

## **Vertical constructed Wetland for Greywater treatment and reuse: Feasibility study in a touristic resort**

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**Abstract**

In order to counteract increasing water scarcity, while facing growing water demand through increasing tourism activity in the Mediterranean region, this study provides data on the efficiency of a decentralized, nature-based solution for hotel greywater (GW) treatment and reuse. The chosen solution is a vertically constructed, horizontal flow constructed wetland. The Vertical Ecosystem (vertECO) pilot plant, installed in a large hotel provided with GW separation, was operated for 12 months. Influent GW and treated effluent were characterized, and the energy consumption was monitored. vertECO achieved a removal efficiency higher than 84% for COD and TSS and higher than 95% for turbidity and BOD5. The monitored physicochemical parameters in the effluent meet the requirements for many of the water reuse purposes mentioned in the EU and Spanish water reuse regulations. Based on the pilot operation, a design and economic model was set to estimate its economic feasibility (CAPEX, OPEX, payback period of investment) at several treated volumes: GW separation, GW tanks construction, vertECO technology construction and operation, and

disinfection were considered. The payback was calculated at water and energy prices of different countries, with a planned operation period of 20 years. Modelled payback periods were found to be decreasing with the rise in water price, as well as with a lowered energy price. Finally, co-benefits of vertECO (e.g., biodiversity, thermal regulation) were considered alongside economic terms and treatment efficiency, and compared with another intensive technology (i.e., membrane bioreactor). vertECO obtained a higher rating, confirming that nature-based solutions offer a good solution.

**Keywords:** Horizontal flow, economic feasibility, water price, co-benefits.