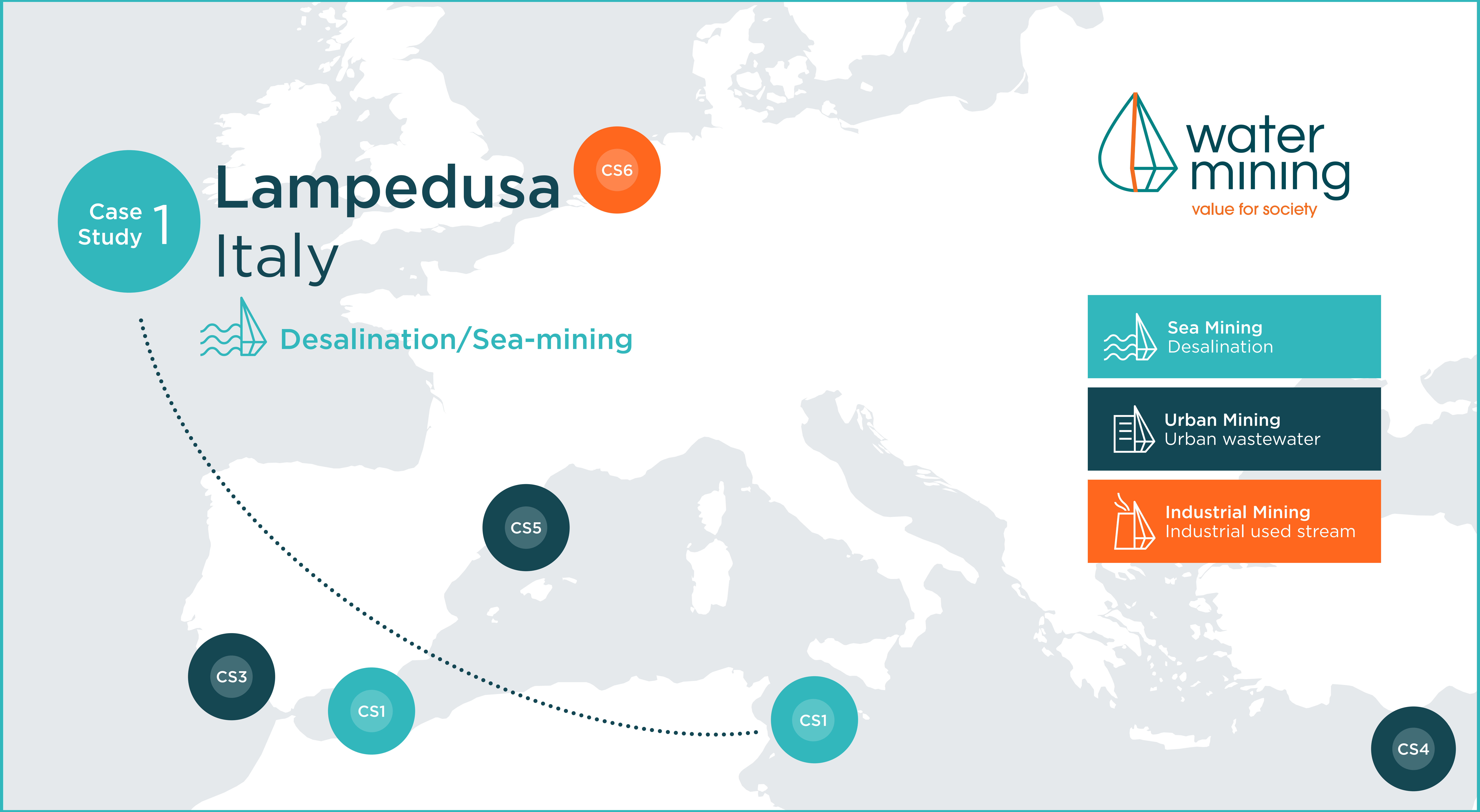

Case Study 1
Lampedusa
Italy
Desalination/Sea-mining
water mining
value for society
Sea Mining
Desalination
Urban Mining
Urban wastewater
Industrial Mining
Industrial used stream
CS6
CS5
CS3
CS1
CS1
CS4

Case Study 1

Lampedusa Italy

Desalination/Sea-mining

Photo: A view of the sea from Lampedusa, Italy. S.E.L.I.S.

Overview

CS1 demonstrates innovative technologies to extract valuable minerals, produce drinkable water and chemicals from desalination brine/seawater, and utilise low-grade waste heat. The treatment process involves various methods for the recovery of minerals like magnesium hydroxide, sodium sulfate, and sodium chloride from seawater, along with the production of sodium hydroxide and hydrochloric acid solutions. Each pilot unit has a capacity of 2.4 m3/h for treating desalination brine/seawater. After initial supplier testing, the pilots were deployed to Cala Pisana in Lampedusa for real-world operation and further optimization.

Main challenges

Sea-mining | CS1 Lampedusa / Italy

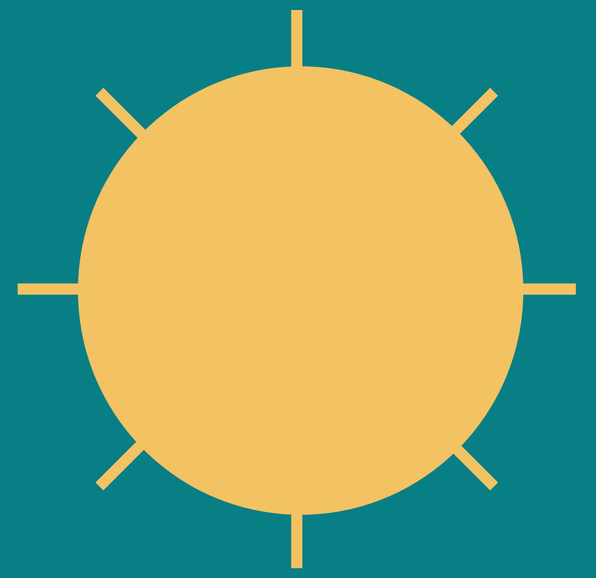
Recovery of magnesium and calcium with the Multi Feed–Plug Flow Reactor (MF-PFR): The presence of these ions could compromise the functioning of the technologies downstream (i.e., the scaling of the membranes in the Electrodialysis unit);

Quality of the chemicals produced: Low concentrations of sodium hydroxide produced by the Electrodialysis with Bipolar Membranes (EDBM) unit could not be sufficient for the MF-PFR target operation;

Employment of waste heat: The waste heat produced within the power plant could not fit all the requirements from the MED unit.

CS1 is investigating mineral extraction, chemical production, and drinkable water generation as well as the adaptability of this treatment process to varying levels of available low-grade waste heat along with its responsiveness to fluctuations in the volume of desalination brine/seawater to be treated.

In terms of mineral recovery, the case study is examining the ability of the treatment process to consistently produce market-standard magnesium hydroxide, sodium sulfate, and sodium chloride. Additionally, it is exploring the feasibility of utilizing in-situ produced alkaline solutions along with the economic and environmental advantages they could bring to the overall sustainability of the treatment process.



Key innovations

Waste heat recovery: Waste heat provided by the power plant of Lampedusa for the operation of the Multiple Effect Distillation (MED) process allows low energy consumption.

Mineral recovery: Production of high valuable salts, such as magnesium and calcium hydroxides, sodium sulphate and table-salt. In addition, chemicals like hydrochloric acid and sodium hydroxide are produced, which can be used as process reactants or for cleaning purposes.

Water production: High quality water will be achieved, suitable for drinking purposes and/or also for agricultural and industrial needs.

Magnesium Hydroxide is a versatile mineral with applications in wastewater treatment, flame retardants, and nutraceuticals. In CS1, it's utilized as a flame retardant (purity: 90-95%) and a nutritional supplement (purity: >98%). Sodium chloride production serves various industries like food and sodium hydroxide manufacturing. Sodium hydroxide and hydrochloric acid solutions have dual roles within CS1 and for desalination plant maintenance. All incoming desalination brine/seawater is fully used for product recovery, aligning with circularity principles.

Technical outcomes

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+ 50%

More than %50 of waste heat recovered to drive the process

-10%

Reduction in energy consumption by 10%

80%

Total water recovery up to 80% (doubling the current value for standard desalination)

90%

Purity of magnesium hydroxide higher than 90%

+90%

Purity of sodium chloride higher than 90%

Expected impact on society

Less expensive method for water production

Reduced volume of desalination brine

Secure sustainable access to Mg

High value salts

The pilot drives sustainable development in line with UN SDGs 6,9, and 12

Business opportunities

Business prospects stem from magnesium extraction as magnesium hydroxide, chemical production, table salt manufacturing, and augmented potable water output.

These product recoveries drive a circular business model, offering substantial economic gains and rendering Lampedusa Island appealing for potential industrial investments.

These investments can be readily recuperated through revenue streams, such as magnesium hydroxide, sodium chloride, and drinkable water.

Water

Ca Mg

Magnesium and calcium

Salts

Chemicals reuse

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