

## Technologies & Innovation

- 1 Heat Recovery**  
Waste heat recovery with non-clogging heat exchanger.
- 2 Membrane Distillation**  
Concept of water recovery by membrane distillation.
- 3 Coatings**  
Coatings for corrosion and wear protection of heat exchanger surfaces, micro turbine parts and nozzles.
- 4 High Temperature Heat Pump**  
Concept for waste heat reuse by high temperature heat pump for steam production and sludge drying.
- 5 Micro Turbines**  
Concept for hydropower recovery by micro-turbine to produce electricity.
- 6 Smart Monitoring & Software Tools**  
Development of smart monitoring concepts and tools for the energy and water recovery techniques.



### Coordinator:

Martin Hubrich, BFI  
Martin.Hubrich@BFI.de

### Dissemination Manager:

Themis Sarantaenas, QuestHub,  
t.sarantaenas@questhub.eu



Co-funded by the  
European Union

This project has received funding from the Research Fund for Coal and Steel (RFCS) under grant agreement No 101216643.

### Consortium



## ENERGY AND WATER RECOVERY for a Sustainable Steel Industry

EnWaRec develops technologies and tools for energy and water recovery in the European steel industry, contributing to the Green Deal and circular economy goals.

For latest updates please visit: <https://enwarec.eu/>

## Background

Energy-intensive industries, such as steel industry are indispensable to Europe's economy, as they supply several key value chains. The transformation of iron and steel industry from carbon to hydrogen based, CO<sub>2</sub>-free steel production is embedded in environmental, technical and political frameworks influencing the realization of the decarbonization of the iron and steel industry.

New process streams occur by application of direct reduction plants (DRP) leading to high temperature condensate and high energy intake into gas washing water with temperatures up to 80 °C, leading to an increased cooling water demand to fulfill operational temperature requirements and legal discharge limits. Climate change is causing a rise of the water stress, which reduces water availability and increases salt contents. This occurs in combination with higher water temperatures leading to an increase of the freshwater demand. Due to challenging water compositions, high temperatures, high corrosion and scaling, high salt contents and abrasive particles, no recovery of energy or water is practiced from such streams.

## Therefore

To address these challenges, EnWaRec develops a holistic approach for cooling water circuits, consisting of heat, electricity and water recovery, energy and water reuse, and tailored water conditioning. Monitoring sensors measuring scaling and corrosion potential provide the base for tailored dosing of treatment chemicals, applicable up to 80°C. Heat exchangers with coated surfaces recovery heat for e.g. enhanced sludge treatment, steam production or water recovery. Micro turbines recover the potential energy of water streams for sludge drying or operation of membrane distillation for similar reuse. Software tools determine optimized operational conditions.



All objectives are clearly related to the objectives of the RFCS objective No. 10: "Conservation of resources, protection of the environment and circular economy".

## Specific Objectives

- ➔ Holistic approach combining different technologies, sensors and tools for achieving goals regarding energy recovery and utilisation for decreasing CO<sub>2</sub> emissions including water recovery.
- ➔ Suitable corrosion and scaling measurements for a tailored chemical dosing as mandatory step for an ensured heat and energy recovery including thermal stable treatment chemicals up to 80°C.
- ➔ Coatings for corrosion and wear protection in micro turbines, heat exchangers and sparging nozzles.
- ➔ Heat exchanger with wear and scaling resistant surface for recovery of waste heat up to 80°C.
- ➔ Utilisation of recovered waste heat for steam production with high temperature heat pumps and water recovery by membrane distillation producing a high-quality feed water for steam production - further waste heat utilisation: enhance sludge dewatering and drying.
- ➔ Application of micro turbines in suitable water circuits with corrosive, abrasive or potentially scaling compositions for production of electricity by recovery of hydropower for enhanced sludge treatment and water recovery.
- ➔ Software tools determine the most suitable positions for installing heat exchangers and micro turbines to achieve maximum energy recovery.

