

## OPERATIONAL-ENERGY OPTIMISATION OF SYSTEMS FOR THE CONVERSION AND STORAGE OF NEW RENEWABLE ENERGIES

### Doctoral thesis – Abstract

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The doctoral thesis aims to develop renewable energy sources (RES) technologies and policies for their development and integration into the global energy mix and proposes new or underexploited RES. Thus, it explores the conversion of the potential energy of technological waters into electricity, analysing the unexploited energy potential of gravity water supply systems, the hydraulic and thermal potential of mine water pumped to the surface to maintain the flood level, as well as the energy potential of rainwater and domestic water from high-rise and very high-rise buildings. Mathematical models are developed to simulate the dynamic regimes of a system for converting the potential energy of thermal wastewater from a surface water heat pump (SWHP) into electrical energy, consisting of a storage tank descending from a height  $h$ , coupled to a mechanical system, which drives a synchronous generator (SG) with permanent magnets or an asynchronous generator (ASG) that produces electrical energy stored in electrochemical accumulators, in the form of heat (water rheostat), or by coupling to the national energy system. The calculation models were experimentally validated through laboratory investigations using three experimental conversion stands: (1) integrating a Pelton microturbine, (2) a gravity-electric system of the tank-counterweight type with SG, (3) a gravity-electric system with ASG and storing electricity in different environments. The electrical energy produced in 90 days by converting the potential energy of a flow rate of 52.5 l/min of thermal wastewater from a SWHP operating 24 hours/day by systems (1), (2) and (3) is respectively 115 kWh, 12 kWh and 42.2 kWh, adding a reduction in CO<sub>2</sub> emissions of 30 kg, 3 kg and 11.2 kg respectively.