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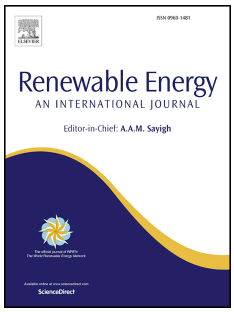

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OPTIMAL DESIGN OF WATER SUPPLY NETWORKS USING AN ENERGY RECOVERY APPROACH

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ABSTRACT: Water Distribution Networks (WDNs) represent a major investment for water supply systems development. The standard procedure for their design is to search for the minimum cost, which is produced by the smaller diameters capable of maintaining the minimum required pressure. However, some District Metered Areas (DMAs) have a significant topographic elevation difference, and even if the minimum diameters are reached, the pressure remains high, and a Pressure Reducing Valve (PRV) is necessary. However, if the pipe diameters of the network are increased, distributed headloss will be reduced, and this additional energy will be locally dissipated in PRVs to maintain the pressure in the DMA below the maximum allowed value. If a turbine is installed instead, the dissipated energy can be used, creating a benefit that can justify the additional investment due to the diameter increment. Therefore, this paper presents a method for the optimal design of a WDN considering energy recovery. The use of Pumps as Turbines (PATs) is considered for energy production. The optimal design is obtained using a two-level optimization procedure: the first is used to obtain pipe diameters, and the second is used for PAT selection. Particle Swarm Optimization is used, and two case studies are presented.

KEYWORDS: Water distribution networks, pumps as turbines, energy recovery, energy efficiency, optimization.