Water Utility Journal 1: 19-29, 2011.

A pilot initiative for improved urban demand estimation based on stochastic analysis of water consumption

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Abstract: Water utility companies in big cities often register a high water loss due to various problems in covering the extensive water supply networks and a large number of households. Any significant improvement would require a better understanding of water demands in detail. Hence, the application of Stochastic Analysis to the measured water use in the selected pilot areas is proposed for achieving the results that can be applied to the urban water supply network as a whole. As the basic prerequisite, this initiative foresees the installation of a number of high-accuracy water meters equipped with data-loggers to households in several selected pilot areas. Main targets of the proposed pilot initiative can be summarized as: (a) application of high-accuracy meters and statistical analysis of measured data in the selected representative pilot areas, (b) development of a stochastic generator of water demand patterns, (c) creation of the improved water demand estimation, capable of extrapolation to the urban supply networks. The stochastic simulation of demand, in combination with the socio-economic status of each household and comparison with the historic data, is expected to provide a much better and detailed understanding of water demands and the way of operation of the water supply network .The ultimate goal of this initiative is to enable water utility companies to obtain and apply more rational and detailed information on water consumption that would improve, among other things, the following aspects of their operation: (a) demand forecasting and planning, in particular for regional and long-term development; (b) maintenance and actions leading to the reduction of water losses.

Keywords: water supply; urban distribution networks, unaccounted for water, stochastic simulation of demand; water meters accuracy

1. INTRODUCTION

One of the major characteristics of the water supply network performance is its efficiency. Apart from the quality of water measured and billed, a certain percentage is water losses or unaccounted for water (UFW). EU and member countries are attempting to reduce this percentage to the lowest possible level by proactively supporting the efforts in UFW reduction through scientific projects, various measures and legislation. One important step in performing such a task is the understanding of water balance, the decomposition of UFW into controllable and measurable components and the proper maintenance and control of the water distribution system (WRc, 1994). A domestic water user as a final link in the water supply network is the most common and most important component in the water balance. Understanding and a proper, reliable metering of domestic water consumption is, therefore, an extremely important task especially in the water shortage-prone systems (Tsakiris, 2007).

Detailed information on domestic water consumption (American Water Society, 1999) can be obtained combining precise and frequent measurements. However, to address the problem of metering accuracy (Janković-Nišić, 2002) through a simple replacement of water meters by more precise ones (change from A or B classes to C or D) means a huge cost due to the large number of water meters. The process of changing water meters, therefore, requires careful planning and systematic effort.

Implementation of statistical tools on detailed information of water consumption in selected areas can produce patterns that would allow for a fairly adequate understanding of the water system

(Ivetić et al., 2007). If combined with properly distributed sampling, statistical tools (Buchberger, Wells, 1996) can produce a fundamental background for the most efficient upgrading of water meters.

The proposed initiative presents an integral and comprehensive methodology for water demand estimation (Ostojić, 2007), which includes a detailed pilot project as foreseen for the Athens urban area. That area is under the jurisdiction of the Athens Water Supply and Sewerage Company (EYDAP SA), the largest water utility company in Greece operating in the water sector. EYDAP SA, using the most up-to–date scientific standards, supplies over 4,000,000 inhabitants of Attica with potable water, through an extensive network that includes 1,899,772 metered connections and a total length of pipes of 8,210 km. The sewerage sector serves 3,300,000 inhabitants, with a total length of conduits of 5,800 km.

According to the official statistics, for years the percent of unaccounted for water (UFW) in Athens urban area is around 20-23%. More precise information is given in the following Table 1, extracted from Annual Bulletins of EYDAP from 2001 to 2008.

Table 1. Percentage of Unaccounted for Water to Total (UFW) in the period 1999 - 2008

Year	2008	2007	2006	2005	2004	2003	2002	2001	2000	1999
UFW [%]	20.2	18.0	22.7	19.2	22.6	22.0	26.1	23.5	21.4	21.6

It has to be taken into consideration that the highest percentage of the Invoiced Water Sales comes from domestic water use (Fig. 1). The part of water distribution network that covers domestic users is the largest and the most complex. It is, therefore, the primary target for investigation on measurement problems, water loss and other causes of unaccounted for and non revenue water (Janković et al., 2000).

Finally, Table 2 and Figures 2a and 2b give a gross estimation of the volumes and percentages of water conveyed and distributed by EYDAP SA together with the unaccounted for water.

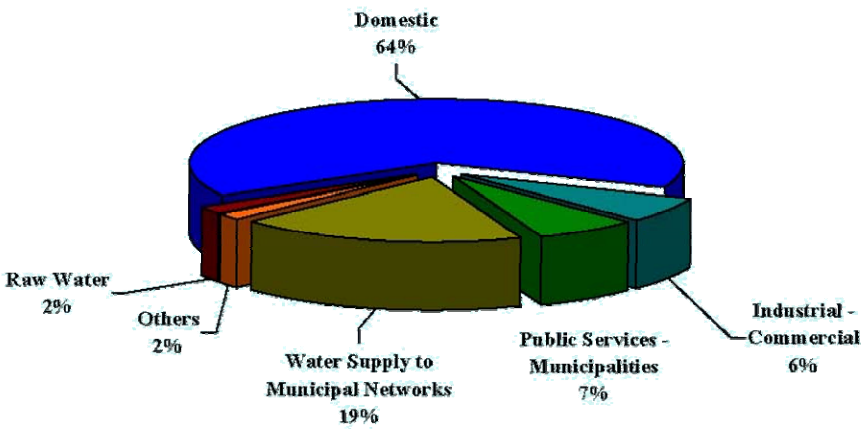

Figure 1. Analysis of water invoiced average share 2004-2006 (Annual Bulletin of EYDAP – 2006)

Table 2. Analysis of water supply revenue water consumption (million m^3)

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Water consumption invoiced	274.5	301	306.1	306.7	310.6	312.2	318.1	313.7	347	343.8
Unaccounted for water	77.5	83.5	95.4	110.3	88.9	92.4	76.7	93.8	77.8	88.7
Water distributed for free – discounts	6	5.5	4.7	4.8	5.1	5.1	5.5	6.1	6.8	7.0
TOTAL	358	390	406.2	421.8	404.6	409.7	400.3	413.6	431.6	439.5
Unaccounted for water to Total (UFW) (%)	21.6	21.4	23.5	26.1	22.0	22.6	19.2	22.7	18.0	20.2
Non revenue water (NRW) (%)	23.3	22.8	24.6	27.3	23.2	23.8	20.5	24.2	19.6	21.8

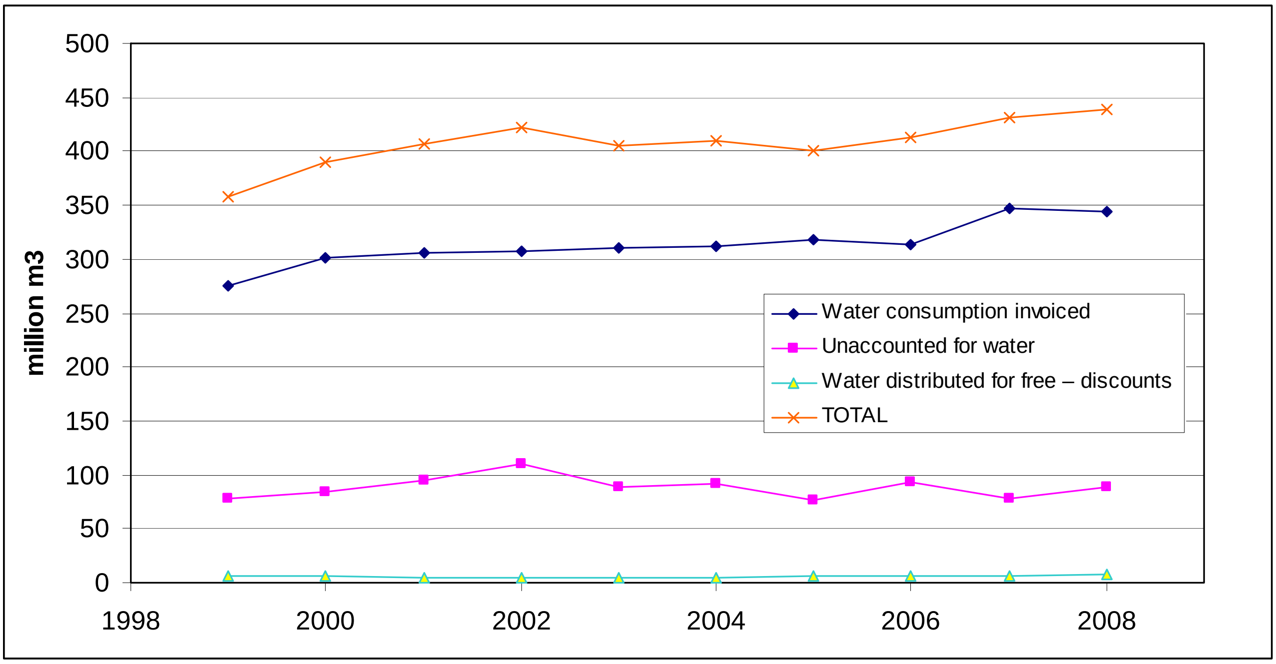

Figure 2a. Constituents of water distributed by EYDAP (1999 – 2008)

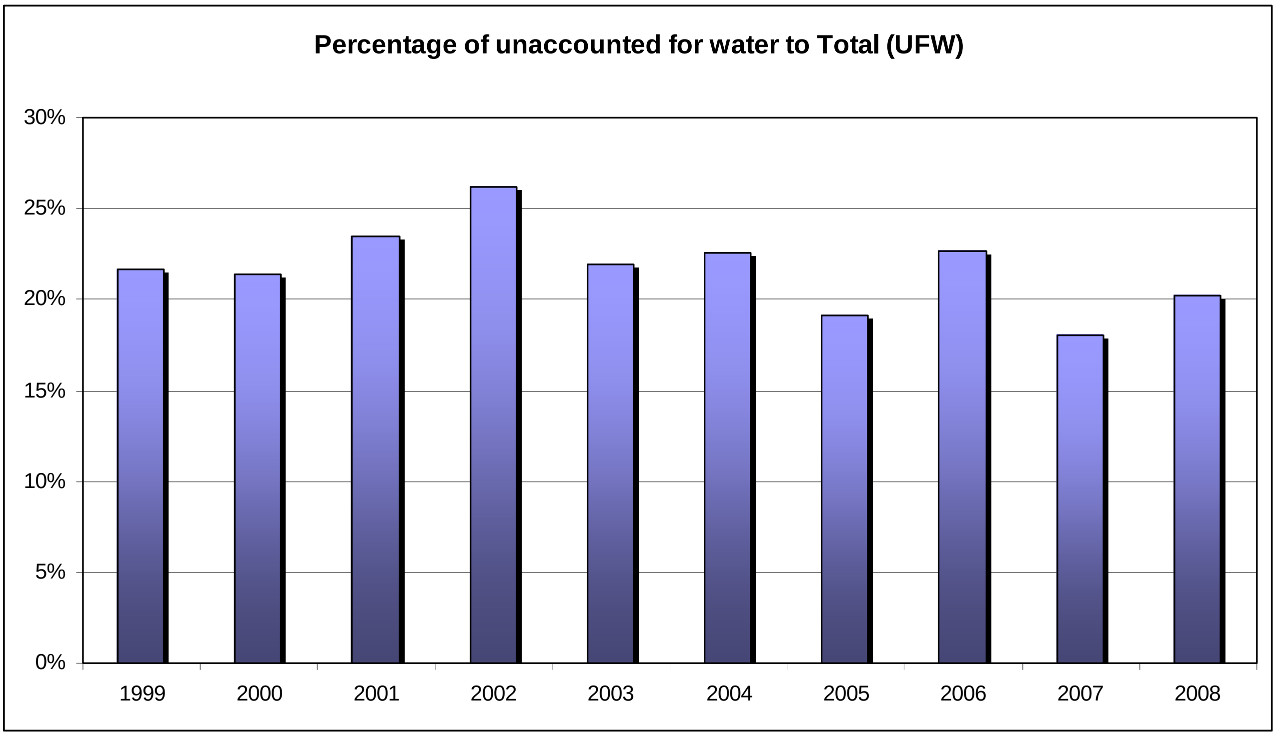

Figure 2b. Percentage of UFW of EYDAP network for the period 1999 – 2008

The proposed pilot initiative presented here is based on the above information and it aims are to attain the following main targets:

- Application of high-accuracy meters and statistical analysis of measured data in the selected representative pilot areas,
- Development of a stochastic generator of water demand patterns
- Creation of improved water demand estimation, capable of extrapolation to the entire urban supply networks

2. DESCRIPTION OF THE PROPOSED INITIATIVE

The Laboratory of Reclamation Works and Water Resources Management of the National Technical University of Athens (NTUA) puts a lot of effort into implementing procedures for improving water use, better management and other water related issues in Greece for years. A very successful seminar on "Water Conservation in Urban Water Systems" took place four years ago with the participation of experts in domestic water loss management. During the preparation phase and during and after the seminar, an idea emerged to implement some of the presented new methodologies in order to reduce the unaccounted for water in Athens. The following Initiative for the implementation of a research project that incorporates field measurements with advanced system analysis tools comes as the result of those ideas, improved through several iterations until today.

The Greek domestic water supply systems grow, together with the demands, year after year. That growth is especially noticeable in Athens, as a constantly expanding mega-city. Municipal water companies in Greece are, so far, coping with the increasing demands. However, as in many other areas of human life, there is a constant need for a more efficient and up-to-date control and detailed understanding of the system. One concrete issue worth further investigation is the estimation and the reduction of the level of unaccounted for water. Two major points, among others, need attention:

i. The issue of water meters used for measuring domestic water consumption. The meter type, its accuracy, the way of instalment and application, distribution within the system and data reading and handling are some of the important parameters directly influencing the results of governing water networks.
ii. Way of understanding, analyzing and predicting the water consumption in the network, down to the level of the individual consumer and his/her habits combined with the appliances used. By shifting from the use of the averaged consumption derived from general statistics (known as node demand) to the detailed consumption at the level of a single domestic user, a much better understanding of the water network can be obtained with many related benefits.

Main objectives of the Initiative are to answer and give guidance to various questions that such an investigation would raise and to produce as reliable data as possible. As a part of the Initiative an installation of a significant number of high-accuracy water meters is foreseen. The meters would be strategically placed around Athens greater area and measurements collected through data-loggers for a period of at least 12 months, therefore completing an entire yearly cycle including all the seasons, with the recommendation for 24 months of continuous measurement. Data transfer from data-loggers to the central database would be performed through telemetry. Among other calculations, comparison with the historical data would be performed wherever possible.

It is planned to install the water meters equipped with data loggers, having the possibility to take the readings as fast as one measurement per second (or several seconds). Using true, measured water consumption with sampling rates much faster than usual (once per month), it is possible to analyze water consumption statistically. By taking into account the number of inhabitants, in house appliance types, economic and social category of consumers and other related elements, a stochastic demand pattern generator can be created and used instead of the usual, high average demand pattern with constant peak water demand multipliers. The stochastic generator can easily cope with different levels of connection aggregations (Blokker, Vreeburg, 2005).

Once properly calibrated for different user categories, it can be used from the level of one connection to the level of DMAs. Also, it can be used to predict the consumption and pattern in the future for different scenarios of society development and economic changes.

Important results and conclusions expected as an outcome of the initiative can be summarized as follows:

1. Better definition of actual demands for various user categories and seasons.

2. Identification of areas with high deviation of actual to recorded (by standard meters) consumption.
3. A stochastic water consumption model generator for realistic derivation of demand patterns, calibrated for different user and connection types and verified for different aggregation levels.
4. Recommendations for the use of water meters in the future with guidelines for application of high-accuracy meters. This will include monitoring of the current utility company meter sizing procedure with suggestions for its revision based on the results of stochastic generator.
5. Identification of major causes of water losses in the network.
6. Prioritization of areas for implementing Water Loss Management procedures.
7. Processed measurements from the network of installed high-accuracy water meters for 12 or 24 months.

The concept, methodology and objectives of the Initiative are analysed in detail in the following chapters.

3. PILOT AREAS, WATER METERS AND EXPERIMENTS

3.1 Advantages of pilot areas measurements by accurate water meters

Each pilot area would be selected as a representative area out of the 4-6 types within the Athens' urban water supply network. It is recommended that all these types of areas be identified based on geographical, spatial planning, social and economic characteristics and have an experimental sample area in each of these types. Therefore 4-6 pilot areas will be selected after the preliminary analysis of the 'preparation phase'.

Each pilot area selected will be fully described and monitored with respect to pipes and equipment, discharge and pressure variation, households served and their characteristics, historical consumption rates, etc. A GIS platform will be created for each pilot area to store all the necessary data together with their geo-reference (Tsakiris and Salahoris, 1993).

Each pilot area will be selected, if possible, in isolation from the network by means of having recorded inlets and outlets. This will enable us to have the exact inflow and outflow volumes from the pilot area under study. The continuous recording together with accurate measurements of consumption will produce fairly accurate information of the spatial and temporal identification of water losses. Reliable estimations on the contribution of water meter inaccuracy towards the unaccounted for water will be also deduced.

3.2 Types of water meters based on accuracy

Water meters (also called cold-water meters) are classified according to criteria related to their flow rates, which are expressed as "Q values" or more specifically - according to the values of Qmin (minimum flow rate) and Qt (transitional flow rate). Definitions of Qmin and Qt are the following:

- The minimum flow rate, (Qmin), is the flow rate above which the meter must not exceed the maximum permissible errors, and is fixed as a function of Qn (nominal flow rate).
- The transitional flow rate, Qt, is the flow rate which divides the upper and lower regions of the flow range and the rate at which the maximum permissible errors become discontinuous.

According to EU regulations there are three metrological classes of water meters: A, B and C; starting from A as the lowest level and coming to C as the most accurate level. Table 2 below sets out the various Q values for the different classes of meters (D class is not included).

Table 2. Different classes of water meters in most countries of EU.

Classes	Nominal flowrate Q_n	
	< 15 m^3/h	≥ 15 m^3/h
Class A		
Value of: Q_{min}	0.04 Q_n	0.08 Q_n
Value of: Q_t	0.10 Q_n	0.30 Q_n
Class B		
Value of: Q_{min}	0.02 Q_n	0.03 Q_n
Value of: Q_t	0.08 Q_n	0.20 Q_n
Class C		
Value of: Q_{min}	0.01 Q_n	0.006 Q_n
Value of: Q_t	0.015 Q_n	0.015 Q_n

The class does not indicate the accuracy of the water meter but the width of the flow range metered with the common accuracy figures. Accuracies are ± 5% at the meters minimum flow rate and ± 2% at the meters normal range (between Qt and Qmax) for cold water meters. The higher the class of water meter, the higher the accuracy at very low flow rates (class D having the highest accuracy and class A the lowest).

When deciding if a low flow reading is required it should be remembered that even a class A Qn=2.5 (a ¾ meter) would start to read, within its tolerance band, at a flow rate of 1.66 L/min (e.g. a basin tap would flow between 6 and 10 L/min). For general registration of the volume of water used a class A or B meter is sufficient. If the effects of dripping taps and low flows caused by float operated valves are to be taken into consideration, then a class C or even D meter should be selected.

3.3 Initiative for experimental application of high-accuracy water meters

The number of connections with potable water for domestic use, as mentioned in the introduction, that EYDAP is handling is close to two million. Despite of the potential advantages of high-accuracy water meters, any upgrade of water meters is a long-term and expensive process. Therefore, besides a thorough analysis of potential benefits in general and economic calculation on the possible pace of replacements per year, a detailed strategy has to be developed in order to make the upgrading of water meters effective and financially beneficial.

The information necessary for any realistic decision upon the upgrade of water meters to high-accuracy ones, considering the amount of water meters bound for potential replacement, can not be based only on theoretical research. Definition of the optimal long-term strategy requires a pilot application of high-accuracy water meters. Considering the complexity of the water network of Athens, a pilot application has to be a representative sample. The decision over the appropriate pilot application requires the answer to several questions:

- Optimal category of high-accuracy water meters (type, class – accuracy, diameter, and other important characteristics, versus price).
- Number of water meters necessary to create a representative sample.
- Distribution of water meters.
- Means, accuracy and sampling interval of measurements.
- Duration of the monitoring period.

The final answer to the above mentioned questions needs detailed analysis, foreseen within the initial phase of the proposed project. However, as a first assessment and starting point, the following estimations are proposed:

- Installation of high precision meters class C or D, with the minimum recording flow-rate under 6 L/h and the starting flow-rate at least 2 L/h. The selection of the provider of water meters should be carried out by the municipal water company, in this case EYDAP, in a form of a Tender. The Tender Documentation may be prepared by the NTUA research team as a part of the initial phase of the project.

- Based on some of the previous research projects carried out for the Athens' urban water supply network, the number of water meters necessary to create a representative sample is estimated to be within the range of 200 to 600.
- Adequate sampling for pilot application will require 4-6 case studies (pilot areas), established by locating evenly distributed groups of water meters in 4-6 characteristic districts within the water supply network.
- To achieve the necessary accuracy and required sampling interval for measurements, water meters have to be equipped with pulse units and data-loggers (one data-logger per every meter or a small set of meters connected to one data-logger, where possible). The data logger must have the capability of sampling rate starting at 1sec. Final sampling rate (ranging from 1 sec to 1 min) would be defined at the initial phase of the project.
- In order to cover the water consumption during the whole hydrological cycle and all seasons, a monitoring period of full 12 or 24 months is necessary.

4. STOCHASTIC SIMULATION OF DEMAND

The stochastic simulation of demand could be based with the support of the University of Belgrade (Faculty of Civil Engineering, Institute for Hydraulic Engineering, FCE-IHE) which has extensive experience in the application of Stochastic Analysis in the water supply network.

4.1 Overview

Depending on its position in the distribution system, the flow in a water supply branch can be a highly variable quantity (Spiliotis and Tsakiris, 2011). As a general rule, due to the stochastic nature of water consumption, increasing the number of downstream consumers from 1 to N would shift flow variability (Tribut, 1969) from short time scales (seconds and minutes) to large time scales (days and months) while the ratio of mean flow to peak flow would decrease from 1:20 (or more) to 1:1.5 (or similar). The flow variability at the level of one connection (level of one house) depends also on sampling interval: if flow rates are rapidly sampled, high variability can be observed, otherwise, the variability would be much lower due to averaging process (Tricarico et al., 2007).

Standard demand patterns, as usually used in Water Supply Simulation Models with constant peak water demand multipliers, are not able to represent water demand stochastic nature. Since flow patterns are deterministic, they are not able to present empirically proven relations between peak demand dimensionless factor with the number of connections increase and/or monitoring time step increase. Thus, standard demand patterns are of limited benefit for modelling of small networks, or detailed network models (up to the level of one household connection). Also, such flow patterns are of limited value for prediction of future water demands in "what-if" scenarios.

An alternative approach is to observe the water consumption at the level of one consumption unit (or water appliance) such are toilets, baths, washing machines, etc (Ostojić, 2007). Using a random sampling procedure, the statistical data about their operations are extracted. Having the database of the appliance's statistical parameters, the model (or generator) of stochastic water consumption can be created for the level of one household (or one connection). Such a model can take into consideration, among other factors, the apartment size with related appliances and their characteristics, number of inhabitants, their habits, social characteristics, etc.

Although the model is stochastic in nature, its basic concept is physical: the real appliances are considered, with their (statistical) parameters (Ivetić et al., 2007). The model can be calibrated with the measured consumption data, collected through the operation of the planned installation of high-accuracy water meters equipped with data-loggers. The extrapolation of the model to the parts of the unmetered network can be verified using existing readings on a monthly basis.

The results of such a statistical model (or stochastic pattern generator as given by Ostojić (2007) are sets of demand patterns, for each computational node which can be one house connection, averaged several connections, or the whole District Metering Area (DMA). Having stochastic demand inputs, a simulation model has to be used a number of times, producing also stochastic results of pressure and flow rates. This approach would lead to a more realistic simulation of the network operation, since most possible scenarios are captured and checked. The up-scaling and down-scaling of network simulation model is straightforward, the testing of water quality problems in small pipes due to intermittent flow is also possible, and the inclusion of metered consumption is easy to apply through a recalibration process of the stochastic model. The stochastic approach is very important especially in small networks with high flow variability factors, where continuity equation for each time step cannot be applied for upstream junctions (Branisavljević, Ivetić, 2006). In such networks the looped parts of the system is especially problematic to solve using classical (deterministic flow pattern) approaches.

4.2 Data needed

Since the proposed stochastic pattern generator can be calibrated, its operation largely depends on the quality and availability of the flow data. To obtain the best results, the following data are needed:

1. Flow rates from all flow meters. Exact hydraulic (connection) scheme is essential.
2. At least three levels of instantaneous flow rate data: at the level of one household/family, several households/flats/families (about 10 or so), at the level of fifty to hundred connections and at the DMA level (about thousand connections or more). At least three different consumption zones should be covered by this rule.
3. If possible, in some flats, the appliance level can be monitored using low cost flow switches. The signal from flow switch can be stored at the same data logger used for flow meter at the connection level. At least 10 flats, within different zones, should be equipped with flow switches.
4. Some connections should have the pressure transducer downstream the flow meter, at the connection level. All connections with flow switches (item 2) should have the pressure transducer. If possible, at least 50 connections should be with pressure sensor.
5. Interviews with customers (number and type of appliances, usage habits …). Interviews have to be carried out at least with customers/users with installed pressure sensors (item 4).

It is assumed that all data loggers are capable of 1sec sampling rates and with enough memory to hold data between two data transfers. During 12 or 24 months measuring campaign, in certain data loggers the sampling interval can be changed, according to ongoing results. Also, items between 2 and 4 should cover different zone types, with different users.

Apart from the flow data, a set of data is needed for the simulation model creation. For selected experimental zone, the hydraulic model would be created using 3DNet-EpaNet software or other efficient algorithm (Spiliotis and Tsakiris, 2011). To create the model, the following data are needed:

1. Data about terrain elevations,
2. Network data (network layout, pipe type and diameters, house connections, valves etc.),
3. Housing data (number of inhabitants, type of housing, no. of floors), and
4. Pressures and flow rates from existing SCADA systems (if DMAs are of transit type, data on entrance and exit nodes are also needed).

Most of this data could be exported from existing WSS GIS and/or existing hydraulic model, once pilot areas are delineated.

4.3 Stochastic model calibration and verification

The proposed stochastic model will be calibrated using measured flow and pressure data. Since a large number of high-accuracy water meters equipped with data loggers is planned to be deployed, with fast sampling rates, a massive data handling procedure will be developed. Using the sampling techniques, data series for calibration of the model on different consumer aggregation levels and for different user types will be extracted. Also, another set of data series for model verification will be used. To analyse in detail the measured data, search for patterns in different zone types and for different connection types will be performed. Analysis of small leaking flows at the house connection level is expected to give the stochastic background flow as it can be added to intermittent stochastic component of appliance usage.

A full test of the calibrated model will be performed through the stochastic model usage. For the selected DMA the simulation model will be created using the EpaNet software or other efficient algorithm. The model would be embedded in 3DNet environment (FCE-IHE Belgrade), using Access as main SQL database. The stochastic simulations of selected periods with statistical analysis of obtained results will be performed. The comparison of the stochastic approach versus the deterministic one is expected to show the usefulness of the proposed approach.

Using the deterministic model with stochastic demands generator, several tests can be preformed:

- The required number of simulation model runs (or, number of stochastic water demand realisations) depending on network size and user type.
- For certain user groups, tests on water meter operation can be performed in order to test the water sizing policy.
- Water quality test can take place at the connection level versus node level, taking into account the intermittent flow.
- The algorithm for the connection demand aggregation would be tested, as the prerequisite for the simulation model up/down scaling and for direct usage of metered consumption in the simulation model.

Since the network which will be used has its own simulation model, the results obtained using stochastic demand patterns model which will be created in this project could be compared with the results from the existing model for selected supply zones.

4.4 Deliverables

The deliverables from this phase of the Project are:

1. Statistical analysis of measured data using high-accuracy meters
2. Calibrated model, the stochastic generator of demand patterns, for different user types and aggregation levels. That will provide the most near to “real” water use of a single household throughout the day (24 hours), enabling various types of further analysis (e.g. behaviour of water network during the night).
3. Calibrated simulation model for selected zones (and/or DMAs).
4. Guidelines for simulation model usage in small networks and/or at the level of DMAs, based on the usage of stochastic consumption data.
5. Critical review of existing practice for flow meter sizing policy, based upon the obtained measurements and the results derived from the stochastic generator.

5. IMPLEMENTATION OF THE INITIATIVE

The Initiative foresees 12 or 24 month period of continuous consumption monitoring and data collection. It also takes into consideration a preparation phase, a period for selection and installation of high-accuracy water meters and time for analysis of the results and creation of the final report. Therefore, it is proposed that the total duration be between 24 and 36 months. Major phases of the project will be as follows:

i. Preparation phase.
ii. Selection of high-accuracy water meters with data-loggers and telemetry.
iii. Installation of high-accuracy water meters with data-loggers and telemetry.
iv. Monitoring phase and data processing.
v. Final analysis of data.
vi. Creation of the final report.

Major tasks foreseen to be completed within the project, with the corresponding phases, can be seen in Table 3.

Table 3. Major tasks foreseen to be completed within the project.

	Task	Starting Phase	Duration
1.	Stochastic Simulation of Demand	Phase (A)	Continuous development throughout the project (until the final phase F).
2.	Case studies selection (4-6 pilot areas)	Phase (A)	Phase (A)
3.	Creation of the tender documentation for the purchase of high-accuracy water meters with data-loggers and telemetry	Phase (A)	Phase (A)
4.	Support in the selection of high-accuracy water meters with data-loggers and telemetry	Phase (B)	Phase (B)
5.	Support in the installation of high-accuracy water meters with data-loggers and telemetry	Phase (C)	Phase (C)
6.	Monitoring with data collection	Phase (D)	Phase (D)
7.	Data analysis	Phase (D)	Phase (D) - (E)
8.	Comparison with historical data	Phase (D)	Phase (D) - (E)
9.	Identification of areas with high deviation of real to recorded (by normal meters) demand	Phase (D)	Phase (D) - (E)
10.	A water consumption model generator for realistic derivation of demand patterns	Phase (D)	Phase (D) - (E)
11.	Definition of real demands	Phase (E)	Phase (E)
12.	Guidelines for application of high-accuracy meters	Phase (E)	Phase (E) - (F)
13.	Prioritization of areas for Water Loss Management Projects.	Phase (E)	Phase (E) - (F)
14.	Final report	Phase (F)	Phase (F)

6. CONCLUSIONS

The Athens Water Supply and Sewerage Company (EYDAP SA) is a fairly modernized company, but still registers a water loss that could be further reduced. Also, due to extensive water supply network within its jurisdiction and the big number of households, it is necessary to improve the understanding of domestic water demands in detail. To achieve this goal the improvement of metered water accuracy together with the application of the Stochastic Analysis to the measured water use in the selected pilot areas is proposed. The time span for performing measurements should be at least 12 months (one entire year), with the recommendation for an additional 12 month period of continuous measurement for further testing.

It is expected that EYDAP will have a significant direct benefit from selective and optimised upgrade of water meters. Therefore it is important to underline that the overall idea of the Initiative is not to assess the global change of all water meters from class A/B to class C or D. The target is to create the methodology of optimal meter class selection, based on the type and number of users and net flow rate. Also, the Initiative considers the current meter sizing procedure in Athens' urban water supply network and suggests its revision based on the results of the stochastic water demand generator.

The application of Stochastic Analysis to water demands in water distribution networks has been proven in several cases, but not yet in Greece. The Stochastic Analysis of data gathered from Athens WSS during the proposed Initiative, in combination with the socio-economic status of households and comparison with the historic data, is expected to provide a much better and detailed understanding of water demands and insight into the operation of the water supply network .The main goal of this initiative is to enable the water utility company to obtain and apply the correct and detailed information on water consumption that will improve demand forecasting and planning, in particular for regional and long-term development, network maintenance and preparation of actions leading to the reduction to water losses. The ultimate target is to verify the integrated methodology that is adaptable and scalable for application in almost any urban water supply network.

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