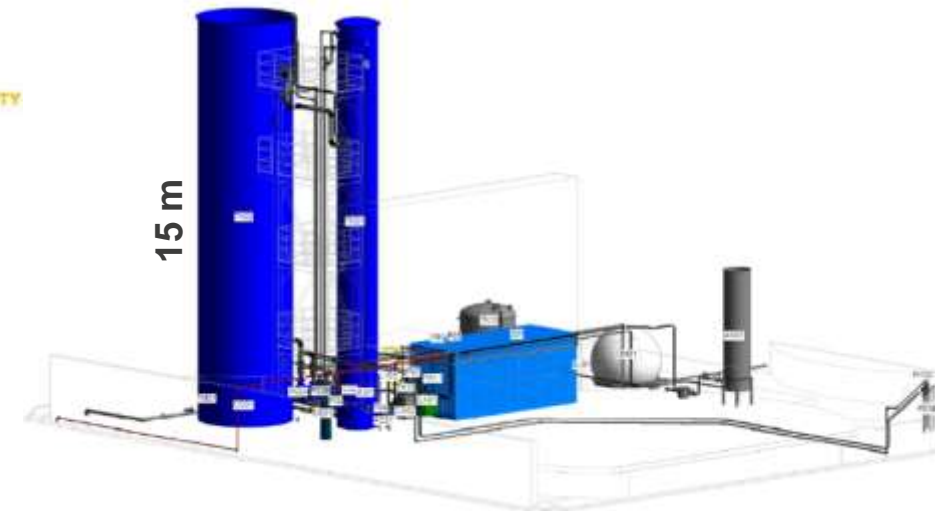
Anaerobic membrane bioreactor



Pilot: electrostimulated anaerobic reactor



Full-scale: electrostimulated anaerobic reactor



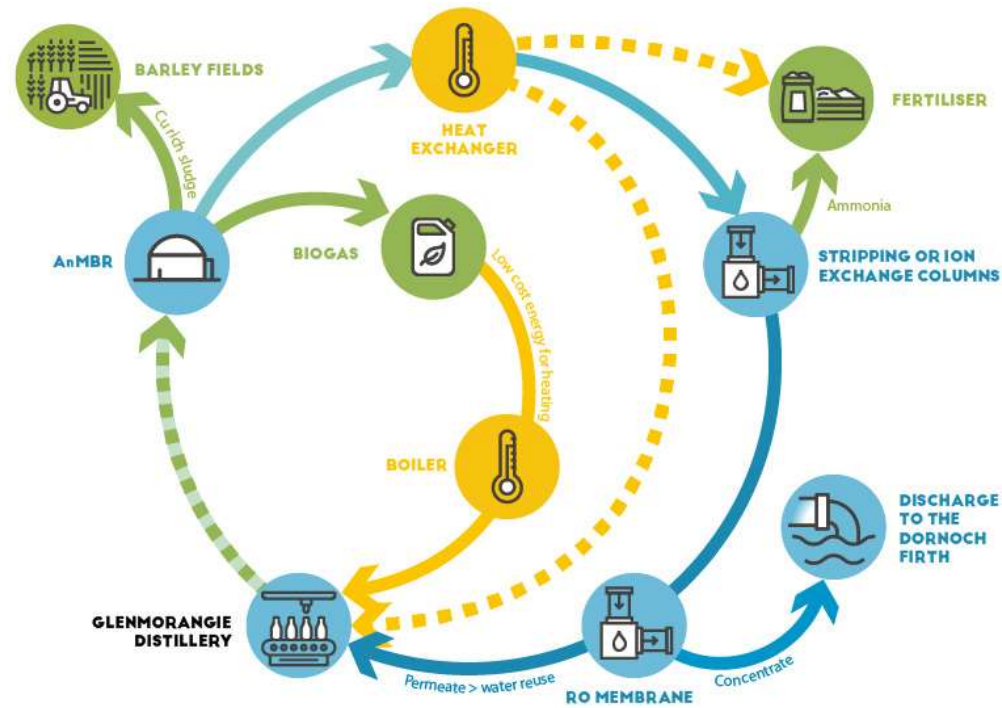




# CS7 Tain (UK)

- Whiskey distillery
- Biogas production, heat recovery
- Struvite and ammonium sulphate production (P and N removal and recovery)
- Fit-for-purpose water for industrial reuse

## Struvite & ammonium sulphate production



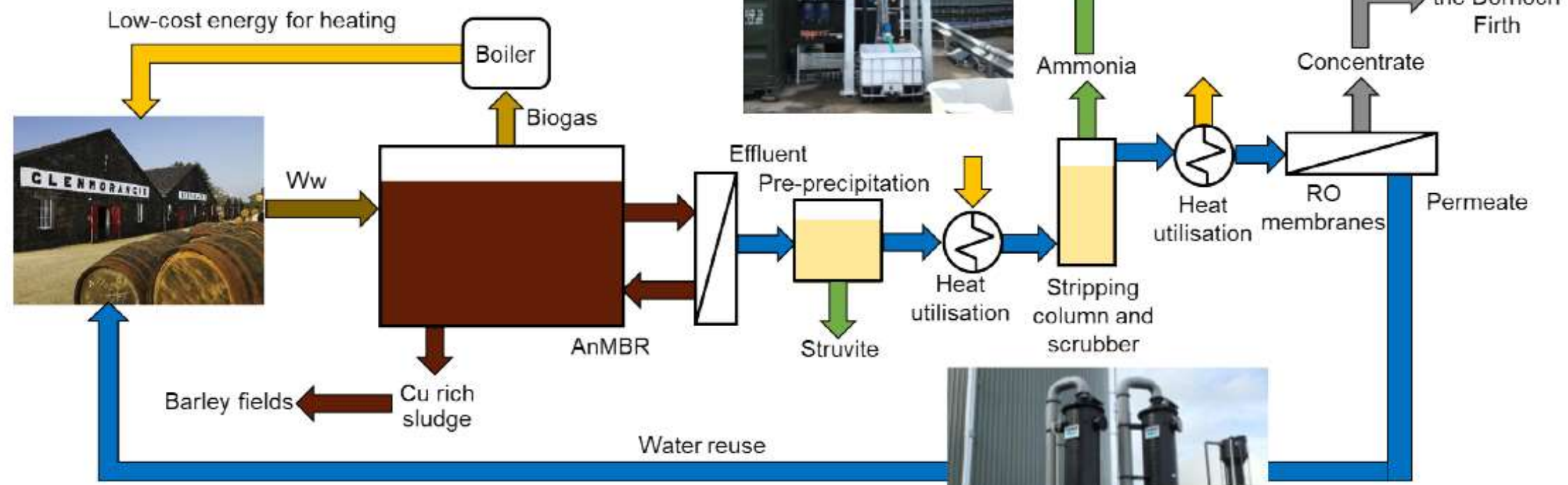
## Reverse osmosis unit





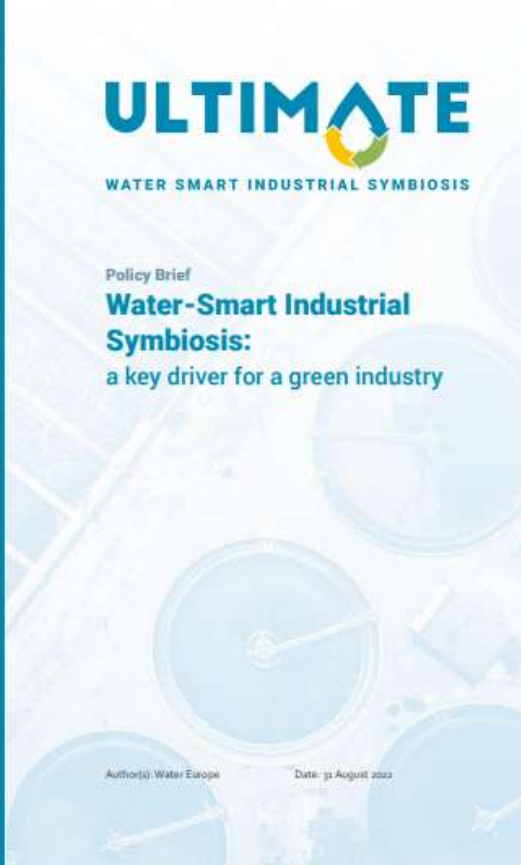


# Ultimate interventions





# 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.





# Final messages

- Water Smart Industrial Symbiosis (WSIS) is a special type of Industrial Symbiosis in which **water, energy and materials** from municipal and industrial wastewater **are recovered and reused**
- Successful circular transitions depend on **systematically addressing technological, digital, socio-economic, governance and business systems interdependencies.**
- Showcasing WSIS cases (in living labs) with emphasis on **cross synergies, transferability and applicability** of the concept may contribute to a further acceptance and understanding.
- **Transformation** of linear production-consumption-disposal chains in industrial processes to circular systems may reduce the vulnerability to climatic changes and environmental degradation and **contribute to a more competitive industry.**







# Water Europe Marketplace: Technology Evidence Base

The screenshot displays the Water Europe Marketplace website. At the top left is the Water Europe Marketplace logo. A search bar contains the text "Search for anything..." and "Any type" with a dropdown arrow. To the right are "Login" and "Sign-up" buttons. A left-hand navigation menu lists: "About the Marketplace", "Technologies +", "Products", "Case studies +", "Marketplace", "Events", and "Networking". The main content area features a large banner with the text "Welcome to the Water Europe Marketplace" and "A marketplace for problem owners, solution providers, investors and other stakeholders in the Circular Economy". Below the banner are six cards: "Technologies" (Discover technologies of the Circular Economy), "Products" (Products, Tools and Services related to the Circular Economy), "Case studies" (Discover concrete solutions to real-life problems), "Networking" (Connect with other stakeholders, find partners, clients and investors), and a large blue "Marketplace" card (Unlock the full potential of this knowledge portal; Personalise your experience and upload your products, meet problem owners and solutions providers and join events all over Europe and beyond. Log-in or Register). The footer includes the Water Europe logo and three small circular icons.



Groningehaven 7  
3433 PE Nieuwegein  
The Netherlands

T +31 (0)30 60 69 511

E [info@kwrwater.nl](mailto:info@kwrwater.nl)

I [www.kwrwater.nl](http://www.kwrwater.nl)



@KWR\_Water



KWR



KWR\_Water



Joep van den Broeke

[Joep.van.den.Broeke@kwrwater.nl](mailto:Joep.van.den.Broeke@kwrwater.nl)

+31 30 6069658



Gerard van den Berg

[Gerard.van.den.berg@kwrwater.nl](mailto:Gerard.van.den.berg@kwrwater.nl)