# Advanced treatment technologies for water reclamation

## Market Place, DEMOWARE workshop

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LIFE WIRE

Water Cycle Efficiency Improvement by Boosting Industrial Water Reuse

www.life-wire.eu

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# Introduction



- Water use has been growing at **more than twice** the rate of population increase in the last century (FAO, 2007)
- In Europe, 1/3 of countries are considered to be affected by **water scarcity** (EC, 2012)

**Water reuse as a water conservation strategy**

- Wastewater reclamation and reuse is considered to present a **lower environmental impact** and potentially lower cost than other alternative water supplies (California Energy Commission, 2005).
- Nevertheless, some challenges still need to be addressed…

# Introduction



- Environmental use: the removal of **priority** and **emerging pollutants** is a main concern due to their significance for environmental and indirect reuse applications.

- Municipal & agricultural uses: the **microbiological risks** are a concern for the potential contact with human/food.

- Industrial use: **Industries** account for **18%** of drinking water consumption in Europe (EEA, 2004). Only **0.7%** of total treated wastewater in Spain is reused in industry (Iglesias, 2008).

Demonstrative projects are needed to prove the feasibility, reliability and competitiveness of this practice, and hence, to boost water reuse

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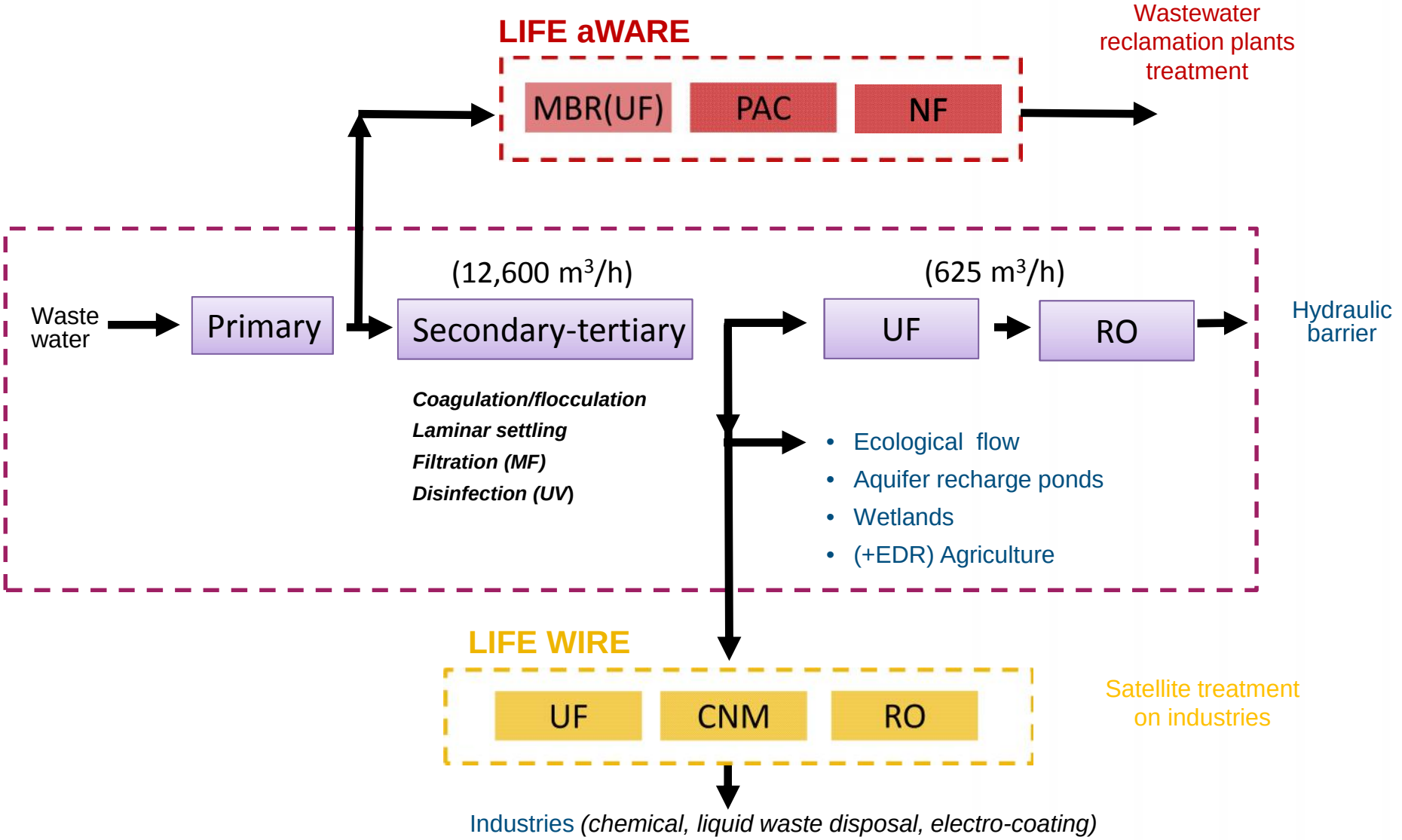
qWARE — Innovative hybrid MBR-PAC-NF systems to pormote water reuse

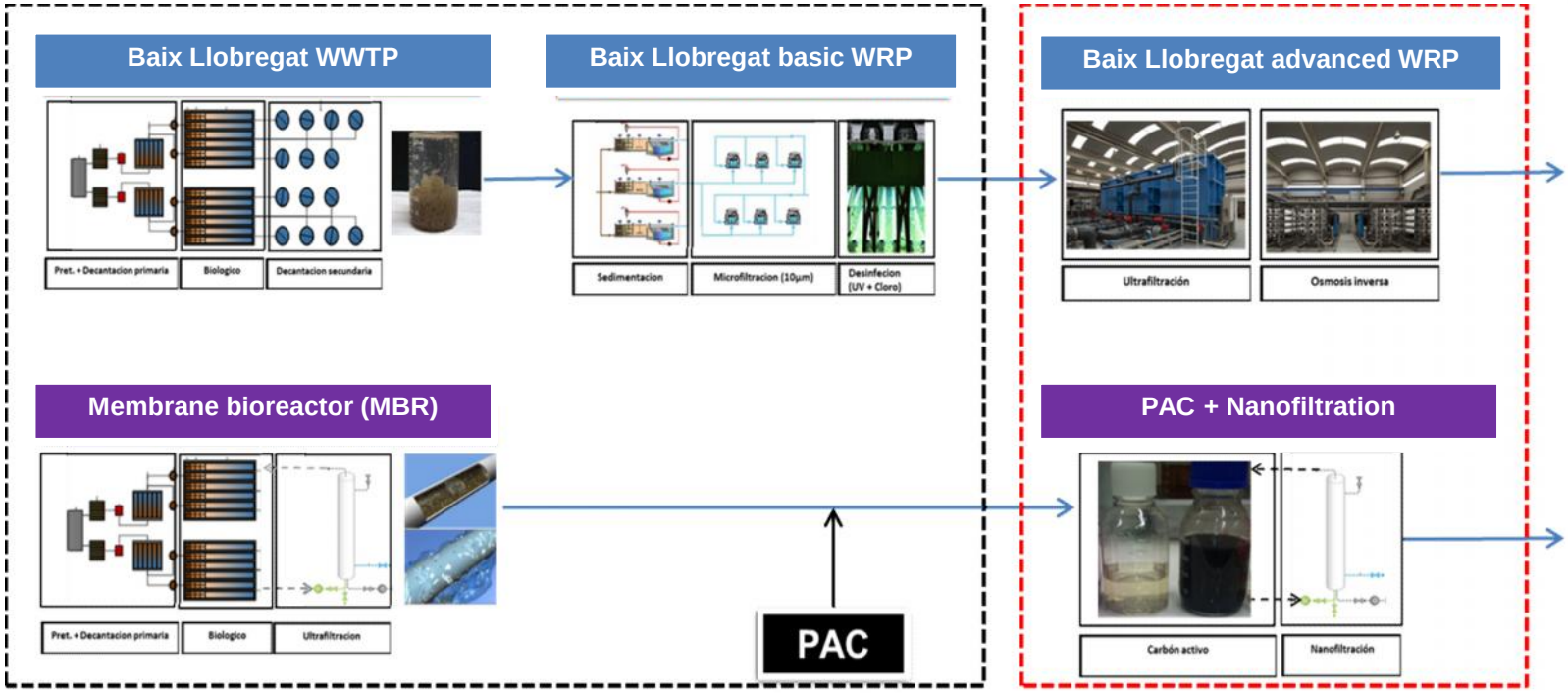
**Assessment of the technical, economic and environmental performance of different treatment technologies for water reuse**

## WWRP El Baix Llobregat (Barcelona area, Spain)



## Membrane bioreactor and activated carbon – nanofiltration

The optimization is focused in achieving the combination of **PAC** with **biological** and **membrane** processess that enhances water quality and reduces associated costs of membrane operation in Membrane Bioreactors (MBR) and nanofiltration membranes (NF)



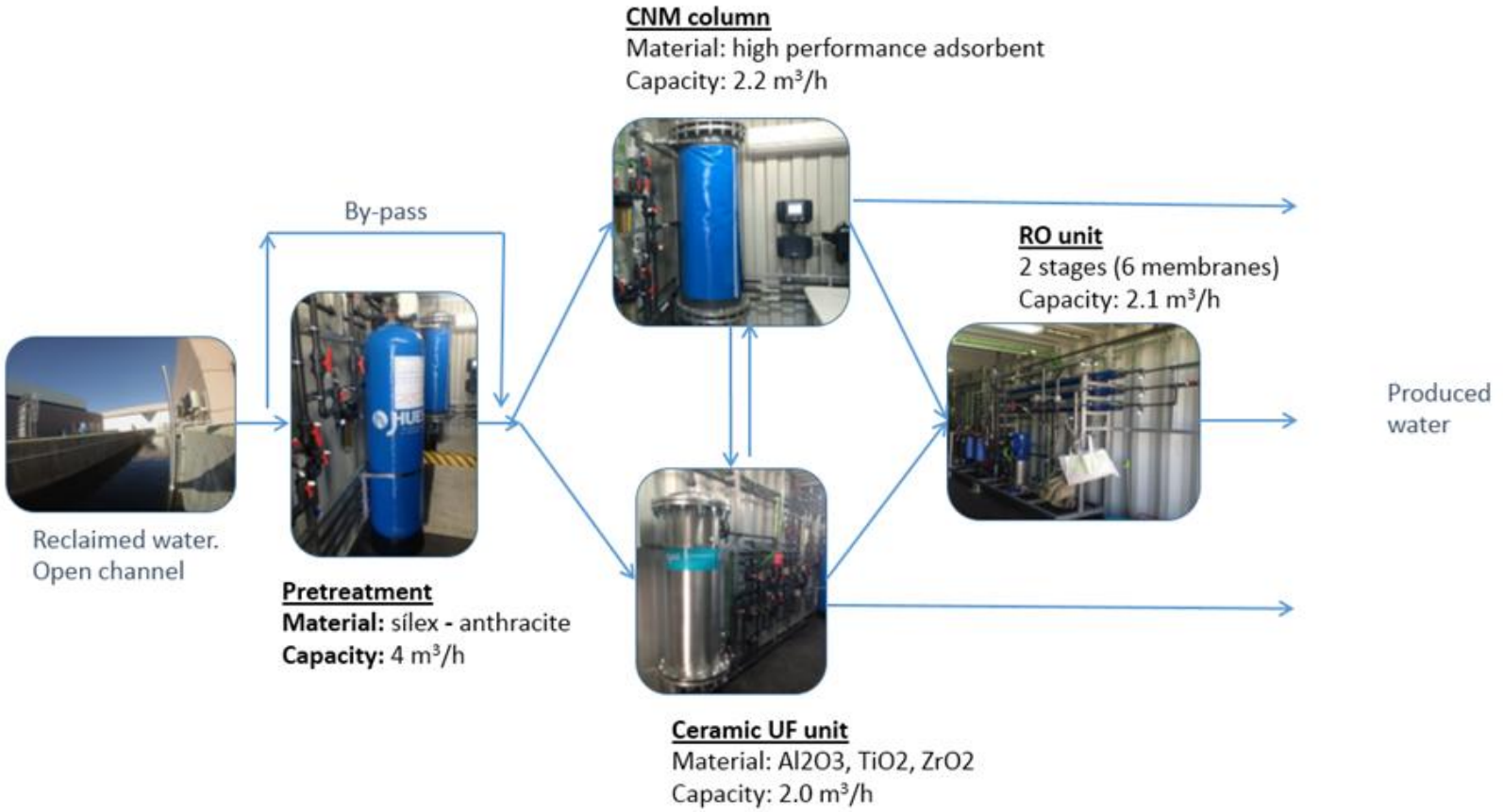
## Membrane bioreactor and activated carbon – nanofiltration

- **MBR vs conventional treatment:**
  - 30% higher OPEX, but more robust removal in terms of SS, turbidity, organic matter (COD, DOC) and microbiological parameters
  - PAC addition significantly improves the removal of some recalcitrant organic compounds (diuron, carbamazepine) and certain metals (cobalt, nickel, zinc, lead)

- **PAC-NF vs UF-RO:**
  - 40 % lower energy demand
  - No removal of salts but comparable levels of removal of organic matter and organic micropollutants with PAC concentrations that match the cost of chemicals in UF-RO systems.
  - Brines can be treated in a biological system reducing economic and environmental impact of the advanced reclamation system

## Fit-for-use reclaimed (urban) water for industries

Characterisation of the performance of different treatment units (membranes [UF, RO] and adsorption [high performance media, CNM]) to achieve fit-for-use water for different industrial sectors & uses



## Fit-for-use reclaimed (urban) water for industries

- The water produced (CNM+RO) is stuitable for most of the uses envisaged: cooling, boilers, reagents preparation, cleaning (facilities, equipment, containers,…), toilets fl.,…
- **CNM**
  - High water yield (>99%)
  - No chemical consumption
  - Regeneration still not needed (> 20,000 bed volumes)
  - Certain removal of organics (TOC, COD: 75% initially)
- **RO**
  - Low chemical consumption: antiscalant (3.0 mL/m3), reducer (3.3mL/m3)
  - CIP frequency: every 500 m3 (no flushings) - 900 m3 (1 flushing/day) treated; 0.46 L NaOH & 2.80 L HCl consumed per CIP
  - High and consistent water quality (< 25 uS/cm, TOC: 0.26 mg/L, COD: < 4 mg/L, Nkldj: 1.03 mg/L, SO4-: < 3 mg/L)
- Other configurations are being assessed, in order to meet other industrial requirements
- The results may be applicable in other indsutrial sectors (e.g. pulp & paper) with similar quality requirements (refrigeration, boiler, etc.)

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# Thanks for your attention

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