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Water Consumption on Spanish Households

A. Castillo, A. Gutiérrez, J. M. Gutiérrez, J. M. Gómez, and E. García-López

***Abstract*—**Water has always been a very precious resource. However, many of us do not fully understand or appreciate water's value until there will be a shortage. We intended to analyze the water consumption into the Spanish households to understand their behavior according to the habitants of the house. In this research was carried out a survey of users, asking for water consumption of their households. The aim of this paper is get a reference value of consumers in Spanish households to help to check their bill and realize if their consumption is excessive, including some tips to decrease it.

***Keywords*—**Households, survey, water consumption.

I. Introduction

THE climate change depends on the growth of population and the industrialization that are suffering cities in the last years which are prompting the need to make a high efforts to have a responsibility use of the resources to try not to lower the standard of living of the citizens.

As farmers, industry and people take too much water there is nothing left for nature: Increases in water use have resulted in high environmental costs, including loss of biodiversity as well as affecting natural water systems such as rivers and aquifers. Half of the world's wetlands have disappeared over the last century, with some rivers that now don't reach to the sea, and over 20% of the estimated 10,000 freshwater fish species are now endangered or extinct [1].

In 60% of European cities with more than 100,000 people, groundwater is being used at a faster rate than it can be replenished. Even if some water remains available, it costs more and more to capture it [2].

A.Castillo is with the Computer Science Department, University of Alcalá, Spain. (e-mail: ana.castillo@uah.es).

A. Gutierrez is with the Computer Science Department, University of Alcalá, Spain. (e-mail: alberto.gutierreze@uah.es).

J.M. Gutiérrez is with the Computer Science Department, University of Alcalá, Spain. (e-mail: josem.gutierrez@uah.es).

J.M. Gómez is with the Computer Science Department, University of Alcalá, Spain. (e-mail: jose.gomez@uah.es).

E. García-López Gutierrez is with the Computer Science Department, University of Alcalá, Spain. (e-mail: eva.garcial@uah.es).

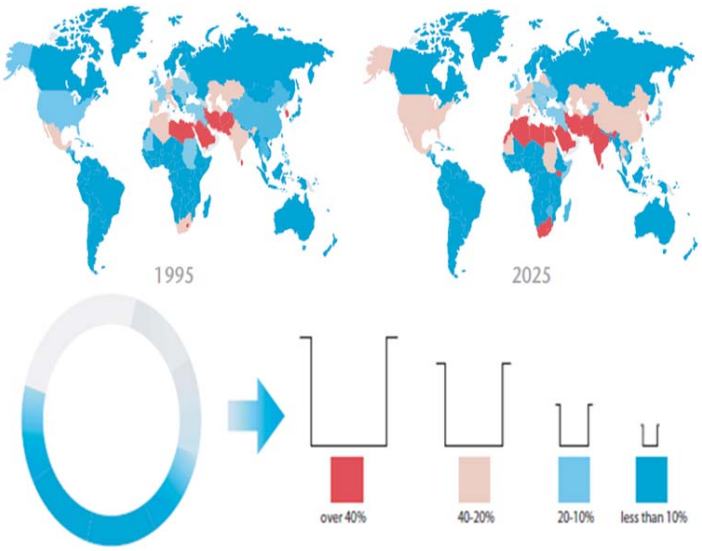

Fig. 1 Fresh water stress [3]

For that reason, from the public administration are running some methods to awareness citizens to make a responsible usage of the water consumption. Thanks to that kind of initiatives was possible reduce the water consumption per inhabitant in the most of places. The problem appears when users don't know if they are using the water correctly. For that reason the aim of this paper is to analyze the user behavior in the water consumption in their households.

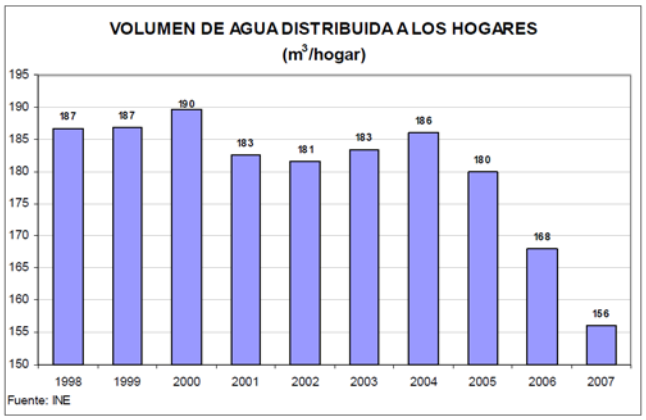

Fig. 2 Evolution of the water consumption in Spain [4]

II. How to Save Water

The advances on technology and the worry of the public administrations about the waste of water are changing the mind of the citizens on the uses of water. For that reason, is

not unusual find a lot of ways to save water consumption in normal households.

The main tips for saving water at home are:

- **Healthy teeth, healthy rivers**: Turn off the tap while brushing your teeth - a running tap wastes over 6 litres per minute.
- **Showers save water**: A bath typically uses around 80 litres, while a short shower can use as little as a third of that amount. But beware since many power-showers may actually use more than a bath. Try taking shorter showers to reduce the amount of water you use. When you do have a bath, you can minimise your water use by reusing your bathwater to water your houseplants or garden.
- **Fill up those dishwashers & washing machines**: Before starting your washing machine or dishwasher, wait for a full load - you'll be able to save money on energy and water.
- **Frigid water**: Fill a jug with tap water and leave it to cool in your fridge. This way you don't have to run the tap for ages just to get a cold drink.
- **Sparkling asparagus**: By washing your fruit and veg in a bowl rather than under a running tap, you could cut down on water waste effortlessly.
- **Rubbish for rubbish bins**: Try to avoid flushing away cotton balls, make-up tissues, and those pesky spiders – throwing them in the bin will cut down on the amount of water that is wasted by every flush.

III. The Water and the Household

In cities, water has a lot of usages like watering gardens, filling the fonts or supply to buildings. If we take a look the amount of water used to these purposes. Undoubtedly the use with most consumption is to supply water to buildings, in particular the households. As shown in the image below, in the case of the City of Madrid the water consumption in houses exceeds 69%.

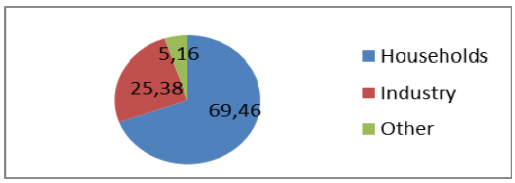

Fig. 1 Factured Water Madrid 2004 [5]

To start our study about the behavior that water consumption follows in Spanish households is necessary to know the most influent elements that affect into the consumption. For that reason we only will have into consideration the most common elements in Spain and how they usually effects on the final water consumption of our households. Is shown below a graph to see with what percentage of the consumption corresponds each element taken into account.

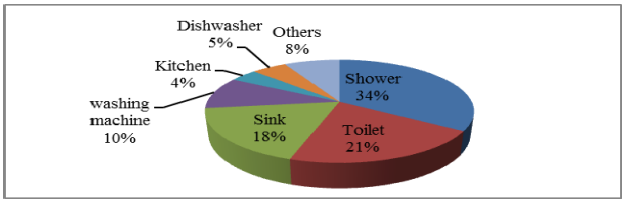

Fig. 2 Water consumption in a gardenless house [6]

The main problem to calculate the water consumption is that every one of the above elements is strongly influenced by the use that make the user of it. For that reason we have preferred to make an analysis of how affect the number of inhabitants into the water consumption.

We want to make a question for the readers: why the water for the loo or the washing machine has been treated to drinking water quality guidelines.

There are now devices to separate blackwater (which is typically sewage) from greywater (which is typically water from dishwashers and showers). As the greywater can undergo minimal treatment and then be used for watering lawns and other purposes that do not require treated drinking water then we could decrease our water consumption.

A. Water Consumption per Habitant

The next step is to find a real data about the consumption in different Spanish households. To do that we chose to make a survey to collect the number of persons in the house and the water consumption in the different months.

With the data obtained we can calculate the average of the consumption for houses with the same number of inhabitants.

The next table shows some examples of the survey.

TABLE I
Examples of the Survey

Nº Persons	Surface	Anual m3 Consumption
2	90	84
1	60	48,3
2	55	72
5	92	192

Analyzing the above table we see that the water consumption does not depend on the housing surface but rather the number of people.

IV. Other Studies

The study carried out by INE [7], establishes the average consumption of water per capita per day in Spanish household. This study establishes that the national average consumption in Spain is 144 liters per capita per day. However, the work allows a more detailed analysis dividing the consumption regions.

TABLE II
AVERAGE CONSUMPTION OF WATER PER CAPITA PER DAY IN SPANISH HOUSES [7]

Litres / inhabitant / day	
Andalucía	143
Aragón	144
Asturias, Principado de	159
Balears, Illes	121
Canarias	149
Cantabria	173
Castilla y León	167
Castilla-La Mancha	152
Cataluña	133
Comunitat Valenciana	157
Extremadura	160
Galicia	132
Madrid, Comunidad de	140
Murcia, Región de	158
Navarra, Comunidad Foral de	128
País Vasco	122
Rioja, La	122
TOTAL	**144**

University of Alicante has done an important work studding the water consumption [8] by surveying major tourist cities of Valencia.

According to the study, drinking water consumption billed by consumption units is as follows:

• Homes: 663 liters / house / day.

The drawback to use these data is that the information does not take into account the number of people occupying the house, but make a comparison with results similar to those presented by the INE, which indicate that an average household consisting of three or four on permanent settlement was reached modules ranging from 140 to 180/l/user/day.

V. OUTCOME OF THE SURVEY

Let's compare the survey data from the Community of Madrid with the values provided by the INE survey.

TABLE III
COMPARISON BETWEEN SURVEYS

Estimated by INE	l/user/day
140	115,07
140	169,35
140	170,83
140	132,33
140	188,89
140	98,63
140	105,21
140	87,67
140	**133.49**

Looking at the above table taking into account each of the survey data we see that error occurred may vary between 5% and 34.9%. But if we analyze the join behavior of all the error produced when compared to the results of INE drops to 4.64%, thus giving validity to the values of the INE as a benchmark for the model.

VI. HOW MUCH WATER IS DO I REALLY NEED?

Countries like Canada [9] or Spain are using ten to twenty times more water than is necessary to meet basic human needs. In developing countries, 20 to 30 litres of water per person per day are considered adequate for basic human needs. We generally use that amount of water in one or two flushes of the toilet!

VII. WATER CONSUMPTION BY HOUSEHOLDS IN EUROPE

Although we are not the country with lower water consumption, Spain is well positioned, we exceeded Belgium, Denmark and Germany, although we think we have to take another step to reduce consumption and increase efficiency.

The following image shows the position of the countries in terms of water consumption in households.

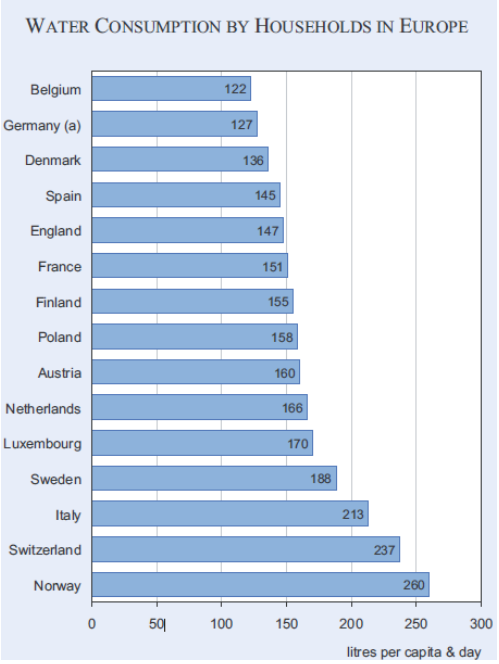

Fig. 5 Water consumption by household in Europe [10]

VIII. CONCLUSIONS

The average water consumption in Spain is 144 litres per person per day, which is consistent with our survey, but we believe that this value is still too high.

It is necessary to take action before it's too late to fix it as:

- Raising awareness of politicians, executives and the broader public about the importance and value of water in the economy and society.
- Motivating technically and economically efficient use in water supply.
- Encouraging the responsible use of water to support long-term availability and quality.
- Advising government departments, entities and municipalities on in-house water use and efficiency.

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