iWAYS

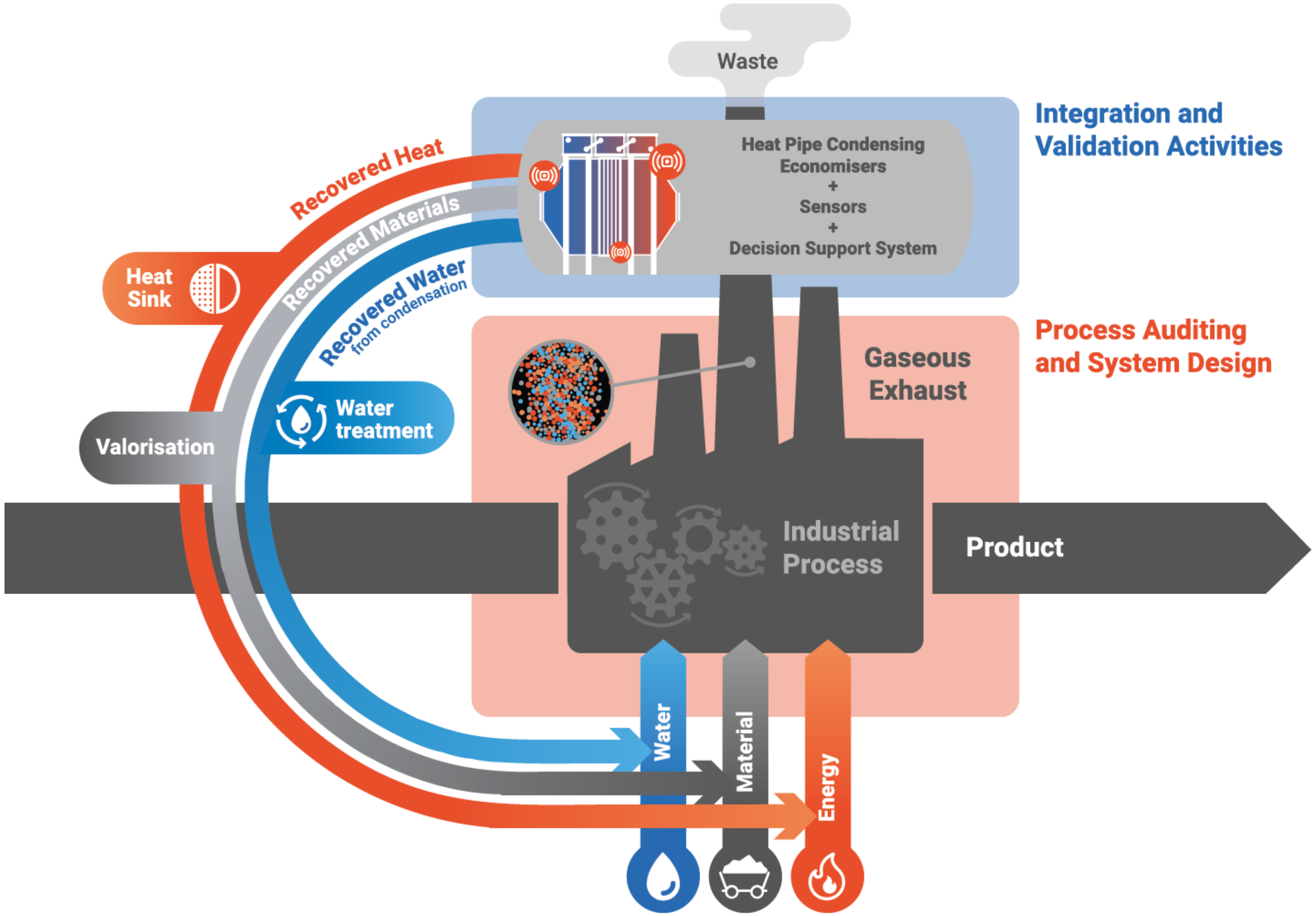
innovative water recovery solutions

What is iWAYS?

Innovative WAter recoverY Solutions through recycling of heat, materials and water across multiple sectors is a project that will develop a set of technologies and systems for industrial processes in order to recover **water** and **heat**, and in some cases **materials**, from exhaust streams

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°958274

iWAYS: concept and methodology



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Why is this approach different**?**

Currently, there are no significant studies, demos, or real applications, to condensate and reuse industrial streams

By using Heat Pipe Condensing Economisers with new materials and special designs capable of operating in peak conditions, iWAYS will withstand better the **corrosive and high particle loaded exhaust**

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iWAYS in numbers

19 partners

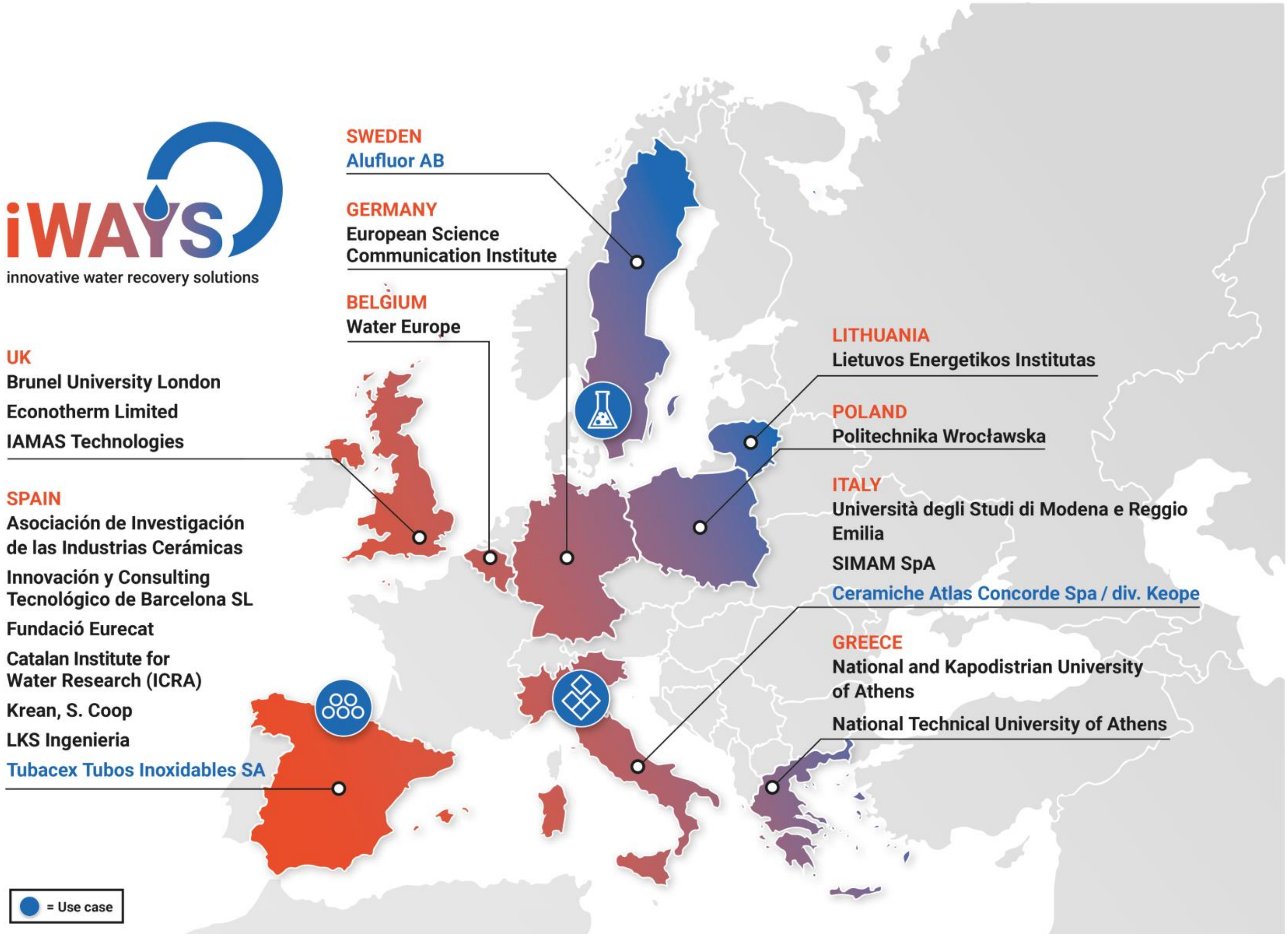
9 countries

3 demo cases

4 technology providers

60 months

> 10M€ EU funding



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iWAYS

Who is part of the consortium?

UNIMORE
UNIVERSITÀ DEGLI STUDI DI MODENA E REGGIO EMILIA

Brunel University London

AICE

jtc

UNIVERSITAT JAUME·I

acea infrastructure

Simam

econotherm
WASTE HEAT RECYCLING TECHNOLOGY

ESCI
European Science Communication Institute

Water Europe
Technology & Innovation

incotec
INNOVACIÓN EFICIENTE

CERAMICHE KEOPE
MADE IN ITALY
a division of
atlas concorde

alufluor

eurecat
Centre Tecnològic de Catalunya

HELLENIC REPUBLIC
National and Kapodistrian University of Athens
EST. 1837

LITHUANIAN ENERGY INSTITUTE

ICRA
Institut Català de Recerca de l'Aigua

TUBACEX GROUP

KREAN

IAMAS
Earth Friendly Technologies

Wrocław University of Science and Technology

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iWAYS: specific objectives

SO1: To create a framework streamlining the design process of iWAYS systems with regards to customized installations to condensate water from exhausts and purify the recovered water

SO2: Realizing water closed loops and a substantial reduction in freshwater

Reduction of freshwater consumption > 30 % for the industrial processes

SO3: Achieving a substantial reduction in thermal waste and process energy requirements

Payback <5 years, process or in plant heating reduction >20%,

SO4: Recovery of materials by valorising challenging exhaust streams

SO5: Reclaiming, treating and reutilizing water in industrial processes

SO6: Utilization of alternative water resources and rainwater harvesting

SO7: Real time smart monitoring of recycled water and gaseous emissions composition

SO8: Develop a methodology to select the best available synergies

SO9: Streamlining the iWAYS solutions and accelerating the commercialization process

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Technology components

1. Heat Pipe Condensing Economisers

2. Decision support system and sensors

3. Water treatment

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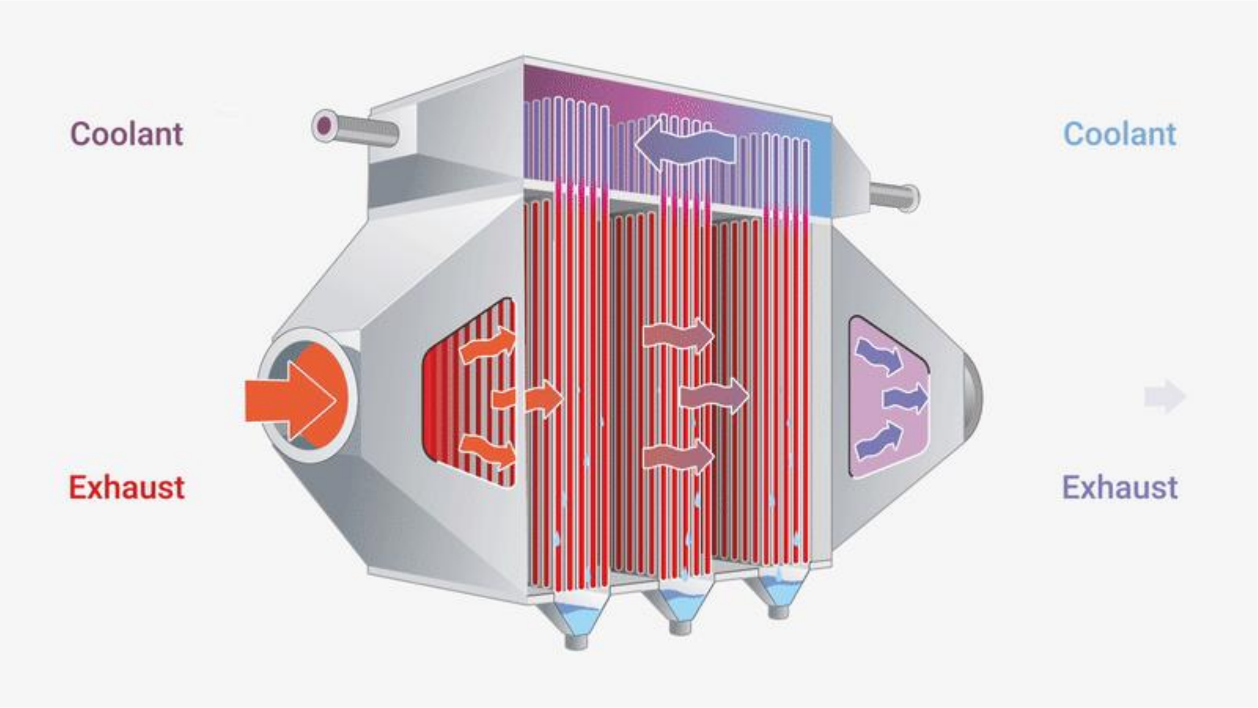
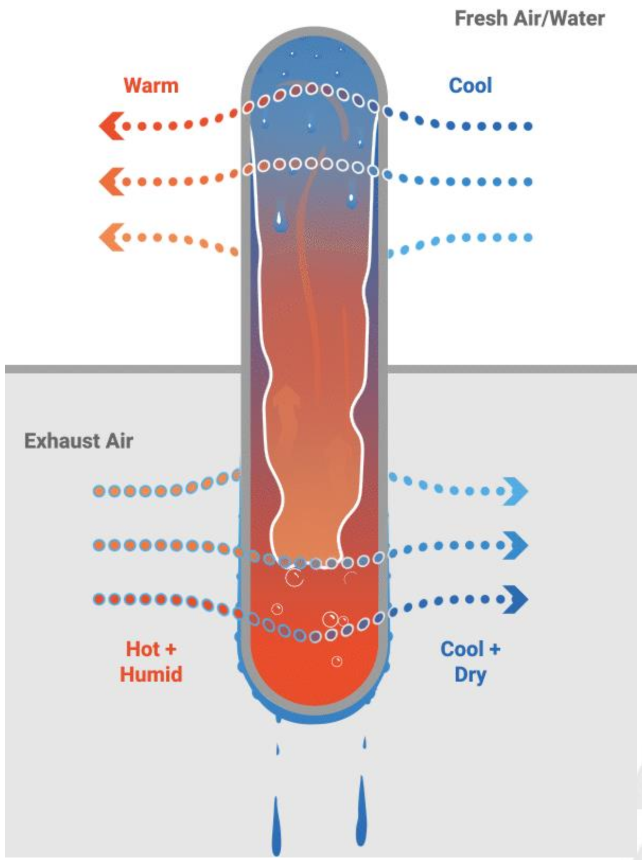
Technology components
Heat Pipe Condensing Economiser





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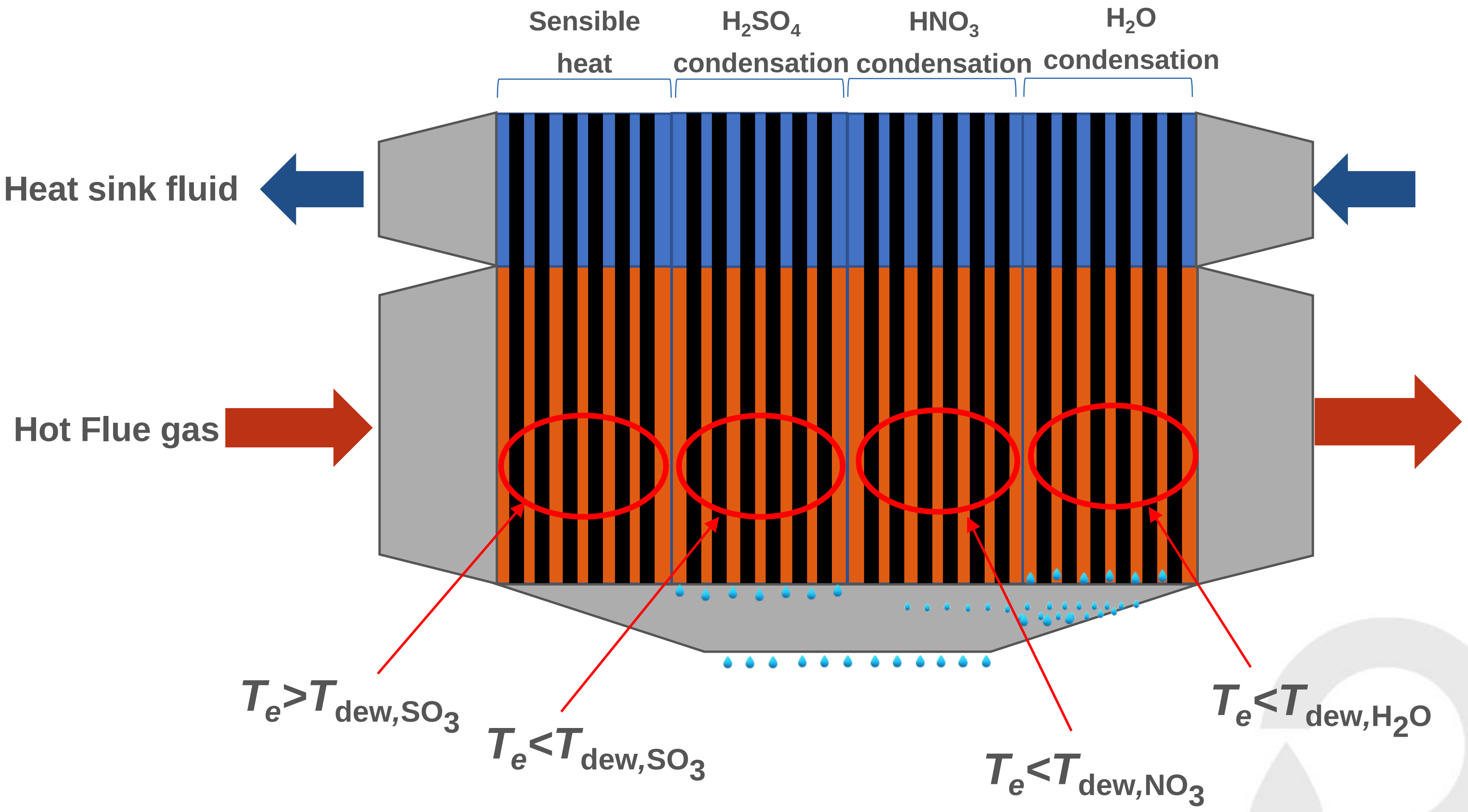
Technology components
Heat Pipe Condensing Economiser

Condensation occurs when the heat pipe surface temperature T_e is lower than the dew point of the composition

T_{dew}=T_e<T_{dew}



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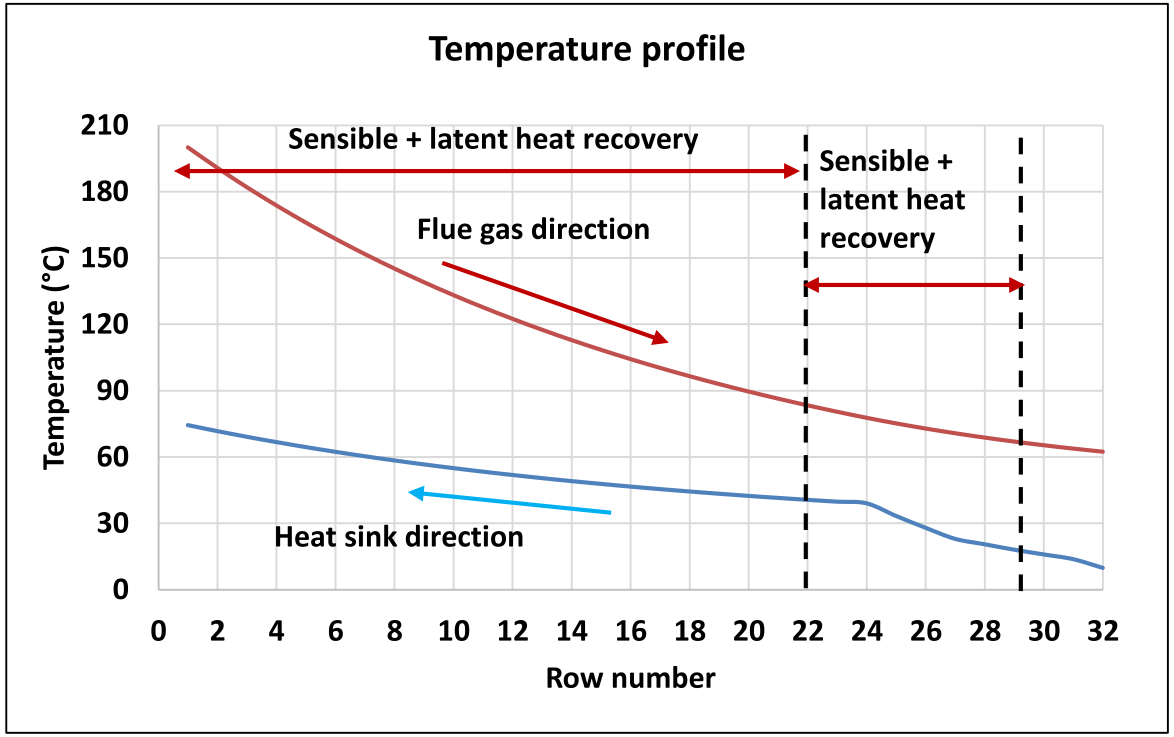
Technology components

Heat Pipe Condensing Economiser

Composition	Volume fraction (%)
N2	76.2
O2	3
CO2	10.4
H2O- vapour	9.8
SO2	0.3
NO2	0.29

Moisture Dew points	
H2SO4 dew point	150 (°C)
HNO3 dew point	57.6 (°C)
H2O dew point	46 (°C)



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Technology components

Decision support system and sensors for real time monitoring system

- 3D visualisation and data analytics
- Integration of forecasting and decision-making in **real-time**
- Flexible monitoring process, control and optimisation dashboard supporting an end-to-end process of data collection, harmonization, processing and visualization

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Technology components

Water treatments

- Photocatalytic Nanofiltration (current TRL 5)
- Membrane Distillation (current TRL 4-5)
- Ultrafiltration * (current TRL 6)
- Reverse Osmosis * (current TRL 6)
- Evaporation-Crystallisation * (current TRL 6)

* The water treatment technologies are used in relevant and operational environment, but not yet for the treatment of the specific streams considered in this project

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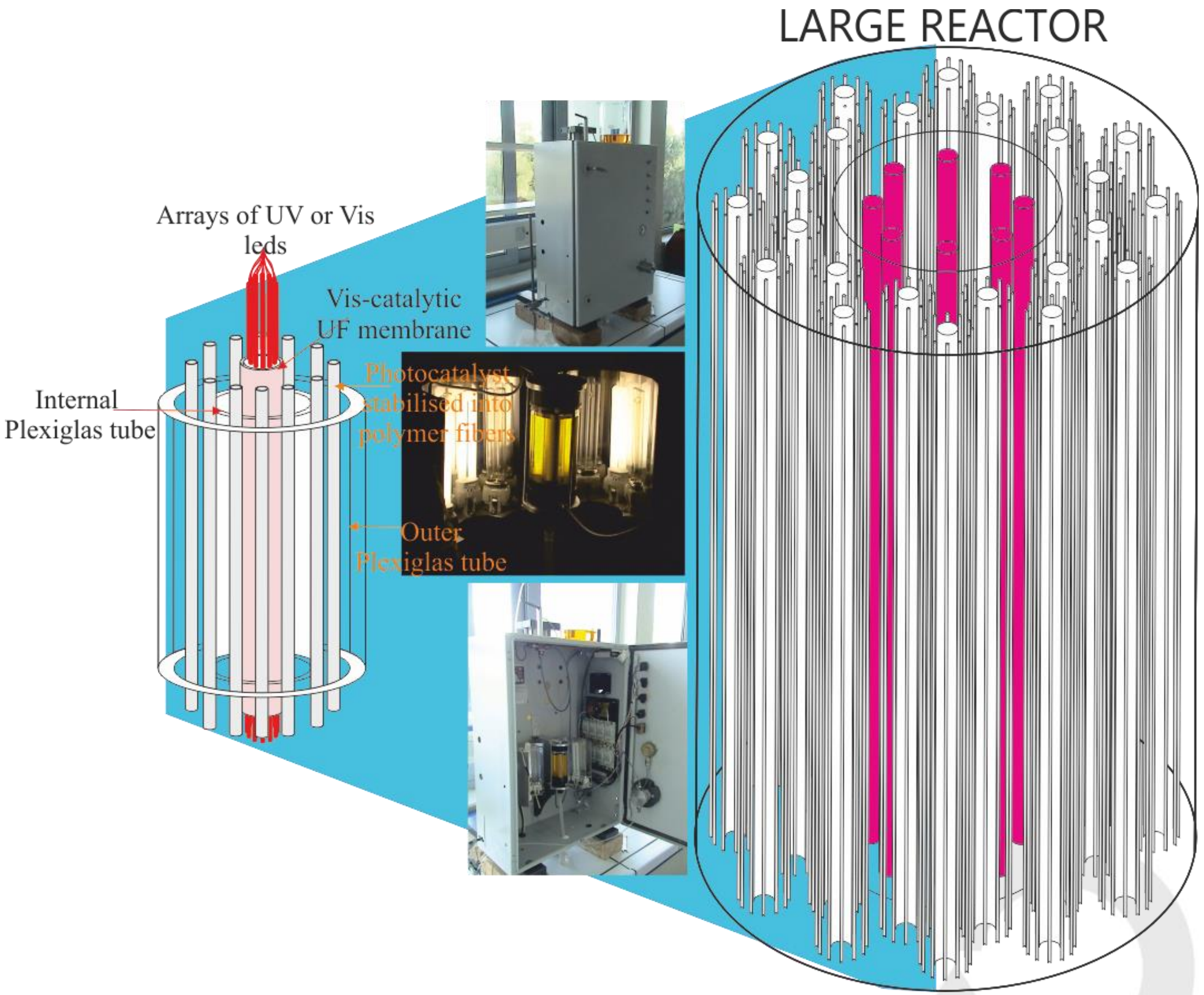
Technology components

Water treatment

- Photocatalytic Nanofiltration reactor (PNFR)

- Applied to steel industry to produce high quality permeate water

- Recycle of the retentate water within the PNFR process is made possible by oxidative removal of pollutants by photocatalysts on the membrane surface



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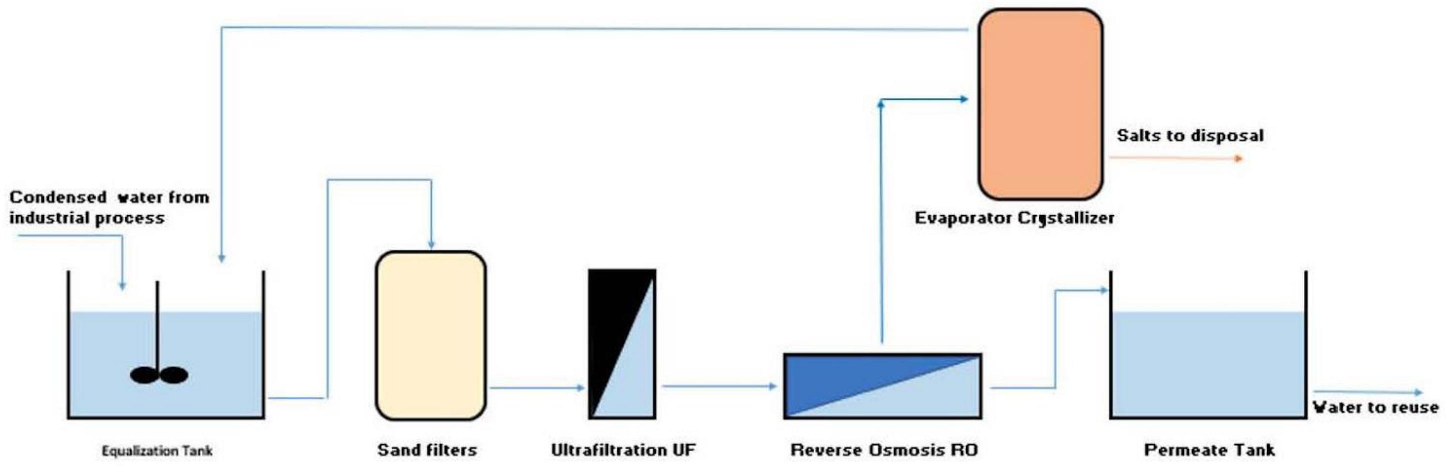
Technology components

Water treatment. General layout of the proposed process

- An equalisation tank is operated, followed by sand filter and ultrafiltration to reduce RO membrane fouling

- Evaporative crystallisation is applied to the RO retentate to further recover water



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Industrial demo sites

Application to ceramic, chemical and steel industries

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Demo Site 1- ceramic Industry

Ceramiche Atlas Concorde

- Recovery of a substantial amount of the water discharged through the spray dryer exhaust
- Available freshwater to be recovered
- Suspension of the particles in the stream

Objectives:

- Reduction of about 50% the freshwater directly used in grinding
- 1,5t/h or 10,000t/y per system, or 50% of the clean freshwater used in grinding to be recovered

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Demo Site 2 – chemical industry

Alufluor AB

- Aluminium fluoride production: extremely corrosive exhausts
- Potential heat recovery

Objectives:

- Recover water vapour
- Recover corrosive acid such as hydrofluoric acid. 70 tonnes of acid per year
- Recover heat from the streams
- Install 500kW thermal of heat recovery delivering 5.18 Gwh
- Recover up to 33% of the production line water demand

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Demo Site 3 - steel industry

Tubacex Tubos Inoxidables (steel tubes manufacturer)

- Waste heat recovery
- Water condensation potential
- Reducing the contaminant content of wastewater before reuse in the process

Objectives:

- Waste heat to be recovered
- Water to be condensed
- Providing high quality decontaminated water for the process

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How is the project organised?

European Commission

Project Coordinator:
Prof Luca Montorsi

University of Modena and Reggio Emilia

Scientific and Technical Director:
Prof. Hussam Jouhara

Brunel University London

Dissemination, Exploitation and Communication Manager:
Elmar Bartlmae

European Science Communication Institute (ESCI)

WP Leaders

University of Modena and Reggio Emilia

Brunel University London

Fundacio Eurecat

Simam Spa

Econotherm

LKS Ingeniería

Asociación de investigación de las industrias cerámicas ITC-AICE

European Science Communication Institute (ESCI)

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Thank you for your kind attention!

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