

CHALLENGES AND SOLUTIONS

The E4Water project focuses on innovative solutions to societal, environmental and economic challenges around water management.

Societal needs: Reduce the industry demand for water in water stressed regions by the closure of industrial water loops

Environmental needs: Mitigating water stress in aquatic ecosystems; avoiding incineration of high concentrated streams.

Economic needs: Decoupling economic growth from an increase in resource use; increasing production efficiency and stability through higher independence from fresh water resources; enable industries to comply in a more sustainable and eco-efficient way with future EU regulatory requirements.

E4Water aims to implement the project concept by:

- creating water loop interfaces, synergies and symbiosis: (a) in industry (b) with urban & agricultural water management
- developing and testing innovative materials, process technologies, tools and method-ologies (e.g. closure of industrial water loops, reuse/ recycling of waste water)
- providing an open innovation approach for testing E4Water developments with respect to other industries
- implementing and evaluating the developments in six industrial case studies, representing critical problems for the chemical industry and other process industries
- implementing improved tools for process efficiency optimisation, linking water processes with production processes, and eco-efficiency assessment

To achieve this, the project involves chemical industry actors along the whole value chain as well as other process industry sectors, such as mining, industrial biotechnology, health, food, electronics, pulp and paper, and energy.

WHAT IS E4WATER?

E4Water addresses crucial process industry needs to overcome bottlenecks and barriers for an integrated and energy-efficient water management.

The main objective of E4Water is to develop, test and validate new integrated approaches, methodologies and process technologies for a more efficient and sustainable management of water in the chemical industry, with cross-fertilization possibilities to other industrial sectors.

E4Water unites in its consortium large chemical industries, leading European water sector companies, innovative RTD centers and universities. The partners – all active in the area of water management – are also members of the European Water Platform (WssTP) and the European Technology Platform for Sustainable Chemistry (SusChem).

EXPECTED IMPACT

- Lead to a 20% reduction in water and related energy usage, as well as in industrial waste water production at the industrial case study sites (reduction of 20–40% in water use, 30–70% in waste water production, 15–40% in energy use)
- Enable industries to be fully compliant with the EU policies on water pollution and industrial emission in a more sustainable and eco-efficient way.
- Generate direct economic benefits for the process industry and the value chain.

CONSORTIUM

CAMPDEN	Campden BRI – United Kingdom
CBD	Kalundborg Kommune – Denmark
CEFIC	Conseil Européen de l'Industrie Chimique – Belgium
DECHEMA	DECHEMA Gesellschaft für Chemische Technik und Biotechnologie e.V. – Germany
DOW	Dow Benelux B.V. – Netherlands
DTU	Danmarks Tekniske Universitet – Denmark
EVIDES	Evides Industriewater BV – Netherlands
FHNW	Fachhochschule Nordwestschweiz – Switzerland
IVL	IVL Svenska Miljöinstitutet AB – Sweden
ONDEO IS	Ondeo Industrial Solutions SA – France
PG	Procter & Gamble Services Company NV – Belgium
SOLVIC	Solvic NV – Belgium
SOLVIN	Solvin Spain SL – Spain
TNO	Nederlandse Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek – Netherlands
TOTAL	Total Petrochemicals France SA – France
TUB	Technische Universität Berlin – Germany
TUD	Technische Universiteit Delft – Netherlands
UCM	Universidad Complutense de Madrid – Spain
VITO	Vlaamse Instelling voor Technologisch Onderzoek N.V. – Belgium



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**Economically and Ecologically
 Efficient Water Management
 in the European
 Chemical Industry**

www.e4water.eu

CONCEPT

INDUSTRIAL CASE STUDIES

The six industrial case studies are designed to ensure and demonstrate the relevance of the E4Water approach to the chemical industry, a highly diverse sector with complex value chains.

- CS1: Mild desalination of water streams for optimum reuse in industry or agriculture at affordable costs**
Led by Dow, Netherlands
- CS2: Enhance the water reuse by global management and synergy identification on a multi-company site**
Led by Solvic NV, Belgium
- CS3: Ensure process continuation by closing the water loop and minimizing fresh water use**
Led by Solvin Spain SL
- CS4: Enhance in-process water loop closure by integrating biocidal with wastewater treatment technologies**
Led by PGB, N.V., Belgium
- CS5: Towards integrated water management system in petrochemical site**
Led by Total, France
- CS6: Bioextraction technology in a symbiotic industrial wastewater treatment concept creating added value**
Led by CBD, Denmark

TECHNOLOGY DEVELOPMENT

E4Water will develop innovative methods and technologies along the following broad lines of action:

- Development of innovative treatment technologies for **complex (concentrated) wastewater streams**.
- Development of selective treatment technologies and treatment trains unlocking barriers for **recycling and reuse** of industrial water streams.
- Stronger integration of **eco-efficient water management** in industrial processes.
- Integrated water management networks to reduce **freshwater withdrawal**.
- **Demonstration and evaluation of innovative water management options on industrial sites**, related to various chemical sub-sectors all over Europe using a wide range of new treatment technologies.

E4Water will work on following technology developments:

- **Technological reduction and management of risks associated with advanced loop closure**
Led by VITO, Belgium (technologies for CS 4, 5)
- **Optimisation and debottlenecking of separation processes**
Led by UCM Spain (technologies for CS 3, 4)
- **Mild and extensive demineralisation technologies for process water production**
Led by TNO, Netherlands (technologies for CS 1, 2, 3)
- **Integration of processes to allow residual heat, nutrients and value products to be reused**
Led by DTU (technologies for CS 1, 2, 3)

MODELLING, ASSESSMENT & POLICY

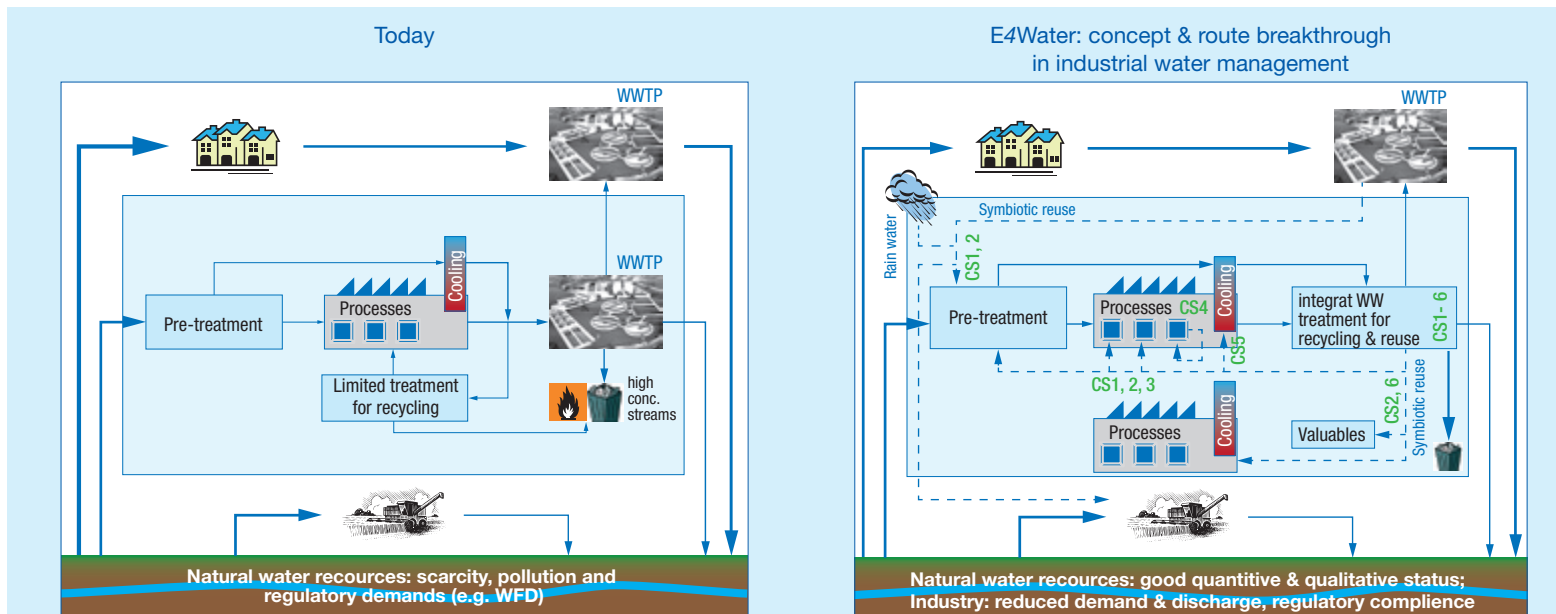
Modelling and assessment tools provide an important information basis for industrial decision making. Both activities address a variety of complexity scales, from single treatment technologies to integrated site scale.

Within E4Water, modelling and assessment activities focus on one case study as a master site for the full integrated site scale assessment. The objective is to prove the applicability of the tools and elaborate on them on the treatment train level for the other case studies.

The dissemination and exploitation approach of E4Water also addresses EU policies and industry. The E4Water outputs will be assessed in the context of the Industrial Emissions Directive (IED) – 2010/75/EC, through discussions on the technical and economical feasibility, the applicability and degree of maturity (emerging versus proven) of the outputs.

This will require the following working steps:

- **Development of a tool for the management of industrial water, related mass and heat flows**
Led by TUB, Germany
- **Environmental and economic evaluation**
Led by IVL, Sweden
- **EU policy evaluation and BREF Recommendation**
Led by CEFIC, Belgium



Today's situation with limited recycling/reuse components and limited connections across sectors (the width of arrows is in both figures an indicator for the water demands).

The E4Water concept, following an integrated, multi-disciplinary and holistic approach in different industrial scales and across sectors. The dashed lines indicate the impact by E4Water, CS (= case study) indicate where on site industrial pilot testing and demonstration are focused on, the number allows their identification.

