

SmaCuMed

Smart Irrigation Cube for the Mediterranean Area

Background

In common with many North-African countries, Morocco and Tunisia are affected by **climate change**. Significant amount of available groundwater and surface water face **progressive salinization** due to seawater intrusion in coastal regions and geographic water irregularities as consequence of uneven rainfall repartition.

Meeting **agricultural needs** by rainfall alone is challenging. Alternative resources such as seawater and brackish groundwater need to be considered.

The Innovation

The innovative core of the project is to develop, test and integrate a novel **all-in-one smart irrigation cube** system for the desalination of brackish groundwater for irrigation, which is controlled by IoT based sensors and autonomously powered by solar PV.



Sustainable Agriculture in Morocco

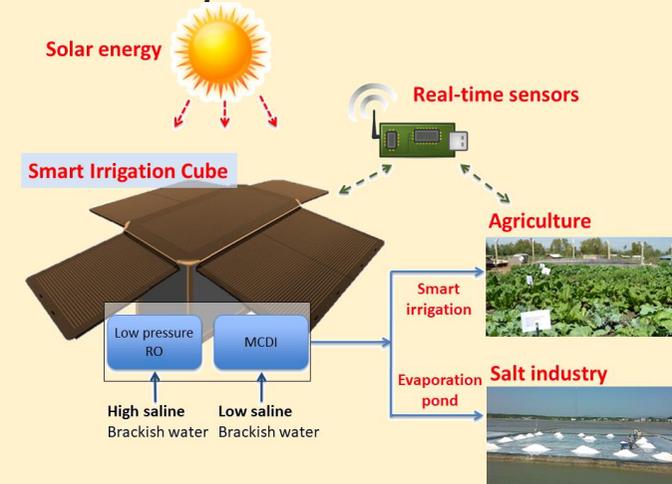


REGION QUARZAZATE MOROCCO

The Solution

- Development of an innovative, energy-efficient, modular process for desalination of brackish groundwater and IoT based **smart irrigation**.
- Low-pressure reverse osmosis (LPRO) and novel technology membrane capacitive deionization (MCDI) used to reduce the energy requirements for the **desalination** and significantly improve the water recovery.
- Tracking real time weather and soil data using IoT based sensors to develop an innovative algorithm to improve irrigation strategy and **increase agricultural yield**.

The Concept Structure

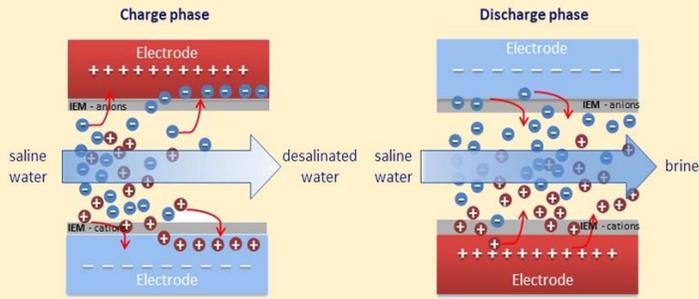


Modular concept view

- **Treatment of groundwater:** MCDI/LPRO technologies for efficient brackish desalination
- **Renewable energy supply:** Autonomously powered by solar PV with low CO₂ footprint
- **IoT based sensor system:** For real time data tracking and smart irrigation
- **Concentrate management:** Evaporation ponds for sustainable brine disposal and salt recovery



Membrane Capacitive Deionization (MCDI)



Principle of membrane capacitive deionization

- The process is divided into two alternate cycles: adsorption of ions and regeneration of electrodes
- Saline water flows between two porous electrodes
- Applied electrical voltage forces the dissolved ions towards their respectively oppositely charged electrode
- Once the electrodes are saturated, polarity is reversed to release salts and regenerate the electrodes

General advantages include low energy consumption, high recovery of produced water and tuneable desalination.

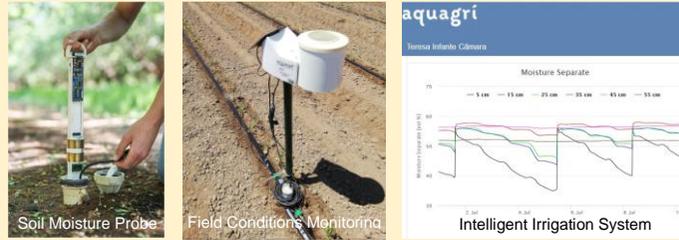
Advantages of SmaCuMed

- Modularity and adaptability
- Innovative technologies with low energy consumption
- Improved agricultural high value products
- Sustainable water management and brine disposal
- Raising awareness on sustainable agriculture



Agricultural products from argan, olive and date fields

IoT Smart Sensors



IoT sensors for smart irrigation management (Aquagri)

Data tracking from smart sensors is used for developing water balance models and algorithms for sustainable irrigation and improved crop productivity by:

- Optimizing water management for irrigation of date palms, olives trees and argan trees
- Increase irrigation efficiency by adapting crop productivity
- Improving soil and water management practices in Morocco, Tunisia, and other Mediterranean countries.

Sustainability Assessment

Life cycle assessment (LCA) and socio-economic evaluation of the SmaCuMed concept are carried out for the integrated system.

SmaCuMed also directly contributes to 6 out of the 17 Sustainable Development Goals (SDG) set by the United Nations including promoting **sustainable agriculture** (SDG 2.4) and increasing **water-use efficiency** to address water scarcity (SDG 6.4).



SDGs in SmaCuMed (source: sdgs.un.org/)

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