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**Brine utilisation for blue energy generation: Life HyReward project**

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**A B S T R A C T**

The Life HyReward project, funded by the European Union, seeks to validate the technical and economic viability of a more environmentally friendly desalination approach by integrating reverse osmosis (RO) with reverse electrodialysis (RED). RED technology generates blue energy—a renewable, emission-free form of electricity—by harnessing the salinity gradient between two solutions of different salt concentrations. In the framework of the project, brine produced by the reverse osmosis process is used as the high-salinity input, while treated wastewater functions as the low-salinity counterpart. The osmotic gradient between these streams enables the production of clean electricity, which can be fed back into the system. This method has the potential to recover up to 20% of the energy consumed in the reverse osmosis stage, thereby enhancing energy efficiency and reducing the overall power demand of desalination. Pilot-scale trials delivered encouraging results, achieving energy outputs of up to 0.31 kWh/m<sup>3</sup> of brine, contributing to a significant reduction in the total energy consumption of the reverse osmosis process, which ranges between 2.5 and 4 kWh/m<sup>3</sup> in large seawater desalination plants [1]. These outcomes highlight the promise of RED as a complementary technology for improving desalination systems while lowering their environmental footprint and energy usage.

**Keywords:** Desalination; Reverse electrodialysis; Blue energy; Reverse osmosis; Energy efficiency; Sustainability

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