



Production of Technical Water in Denmark

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Who We are

Global Solutions & Expertise

- Global provider of water and wastewater solutions
- Design, engineering and fabrication of water and wastewater treatment facilities for industrial clients
- Portfolio includes UPW, water reuse, resource recovery, ZLD/MLD, and digital water solutions

Strong Heritage & Proven Performance

- Gradiant Germany (H+E) has over 90 years of history
- 30,000+ installed systems
- Deep in-house expertise

Technology Leadership & Impact

- Solutions for a variety of industries such as green hydrogen, power plants, semicon, data center, chemical, pharma, food & bev
- Proprietary technology stack combines advanced treatment technologies with AI and is protected by 250+ patents

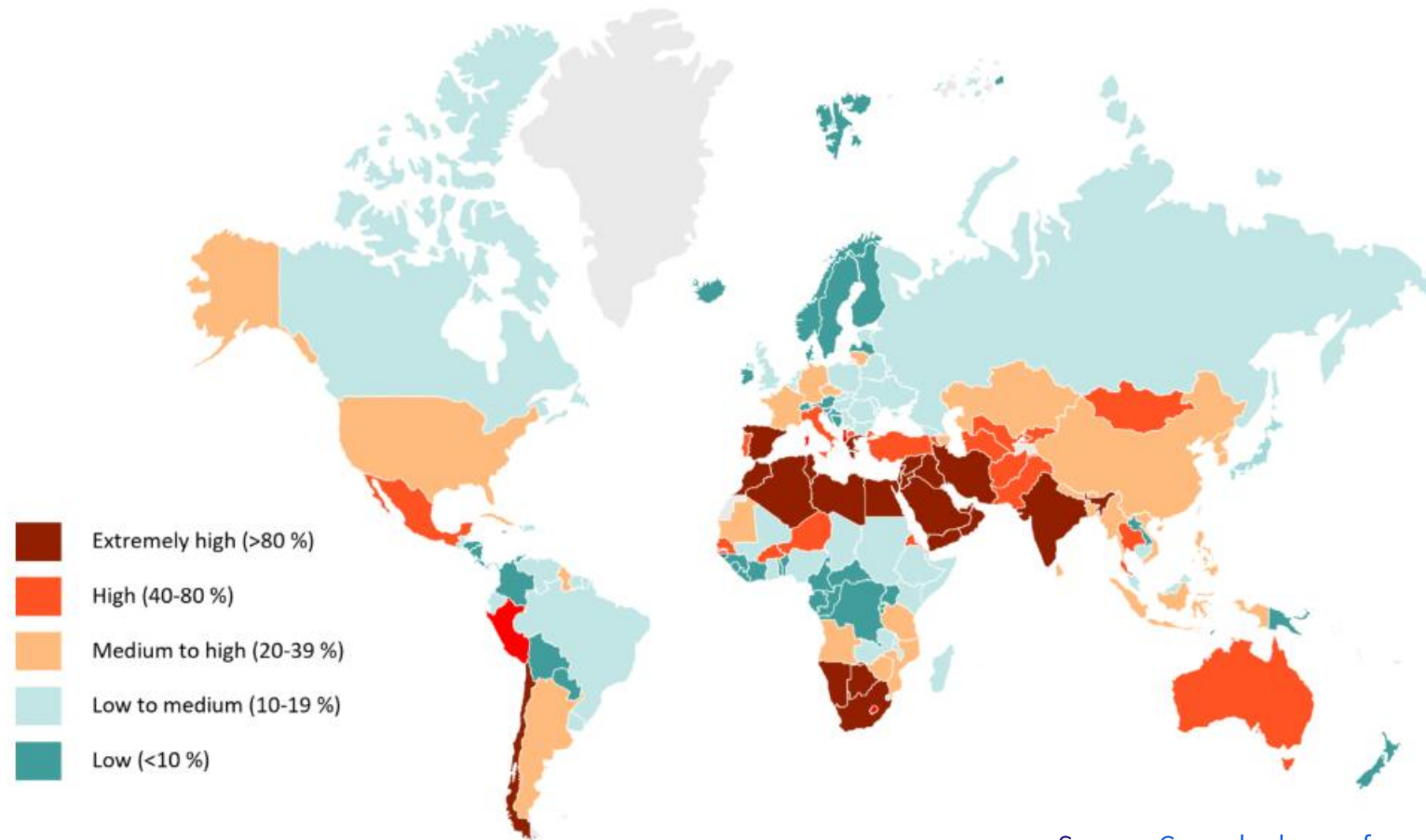


Overview

- Green hydrogen and water stress
- Key challenges in water sourcing
- Typical impurities in different water sources
- Wastewater as a source of technical water
- Treatment technologies
- Treatment challenges
- Example projects



Green hydrogen and water stress



Source: [Green hydrogen faces a water problem - www.svp.de](http://www.svp.de)

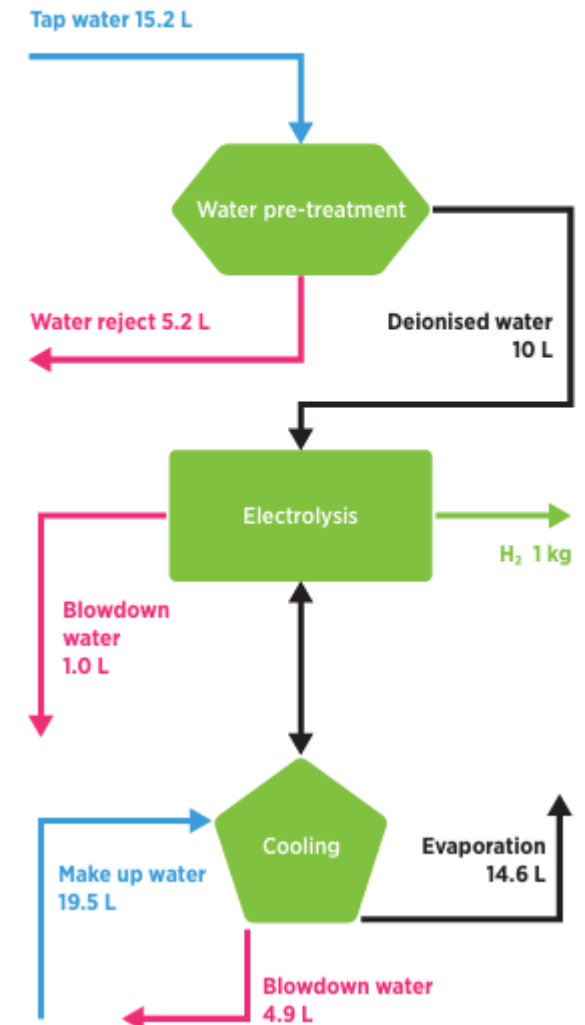
Key challenges in water sourcing

- Significant water requirements (0,2 m³/h and MW)
- Competition with other water uses
- Competition most acute in water-stressed areas
- Network capacity and public perception can pose significant problems even in non-water stressed areas
- Quality, availability and reliability of water sources have to be taken into account
- Combination of different sources and backup strategies might be necessary
- Volume requirements depend on water source
- What happens with the wastewater (reject)?

Source: IRENA and Bluerisk (2023), Water for hydrogen production, International Renewable Energy Agency, Bluerisk, Abu Dhabi, United Arab Emirates.

Green hydrogen

Volume requirements for alternative water sources
River: 17.2 L
Groundwater: 17.2 L
Seawater: 28.6 L



Typical impurities in different water sources

Impurity	Surface water	Groundwater	Rainwater	Seawater	Treated wastewater
Suspended solids	++	0	++	+	++
Dissolved solids	+	++	0	+++++	+++
Calcium	+	++	0	++	++
Iron and manganese	+	+++	0	0	0
Organics (TOC)	++	+	+	+	+++
Microorganisms	++	0	+	++	+++

Wastewater as source of technical water

Municipal wastewater

- COD 20 – 80 mg/l
- TSS < 30 mg/l
- Cond. 500 – 2500 $\mu\text{S}/\text{cm}$
- Calcium 50 – 250 mg/l

Paper industry wastewater

- COD 150 – 250 mg/l
- TSS < 30 mg/l
- Cond. 1000 – 3000 $\mu\text{S}/\text{cm}$
- Calcium 100 – 300 mg/l

Sugar industry wastewater

- COD 50 – 80 mg/l
- TSS < 30 mg/l
- Cond. 1000 – 3000 $\mu\text{S}/\text{cm}$
- Calcium 150 – 400 mg/l



Treatment Technologies

Pre-Treatment Processes

- Phys-chemical Separation
- Dissolved Air Flotation (DAF)
- Media Filtration (Sand, GAC, MMF)
- Membrane Filtration (MF & UF)

Desalination

- Reverse Osmosis / SBRO
- Ion exchange technologies (IEX)
- Membrane degassing for CO₂ removal

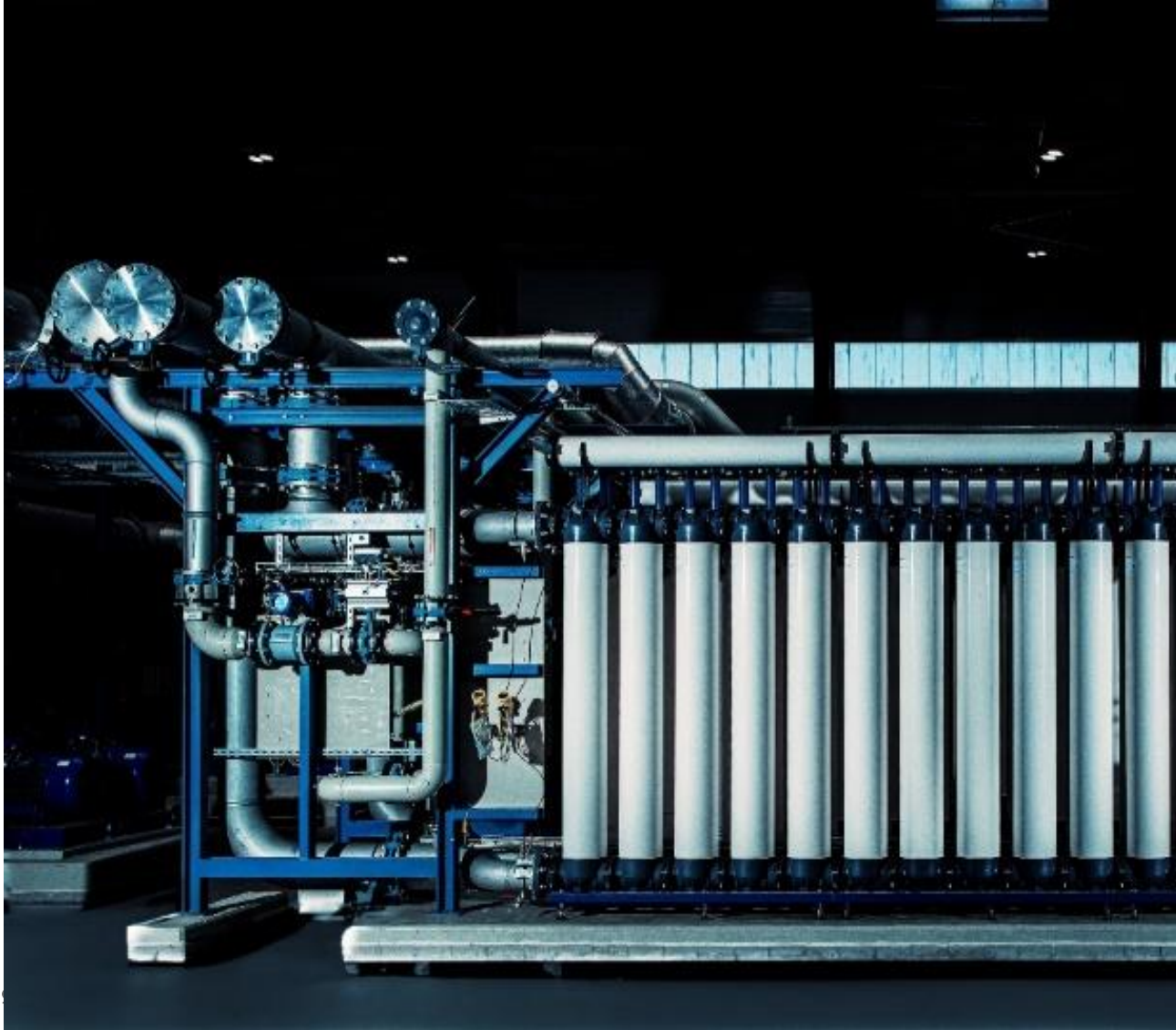
Polishing

- Electrodeionisation (EDI)
- Ion exchange (polishing mixed bed)
- UV for TOC removal or disinfection

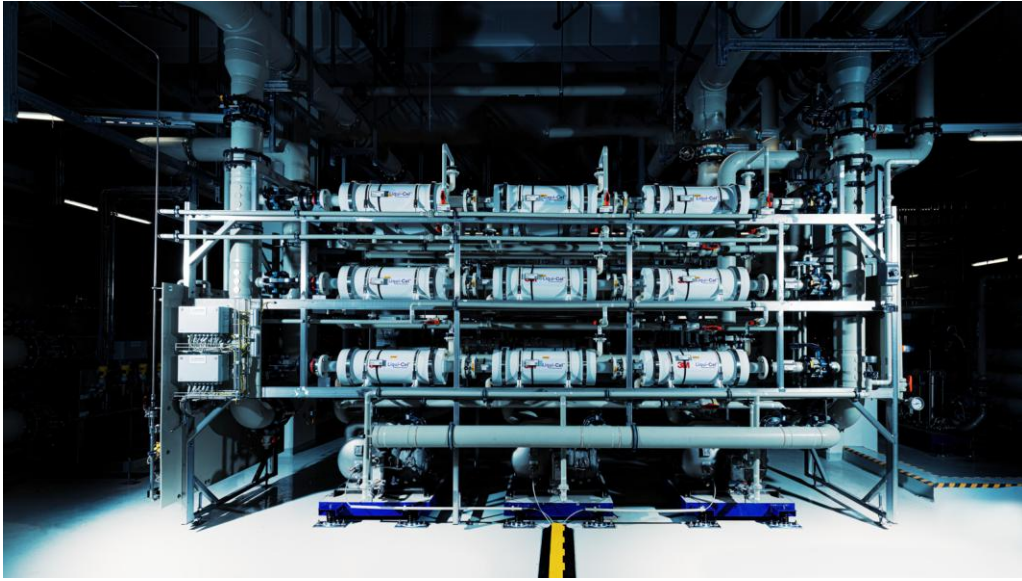
Reject Water Treatment

- Flocculation / precipitation
- Biological treatment
- Advanced Oxidation (AOP)
- Selective removal of PFAS, heavy metals and other contaminants

Pre-treatment Processes



Desalination



Polishing



Reject Water Treatment



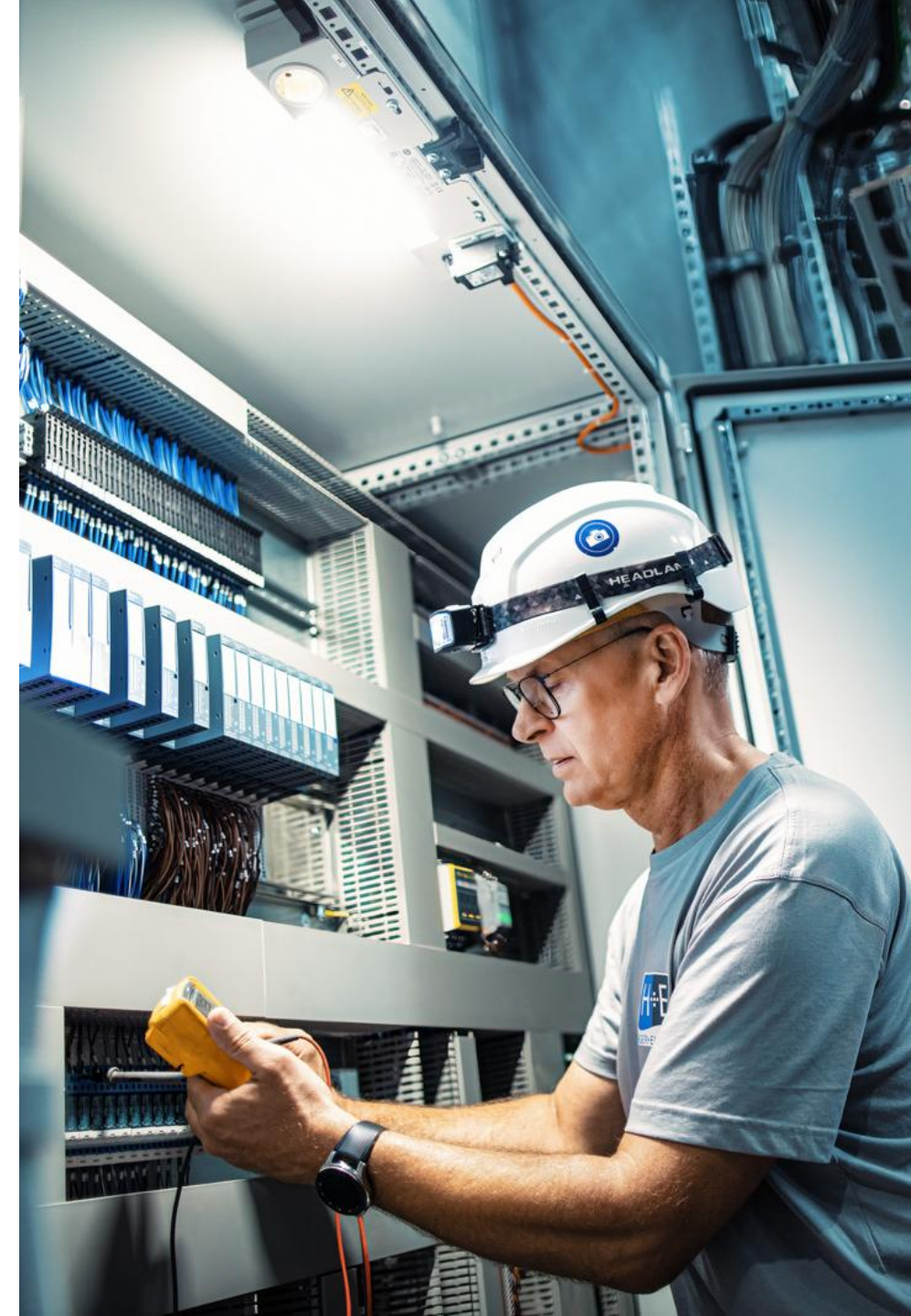
Treatment challenges - Process

- **Correct sizing**
Not too large, not too small
- **Redundancy / availability**
Sufficient operational safety,
but no over-engineering
- **Different water sources / seasonal fluctuations**
Where is my design point?
- **Ramp-up / ramp down**
Flexible processes or more storage?



Treatment challenges - Plant

- **Containerisation / building**
What is the most cost-efficient option?
- **Standardisation across different projects**
Sweet spot between savings through standardisation and over-design (e.g. ex-proof)
- **Material selection**
Which materials can damage the stack?
Which materials are most cost-effective for the desired lifetime?



Treatment challenges - Operation

- **Control system**
Investing in automation or operators?
Which system is more robust?
- **CAPEX versus OPEX**
Paying now or later ... or:
What are the long-term results of investment decisions?
- **Predicting operational cost**
Easy estimates and difficult decisions



River water treatment plant

The Challenge

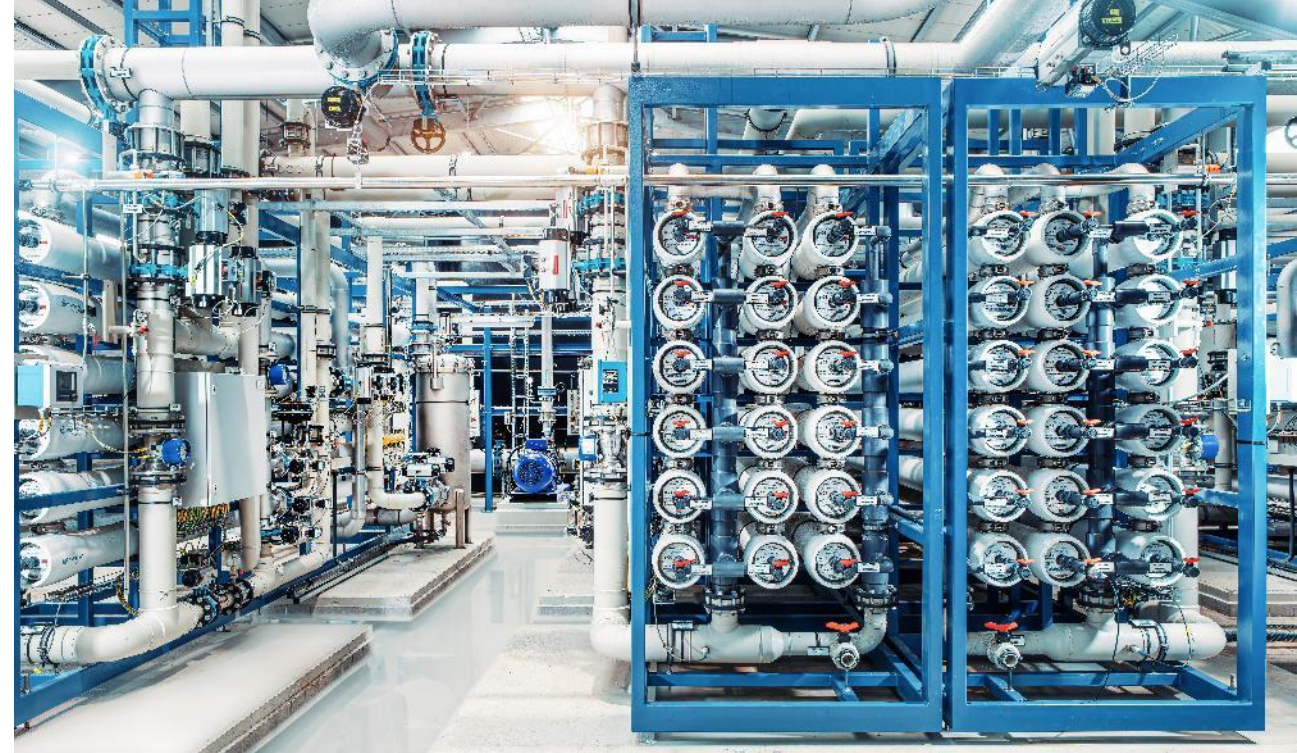
- Increasing demand for cooling and demin water at the Leuna site
- Need for a reliable, efficient water treatment system to handle river and cooling tower water.

The Drivers

- Rising production needs at the chemical site.
- Need for sustainable water usage and waste minimisation.
- Desire for efficient operation, including waste heat recovery and reduced downtime.

The Solution

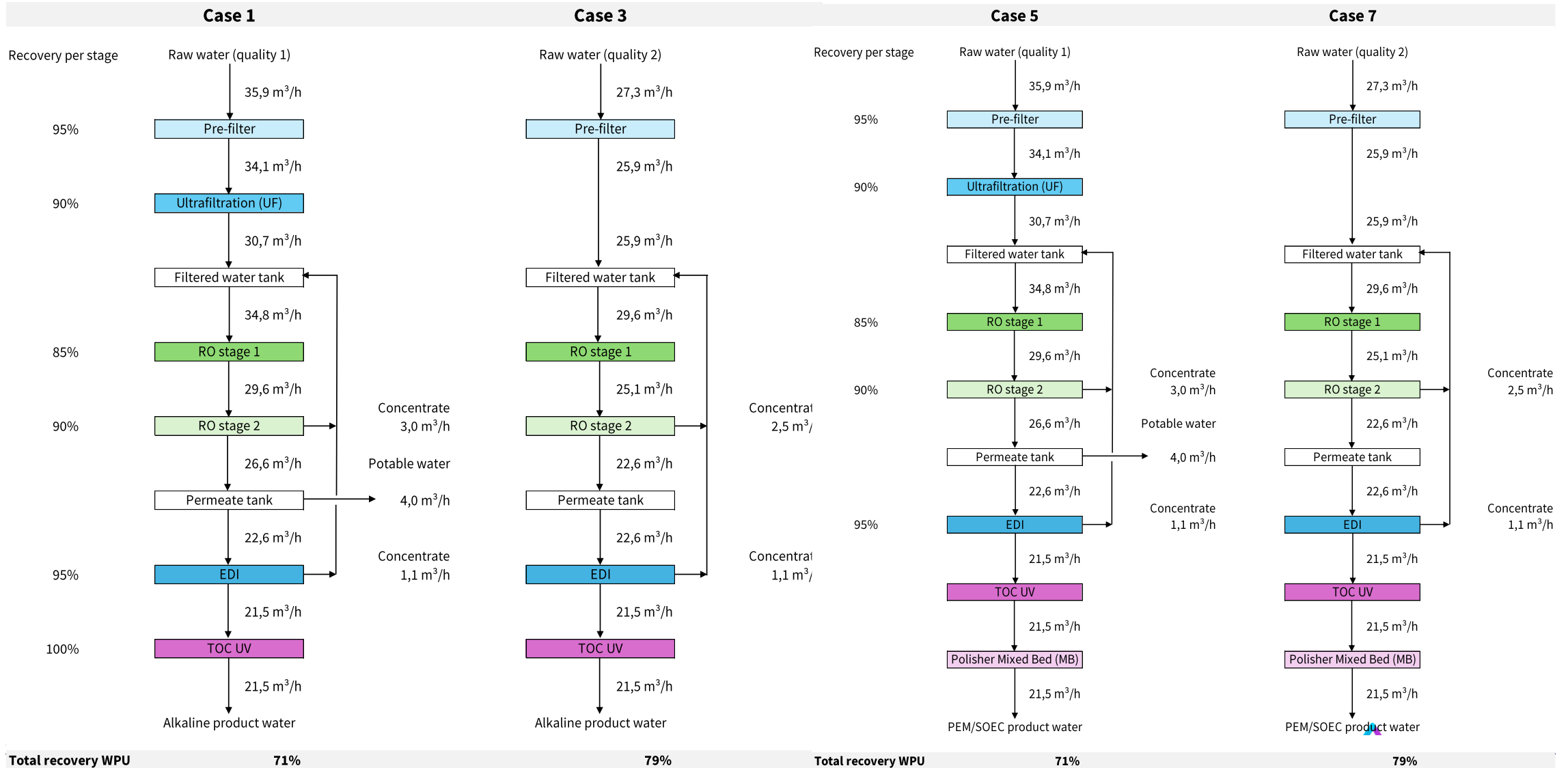
- H+E designed and delivered a complete water treatment plant
- Combination of ultrafiltration, reverse osmosis, and ion exchange to produce high-quality demineralised water
- Integrated systems for pre-filtration, chemical dosing, and wastewater management
- Use of waste heat for preheating, supporting efficient year-round operation
- Advanced control system with redundancies ensures operational safety and efficiency



Project Fast Facts

Industry:	Chemical
Customer:	InfraLeuna
Location:	Germany
Feed water:	TSS max. 4 mg/l, conductivity 706–1827 $\mu\text{S}/\text{cm}$, COD max. 13 mg/l
Demin water capacity:	375 m^3/h (normal), 450 m^3/h (max), expandable to 775 m^3/h 8 ultrafiltration lines at 150 m^3/h each, 5 reverse osmosis lines at 110 m^3/h permeate, 4 lines of demin plants @ 150 m^3/h
Built:	2024

Example: Green Hydrogen Project Standardisation



PtX Project Esbjerg

- **Technical water treatment**

 - Feed water is treated municipal wastewater

 - Established technologies (e.g. UF / RO)

 - Redundancy / availability / recovery

- **Reject water treatment**

 - Backwash from UF, concentrate from RO, CIP

 - Strict limit values (same as for original discharge)
and very low PFAS discharge limits

 - Challenging and complex treatment sequence

Reject water treatment is significantly more complex!





Any Questions? Get in Touch!

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