

ZELDA

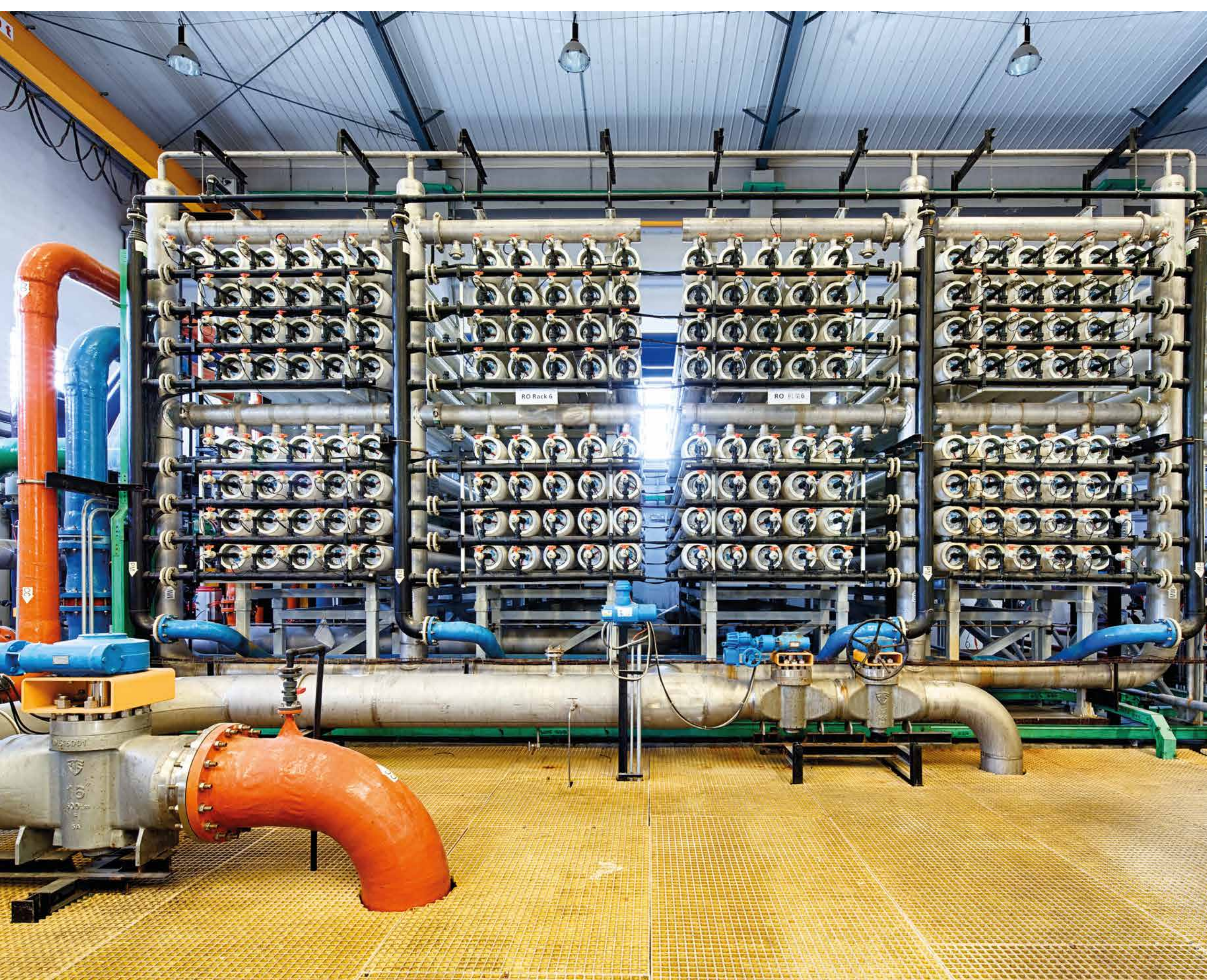
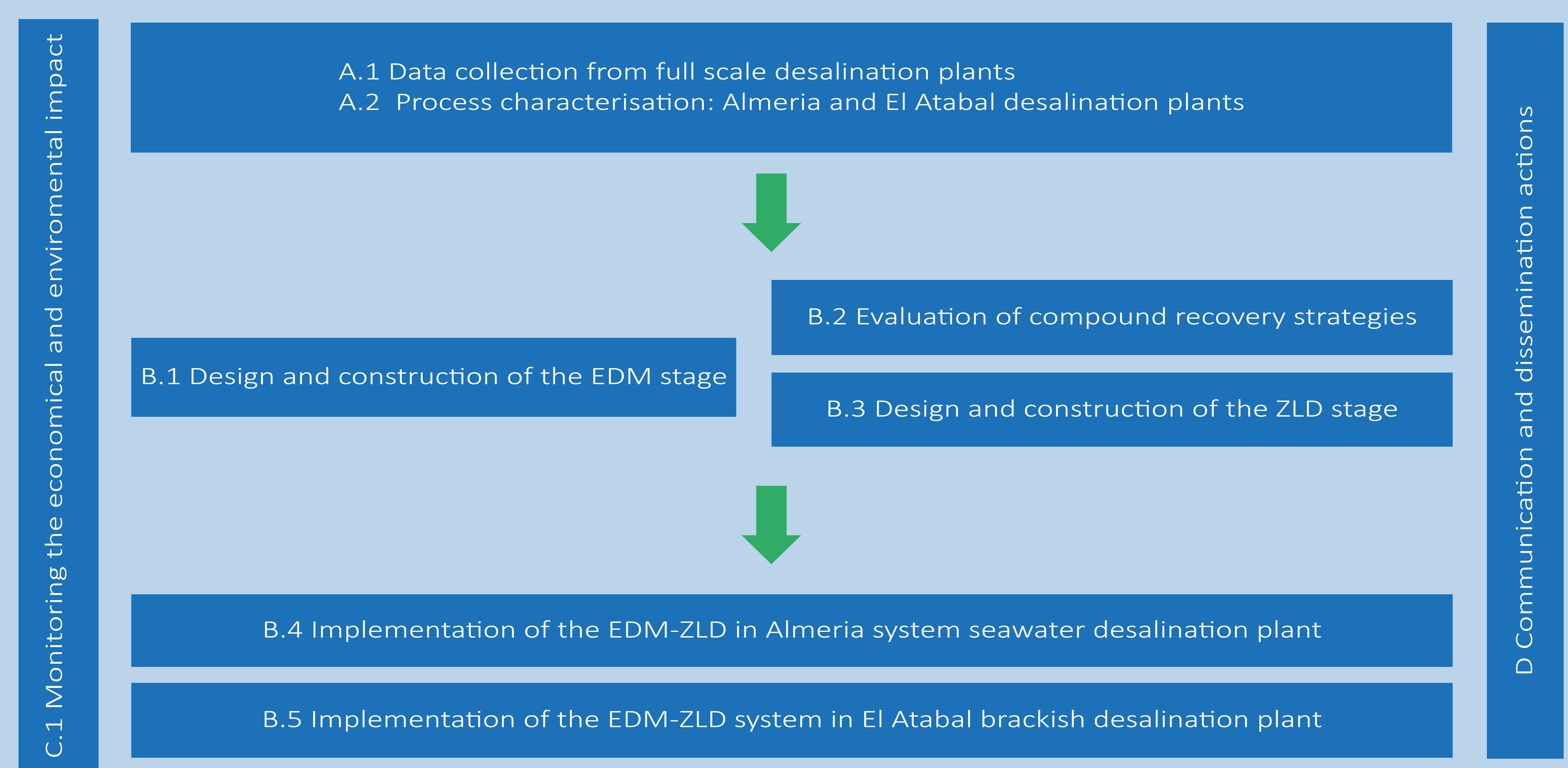
Zero ● Liquid 💧 Discharge ➤ Desalination

Environmental problem targeted ●💧➤

The Life+ Zelda project aims to demonstrate and disseminate the technical feasibility and economical sustainability of decreasing the overall environmental impact of desalination systems for freshwater production by adopting brine management strategies, based on the use of electrodialysis metathesis (EDM) and valuable compound recovery processes, with the final aim of reaching a zero liquid discharge (ZLD) process



Project Structure



ZELDA expected results ●💧➤

- Versatile brine treatment system based on EDM-ZLD technology.
- 💧 Performance and operational costs of the new EDM-ZLD system to treat brines from both, seawater and brackish water desalination plants.
- Influence of the brine composition and operating conditions of the EDM-ZLD system on the overall sustainability of the desalination process.

- ▲ Increase the water recovery of the existing desalination plants
- ▲ Increase the public awareness on the environmental impact of current brine discharge strategies.
- ▼ Decrease the brine discharge into water bodies.
- ▼ Decrease the environmental impact of obtaining valuable compounds recovered via conventional mining activities.



www.life-zelda.eu



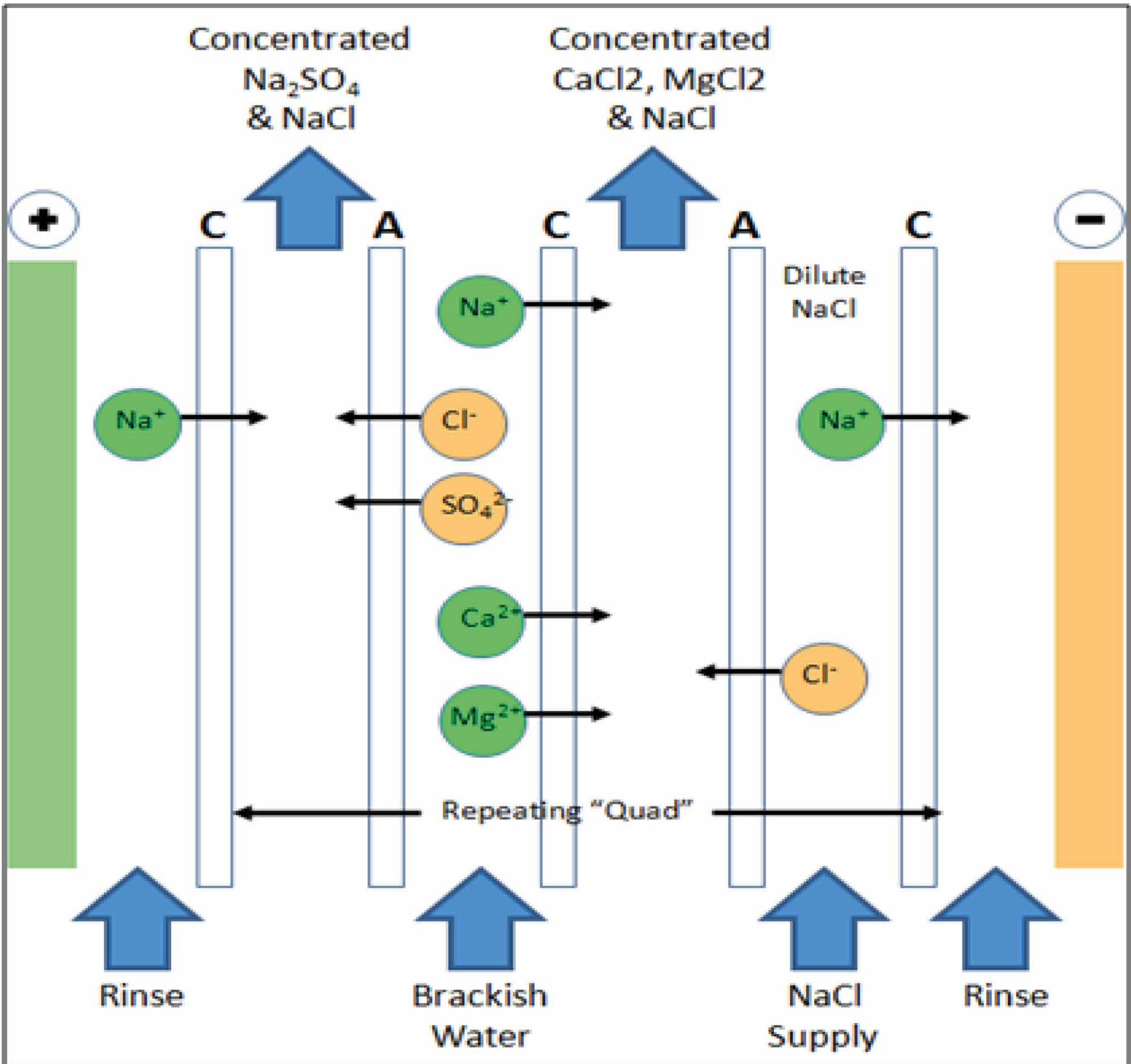
ZELDA

Zero Liquid Discharge Desalination

Electrodialysis Metathesis

Principle

A direct electric potential is applied to the ends of the stack, resulting in a direct current that is carried by ions migrating through the membranes and solution compartments. The DC potential pushes ions through membranes from a lower-concentration to a more concentrated solution. A four-compartment electro-dialysis metathesis stack is used, in which there are two depleting streams and two concentrating streams. The two depleting streams are (1) e.g. RO/NF concentrate, typically rich in calcium, salts, and (2) sodium chloride (NaCl) feed. The two concentrating streams are (1) Mixed sodium salts, and (2) Mixed chloride salts.

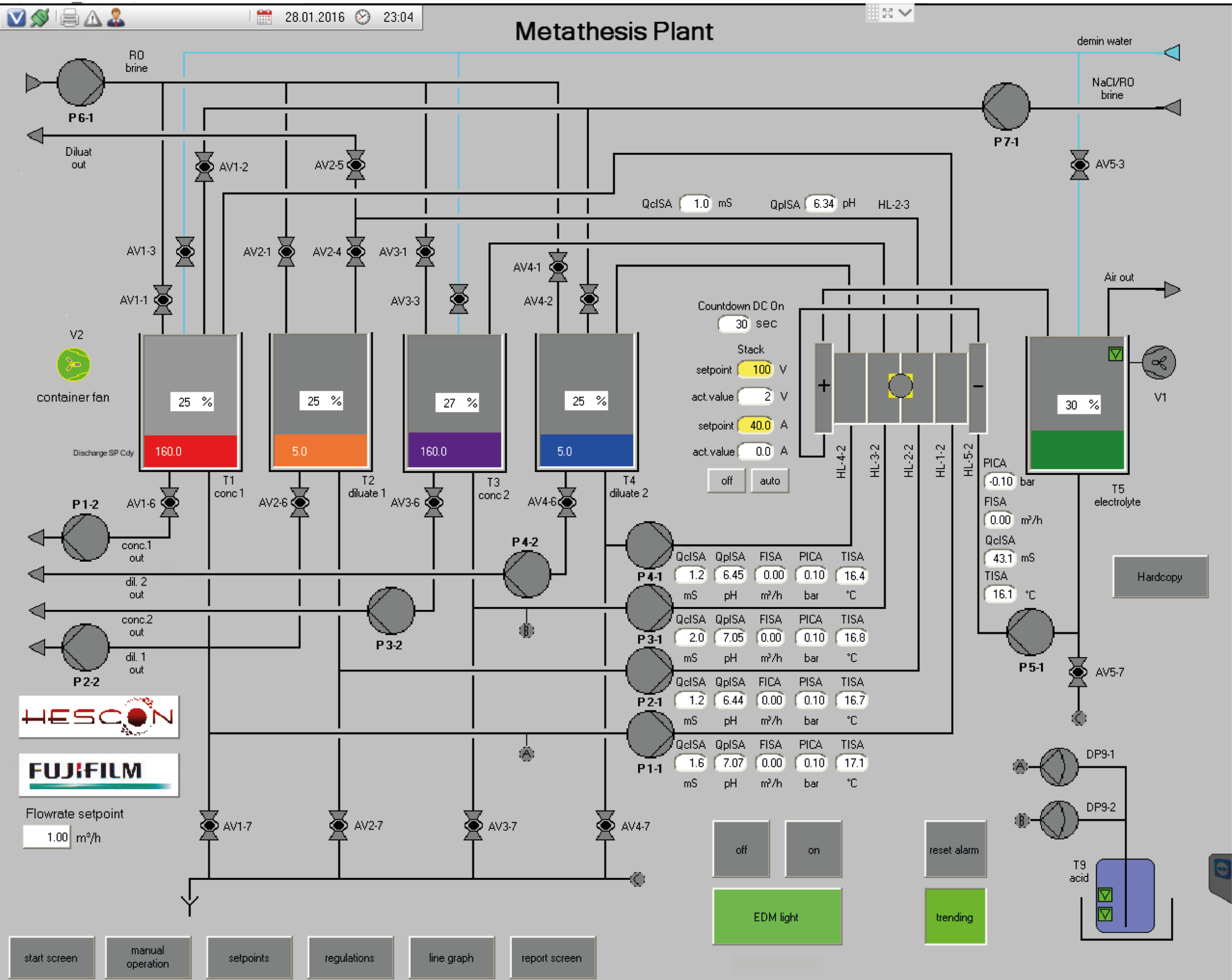


Advantages

- High water recovery > 80%
- High concentrations obtained of valuable salts (> 100 gr/L TDS)
- No scaling of multivalent ions
- Less waste costs (high concentration and low volume)

From bench scale to pilot

After successful bench-scale tests this unique technology will be proven also on pilot scale treating 1 m3/h BWRO and SWRO brine.



System

- Capacity 0.5-2.5 m³/h
- Fully automated batchwise system
- 5 µm pre-filtration
- Auto logging and remote control

Stack

- 50 x 50 cm
- Ti/Pt electrodes
- 300 cellpairs, 105 m² membrane area
- 150 kg



www.life-zelda.eu

FUJIFILM

ABENGOA WATER



ZELDA

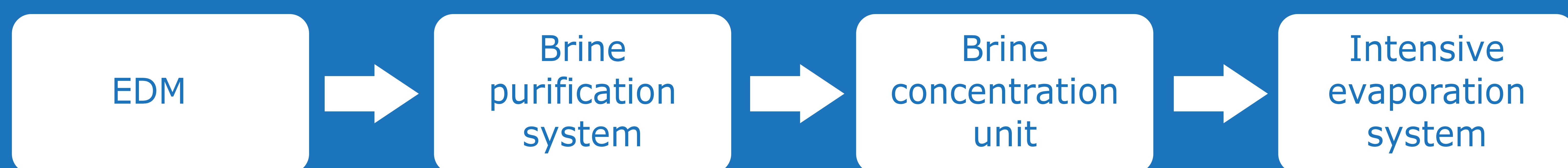
Zero ● Liquid 💧 Discharge ➡ Desalination

Innovative brine management technology ZLD desalination process

Project description

The main objective is to demonstrate the technical feasibility and economic viability of a new brine management system based on the use of EDM and valuable compound recovery processes with the final aim of reaching ZLD.

Strategy



Pilot plants description

EDM System » 1 m³/h (average flow)



Electrodialysis metathesis (EDM) is an innovative electroseparation technology that allows the recuperation of two concentrates with high soluble salts. The EDM pilot plant consist of an ED stack with electrical and hydraulic connections, a control box, tanks with pumps, filling and drain piping and flow and pressure measurement units.

The plant has five different circuits: electrode rinse circuit, salt 1 circuit (concentrate 1), salt 2 circuit (feed), salt 3 circuit (concentrate 2), and salt 4 circuit (NaCl solution).

Brine purification system » 1 m³/h (average flow)



Pilot plant designed to purify high saline effluents.

The pilot plant includes:

- 💧 Carbonic species removal system
- 💧 Reaction tank
- 💧 Flocculation tank
- 💧 Two clarifiers (lamella and sludge blanket clarifier)
- 💧 Sludge holding tank
- 💧 Storage tank for purified brine

Brine concentration unit » 1 m³/h (average flow)



The pilot plant can operate under falling film or forced circulation and under different vacuum levels.

The pilot plant includes the following elements:

Evaporator, condenser, feed storage tanks, temp. and pressure indicators, pumps (feed, concentrate, distilled, FF and FC recirculation, and vacuum), liquid-vapor separator, pre-heaters, boiler, air-coolers with double fan, flow-meters (feed, concentrate, distilled and FF recirculation)

Intensive evaporation system » 7.5 m³ (average volume capacity)



Evaporative technology designed taking into account minimal air volume contained within the greenhouse, control of the brine depth, control of temperature and humidity, thermal isolation of the ponds and considering air flow speed over the evaporation film.

Pilot plant specifications: intensive evaporation performance: 2 m³/m²·year, natural evaporation performance: 1.2 m³/m²·year, pond surface: 8.3 x 3 m = 25 m², total evaporation surface: 50 m², total evaporation capacity: 80 m³·year

Expected results

- 💧 Versatile brine treatment system based on EDM-ZLD
- 💧 Increase water recovery of existing desalination plants
- 💧 Decrease brine discharge into water bodies
- 💧 Extraction of valuable salts from desalination brines

Project Ref.: LIFE12 ENV/ES/000901
Duration of the project: July 2013-June 2017
Piloting location: Almeria seawater desalination plant
Total Budget: 2,443,665.00 €



www.life-zelda.eu

FUJIFILM

ABENGOA WATER

