

## **Options for the reuse of municipal wastewater in the Antofagasta mining district: a 3-E analysis for a nearly-energy positive WWTP**

G. Campo<sup>1</sup>, B. Ruffino<sup>1</sup>, A. Reyes<sup>2</sup>, M.C. Zanetti<sup>1</sup>

<sup>1</sup>Department of Environment, Land and Infrastructure Engineering, Politecnico di Torino, Turin, I-10129, Italy

<sup>2</sup>Department of Ingeniería en Minas, Universidad de Antofagasta, Antofagasta 1240000, Chile

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Presenting author email: barbara.ruffino@polito.it

The region of Antofagasta is the mining hearth of Chile. The water requirement of the local mining sector is of approx. 65% of total water uses, with a water consumption of 10 m<sup>3</sup>/s in the year 2021. The new wastewater treatment plant (WWTP) of Antofagasta will be built with the two-fold aim of (i) purifying the totality of the wastewater generated from the city (approx. 320,000 equivalent inhabitants), and (ii) allowing the reuse of 100% of the treated wastewater in the local mining sector, in agreement with the goals of the Chilean government. The new Antofagasta WWTP will include preliminary treatments and a conventional activated sludge (CAS) process. This study compared, through an energy-economic-environmental (3-E) analysis, the scheme of the planned WWTP with three scenarios, which introduce some processes/operations (namely anaerobic digestion of the sludge, primary sedimentation, a nitrification/denitrification process) that could improve the performances of the WWTP. The results of the study demonstrated that the above-mentioned changes are essential to promote the transformation of the WWTP into a nearly energy-positive water resource recovery facility, by reducing the electric energy demand from external sources to only 20% of that of the original scheme, and consequently avoiding the emission of 4390 tons CO<sub>2</sub>/y.