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Optimal design of water supply networks using an energy recovery approach

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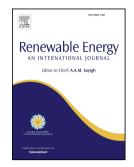
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	ACCEPTED MANUSCRIPT
1	OPTIMAL DESIGN OF WATER SUPPLY NETWORKS USING AN ENERGY
2	<b>RECOVERY APPROACH</b>
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17	ABSTRACT: Water Distribution Networks (WDNs) represent a major investment for
18	water supply systems development. The standard procedure for their design is to search
19	for the minimum cost, which is produced by the smaller diameters capable of
20	maintaining the minimum required pressure. However, some District Metered Areas
21	(DMAs) have a significant topographic elevation difference, and even if the minimum
22	diameters are reached, the pressure remains high, and a Pressure Reducing Valve (PRV)
23	is necessary. However, if the pipe diameters of the network are increased, distributed
24	headloss will be reduced, and this additional energy will be locally dissipated in PRVs
25	to maintain the pressure in the DMA below the maximum allowed value. If a turbine is
26	installed instead, the dissipated energy can be used, creating a benefit that can justify the
27	additional investment due to the diameter increment. Therefore, this paper presents a
28	method for the optimal design of a WDN considering energy recovery. The use of
29	Pumps as Turbines (PATs) is considered for energy production. The optimal design is
30	obtained using a two-level optimization procedure: the first is used to obtain pipe
31	diameters, and the second is used for PAT selection. Particle Swarm Optimization is
32	used, and two case studies are presented.
33	

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

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