

THE CIRCULAR ECONOMY APPROACH FOR INDUSTRIAL WASTEWATER

BENEFITS OF THE ZERO BRINE TECHNOLOGY FOR A SUCCESSFUL **ZERO POLLUTION STRATEGY**

KEY RECOMMENDATIONS

- Support risk approach in brine management
- Address the white spots of brine management in the Zero Pollution Action Plan
- Encourage a BREF on brine in the updated Industrial Emission Directive or a BREF on water efficiency including brine management and consider brine management in each sectoral BREF that ZERO BRINE addresses
- Update list of the **Annex X** of the Water Framework Directive in line with the outcomes of the ZERO BRINE project
- Harmonise the definition of brine at EU-level

Disclaimer: Due to the confidentiality of the data, the project cannot disclose information that confirms the below recommendations. The project consortium can be contacted via media@zerobrine.eu to get this information in the respect of this confidentiality framework.

• **Context**

The Zero Pollution Ambition for a toxic-free environment is a new European strategy which aims to prevent and reduce pollution in water, air and soil and also facilitate remediation. Paired with the objectives to address industrial pollution, the specific action plan wants to fill in the white spots in EU legislation, improve the monitoring processes and also contribute to smarter legislation.

ZERO BRINE proposes a circular economy approach to reduce the negative impacts of brine from process industries and to create economic value from the reuse of mineral salts containing sodium, magnesium, calcium, sulphates, bicarbonates, and fresh water. ZERO BRINE demonstrates the use of a combination of existing and new technologies for the recovery and reuse of both the material constituents as well as energy such as waste heat.

Within this policy brief, ZERO BRINE highlights several benefits¹ for a successful Zero Pollution Strategy with impacts that demonstrate the importance of addressing the white spot that brine management be included in this European action plan.

• **Circular brine management for turning brine into a resource to prevent pollution**

The ZERO BRINE technology tackles a key challenge by managing brines. The discharging of this type of wastewater can have negative impacts for flora and fauna due to its toxicity and even the corrosion of infrastructure. Its release in our environment also impacts the quality of the soil and threatens food security by creating diffuse pollution. Within the **EU Green Deal**, the **4 ZERO BRINE pilot demonstrations** pave the way to several objectives of the European Commission by recovering energy, water and raw materials (See Table 1 on Impacts of the ZERO BRINE technology on water, emissions, energy, and resource recovery in industry).

¹ The data provided in this policy brief remain provisional as the results of the project are still under development.



- **Benefits for the Circular Economy Action Plan**

Annual waste generation is projected to increase by 70% by 2050; the uptake of the ZERO BRINE technology aims to challenge this projection. A sustainable product policy framework needs to be based on resource recovery but also on the feasibility of new industrial processes that ZERO BRINE demonstrates. The project impacts the whole value chain in several sectors by recovering key products for European industry, considering the value of water for less waste, less energy and water consumption and more circularity.

- **Benefits for the Chemical strategy**

Nearly 84% of Europeans are worried about the impact of chemicals present in everyday products on their health, and 90% are worried about their impact on the environment.² Paired with the Industrial Emission aims, ZERO BRINE also contributes to the chemical strategy objectives of the European Union (EU) by demonstrating that the legislation can be strengthened for better protection within a circular economy. Despite the absence of a common definition of brine at EU-level and the composition diversity of brine, the technology can recover several chemicals which can meet market specifications. It creates safe and sustainable business opportunities and contributes to the reduction of diffuse pollution.

In line with latest [conclusions on REACH](#), ZERO BRINE confirms the importance of the REACH legislation and encourages the EU to maintain and reinforce this tool. The project did not need to register substances and therefore cannot clearly express opinions on the potential administrative burden of this registration procedure.

- **Benefits for the Industrial Emissions Directive**

ZERO BRINE is evaluating the opportunities of its technology for a smarter Industrial Emissions Directive. ZERO BRINE can be key to improving energy and water efficiency. Consequently, this technology, as a Best Available Technology, can contribute to the sustainable competitiveness of several industrial sectors in Europe (cf. table 2) while preventing damaging impacts to our ecosystems.

The confidentiality and the ongoing research cannot allow us to release data. However, the benefits of the combination of existing and new or innovative technologies for recovery and reuse of both the material constituents as well as energy such as waste heat can contribute to the revision of the BREFs on:

- BREF Large Volume inorganic chemicals – solids and others industry (LVIC-S)
- BREF Textile Industry (TXT)
- BREF Waste Treatment (WT)

The project is also working on recommendations for a BREF on silica/brine management. This option can also reinforce the necessity to have a horizontal BREF on water efficiency.

² Eurostat, Eurobarometer, 2020.

Table 1 - Impacts of the ZERO BRINE technology on water, emissions, energy, and resource recovery in industry

Expected reduction in:				Recovered resources
	Water	Emissions	Energy	
Demineralised Water Plant	<ul style="list-style-type: none"> • 15-20% reduction in water withdrawal at Evides DWP 	<ul style="list-style-type: none"> • >98% reduction of brine discharged to the environment (>2.5 million m³/year) • 1,012 tons/year CO₂ emissions or 14% CO₂ reduction by recovering minerals, salts, and clean water 	<ul style="list-style-type: none"> • Thermal energy required for the evaporation process can be supplied by waste heat/residual heat of neighbouring industries • 44% less energy used by MED evaporator when compared to conventional methods 	<ul style="list-style-type: none"> • 92% water recovery for internal use (demi water) • 6.2% IEX regeneration solution recovery for internal use (>3.1% purity) • 94.7% Calcium recovery (Ca(OH)₂) for external valorisation (>95.6% purity) • 87.8% Magnesium recovery (Mg(OH)₂) for external valorisation (>88.9% purity) • 93% Sulphate recovery (Na₂SO₄) for external valorisation (unwashed: 94.6% purity)
Coal mine	NA	<ul style="list-style-type: none"> • 92.8% reduction of sodium chloride (NaCl) discharged to freshwater resources • 347 kg CO₂ /ton NaCl or 32.5% CO₂ reduction 	<ul style="list-style-type: none"> • 33% energy reduction 	<ul style="list-style-type: none"> • 90.6% water recovery (demi water) • 92.8% salt recovery (99% purity) • 94.9% magnesium hydroxide recovery Mg(OH)₂ for external valorisation (97% purity) • 0.84 kg/m³ gypsum for external valorisation
Textile factory	<ul style="list-style-type: none"> • 7% reduction in total freshwater consumption of Zorlu Textile or freshwater abstraction by 123,000 tons/year 	<ul style="list-style-type: none"> • 90-95% reduction of brine discharged to the environment • 150-200 tons/year CO₂ reduction 	NA	<ul style="list-style-type: none"> • 70-80% water recovery from brine treatment system for onsite use • 600-700 tons salt/year for onsite dyeing of textiles
Silica factory	<ul style="list-style-type: none"> • 30% reduction in overall annual water consumption at IQE 	<ul style="list-style-type: none"> • 100% reduction of brine discharged to the environment • 60% reduction of sodium sulphate (Na₂SO₄) releases into the Ebro River 6,000 tons/year CO₂ reduction or 5 kg CO₂/m³ of wastewater 	<ul style="list-style-type: none"> • 72% reduction by waste heat (EFC technology compared to direct evaporation) 	<ul style="list-style-type: none"> • 75-90% water recovery suitable for internal use • 90% recovery of sodium sulphate (Na₂SO₄) or 20,000 tons/year for external valorisation (>99% purity) • Sodium hydroxide (NaOH) (94% purity) and sulphuric acid (H₂SO₄) (72% purity) for external valorisation

- **Benefits for the **Water Framework Directive****

With the ambition to prevent pollution of water, the Water Framework Directive plays a key role. **The conclusions of the EC** on the non-effective implementation of this legislation by the Member States demonstrates the necessity to embrace the challenges. Despite this absence of revision, the European Commission has decided to update the list of priority substances to monitor in surface water.

The WFD covers surface water pollutants in two ways – by identifying and regulating those of greatest concern across the EU (Annex X to the WFD) and by requiring Member States to identify substances of national or local concern (river basin specific pollutants – included by Member States in their River Basin Management Plans). ZERO BRINE can contribute to a better implementation of the WFD through these two ways:

- ZERO BRINE shall support the inclusion of one substance in the **ANNEX X** to identify the risk of diffuse pollution by releasing brine into nature.
- ZERO BRINE technology must be mainstreamed by the local and national authorities as contributors to the effective basin management plan tool to reduce local pollution. By extracting raw materials, reusing energy and water, the pilot demonstrations stress the opportunities by reducing pollution and therefore pressure on the pollution and water consumption permits.

This project also demonstrates the necessity to harmonise the definition of brine in Europe. The different national definitions create barriers to allow duplication of technology and higher environmental standards.

- **Benefits for the **Biodiversity strategy****

With only 40% of European water bodies deemed to have a ‘good’ status, ZERO BRINE is a technology that can be implemented during this critical time for biodiversity to protect and restore nature in Europe. Giving space to nature and investing in nature protection and restoration cannot be achieved without considering the industrial activities through a holistic approach. A Water-Smart society must consider the inter-connections between sectors, users and uses. The upstream approach of ZERO BRINE indirectly contributes to prevent pollution and therefore supports the following objectives:

- Protect and restore nature in Europe, particularly, addressing restoration soil ecosystems, offering win-win solutions for energy generations, restoring freshwater ecosystems and reducing pollution;
- Enable transformative changes through stepping up implementation enforcement of EU environmental legislation, building a business model with a whole-of-society approach.

As the EU aims to focus on risk management, the prevention of pollution should also consider the place where brines are released. The negative impact of brine can be neutralised in some areas after pre-treatment in natural saline environments such as the sea. The balance between treatment and natural protection is smartly managed by controlling this risk.

For more
information, see our
Core Policy Brief





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