

Successful results of the ISS-EWATUS

ISS-EWATUS is an innovative integrated decision support system (DSS) enabling efficient management of water resources. It consists of the following modules.

The household DSS is the mobile application and promotes efficient water usage among residential consumers. The DSS allows users to view their household water consumption, broken down by the appliance, across the past 24 hours or on a daily, weekly or monthly basis. The mobile application provides them with feedback on their progress towards this goal. The DSS component is a messaging function which provides personalised information on saving water around the home. In addition, tips are generated in response to the household recent, as well as predicted, water consumption. A water diary function is provided to encourage households to come together and identify water consumption associated with individual household members. An additional function uses information on the user's showering, laundry habits and household appliance efficiency to highlight where the consumer's water use practices do not align with their level of environmental concern. The graphical format of the DSS display has been designed to appeal to children as well as adults.

The second module of ISS-EWATUS is **the urban DSS**. The main function of it is to regulate and optimise water pressure in the water distribution network. It minimises leaks and optimises pumping efficiency. Additionally, the DSS provides a compact yet understandable manner in which proprietary hardware and software are able to communicate and also provides a common ground for analysing data through the spatio-temporal model, the shared data repository. Furthermore, the urban DSS provides innovative observation and monitoring functionalities. The dynamic nature of the system allows expert users to initiate and integrate specific management interventions. The DSS remains open and modular and allows the incorporation of new data and/or functionalities, making it flexible for future updates. It presents information in both conceptual and numerical manner, embodying the current understanding of the water sector. The DSS receives essential feedback that links the latest sensor observations with the next decision-making steps, building on the close collaboration between the DSS developers and decision-makers, in order to correctly capture their experience and decision-making process.

The social-media platform (SMP) is the third part of ISS-EWATUS. It is able to support the promotion of water efficiency in a holistic approach. This includes its impact at local, national and international levels across Europe and its target audiences of water stakeholders at different levels of individuals, households, water managers, researchers and policy makers. The SMP aims to ease the communication and creation of relationships between stakeholders and to produce a sustainable impact for the communities involved. Apart from supporting mainstream social networking activities such as sharing, communications, being friends, asking and answering, providing a forum for discussion, the SMP allows users to share water tips and photos under different environmental conditions, and the shared content can be pinned on a global map. Gamification enables the whole SMP to be used as a platform with gaming elements, which involve game tasks, competitions and rewards. The game tasks can be any user tasks on the social networks or any water use related offline activities such as recording water use activities. Each of these user tasks can be rewarded upon their accomplishment. Managers, NGO sponsors, and policy makers are able to design these user tasks and to award points or prizes to users.

The latest release of the SMP can be accessed on two platforms:

- Web: www.watersocial.org
- Mobile: <https://play.google.com/store/apps/details?id=com.ega>

The last module of ISS-EWATUS is **the adaptive water pricing system** developed to assess the implications of current and optimal water pricing policies. The adaptive pricing module is based on models for which the input is based on consumer behaviour data. It generates predictions of water



consumption in terms of changing the water tariffs (pricing schemes) and compares them with a baseline scenario. The adaptive pricing module is aimed towards strategic level decision-makers to assess the impact of different pricing schemes. The dynamic pricing module is based on mathematical models that are able to distinguish consumer behaviour during normal seasons and tourist seasons. Based on the price demand elasticity, the model is able to predict future water consumption for different pricing schemes. This is relevant for computing other economic indicators that are needed to assess pricing schemes. The developed software also provides an optimisation module in which pricing schemes are evaluated and ranked according to two criteria: 1) the revenues generated from the new pricing scheme, 2) the savings in water consumption associated with the new pricing scheme. The module displays the characteristics of optimal pricing schemes supporting decision-makers in setting the tariffs. The adaptive pricing module is publicly available on the Internet: <http://www.math.vu.nl/~sbhulai/issewatus>

The reduction of water and energy usage and the reduction of seasonal peaks of water and energy distribution loads are the overall quantitative measures that have been used for the validation and evaluation of the entire common impact of the above-described solutions.

Thanks to the ISS-EWATUS installations at urban and household levels, the cumulative water and energy savings over the specified, longer period of time such as months or years have been relatively easily measured. The evaluation of the reduction of peaks in water and energy distribution loads had to be performed by more sophisticated analyses which are presented in the Deliverable 7.2 - Report of the validation and evaluation.

The urban DSS significantly decreases water losses, peaks of pressure and, consequently, economic losses and the risk of failures in water distribution systems (e.g. pipe bursts). For the case study of Skiathos, it is estimated that pressure optimization decreases water and economic losses by 10-18 % depending on the season of the year (the largest savings in summer). The pressure fluctuations were estimated to be 11 % lower, reducing considerably the risk of pipe bursts in Skiathos, where the pressure distribution is very diversified across the city. In the case of the city of Sosnowiec, a decrease in leakage due to the DSS-based pressure optimization can exceed 20 % and is constant during a year. The results of the above-mentioned comparisons are described in details in the D7.2.

The KPIs allowed to assess the value of energy savings. Specifically, for the Skiathos case study, the saved tap water ranges from 0.19 to 1.02 m³ per hour, the percentage leakage reduction ranges from 9.7 to 18.1 %, the leakage reduction in m³/network ranges from 0.63 to 1.44, the reduction of vulnerable spots ranges from 63 to 72, the reduction of pressure at night ranges from 10.1 to 18.5 %, the decrease in pressure fluctuations ranges from 0 to 28%, the energy savings range from 5259 to 10300 kWh and the decrease in NRW ranges from 1210 to 1392 euros.

In the case of the DSS at household level, the validation shows that the reduction of water consumption can be reached at the level of 15-23% (the water reduction was 15.48% in Sosnowiec and 23% in Skiathos). The deliverable D7.2 contains a full description of the validation process and analysis of the obtained KPIs.

Reductions in water consumption may be highly variable, from 5 to almost 20 % in certain cases. More positive effects appear to be related to the intensity of campaigns or when awareness campaigns are implemented together with other measures such as pricing.

In our case, we achieved a reduction in water consumption (up to 20%) in households if we combined different measures of the ISS-EWATUS solution, according to the KPIs report. Specifically:

- a) reduction due to building awareness (household DSS)
- b) reduction due to pressure reduction (pressure-driven demand reduction)
- c) reduction due to pricing policy (elasticity curves)





The ISS-EWATUS project introduces a number of savings. The implemented, integrated DSS enables the following:

- Minimization of economic losses caused by water leakages in the water delivery system – this in turn improves the business operations of water utility companies through the implementation of ICT solutions.
- Optimisation and reduction of energy consumption in the management of water resources at municipal level.
- Improvement of the socio-economic balance between demand and resources by creating a stable and efficient demand/supply relation.
- Possibility for participant partners to develop or improve technological products for the water management and related markets, thus making them more competitive at EU level.
- Reduction of monthly water bills at household level due to the new information tools that allow families to know, control and reduce their household water consumption levels (savings depend on a combination of smart meters and high efficiency water appliances).
- The possibility of offering demand/supply pricing models tailored to both the end-users' and stakeholders' needs.

The ISS-EWATUS project provides improved resource efficiency of water utilities due to the use of ICT tools. The water management companies that are part of the consortium confirm this by offering a clear comparison of the situation before and after their implementation. On the one hand, they implemented technological ICT solutions into their operating network and improved the supply and water transport chain (detection, control and reduction of leakages throughout the piping system) and, on the other hand, they improved their business operations due to the avoidance of these losses.

The implementation of a suitable and automated water management network and its integration as a DSS module enable a more rational response to water supply demands both at household and municipal levels.

There is a strong belief that the ISS-EWATUS optimized water usage allows more water resources to be available to supply more users and, at the same time, generates alternatives to natural resources (recovery of aquifers, waste water treatment and reuse, desalination) and develops more sustainable technologies in terms of energy consumption (given the constraint of available energy resources).

Thanks to the implemented website and the social platform of water stakeholders, a new area of sharing good practice and solutions in different European countries has been organised. The platform will be maintained after the project has ended, given the interest of all the stakeholders involved. It will be invaluable for keeping communication and progress up to date. In addition, the ISS-EWATUS website is linked to regional, national, and European water platforms and websites (for example Polish Platform of Eco innovations, Silesian Water Cluster, the European Water Platform, EUWI - the European Water Initiative, WISE - the Water Information System for Europe).

