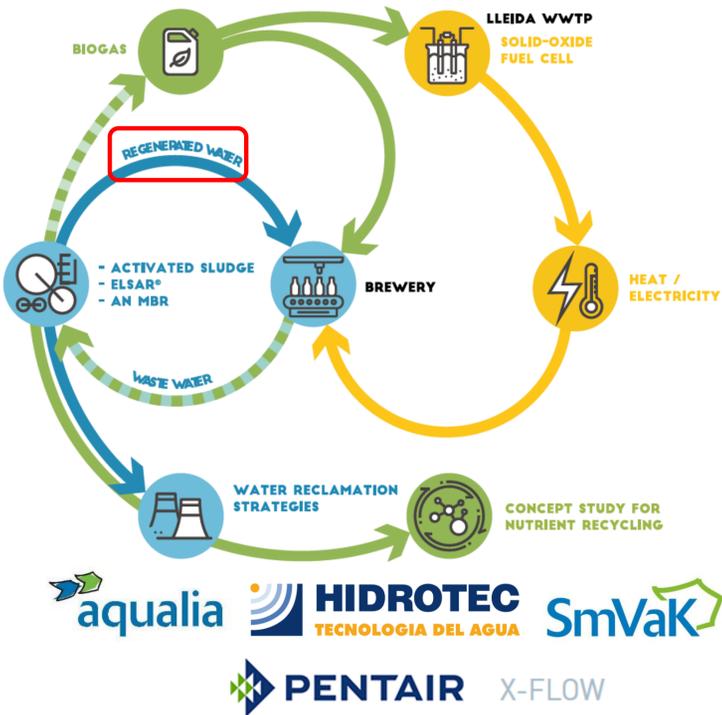


CS5 – Production of fit-for-purpose water

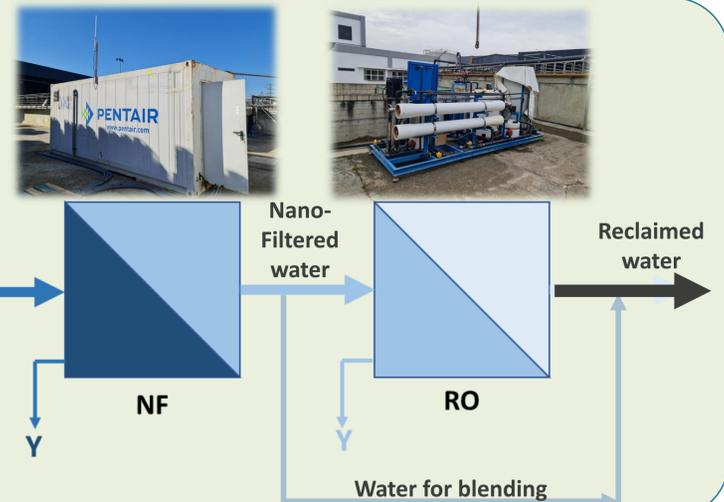


Objective

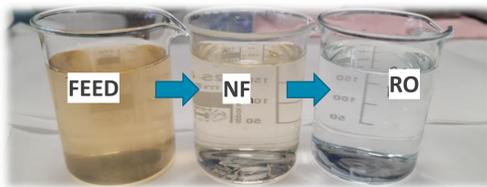
TRL: 7 → 9

- To implement a demo-scale successful water reclamation case:
 - **INNOVATIVE** → by means of a novel tertiary treatment of brewery wastewater
 - **SUSTAINABLE** → reusing regenerated water in cooling towers, achieving up to 10% water savings
 - **SAFE** → meeting legal water reuse requirements
 - **ROBUST** → testing several operating conditions: recovery, flux, filtration time, backwash velocity and chemical cleaning frequency

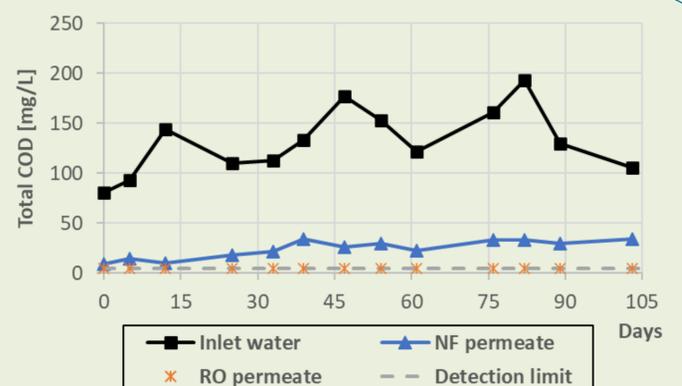
Secondary treated wastewater	
PARAMETER	CONCENTRATION
Legionella sp (UFC/L)	N.D.
Nematod eggs (ut./10L)	N.D.
E. Coli (UFC/100mL)	108388 ± 257040
SS (mg/L)	41 ± 16
Turbidity (UNF)	8.4 ± 3.9
pH	8.3 ± 0.1
Conductivity (µS/cm)	2831 ± 315
BOD5 (mg/L)	22 ± 23
COD (mg/L)	132 ± 33



First results



- Lab scale tests validated nanofiltration (NF) as solution for achievement of regulatory requirements. However, a salinity removal step is needed. Thus, a further reverse osmosis (RO) and a final blending are needed.
- NF membrane removes COD preventing the RO membrane from excessive fouling. 800Da to 1000Da is an enough membrane cut-off in NF for remove COD.
- Reclaimed water meets the water reuse requirements (Royal Decree 1620/2007) for cooling towers—with no exception.
- Operation of NF and RO showed to be **stable** at any tested condition. Obtained average NF permeabilities (standardized at 20°C) are in the range **10.0 - 19.2 L/(m²·h·bar)** and **no heavy clogging was observed**.
- A disruptive and complementary solution based on disinfection/advanced oxidation process is still under development.



Water reuse requirements for cooling towers (Royal Decree 1620/2007)

Parameter	Requirement	Units pH
Legionella' spp	Absence	CFU/1L
Nematode eggs	<1	eggs/10L
'Escherichia coli	Absence	CFU/100ml
Suspended solids	<5	mg/L
Turbidity	<1	TNU

Lessons learned from the construction and start-up

- Dark buffer tanks (even for nanofiltered streams) are required to avoid growing of algae and filamentous organisms that may clog pipelines, prefilters or pumps.
- Disinfectant chemicals may be needed
- A pretreatment based on coagulation seems not to be required

What is crucial in terms of replication of the technology?

- Consolidation / warranty of quality and quantity of produced flow
- Engagement and participation of the water end-user
- Promotion for water reuse strategies in industrial sectors like food and beverage (not waiting until water resources are scarce or not available)
- Simplicity of the solution

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