Pulp & paper case

r3volution

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The EU-funded R3VOLUTION project is redefining industrial water management in Europe, aiming to enable more than 90% water reuse in water-intensive sectors.

Industries such as petrochemical, biochemical, pulp & paper, and steel produce highly complex wastewaters and lose thermal energy, leading to greenhouse gas (GHG) emissions and costly treatment demands.

R3VOLUTION transforms these challenges into opportunities by recovering water, solutes, and up to 50% of thermal energy, while removing hazardous substances. The innovative project solutions are being validated at four demonstration sites across key industrial sectors. This brochure introduces the pulp & paper demo site.

The pulp & paper demonstration case

FELIX SCHOELLER

At the Weißenborn pulp & paper site, operated by project partner **FELIX SCHOELLER**, approximately **2 million m³** of surface water are withdrawn annually for paper production, functionalization, and steam generation in the on-site power plant. After use, the water is treated before being discharged back into the receiving water body.

An additional **350,000 m³** of contaminated process water from surface treatment contains pulp fibres, fillers, dyes, pigments, binders, and chemical regulators, making its treatment particularly complex. Recovering waste heat from low-temperature, contaminated streams presents an additional challenge.

Our solutions

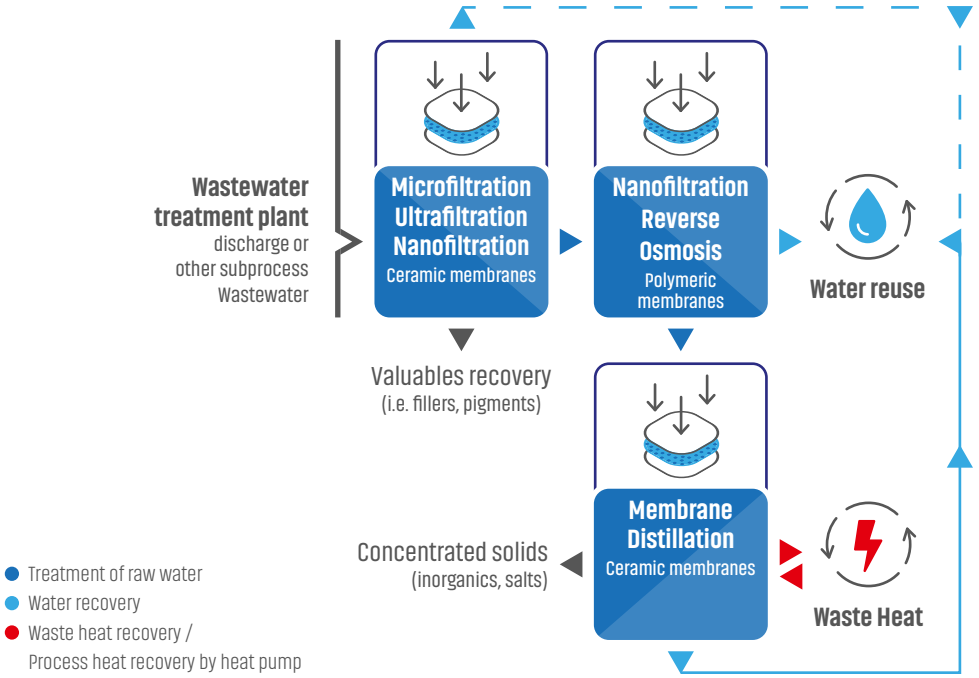
The main solutions implemented in this demonstration case focus on recovering valuable solutes, reusing treated water in production processes or power generation, and reducing inorganic fillers and organic substances to support higher levels of water reuse within a closed-loop system. The proposed treatment train for effluent streams combines several

membrane filtration-based processes using optimized tubular ceramic membrane elements:

- **Microfiltration (MF)** and **ultrafiltration (UF)** to recover suspended solids such as fibres and inorganic particles (e.g. fillers)
- **Ultrafiltration (UF)** to additionally remove colloids, including pigments and binders
- **Nanofiltration (NF)** to target dissolved organic compounds such as chemical regulators, dyes, and optical brighteners

The reduction of residual ionic compounds in pre-treated water prior to recirculation is achieved using polymeric membranes in advanced **nanofiltration (NF)** and **reverse osmosis (RO)** processes. **Membrane distillation (MD)**, employing modified ceramic membrane elements, is used to treat RO concentrates and recover dissolved inorganic salts. This step utilizes either the intrinsic heat of the process water (up to **45 °C**) or waste heat from the production site, such as heat from the cooling cycles of the paper machine. An innovative approach integrating a heat pump into the MD system enhances flexibility in process design and operation.

Treatment train



The demo case is run by:

FELIX SCHOELLER

Fraunhofer IKTS

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