

Water Overconsumption: Devices for Efficient Water Management in Tourist Cities

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Abstract— This project presents the actions and activities that generate lack of water in tourist cities in tourist seasons, showing which ones generate more consumption and the problems that they cause. In addition to analyzing the causes, the consequences of the lack of water in these cities are presented. After this analysis, different devices are presented with their advantages and disadvantages and the way they work. These devices are proposed for accommodation facilities to reduce direct water consumption, which is what can be addressed directly, and thus reduce excess water consumption and related issues. It is expected that this project may generate awareness in people about the importance of taking care of water and generate collective efforts that bring us closer to Sustainable Development Goals (SDGs).

Keywords: overconsumption, tourist accommodation, water saving devices, usage of water.

Resumen— Este proyecto presenta las acciones y actividades que generan falta de agua en lugares turísticos en temporada alta, mostrando cuales son las que generan más consumo y los problemas que ocasionan. Además de analizar las causas también se presentan las consecuencias que tiene la falta de agua en estos lugares. Luego del análisis realizado se presentan diferentes dispositivos, de los cuales se discuten sus ventajas y desventajas y la manera en la que funcionan. Dichos dispositivos se proponen para ser implementados en las instalaciones de los alojamientos y reducir el consumo de agua directo, que es sobre el que podemos tomar acción, y así poder reducir el exceso de consumo de agua y por lo tanto los problemas relacionados. Se espera que el proyecto genere conciencia en las personas acerca de la importancia de cuidar el agua y generar esfuerzos colectivos que nos acerquen a los Objetivos de Desarrollo Sostenible (ODS).

Palabras clave: consumo excesivo, alojamiento turístico, dispositivos de ahorro de agua, uso de agua.

I. INTRODUCTION

Water is an important resource in tourism and services to tourists are heavily dependent on it. Nowadays, tourism absorbs a high percentage of the global consumption of water. As well as this, tourism represents a key economic factor in many cities in the world because large numbers of people go on vacation and water consumption is increasing. As a result, there is overconsumption that results in lack of water.

This problem is connected with Sustainable Development Goal (SDG) #6, which is related to the management and

availability of water [1]. The purpose of this SDG is to ensure the availability of water and for people to have access to it together with the corresponding sanitation services.

As far as the targets connected with this SDG are concerned, 6.b is about the participation of local communities in improving water and sanitation management [1, p1]. If the local communities cooperate with the implementation of some measures, water could be conserved.

In Argentina, water is not a valued resource. There is not awareness about its usage, generating lack of water in many areas. This problem increases in tourist seasons because there are many people using a high quantity of water at the same time without any care. Water consumption generated by the tourist industry needs to be urgently addressed by making it part of the political agenda and discussing different measures to approach it.

The purpose of this paper is to delve into the consequences that the inadequate use of this resource has in tourist seasons and present several devices to decrease overconsumption. To achieve this aim, firstly, the problem of water overconsumption during tourist seasons is discussed in terms of its causes and consequences. Next, the devices chosen to address the problem are going to be presented with their positive and negative aspects. Finally, the effectiveness of the application of the proposed devices will be evaluated. It is expected that this work may awaken interest and develop positive consumption habits in the readers to start caring for such an important resource as water is. Although the idea is that the places offered for tourist accommodation, like hotels, implement devices to reduce the water consumption produced, people at large can use these in their homes to contribute to water conservation.

II. PROBLEM DESCRIPTION

Tourism is dependent on freshwater resources. This represents a problem because water consumption rates span in a range between 84 and 2000 liters per tourist per day [2, p7]. Tourists need and consume water when washing or using the toilet, as well as when using spas, wellness areas or swimming pools. Fresh water is also needed to maintain gardens and landscaping of hotels. Also, the overconsumption of water is connected with tourism infrastructure development, food and fuel production that is used in some things that host consume, such as transportation [2, p7].

In relation to the consumption of water in hotels, the major proportion of water is spent for uses like taking showers, flushing the toilet, and the use of tap water around 55-136 liters per tourist per day. Also swimming pools represent another important factor of water use, accounting for about 15 per cent of the water demand of hotels, approximately 140 liters per tourist per day [2, p7].

If the hotel has laundry service it consumes about 15 per cent, approximately 60 liters per tourist per day and cleaning adds 5 per cent to this amount [2, p7]. This means that the higher the quantity and quality of the services provided, the higher the consumption will be.

Restaurants use considerable amount of water in food consumption because it is estimated that daily water requirements to support human diets range from 2000 to 5000 liters. To this is added the washing of the dishes and kitchen utensils.

Depending on the hotel standard, distance to the destination, as well as the amount of food consumed, these data can increase. An estimated use of resources by tourists is shown in [2, Tab.1]

TABLE I
WATER USE CATEGORIES

Water use category -- direct	L per tourist per day
Accommodation	84-2000
Activities	10-30
Water use category - indirect	L per tourist per day
Infrastructure	n.a.
Fossil fuels	750 (per 1000 km by air/car)
Biofuels	2500 (per 1 L)
Food	2000-5000

Table 1 reveals that overall water use embodied in a holiday will vary considerably, depending on hotel standards, distance to the destination, as well as the type and amount of food consumed [2, p8]. The data presented above provide an estimate of the different uses of water in the tourist area. Certainly, the greater the quantity and quality of the services provided, the higher the consumption.

Another aspect to discuss is related to the technologies used in hotels. Nowadays, activities such as washing dishes or doing the laundry are done with machines that consume large amounts of water because these are used constantly. Laundry accounts for 5 per cent (47 L per tourist per day) [2, p7] of the water used in hotels due to the fact that guests ask for the change of towels and bed sheet frequently and eat several times a day.

In comparison to water use in other economic sectors, tourism is usually less relevant than others such as agriculture. However, in some countries and specific areas depending on the attractions, it can be the main factor in water consumption. As well as this, tourism contributes to a decline in downstream or destination water and potable water supplies quality.

The concentration of tourism in certain regions can place enormous pressure on domestic and industrial water supplies as well as wastewater infrastructure, often in times when they are least able to face this situation. While direct water use is more relevant for water management in the destination, indirect water use is responsible for a greater contribution to the overall amount of water used [2, p.13]. It is important to analyse these two ways of consuming water.

In general terms, indirect water consumption is composed of energy (transport to/from destination), energy use at the hotel, and water embedded in food. Direct use of water refers to the consumption in tourist accommodation made by each tourist [3, p.1]. These concepts are further described below.

A. Indirect use of water

A.1 Fossil fuels for transport

Energy and water use are interlinked, as water is needed for energy production. As well as this, energy is also used for water production (pumping, transport, treatments). In particular, fuel production is water-intensive. It takes 18 L of water to produce 1 L of gasoline [2, p.8]. Although these days there are many hybrid and electric vehicles, fossil fuels continue to dominate in this area.

A.2 Energy use at hotels

Tourist facilities use high amounts of energy for lighting and the operation of all the systems and equipment they have. Energy used in accommodation can be produced by the hotel itself through technologies such as solar panels or can be purchased.

A.3 Food

Considerable amounts of water are also embodied in food consumption. Depending on the local climate, agricultural practices and crop species, it takes a high amount of water to produce food. It is estimated that daily water requirements to support human diets range from 2000 to 5000 liters of water per person per day [2, p.8]. The importance in the context of tourism is the fact that tourists may consume a greater share of foods with greater water footprints when they are on vacation.

B. Direct use of water

B.1 Accommodation

The use of energy per guest per night is high and costly in relation to accommodation although this depends on the infrastructure of the hotel. Studies have demonstrated that there is a tendency for higher-standard accommodation to consume significantly higher water volumes, finding highest water use rates in hotels with spas and large multiple swimming pools [2, p.7].

B.2 Recreational Activities

Various tourist activities add to water use, such as golf and skiing where snowmaking is utilized. The consumption of water in the courses varies considerably depending on soils, climate and the course size [2, p.7].

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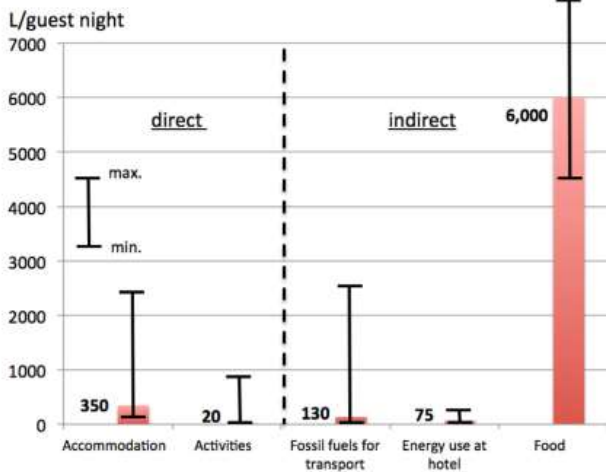


Fig. 1 Globally averaged water footprint, L per guest night. [1]

The consequences of the tourism sector concern the residents of destinations in terms of the quality of service and water quality they receive and also the surrounding cities in environmental terms.

Some of them are:

- Decline in downstream or destination water quality and potable water supplies as a result of poor or no treatment of wastewater, which contains nutrients, chlorinated swimming pool water and chemicals and enters to the water system. [2, p10, p13].
- Tourists may often arrive during the dry season, when rainfall drops to a minimum and water availability is restricted [2, p9].
- Tourisms consume of water reduce pressure on available freshwater resources in other areas of the destination. This may lead to conflicts between residents and visitors [2, p10].

III. PROBLEM APPROACH: PROPOSAL FOR DEVICES FOR WATER CONSERVATION

Most of the water footprint is associated with indirect water consumption as stated above. However, this use involves factors that are not possible to address by means of a device. Therefore, this paper will focus the attention on devices to reduce direct consumption in tourist accommodation.

These devices will reduce water consumption by almost 50% in hotel rooms and accommodation facilities. They are accessories that control the flow of water in toilets, showers and faucets.

Some devices that hotels can implement in their facilities to reduce direct water use of their guests are detailed below.

A. Waterpebble [4]

Waterpebble is an ecological device that offers the possibility of controlling the time and amount of water used in the shower, allowing energy and H₂O savings. Its creation

comes from the fact that showering is described by experts as the home activity in which the most water is wasted.

The device calculates the average amount of water used by the person bathing by placing it on the shower floor or at the bottom of the sink as shown in [Fig 2]. The information is saved in the device's memory and, in the following showers, it informs the user, when it is time to turn off the faucet through a light system similar to a traffic lights. Subsequently, and once the statistics are saved in its memory, Waterpebble reduces the time limit by two thirds. In addition, the device was designed for subsequent recycling, so when it reaches its useful life cycle it can be returned to its developer.

In terms of its operation, if a red light flashes it means that the user has exceeded the consumption and must reduce consumption. On the other hand, if the light remains green, it means that the user remains within the correct measurements compared to the first measurement. If the light flashes a yellow color, it means that the user is about to cross the threshold and exceed the amount of water to be used.



Fig. 2 Waterplebbe

This device can be used in every hotel room to alert each guest about the amount of water that they are using. It is recommended to include a brief description of the use of the device to ensure an efficient application. In this way, especially in rooms that have more than one guest, water consumption in showers is greatly reduced.

B. Water butt [5]

The Water butt is an inexpensive method of rainwater harvesting where rain from the rooftop is redirected through the downpipes and collected in a storage container. It consists of a tank with a tap as shown in [5, Fig 3]. The Water Butt is a great water source to water the garden, clean the sidewalks and wash the car in the case of residential use. This allows rainwater to be recycled and not waste so much running water on these activities.

The Water Butt is also an effective way to save on the user's bills; it reduces water waste and carbon footprint. Capacities can go up to 350 liters. The choice of material, size and location of Water Butt will depend on the characteristics of the place where it will be placed. Apart from this, collecting rainwater can help reduce the risk of flooding.

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Fig. 3 Water butt

Hotels can place Water Butts in their gardens, principally those that have extensive gardens. As it is known, watering and maintenance landscaping is water intense. This device allows rainwater to be used for this purpose. The only requirement is rain.

C. Samsung Ecobubble [6]

Samsung Ecobubble, shown in [6, Fig 4], is a washing clothes machine that is capable of removing dirt from clothes by means of a bubble generator system. The bubble generator dissolves the detergent in the water and then injects air creating a layer of foam inside the machine. These bubbles are distributed evenly, penetrating the fabrics and removing dirt 40 times faster than conventionally dissolved soap, without needing the use of hot water.

Also, Samsung has AI Wash technology that uses intelligent sensors that automatically detect the weight of the clothes entered for washing and their level of dirt to be able to optimally calculate the ideal amount of water and detergent that each washing process needs, thus avoiding any type of excess or waste. As a result, lower energy consumption and the cost of the electricity bill are favored.



Fig. 4 Samsung Ecobubble

This device can be installed in hotel laundry rooms. For maximum efficiency, it is recommended to accumulate

garments in order to use the machine to its maximum capacity, avoiding unnecessary washing.

D. Water Aerator [7]

The Water Aerator, shown in [7, Fig. 5] is a small attachment that fits on the end of the tap. This water saving device will control the amount of water that flows through the tap without affecting the water pressure because it mixes the water with air. The aerator acts as a sieve, separating a single flow of water into many tiny streams which introduce the air into the water flow. Also, as there is less space for the water to flow through, the water flow is reduced, resulting in water savings. Estimates are that aerators can save users up to 1,274 litres of water a month.



Fig. 5 Water Aerator

This device can be used in every faucet in hotels due to the fact that it is adaptable. It can be used to reduce consumption both in rooms and in the hotel kitchen.

IV. POSITIVE AND NEGATIVE ASPECTS OF THE DEVICES

To face the problem connected with water overconsumption in tourist destinations, it is necessary to talk about positive and negative aspects of the devices proposed. To do this, the section will discuss the economic aspect of them and their use.

As far as positive aspects are concerned, the use of the devices will contribute to reduce the energy used in water treatment for population consumption. As well as this, they will ensure the potable water availability in all areas of tourist destinations due to the increase in the water pressure. The main advantage is the fact that the devices proposed can be implemented in every house or building such as an apartment all around de world.

In relation to the devices themselves, a negative aspect is the fact that they may be expensive. Therefore, not every person has the possibility of acquiring them since a low-income person will not be able to buy them. Apart from this, their goal may not be met because their usage and control depend on the user. This means that it is not possible to ensure that the user commits to saving water.

V. CONCLUSION

There is a vast number of papers that discuss the problem connected with water shortage, droughts and overconsumption. However, few of them talk about how touristic activities cause these problems in destinations. In current times, tourism is a key economic factor in many countries around the world, but it also affects the

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environment if developed with no care. Thus, approaching this topic is important to contribute to meet the Sustainable Development Goals which involve water management.

This paper has developed statistics about water use in every touristic activity carried out, the consequences it brings about and a proposal of devices which aim to save potable water. From all the information available in this work, the aim is to encourage people to be concerned about water use and raise awareness so that, collectively, the availability of this resource is not compromised.

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