

Innovative circular and sustainable process to advance the extraction of critical raw materials from seawater



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SEArcularMINE, a €6 million Research and Innovation project funded under EU Horizon 2020, officially launched its activities on 1 June 2020, working towards developing leading technologies to ensure the sustainable supply of raw materials for key industrial value chains in Europe.

“We will prototype an innovative integrated process aimed at recovering energy and critical raw materials such as magnesium, lithium, rubidium and other trace elements from waste brines in Mediterranean basin saltworks” explains Professor Andrea Cipollina, project coordinator.

The team is composed of 12 partner organisations from universities, research institutes, SMEs and multinationals from Europe and the wider Mediterranean basin. Led by the University of Palermo in Sicily, the project’s activities were initiated with a meeting on 24 June 2020 where the plans for the next four years were discussed.

Europe currently depends on imports of raw materials that are critical for economic development. The minerals targeted by **SEArcularMINE** are increasingly needed in a range of high growth industrial sectors including advanced battery technology and plastics alongside pharmaceutical and medical applications. As the market leader, China supplies more than 85% of global magnesium demand*. **SEArcularMINE** will contribute towards lowering the dependency of Europe on imports, especially for the materials that have been classified by the European Commission (EC) as Critical Raw Materials (CRM).

“Harvesting minerals from the sea through sustainable approaches which are environmentally friendly and economically competitive is one of the most ambitious challenges and most promising options for alternative mining” states Professor Giorgio Micale of University of Palermo.

Magnesium, a designated CRM, is one of the most abundant elements in seawater. Its extraction from seawater by industrial electrolysis was widely employed, but uneconomical production costs now make this technology uncompetitive. **SEArcularMINE** will use very concentrated seawater brine as its starting point to develop 3 core innovative technologies, with additional process innovations also expected. A working prototype and new visitor centre in the picturesque traditional saltworks of

Trapani, Sicily will be created, advancing a 2,700 year old industry into the 21st Century with globally applicable technological innovation.

Environmental sustainability is a key pillar to the project, embracing the respect for nature of the traditional saltworks process. The project will target very low energy consumption, alongside using novel technology to generate electricity from salinity gradients of seawater. A critical aspect of the project will be a circular approach, aiming to eliminate the generation of waste streams. This circularity also avoids the use of any external inputs, maximising resource efficiency and economic viability.

The economic impacts could be far-reaching for coastal areas of South Europe and North Africa, where saltworks are performing under capacity or are totally abandoned. The team will also consider integration with desalination technologies which could potentially help mitigate the water scarcity crisis for local communities. **SEArcularMINE's** circular process concept will utilise waste streams and current infrastructure, minimising environmental and physical impacts by design, whilst developing innovative, sustainable and cost-effective technologies that will contribute to securing European access to CRM.

More information coming soon: www.SEArcularMINE.eu

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Contact us: Project Coordination: Andrea Cipollina (andrea.cipollina@unipa.it) | Communications: Tara Murphy (tara@intrigo.eu)

Notes for the editor:

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SEArcularMINE addresses the Priority Area 'Technologies for primary and secondary raw materials production' where the objective is to develop new holistic processing concepts and systems with higher technical, economic, energy and environmental performance and flexibility, versatility and modularity for processing and recovery of different raw materials.

The Engineering Department of the University of Palermo (**SEArcularMINE** co-ordinators) has developed innovative technologies for the valorisation of brines, successfully demonstrating the feasibility of magnesium compounds recovery at high purity and competitive conditions. More information: www.unipa.it

INTRIGO are the dissemination and knowledge transfer partner for **SEArcularMINE** (www.intrigo.eu).

The **SEArcularMINE** consortium comprises of academic institutes University of Palermo (Italy), Universitat Politècnica de Catalunya (Spain), Ecole Nationale d'ingénieurs de Gabès (Turkey) and University of Helsinki (Finland); not for profit R&D organisations Instituto de Biologia Experimental e Tecnológica (Portugal) and VTT Technical Research Centre of Finland (Finland); industry partners Suez Group (France) and Sosalt SpA (Italy); three SMEs ResourSEAs Srl (Italy), Ekodenge (Turkey), and Intrigo Ltd (Ireland); and the research institute Fraunhofer-Institute for Solar Energy Systems ISE (Germany).

*<https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52017DC0490&from=EN>

*Image caption: The newly launched **SEArcularMINE** project will advance the extraction of critical raw materials such as magnesium from seawater ©Unsplash; Aylin Coba*