



Exergy cost of water supply and water treatment technologies.

Amaya Martínez^a, Javier Uche^{a*}, Carlos Rubio^b, Beatriz Carrasquer

^aCIRCE Foundation, University of Zaragoza, Zaragoza, Spain

Tel. +34976762584; Fax +34976732078; e-mail: javiuche@unizar.es

^bMechanical Engineering Faculty, UMSNH, Morelia, (Michoacán, México), c/ Maria de Luna 3, 50018, Zaragoza, Spain

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ABSTRACT

Exergy analysis (EA) has demonstrated to be useful in the assessment of the energy performance of technologies, including those regarding water management. In this paper, an EA-based index like the unit exergy cost (UEC) of different water-related technologies were obtained, from transport (pumping) to depuration and even brackish and seawater desalination. Those coefficients are important to quantify the additional energy consumption of present technologies with respect to the ideal ones, which correspond to the behaviour of a reversible process. Minimum UEC values were obtained in pumping techniques (1.5). Wastewater treatment plants (WWTP) ranged from 4 to 5, and commercial desalination varied from 5 (reverse osmosis) to 21 (multi-stage flash distillation). This affirms the fact that chemical-based water treatments are less efficient from the point of view of thermodynamics, however further improvements might be reached in those processes. Besides their embedded energy-efficiency information, the UEC values could be applied to assess water costs. For instance, the European Water Framework Directive (WFD) considers that environmental costs (those to restore water bodies up to an objective state) have also to be charged to water users. Consequently, the UEC values of water technologies together with energy prices could easily be used to estimate those environmental costs associated to physico-chemical degradation of water bodies.

Keywords: Exergy; Exergy costs; Energy efficiency; Desalination; Pumping; Wastewater treatment plant; Water cost

*Corresponding author