Watermining Synergies: Pilot System for Water, Salt and Energy recovery from urban wastewater

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Larnaca WWTP with numbers

Person Equivalent 100.000

Average Inflow 18.000 m^3/day

Maximum Inflow 27.000 m^3/day

2.500.000 m^3 of water/year

5.000 m^3 of sludge/year

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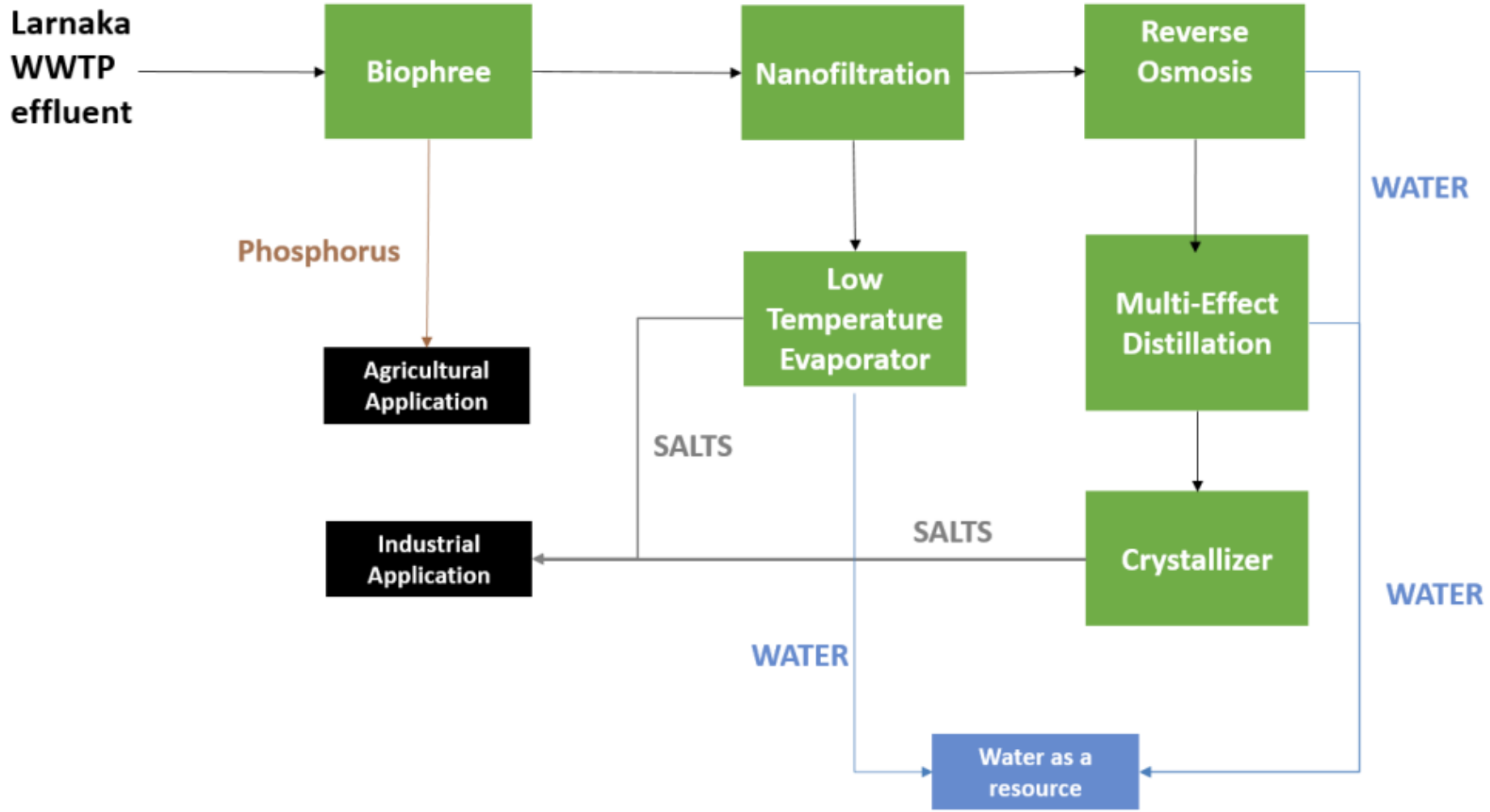
Problem

Water of high salinity→ salt accumulation will cause problems to land and cultivations

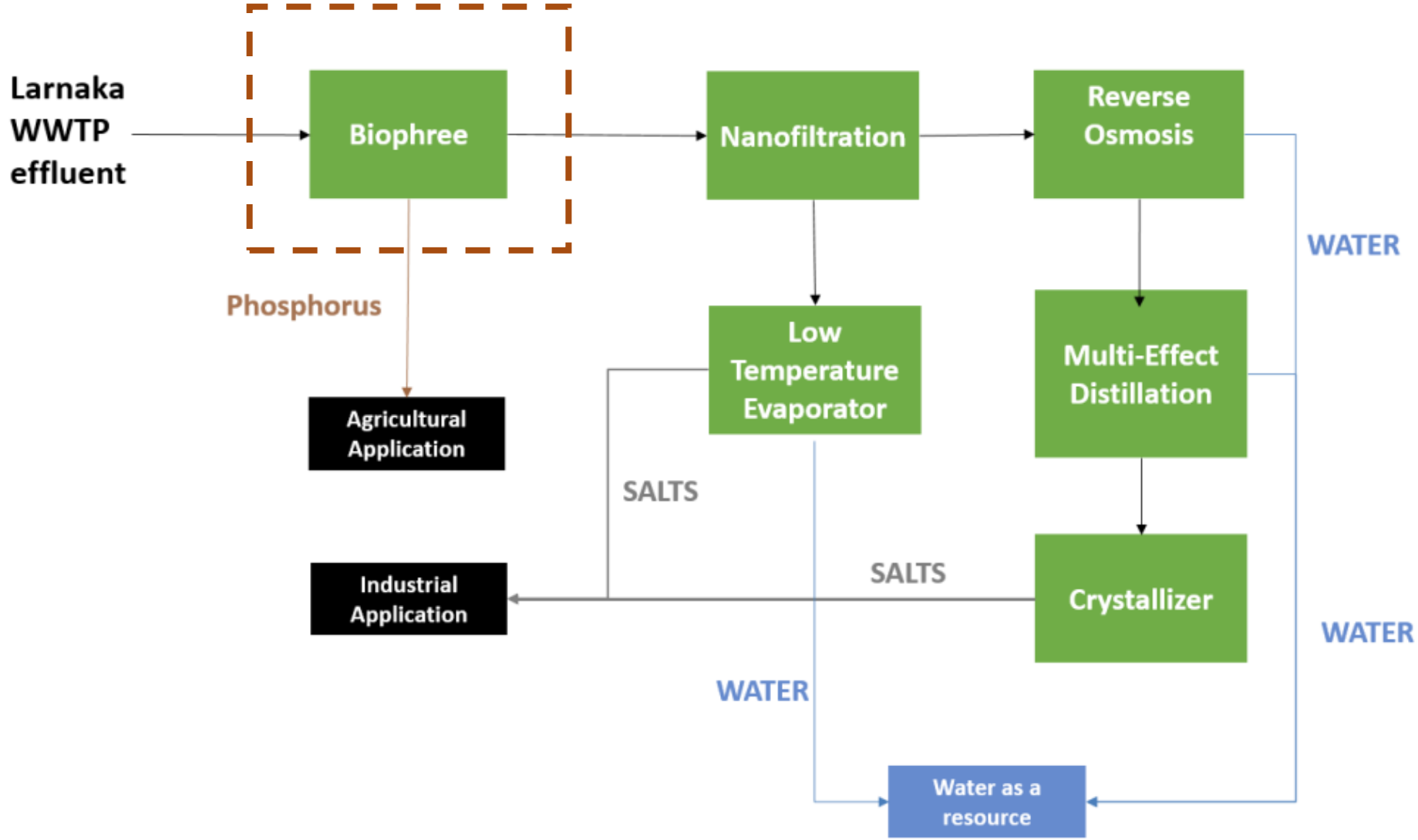
Pilot Objectives

- Ultra low phosphorus concentration in the effluent (<0,05 mg/L)
- Recovery of phosphorus
- Recovery of NaCl
- Recovery of water

Process flow diagram of pilot



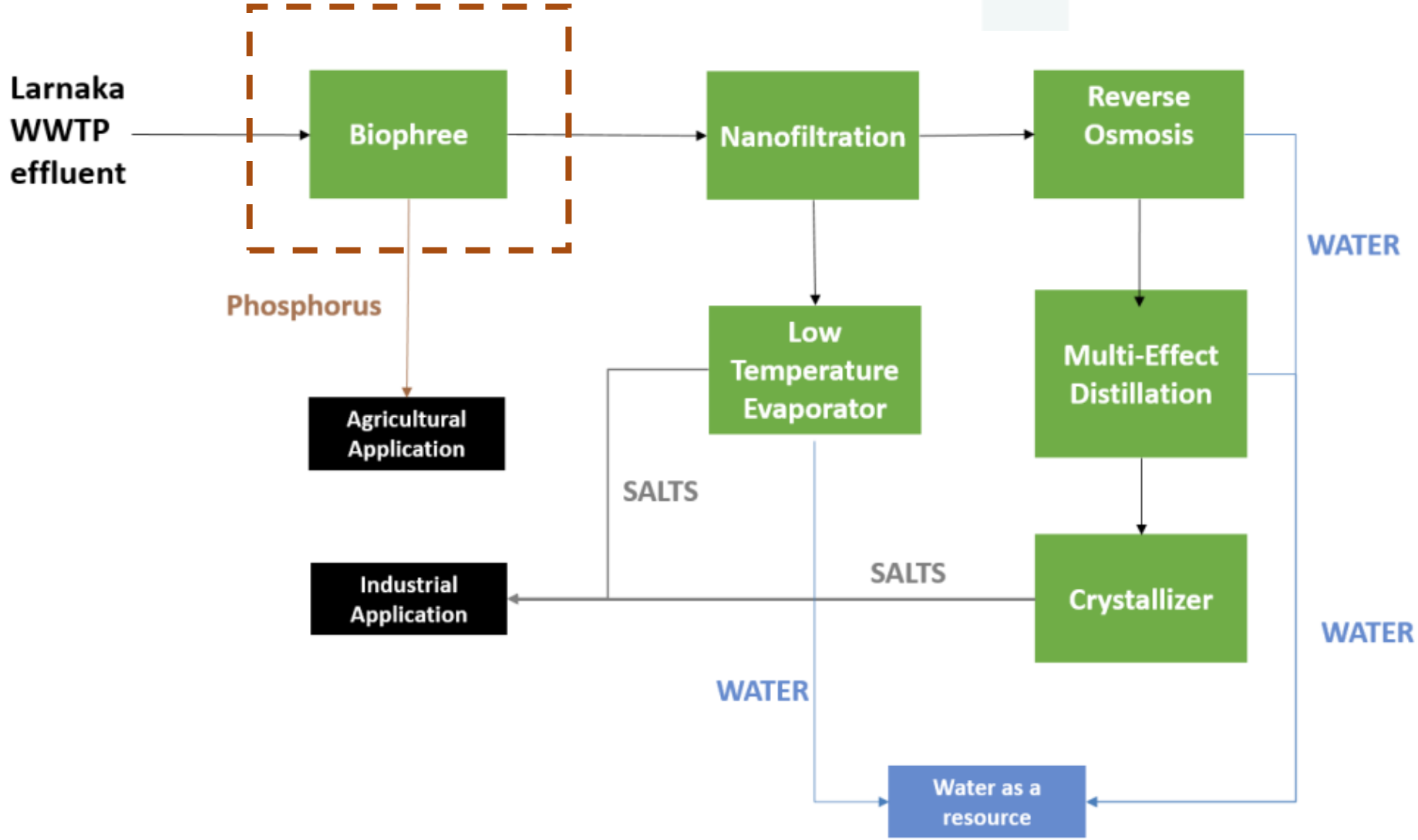
Process flow diagram of pilot



Biophree

- The effluent from the membrane bioreactor will be treated in a pilot scale Biophree installation (capacity 1 m^3/h).
- Biophree will be supported and constructed by WETSUS
- Biophree will absorb the remaining phosphorus in the permeate of membrane bioreactor.
- Phosphorus concentration will be decreased from 0,5 mg/L to 10-40 ppb .
- At these low levels of phosphorus concentration biological growth is limited.
- Reduction of biofouling and prevention of harmful algae growth in the intermediate reservoirs.

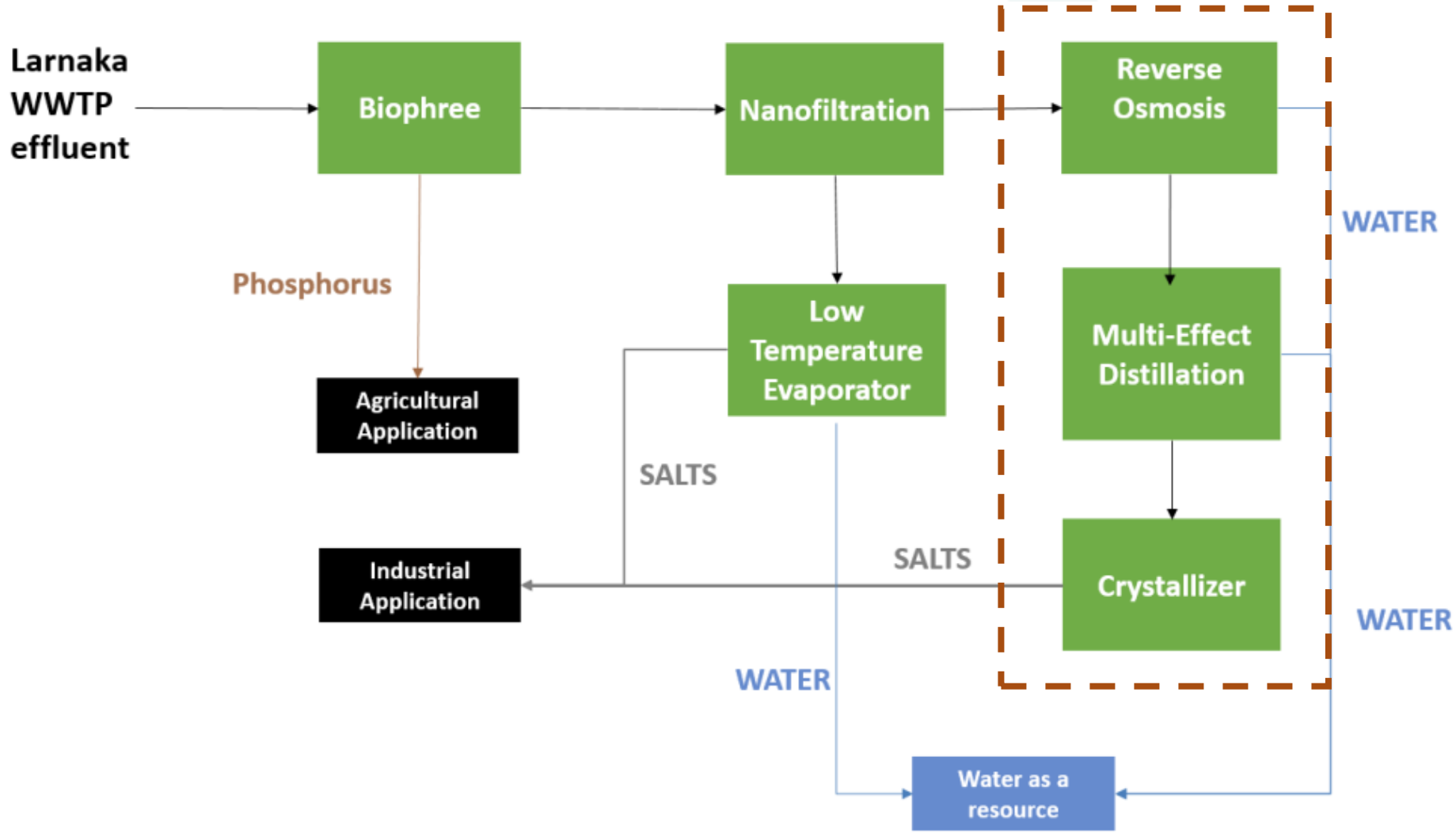
Process flow diagram of pilot



Nanofiltration and Low Temperature Evaporator

- Inflow: the effluent of Biophree ~1 m^3/h
- Separation of Monovalent form divalent ions (Mg and Ca)
- Condensate about 30% →LTE
- LTE recovers salts of Mg and Ca (80mg/L and 150 mg/L).
- LTE works with low temperature for avoiding scaling.
- About 30% of water recovered at this stage.
- Permeate to the next treatment stage.

Process flow diagram of pilot



Reverse Osmosis Multiple Effect Distillation (MED) Evaporator

- RO inflow: the permeate of NF ~0,6-0,7 m^3/h (NaCl~2%)
- Separation of monovalent ions from water ~0,42-0,49 m^3/h of water with low conductivity
- Condensate about 30-40 % →MED (NaCl ~7%)
- MED evaporator will condensate NaCl solution from 7% to about 19% and produce clean water.
- Crystallizer condensate MED effluent (NaCl concentration ~19%) → saturated solution ~26% NaCl
- The saturated solution of NaCl will be used in the chlorination unit.
- Water for irrigation or industrial unit.

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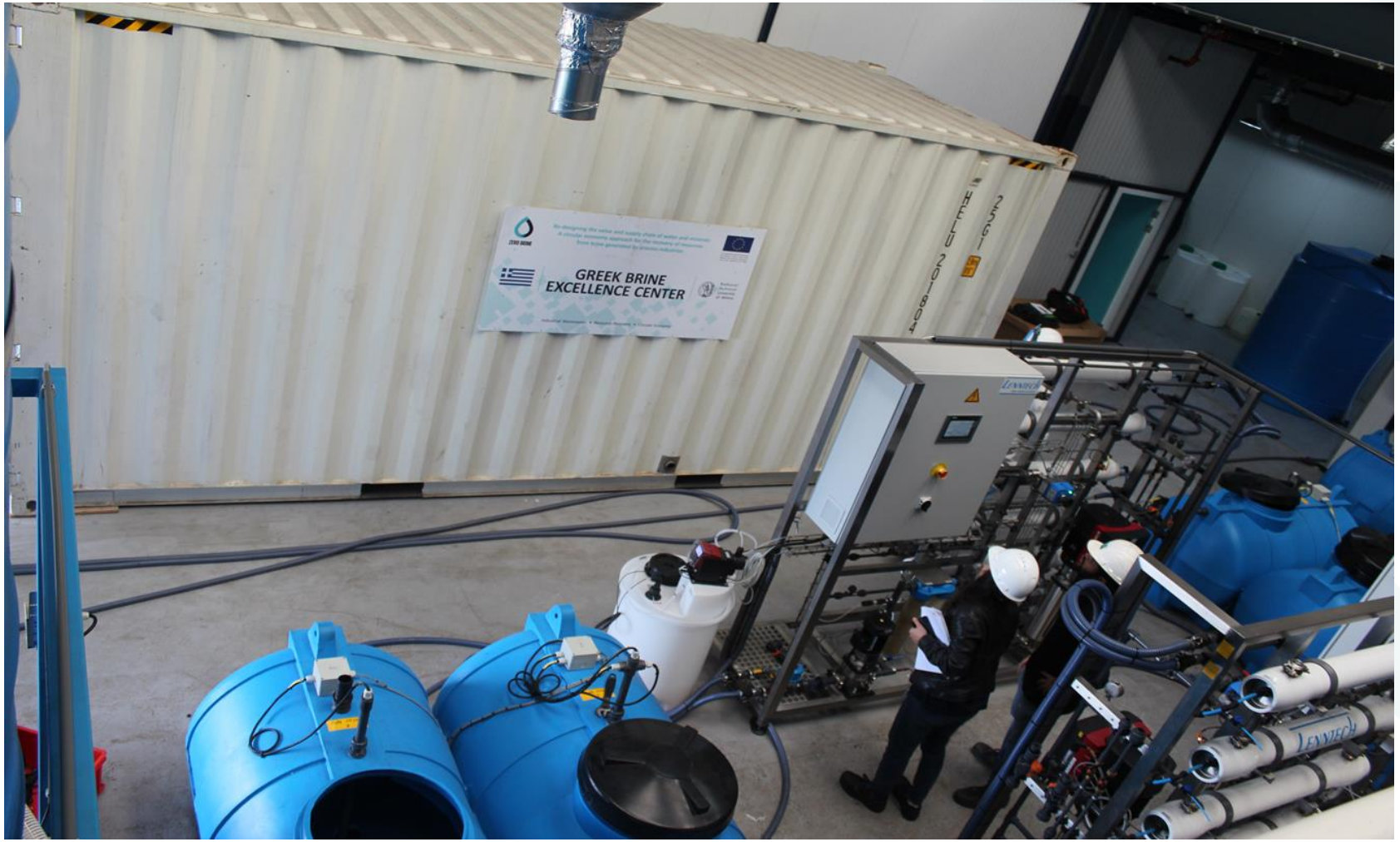

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Renewable Energy

- MED evaporator will be coupled with solar panels.
- Energy needed for the other technologies of system will be produced by photovoltaics in order to minimize environmental footprint of the project and CO_2 production.

Thank you for your attention!!!

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