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Estimation of Domestic Water Saving Potential[1]

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Abstract: Domestic water saving potential in the case of Manisa, Turkey has been investigated. The water conservation measures for each water practice are examined and some easy-to-apply measures proposed. An experimental study was, then, conducted to determine if the domestic water conservation measures proposed were applicable for the city considered. For this purpose, a questionnaire was developed and 200 respondents were asked to fill it in. Based on the results of the study, it is shown that the measures proposed are quite applicable and around 28 % saving is manageable if the proposed measures are publicized adequately and applied effectively.

Key words: Domestic water • Water saving • Demand management • Manisa

INTRODUCTION

Growing number of human beings who demand water and the industrial development threaten water supply not only for ecosystems but also for us. The latest UN report states that at least one-third of the world population do not have access to safe water resources, which results in so many health problems [1]. Therefore, it is very urgent to establish a legal basis for effective water use. Such legislation should ensure effective use of water resources by demand management measures. Demand management can be described to yield some quantity of water from the water in service through some measures such as metering, pricing, using water saving devices, introducing water-wise water by laws, water restriction, controlling water leaks in distribution system and in homes and above all education [2]. Demand management may be the cheapest option to supply consumers with safe water since the water quantity yielded is already in service, thus saving us from all the cost of water supply including abstraction, transfer and treatment. Moreover, there is another cost figure saved by demand management, which is the treatment and disposal cost of saved water which would be used otherwise; therefore, requiring treatment prior to its disposal. All the measures taken for managing water demand are not costless activities. There are costs to introduce, publicize and apply the measures [3]. However, demand management is not a selection that we should choose on economic basis. It is essential to conserve water resources by abstracting less water for the same service, to protect environment by disposing of less used water to the nature and by leaving more water in its source thereby saving the surrounding ecosystems.

Despite the world-wide high-level popularity of demand management [4,5] it is unfortunately discovered that the importance of water conservation has not been recognized in normal people level. People should be given a wider perspective to encourage them to act wisely when using water wherever they live (in a developed or developing country). They should see the overall end product of their single and simple practices toward efficient use of water. Therefore, this paper aims to give an idea to the authorities for how much water can be saved through applying several water saving measures in homes while attempting to show consumers what they can do and what the outcome of what they would have done would be. The study also aims to discover the feasible water saving measures in a city selected from a developing country.

Domestic Water Saving Measures: There are several places where we use water in our homes, including toilets, bathrooms and kitchens and out buildings. When dealing with water saving based on domestic water use practices, we need to know or at least predict the quantity or percentage of the quantity used for a particular practice in total domestic use. In this study, the predictions are made

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Table 1: Domestic water use percentages

Location	Purpose of use	Percentage in total domestic use
Lavatory	Hand/face cleansing Shaving Tooth brushing	5
Bathroom	Showering Hair washing General cleaning	25
Kitchen	Food preparation Dish washing Drinking	25
Toilet	Reservoir flushing Toilet tap use	35
Washing machine	Clothe cleaning	4
Dishwasher	Dish washing	3
Outbuilding	Garden watering Car washing Outbuilding cleaning	3

Table 2: Water saving potentials of the conservation measures considered

Water saving measures	Estimated water saving potential (%)
Immediate repairing of domestic leaks	50
Reducing main valve	35
Using tap-end devices	50
Using water-saving type taps	50
Closing taps when not using	60
Reducing bathing time	40
Mopping bathroom floor	75
Reducing reservoir volume to 6 liters.	30
Using low-flush or two-way reservoirs	78
Using toilet tap wisely	50
Rinsing dishes in a pot	60
Opening tap sufficiently while hand washing dishes	60
Changing washing or dishwashing machine to a water-wise type	40
Garden watering during night	15
Using a pot when washing cars	75
Cleansing carpets by a machine	75

based on authors' own observations in Turkey and the percentage water uses in a typical Turkish home are given in Table 1. When making these predictions, the average family size is accepted 4 persons and the attitude towards water use are regarded average (not conservative and not extravagant). It is clear that the figures given in Table 1 are subjective value judgments of the authors and as such they are totally arguable.

There are several domestic water saving measures that can be applied. Among them, several measures, which are thought to be acceptable to ordinary Turkish people, are chosen. The measures are categorized as to where the water uses in homes take place compatible with Table 1. The saving potentials in relation to the measures proposed are given in Table 2.

Potentially Applicable Domestic Water Saving Measures for Manisa: Questionnaire Development: The measures described previously were asked people living in a municipal area in Turkey. The city selected, Manisa, is a mid scale area located in western part of Turkey. A questionnaire has been prepared in an attempt to investigate what the potential measures by which water can be saved could be. Also aimed by this investigation is to reach a potential saving figure that can be achievable by applying/promoting the measures proposed.

When preparing the questionnaire, several potential measures which are given in Table 2 were asked to the respondents. The respondents are informed about how much water she/he can save. What is asked is whether/how much the respondents are willing to apply the measures proposed. The degree of their willingness was used to estimate the saving potential for the particular measure and subsequently for whole domestic use. These calculations are based on the responses obtained from the respondents as to when they are/will be ready to apply the measures or under what conditions they can/will apply them.

The questionnaire was directed to approximately 200 persons from different educational background, economic level and family size in an attempt to represent the community living in the city. The respondents were asked to give idea for their household consumption. Therefore, the age distribution of the respondents, although it was not measured, is above 25. The study was conducted in urban population, some of which earn their living by agricultural activities as mentioned previously. The number of respondents, 200, is quite small in comparison with the total population. However, the study was conducted for an academic purpose with several limitations and aims to show there is considerable water saving potential. Nevertheless, the respondents were

Table 3: Water saving potential

Water use area	Saving measure	Applicable Saving potential (%)	Average potential for the use area (%) a	Percentage in domestic use b	Saving potential for the use area (%) Axb
Lavatory	Using tap-end devices	27	41	5	2.1
	Closing taps when not using	54			
Bathroom	Using tap-end devices	25	31	25	7.8
	Reducing bathing time	30			
	Mopping bathroom floor	39			
Toilet	Reducing reservoir volume to 6 liters.	23	23	35	8.1
	Mopping toilet floor	22			
Kitchen	Using tap-end device	28	29	25	7.3
	Rinsing dishes in a pot	27			
	Opening tap sufficiently while hand washing dishes	32			
Washing machine	Changing washing machine to a water-wise type	17	17	4	0.7
Dishwasher	Changing dishwashing machine to a water-wise type	12	12	3	0.4
Outbuilding	Garden watering during night	11	36	3	1.1
	Mopping out floor	38			
	Using a pot when washing cars	50			
	Cleansing carpets by machine	43			
Total					28

chosen based on different criteria mentioned previously; therefore, they are regarded t enough to represent the whole community.

Evaluation of Questionnaire Responses: As already mentioned, this survey-based study is conducted in an attempt to reach a potential water saving figure for the whole city. The questionnaire includes two main groups of questions: one for portraying the profile of city citizens with respect to their education, economic level, family size and water saving concept, the other group of questions for determining water saving potential based on where water is used. The latter includes several proposed saving measures some of which could be replicable. In these cases the responses should be considered reciprocally. This could be achieved through making combinations among the measures proposed. In this way, it is obvious to obtain more than one overall saving figures for the city. For example, there are two measures for top uses such as tap-end device attachment and tap replacement as seen from Table 2. These two measures should not be expected to be applied simultaneously.

The questionnaire responses to the questions prepared for measuring people's attitude and perceptions toward their future water use, as expected, are varying and very much dependent on their income, position, education etc. These responses are considered to estimate an urban water saving potential as follows: a what it might be called "applicable saving potential" for each measure is calculated by multiplying the saving potential of each measure given in Table 2 by the rate of positive responses for that measure. There are choices in several questions such as "Yes" or "Partly", both of which can/should be regarded positive. However, the effects of these should be different. This differentiation is achieved by accepting "Yes" as full and "Partly" as half. To achieve one saving figure for each end use (lavatory, bathroom, toilets and kitchen etc.) the applicable saving rates of measures that can be applied to that end use are averaged. The saving potential for each end use are calculated and presented in Table 3.

As seen from these tables, when making choices regarding the measures that could be applied for a particular use, consideration was also given to the fact that all the measures for a particular use would not be applied. Then these average saving figures are multiplied by the percentage domestic use value for the end-use considered to achieve a saving potential for that use. The sum of all saving potentials for all end uses (e.g. total domestic saving potential) is then obtained by adding these measures. This means around 2.7 million m^3 saving out of 9.6 million m^3 average yearly consumption of the city.

CONCLUSIONS

An experimental study is conducted to investigate people's attitude toward water saving in an urban area. The aim of the study is to obtain a potential saving figure for a metropolitan area and around 30% saving is shown to be feasible. Such conclusions are quite stimulating. Water managers should take this seriously and direct their management policies towards this direction rather than

diving another well or considering long distance water transfers, which are not only costly solutions but also unsustainable. It can be said that behaving wisely towards water is one of the characteristics that a civilized person should posses. Human beings will definitely find out that it is not an exaggeration although it is not written in the books. Human interaction with water has always been important since the beginning. However, sustainability of conventional water resources management is impossible [1] and future seems to be formed as to how effective people will use water.

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