

Quantifying Energy Consumption to the Level of Service Pressure in Water Distribution Network

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Abstract

It is essential to reduce global carbon emissions, mainly from energy use. The water supply and distribution sector is a vital part of human society and is one of the primary energy consumers. The procurement and distribution of water require electricity to operate the pump to deliver water to users with sufficient pressure. As the water users are spatially distributed over a wide area, the energy required to deliver water to each user differs depending on the corresponding supplying element (reservoir, tank, pipe, pump, and valve). This difference in energy required for each user also comes with a difference in pressure availability which affects the level of service for individual users and the whole network. Typically, there is a disproportion where users close to the source experience excessively high pressure with low energy consumption. In contrast, remote users need more energy to get the minimum pressure. This study proposes the Energy Return Index (ERI) to quantify the pressure return from particular energy consumption to supply water to each node. The disproportionality can be quantified and identified in the network using the proposed ERI. The index can be applied to optimize the network elements such as pump operation and tank location/size to reach a balanced energy consumption with the appropriate level of service.

Keywords : Energy consumption, Energy Return Index (ERI), Water distribution network

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