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RESEARCH

- **Title:**

Sustainable Environmental Technologies for Energy Harvesting from Waste Streams

- **Description:**

Salinity gradient is a clean and steady renewable energy source that may offer an integrated solution to the water-energy nexus challenge as it supports the phaseout of conventional water-intensive power sources. Salinity gradient energy (SGE) is converted into useful work through reversible mixing of two solutions at different concentration in engineered processes as reverse electrodialysis (RED). RED is an emerging electro-membrane technology that uses ion-exchange membranes to directly draw electric power from the chemical potential difference between two solutions. RED enables generate energy out of abundant yet largely untapped sources, as industrial effluents, thus providing energy and emission savings from an otherwise waste stream.

My research focuses on the techno-economic and environmental assessment of RED technology to harness SGE from waste streams of energy-intensive processes as desalination or wastewater treatment plants. This work aims to develop a multi-objective decision-making modelling tool of the RED system for SGE conversion to devise the upmost process design alternatives and implementation scenarios.

- **Publications:**

Victor Manuel Ortiz-Martínez, Lucía Gómez-Coma, Carolina Tristán, Gema Pérez, Marcos Fallanza, Alfredo Ortiz, Raquel Ibáñez, Inmaculada Ortiz. A comprehensive study on the effects of operation variables on reverse electrodialysis performance, *Desalination*, 482, 114389 (2020).

Carolina Tristán, Marta Rumayor; Antonio Domínguez-Ramos, Marcos Fallanza, Raquel Ibáñez, Inmaculada Ortiz. Life cycle assessment of salinity gradient energy recovery by reverse electrodialysis in a seawater reverse osmosis desalination plant, *Sustainable Energy & Fuels*, 4, 4273-4284 (2020).

Carolina Tristán, Marcos Fallanza, Raquel Ibáñez, Inmaculada Ortiz. Recovery of salinity gradient energy in desalination plants by reverse electrodialysis, *Desalination*, 496, 114699 (2020).

Carolina Tristán, Marcos Fallanza, Raquel Ibáñez, Inmaculada Ortiz. Reverse Electrodialysis: Potential Reduction on Energy and Emissions of Desalination, Applied Sciences, In press (2020).

- **Congress contributions:**

Carolina Tristán, Marta Rumayor, Antonio Domínguez-Ramos, Marcos Fallanza, Raquel Ibáñez, Inmaculada Ortiz. Integration of SGE-RED in a SWRO plant: an evaluation of the potential environmental benefits using LCA. ANQUE-ICCE-CIBIQ 2019, 19-21 June 2019, Santander (Spain). Flash presentation.

Carolina Tristán, Marta Rumayor, Antonio Domínguez-Ramos, Marcos Fallanza, Raquel Ibáñez, Inmaculada Ortiz. Environmental benefits of SGE-RED energy recovery using LCA. The 12th European Congress of Chemical Engineering (ECCE12), 15-19 September 2019, Firenze (Italy). Poster presentation.

Carolina Tristán, Marta Rumayor, Antonio Domínguez-Ramos, Marcos Fallanza, Raquel Ibáñez, Inmaculada Ortiz. Environmental assessment of reverse electrodialysis seawater reverse osmosis hybrid concept. The 4th International Conference on Desalination Using Membrane Technology (MEMDES19), 1-4 December 2019, Perth (Australia). Poster presentation.

Carolina Tristán, Marcos Fallanza, Raquel Ibáñez, Inmaculada Ortiz. Towards RED efficient integration into a SWRO desalination plant. The 4th International Conference on Desalination Using Membrane Technology (MEMDES19), 1-4 December 2019, Perth (Australia). Oral presentation.

- **R&D Projects:**

Title: Tecnologías ambientales sostenibles para el aprovechamiento energético de corrientes residuales (CTM2017-87850-R) (AEI/FEDER,UE)

Participant entities: Universidad de Cantabria (Spain), Agencia Estatal de Investigación (Spain).

Duration, since 01/01/2018 to 30/09/2021.

Main researcher: Raquel Ibañez Mendizabal