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## Progresses in the operation and functioning of pumping stations for water and wastewater networks

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### Abstract

Simultaneously with the social and economical transformations within urban areas, the operating and functioning conditions for all the components of water and wastewater systems have modified in a specific manner in each area.

One important aspect of these changes is the adjustment of pumping stations operating parameters to the new water network demands so that the operating costs of these pumping stations achieve a sustainable level for the water companies.

In this context, the paper presents the results recorded by upgrading and rehabilitating the pumping stations for an urban water network with a primary goal of diminishing the operation and maintenance costs and a secondary goal of reducing the water losses in the water distribution network.

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*Keywords:* pumping stations; distribution networks; operating parameters

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### 1. Introduction

In Romania, the construction of distribution and wastewater systems began as early as the end of the 19<sup>th</sup> century. Although currently at a national level there are water and wastewater systems in most of the urban areas and partially in the rural areas, not all the population benefits from these features. This fact makes the modernization and expansion

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works of these public utility systems to be in a continuously state of transformation both physically (by extending the service area) and technically (by introducing more performing equipment and materials). At the same time, the adaptation of the water and wastewater systems operating parameters to the needs of the consumers and the sustainability of operation for these systems imposed the technological rehabilitation of all the component elements for a water and wastewater system, so that the operating costs and the energy consumption reach a minimum. Consequently, the technical and technological progress in the industry of equipments and tools used in the water distribution and wastewater collection determined the rethinking of the design, execution, operation and surveillance solutions for all the technological elements comprised in the water and wastewater systems.

## **2. Pumping stations characteristics in water and wastewater systems operation**

The process of pumping water within the operation of water and wastewater systems represents the activity with the highest energy consumption and therefore optimizing energy costs is a continuous and priority task for the operators. Within the existing centralized water and wastewater systems in Romania, the pumping stations share some similar characteristics, such as:

- The pumping groups within the pumping stations are in most part composed of pumps coupled in parallel
- The pumped water volume is variable in the course of the day and differs from one day to the other, depending on random factors or restricted by objective factors (exaggerated consumption, restrictions for pumps operation)
- The daily flow variation is done within a limit of maximum and minimum pressure in the discharge pipes, the pressure being imposed by starting/stopping of pumps
- Pumps were chosen based on nominal flow and head, these values being determined based on approximate data that take into account a specific consumption for every type of consumer

The construction of the pumping stations was done in several steps within the distribution systems because the extension works of the water infrastructure developed based on the urbanization of the localities and based on the water demands which at the end of the 20<sup>th</sup> century registered very high values (specific consumption of 500 l/day/pers.). At the same time, in the time period in which these pumping stations were designed and built, the quota of energy costs from the total operating costs was relatively low by today tariffs, when the energy price tends to align with the price in other EU countries. A fundamental requirement that pumping station within distribution systems have to accomplish is to ensure a flow variation in correlation with the consumer needs at a constant pressure, and this is done by adjusting the operating parameters of the pumps.

## **3. Methods of adjusting the pumping stations operating parameter within water and wastewater systems**

Depending on the role of the pumping station within the water and wastewater system, on the type of pumps, on the characteristic parameters of the pumps and on the variable consumer demands, the possibilities for pump adjustment can be one of the following:

- External adjustment – changing the network characteristic, but keeping the pump characteristic unchanged
- Internal adjustment – changing the pump characteristic, but keeping the network characteristic unchanged
- Mixed adjustment – simultaneously changing both characteristics (pumps characteristic and network characteristic)

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