

Case Study on using K-Means Clustering Technique for Energy saving in Pressurized Irrigation Networks

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Abstract

With the continuously increasing cost of energy, conservation of energy in pressurized irrigation networks has become an important goal. Such networks are usually designed to irrigate sectors of approximately equal areas in turns. Pumps are often operated to guarantee the absolute maximum head required for all sectors. This design criterion, however, does not guarantee minimum energy consumption. In this study, the k-means clustering technique is used for grouping (sectoring) hydrants with the same characteristics to minimize energy consumption. Various dimensionless parameters are used to identify hydrants characteristics, the relative elevation z^* , the relative distance l^* , and the relative head h^* . These parameters were combined with different integrations to determine the best combinations from an energy point of view. MATLAB - EPANET Toolkit is used to implement the suggested clustering technique and test the impact of proposed management on energy consumption. The proposed methodology is applied to a drip irrigation network at Kostol area, Egypt. Results show that sectoring the study area using the k-means technique based on dimensionless parameters leads to energy savings up to 16.23% for the whole irrigation season.

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