ISS-EWATUS

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ANNEX IV TO D7.2 Report on the validation and evaluation:

Factors concerning the validation of adaptive pricing system

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1. Introduction

This report describes the factors concerning issues of the validation of the decision support system for adaptive pricing of water. The adaptive water pricing DSS allows stakeholders 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 strategic nature of the DSS prohibits a direct implementation of the tool for validation. Therefore, we describe the water pricing regulations of both Poland and Greece and discuss how it affects adaptive pricing with the implications for the DSS. The adaptive pricing module is publicly available on the Internet: http://www.math.vu.nl/~sbhulai/issewatus

2. Water pricing regulations in Poland

The principles of preparing water and wastewater tariffs are regulated by Parliament Act from 2001 with amendments (Dz. U. z 2006 r. Nr 123 poz. 858). More details related to necessary documents for increasing the tariffs are defined in the Ministry of Construction[1] decision from 2006 (Dz. U. z 2006 r. Nr 127, poz. 886). Such a decision was required by the mentioned parliament act.

The tariffs and prices are calculated in such a manner that the expected annual incomes are to balance the expected costs of water and wastewater provision, the investment activity realised by the water operator, and the company profit[2]. It means that investments have influence on the water tariffs.

Flexibility in tariffs establishing by water operators

Each water operator is obliged to establish its own tariffs in full accordance with the mentioned parliament and minister acts. The structure and differentiation of the tariffs include the following factors:

a) Consumers can be divided into tariffs groups (for example: separate households, services, others);
b) Each group of consumers has an appropriate tariff;
c) Differentiation of the tariffs between groups of consumers has to be justified by different costs of the provision of services (there is a ban on cross subsidies);
d) For each group of consumers with a separate tariff, the cost calculation has to be made separately.

The water tariffs include following factors:

a) The price of $1m^3$ of provided water according to the water clock measure or legal regulation describing the average water consumption in case of the lack of the water clock;

[1] Now: Ministry of Infrastructure and Construction.
[2] Usually approx. 3-4%.

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b) A flat charge per consumer (usually household, however, the single water clock defines the term "consumer". Therefore one consumer is not always equivalent to one household).

Each water operator has a free choice with defining the tariffs in following aspects:

a) the number of tariffs groups (in real life from 1 to 4 groups exist in Poland);
b) the differentiation of the incremental charges (prices and flat rate) between the tariffs groups;
c) the single volumetric tariff with or without the flat charge;
d) the progressive volumetric tariff with or without the flat charge;
e) the number of brackets in case of progressive tariffs (in real life the progressive tariffs are very rare in Poland);
f) The seasonal differentiation of the prices (for example, special summer prices).

Supervision of establishing the tariffs

Each water operator[3] prepares the tariffs proposal which is accepted by self-government (at NUTS-4 or NUTS-3 level). The draft has to be provided 70 days in advance before the expected time to be in force. The new proposal has to be supplemented by a detailed calculation of the expected incomes and a multi-annual program of network (and other infrastructure) development and maintenance.

The mayor of the city is in charge to verify the new proposal at minimum in two aspects:

a) Compliance with legal requirements describing the process of tariffs establishing;
b) Verification and justifications of the predicted costs of the operator's activity.

Finally, the self-government has to vote and take a decision at the latest 45 days after the provision of the new proposal. The self-government has the following options:

a) To confirm (accept) the new tariffs. In such a case, the water operator has to publish the new tariffs not later than 7 days after such a decision.
b) To confirm the costs of calculation but not accept the new tariff (or tariffs). In such a case, the self-government can reduce the new tariff or tariffs but such a decision implies the necessity of subsidising the water provider activity to balance the costs not only by incomes from the consumers but also by additional grants from the municipality.
c) To reject the legal base of cost calculation or just the costs calculation. In such a case, the operator can provide additional justifications. If such additional arguments are not accepted – the tariffs will be not changed.
d) Ignore the procedure and the whole verification. In such a case, the new tariffs will be in charge – the only one condition (for the water operator) is to publish the new regulation 7 days before the deadline.

[3] There are approx. 1,200 water providers in Poland.

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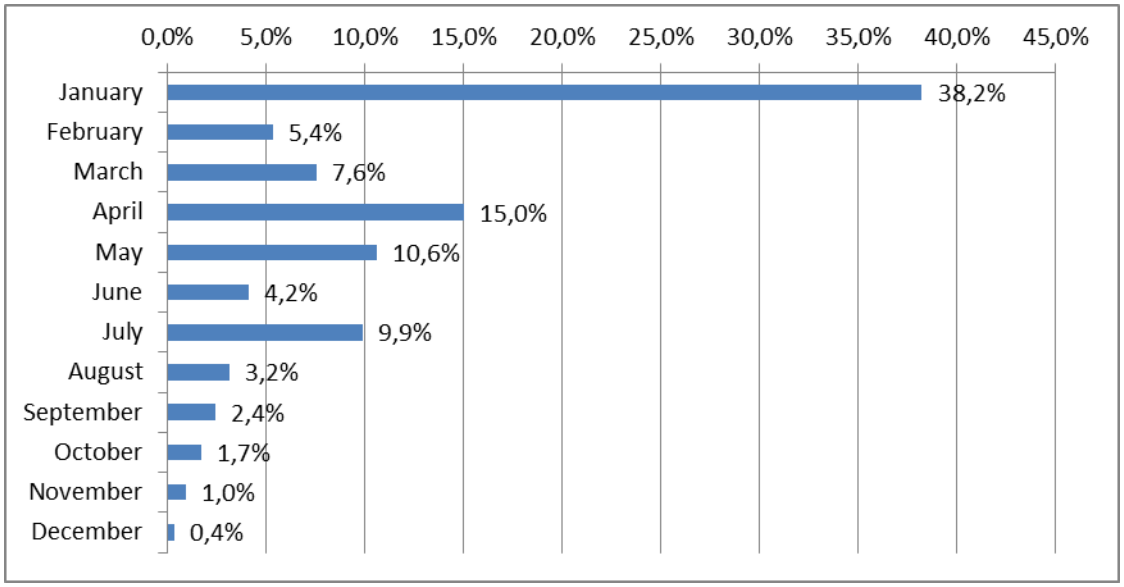
The tariffs are projected for one year and the decision concerning introduction (or rejection) is valid one year (this is the maximum frequency). There is no any obligation to change the tariffs at January 1st. The month of the new tariffs introduction is presented in Figure 1.

Figure 1 Months of the changes of tariffs for water and wastewater services in Poland.



Source: Own calculation using open database of water prices (http://www.cena-wody.pl).

The whole described procedure can be a subject for the next level of supervision. The Supreme Audit Office (in Polish: Najwyższa Izba Kontroli, NIK) is in charge for such an activity and this is not only a theoretical possibility. The last investigation was made in 2015. 10 water and wastewater operators were reviewed (see: Water and wastewater pricing, in Polish: KSZTAŁTOWANIE CEN USŁUG ZA DOSTARCZANIE WODY I ODPROWADZANIE ŚCIEKÓW Supreme Audit Office paper: Nr ewid. 20/2016/P/15/101/LSZ, LSZ/430/002/2015. https://www.nik.gov.pl/aktualnosci/nik-o-ksztaltowaniu-cen-za-dostarczanie-wody-i-odprowadzanie-sciekow.html)

The consumers exposed to high water prices are also supported by the Office of Competition and Consumer Protection (in Polish: Urząd Ochrony Konkurencji i Konsumenta UOKiK). This institution is also allowed to verify if the water price increases are justified by the costs increase. They are in charge to impose a penalty in case of serious violation of consumer's rights. In case of water provision – more detail in the area of charging for water services UOKiK imposed 63 penalties in 2013[4].

[4] https://www.uokik.gov.pl/aktualnosci.php?news_id=10880.

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3. Adaptive water pricing in Poland

Drinking water delivered by water supply systems is priced for all users. Prices have been calculated by water operators on a cost recovery basis (maintenance and operation costs). Changes in the tariffs, therefore, have to be justified as described by the regulations on water pricing in the previous section.

The unit water demand in Poland has been decreasing over the last 10-15 years as far as households connected to water supply systems are concerned. Analysis of municipal companies shows that current unit water demand in households fluctuates between 90 and 110 liters per inhabitant per day (see also Table 5 in deliverable D6.1). Further decrease in households seems to be unfeasible because of the minimum water demand necessary to meet human needs. The influence of water prices, although difficult to be precisely assessed, does not seem to be significant. This renders the applicability and the arguments for applying adaptive water pricing void for Poland.

4. Water pricing regulations in Greece

Greece is a country characterized by great variability in water resources availability and in water demand across its areas and drainage basins. This fact, coupled to the high seasonality in the water resources renewal and water demand, creates the need of extensive infrastructure to cover spatially and temporally diverse water demand, such as basin-to-basin transferring works, reservoirs for retaining necessary quantities for summer use and desalination plants for coastal and insular areas' needs. Directive 2000/60 creates a framework for the protection of water resources by inserting the perception of water as an environmental, social, and financial asset. One of the basic tools of the directive is the water services cost recovery, by defining its components; namely, except for the financial cost, also the environmental cost and the cost of natural resources. This directive was embedded into the national legislative and constitutional framework through the Greek law N.3199/2003. Recognizing pricing policy as an elementary tool for achieving environmental targets can be found among the main new elements of the law: «…water pricing policies should provide for proper incentives at users, to drive them use effectively water resources, and therefore contribute to the achievement of environmental targets…».

The constitutional bodies traditionally charged with the task of regulating pricing policies for water supply among the different regions of Greece are the Municipal Enterprises of Water Supply and Sewerage (DEYA). As described in their founding law (N.1069/80), these bodies are autonomous, they are governed by private law and are directed by a board appointed by the municipal public authorities. Indicatively, most commonly, the president of a DEYA is the mayor of the town himself. In parallel, DEYAs are non-profitable, which means that by the end of each year they must present zero balance, and have spent all income to services, new infrastructure, capacity building, etc. The criteria to traditionally determine pricing policy taken into account by the boards of DEYAs, according to the announcement of the currently leading DEYA (water utility companies of Athens and Thessaloniki are excluded) at its website, are the necessary cost-of-living adjustments and the general economic state.

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Up to date, due to citizens' unwillingness to pay, as water is generally yet perceived as only a social good among users, the rule for most DEYA would be to keep water price the lowest possible, with some coarse adaptiveness characterized by some pricing scales. Taking into account the economic crisis in the country, it can be easily understood how difficult it is for a DEYA to impose higher water pricing policy, without disrupting the orderly flow of water bill payments. In general, however, guidelines are set that would make water cheap and very affordable for the "frugal, or prudent" consumer and really expensive for the "careless, or extravagant" user that uses. Keeping that in mind, we understand why it is rare to see a flat pricing scheme, which charges the same amount per cubic meter of water consumed for all consumers. There is usually a scaling scheme that defines ranges of cubic meters of water consumed and corresponding prices. So, the water utility defines that people that consume from 0 to a number of cubic meters of water pay a low tariff; the ones that consume more pay a slightly higher tariff, and so on, until we get to the extravagant water users that pay the highest cost per cubic meter of water consumed.

So, how is water-pricing policy decided upon in Greece? How are these sliding scales of water consumptions and corresponding tariffs are defined? The director of the water utility will look at consumptions and income, will divide consumers in groups based on their consumption, and will try out different prices/tariffs to see how much income generation can be improved. Or, in times of financial crisis, he/she may decide to lower the price for the low-water consumers that may be the poorest citizens as well. A series of arbitrary scenarios are tried out, following a non-systematic trial and error process on a spreadsheet, until a pricing scheme that "makes sense" is established. Then, the director introduces the new pricing scheme to the municipal council, defends his propositions and presents the improvements that he/she plans to achieve through this new policy. As far as the consortium knows and after contacting several water companies in Greece (excluding the ones in Athens and Thessaloniki) and the Union of all DEYAs in Greece (called EDEYA, http://www.edeya.gr/), there is no tool that is used by directors to guide them in testing different scenarios and in deciding on their water policy.

Opportunities for the adaptive pricing DSS

The adaptive pricing DSS can be a valuable resource for Greek water utilities and other such utilities that operate in a similar fashion.

According to current practices, the water price is simply added up by the components of water supply cost, sewerage and waste treatment cost as well as infrastructure-improvement cost. Up to date, water policy pricing in almost all water utilities in Greece is not designed with any estimation, or prediction of the consumers' reaction to a change imposed in the water price. So, demand elasticity is ignored completely! This means that when scenario calculations are being performed, it is assumed that consumers will continue consuming the same amount of water, regardless of prices. Based on this assumption, the projected revenue is calculated. Of course this is false, since people probably will, to some extent, limit water consumption when faced with higher prices. This reality is not taken into account in Greece; as a result, projections made when pricing policies are planned are most of the times away from reality. In other

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words, the elasticity of water demand is currently not taken into account and the potentially crucial tool, for water resources protection, of water pricing, as suggested by 2000/60, is kept inactive.

Greece has quite a bit of experience in this subject: When the government was trying to increase revenue to face cash flow problems, it raised the prices of heating oil by a significant percentage hoping to see cash flows increasing. A very large percentage of householders switched to alternative fuels—wood, pellets, electricity, etc.—and stopped using the original heating systems that were designed to operate with heating oil. The result was a sharp drop in revenue for the Greek government, even though predictions were giving high increases in revenue. This was the case of not taking into account demand elasticity, which led to wrong projections and a drop in revenue overall, when the opposite was the desirable outcome. Similar situations are documented for Greek water utilities as well, so the ISS-EWATUS water pricing tool could prove an important asset for strategic outlooks and financial planning of water utilities.

Skiathos Island, as a touristic resort with high seasonality both in water resources renewal and in water demand, depicts some peculiarities that shape the conceptual context of water as an asset. First of all, the water consumers in the town of Skiathos are divided into two main groups. The first group is the group of locals, permanently or seasonally living on the island and working on the island. This group is expected to depict a flexible water consuming behaviour that can be shaped both by a potential pricing policy and the willingness to protect local water resources. It is useful to keep in mind that water resources of the island facing severe shortage and quality degradation is an issue primarily and widely concerning the locals. The second group is formed by the tourists who depict a much stiffer water consuming behaviour, since they are not directly charged with the water bill, while it is much more difficult for them to get sensitive on matters of local water resources. On top of these, the touristic behaviour inherently involves a great use or even waste of water, for sanitation, cooling, amusement and food preparation. The two different groups of customers co-shape a rather non-elastic demand compared to that of a purely residential, non-touristic area.

Another issue that also forms the elasticity curve of water demand in Skiathos Island is that its use is strictly not for drinking and cooking, due to its high concentration in mercury. Locals and tourists are using bottled potable water for drinking and cooking purposes. Taking into account that these water uses are basic ones linked to the less elastic end-use demands, this peculiarity forms a slightly opposing mechanism to the previous one.

Taking into consideration all the aforementioned reasons, it can be understood why a pricing policy model tool is of crucial importance for Skiathos water utility, and generally for any utility. The pricing policy tool can enable utilities adapt a fair pricing policy which will integrate all needs and aspects of its case study, such as the touristic component or partial end uses routines. Such a tool can enable a real adaptive pricing policy that will drive to water resources protection in an optimal way as far as the pricing push is concerned.

In case of a spatially and temporally variable case study --as far as the elasticity of water demand is concerned--, such as the case of Greece which can be divided into touristic and

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non-touristic areas, or into touristic and non-touristic seasons, a pricing tool can constitute the catalyst to encourage water utility directors implement fair water pricing policies that will aid achieving environmental targets.

5. Adaptive water pricing in Greece

In the previous section, we have discussed the benefits of applying the adaptive water pricing DSS for the Greek situation. Due to citizens' unwillingness to pay, DEYA is applying a low cost pricing policy. Due to the economic crisis, it is difficult to increase prices since water related charges must be affordable to all. By increasing water prices, what was affordable before, may not be affordable for some consumers anymore (see also the calculations in deliverable D6.3). Consequently, in the households sector, prices are very low in most regions and generally not sufficient for full cost recovery.

Note that DEYAs, although operating as private enterprises, are owned by the municipalities. They are also dependent on municipal funding, especially for investments. Therefore, policies and strategy are strongly dominated by the municipal council. This, together with the point made above, prohibits the use of for adaptive water pricing void for Greece.

6. Conclusion

The validation of the adaptive pricing DSS, being a strategic tool, is a sensitive and delicate task that is influenced by many economic and social factors. In practice, one tries to integrate on the one hand principles of free economy and on the other hand social justice. In both Poland and Greece, one implements a low cost pricing policy while aiming at full cost recovery. In Poland, however, the water demand level is very low, leaving little room for water reduction through adaptive pricing. Adaptive pricing in Greece has more added value, but due to the economic crisis, there is a tension in affordability of pricing when full cost recovery needs to be achieved. These reasons prohibit the adoption of adaptive pricing in practice, limiting the validation of adaptive pricing to simulation studies as in done in WP6. It is important to remain in contact with stakeholders to show the benefit of adaptive pricing so as to implement it in practice and truly validate it.