



CHALLENGE TITLE	
A1: Valorization of Industrial Effluents: Towards Minimization of Liquid Discharges and the Circular Economy	
MACRO-AREA	
Water/Tailings	
PROBLEM/GAP	
The management of brines from desalination and industrial saline streams represents an environmental challenge with significant cost. Currently, the lack of valorization routes for these by-products and the need to minimize liquid discharges into the environment require progress towards a circular water economy model.	
CHALLENGE DESCRIPTION	
The challenge seeks the development and validation of technological solutions for the treatment of brines from desalination and industrial saline streams, with the aim of recovering water and valuable by-products and reducing their environmental impact. Proposals are expected to integrate advanced process configurations such as membrane systems, crystallization, or other emerging technologies that enable progress towards Zero Liquid Discharge (ZLD) schemes. Solutions must be evaluated through pilots under representative conditions, considering operational performance, process continuity, and industrial scaling potential, as well as their environmental and economic viability.	
GENERAL OBJECTIVE	
To develop and validate technological solutions for brine treatment that enable the recovery of water and valuable by-products, advancing towards Zero Liquid Discharge (ZLD) schemes and ensuring operational continuity within the framework of the circular economy.	
SPECIFIC OBJECTIVES	
1.	Characterize brines and identify opportunities for resource recovery while reducing the environmental footprint.
2.	Design the process and select technological solutions at pilot scale for the treatment and valorization of brines.
3.	Reduce environmental liabilities, integrate value/water recovery, and assess techno-economic (TEA) and life cycle (LCA) viability.
EXPECTED RESULTS	
1. Physicochemical characterization of brines and industrial saline streams, identifying resource recovery opportunities and environmental impact reduction. 2. ZLD scheme pilot operated under representative conditions and defined scaling roadmap. 3. Validated business case for the reprocessing and reuse of by-products under a circularity model, with metrics on recovered value, economic viability, and compliance with quality standards for the defined use.	
SCOPE	

Includes:

- Pre-feasibility and conceptual engineering of brine treatment and valorization solutions.
- Design and operation of an integrated pilot under representative industrial conditions.
- Techno-economic (TEA) and life cycle (LCA) assessment of validated solutions.
- Regulatory and environmental coordination for obtaining pilot operating permits.

Excludes:

- Full industrial-scale deployment or detailed engineering.

KEY PERFORMANCE INDICATORS (KPIs)

1.	Reduction of liquid discharge to the environment (% and m ³ /day avoided).
2.	Volume of water recovered and returned to the process (m ³ /day).
3.	Total cost of treated/recirculated water (USD/m ³).
4.	Value recovered from brine or effluent (USD/m ³ of feed).
5.	Specific energy consumption of the process (kWh/m ³ treated).
6.	Percentage recovery of valuable elements (minerals, salts, or others) (%).
7.	Reduction in the volume of generated liability (m ³ or %).
8.	Greenhouse gas emission footprint (kg CO ₂ e/m ³ treated).

DESIRABLE CONTRIBUTION TO ITL CAPACITY BUILDING

- Standardized protocols for brine characterization and assessment, available for future ITL projects and partners. (High)
- Bank of ZLD technologies evaluated under northern Chile conditions, as a reference for decision-making in new industrial desalination projects. (High)
- Analytical capabilities for the characterization and reuse of complex matrices, strengthening ITL's service offering to the regional mining-water sector. (High)

INDUSTRY AFFECTED BY THE CHALLENGE

Sanitation Companies, Environmental Sanitation Companies, Mining, Green Hydrogen Production Industry.