



*“Gheorghe Asachi” Technical University of Iasi, Romania*



---

## **MULTIVARIATE OPTIMIZATION TO DECREASE TOTAL ENERGY CONSUMPTION IN THE WATER SUPPLY SYSTEM OF ABBIATEGRASSO (MILAN, ITALY)**

**Mario E. Castro Gama\*, Quan Pan, Salman A.M. Fadi-Elmola, Andreja Jonoski**

*UNESCO-IHE, Institute for Water Education, P.O. Box 3015, 2601 DA Delft, the Netherlands*

---

### **Abstract**

The application of Information and Communication Technologies (ICT) for water supply systems has steadily increased in the last 20 years. The city of Milan is presented as case study where the main challenge for the coming 20 years is the efficient use of energy. Opposite to other parts of the world, in Milan, water is neither scarce nor there is a growing need for supply. Given that the system completely relies on pumping, optimization algorithms and sensor technologies can be applied to reduce energy consumption. This article presents research in optimization for Pump Scheduling (PS), carried out under the framework of the ICeWater project (funded by EU-FP7). For this purpose approaches using two multi-objective optimization algorithms (Non-dominated Sorting Genetic Algorithm - NSGA-II and Archive based Micro-Genetic Algorithm - AMGA2) have been applied. The results indicate that a tangible energy consumption reduction can be achieved by using pump scheduling optimization.

*Key words:* Genetic Algorithms, ICeWater, Milan, Pump Scheduling, Water Distribution Networks

*Received: December, 2014; Revised final: August, 2015; Accepted: September, 2015*

---

---

\* Author to whom all correspondence should be addressed: e-mail: [m.castrogama@unesco-ihe.org](mailto:m.castrogama@unesco-ihe.org); Phone: (31) 65-271-4956; Fax: (31) 15-3122921