



CITIES

Centre for IT Intelligent Energy Systems

Smart water management to improve water-energy nexus for water supply systems

Background and Motivation

Water Utilities face other challenges, such as infrastructure aging and poor cost-recovery, leading to a lack of finance for O&M (Operation and Maintenance). Energy is required in all stages of water production and distribution, from pumping and treatment to transportation. Energy costs are a top-of-mind concern for water utilities, regardless of geography, size and level of water network efficiency.

Flexible and adaptable solutions to cope with water stress are needed to reduce vulnerability and ensure that the available water is used in the most efficient way. In the last twenty years, there has been an increasing emphasis on demand management, and particularly on educational programmes to encourage public and private user communities to conserve water and to improve the efficiency of water use. Adequate measurements, information and communication at various levels will play an increasing role in making it possible to use water wisely.

The technical drivers for solving the problems are there and are getting better all the time. They are sensor development, development of smart programs to enable the constructive usage of the abundant computer power available and the emerging easy and low-energy and inexpensive communication networks that are becoming available. They are also flexible and agile solutions for treating and transporting water and new ways of thinking and working by means of collaborative development and co-creation. The objective of smart water management is to achieve water security at all levels (building, city and regional) in a sustainability and self-sufficiency manner, through the use of information technology, monitoring and control technology and the implementation of holistic system of all the processes in water cycle.

Objective

The overall objective is to allow water utilities to holistically manage their processes in a flexible way by operational management recommendations focused on: decrease the non-revenue water, improve the pressure management, detect leakages, save energy and water (water-energy nexus), and above all, improve the integrated water resources management in terms of water resources and revenues supporting financial, social and environmental sustainability, while maintaining quality and level of service.

The objective of the project is to calculate demand response capabilities in the water network on the islands of Cres – Lošinj archipelago and possibility to integrate solar PV plants for electricity self-consumption of water and wastewater network company.

The project will consist of modelling, (10 min, hourly) simulation, optimization:

1. reference case for the one year with available data
2. demand min/max demand response capabilities
3. economic evaluation of demand response with current electricity tariffs and future electricity markets
4. sizing of PV plants with profile of (10 min, hourly) generation, location of PV plants
5. economic evaluation of PV plants installation
6. energy and cost savings
7. description of models
8. description of smart technologies/measures
9. presentation for stakeholders

Methodology

The case study includes cooperation with water supply and wastewater disposal company Vodopskrba i odvodnja Cres Lošinj Ltd. which operates in Cres-Lošinj Archipelago, Croatia.

Vodopskrba and odvodnja Cres Lošinj Ltd. is a profit public utility (Ltd.) for water supply and wastewater disposal founded and owned by the municipalities of Cres and Mali Lošinj. The company is operating in the municipal areas of Cres and Mali Lošinj which geographically involves the island of Cres (municipal area Cres) and islands Mali Lošinj, Veli Lošinj, Unije, Susak, Ilovik, Male Srakane and Vele Srakane (municipal area of Mali Lošinj). The company was originally established in 1958. by the towns of Cres and Lošinj. Since then, it has changed several legal forms and from 2014 it operates under the name of Vodopskrba and odvodnja Cres Lošinj Ltd. for water supply and wastewater disposal as its core activities. The company is responsible for water supply, sewerage (sanitation) system, and wastewater treatment including planning, management, operation and maintenance of communal infrastructure in the field of water and wastewater. Vodopskrba and odvodnja Cres Lošinj Ltd. has experience in preparation and implementation of projects financed by the EU. Also, it has vast experience in preparation and implementation of various projects for construction, installation and maintenance of pipelines and water supply networks. Vodopskrba and odvodnja Cres Lošinj Ltd. actively participates in activities carried out in Unije Island demonstration as part of the Horizon 2020 project INSULAE. Average annual electricity cost for years 2016, 2017 and 2018 was around EUR 200,000.00, with the 1.5 mil. m³ annually average water consumption. Expenses by activities in 2017 were: Water tanks/towers: EUR 253k; Water system network: EUR 1.156 mil; Water transport: EUR 156k, and Desalination plant: EUR 1.63k.

The model for demand response operation will be developed and it will be used to determine possible water system operation regarding the CO₂ emission reduction, and water and energy savings. The model will include demand response based on the electricity price on CROPEX electricity market. Combining the available open source models and applications, the connection between water and energy system will be modelled. Integration of future planned PV plants will be studied in terms of electricity self-consumption for water and wastewater network company. Moreover, capacity sizing for additional PV plants to ensure Archipelago's energy sustainability will be studied, with addition of other measures for ensuring secure water supply (water saving measures, installation of new desalination plants etc.).

Partners

- CITIES (UNIZG FSB)
- CITIES WP5 (DTU Compute)
- CITIES WP7 (DTU Compute)

- VIOCL Ltd. (water utility company)
- Tomorrow
- ENFOR

Deliverables

- A presentation of the potential of water utilities for participating in more complex operating schemes and demand response capabilities
- A method for evaluation of the potential in flexibility for one utility based on historical data
- A scientific paper that will estimate the impact of the flexible operation of the water utilities on the energy systems
- A short technical report on the results of the demo project

Time frame

May 2020 - October 2020

Disclaimer

Due to the current state of the emergency measures regarding the SARS-CoV-2 virus, some of the objectives might not be achieved in the proposed time frame.

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