Science of the Total Environment 541 (2016) 815–824

Contents lists available at ScienceDirect

Science of the Total Environment

journal homepage: www.elsevier.com/locate/scitotenv

Performance evaluation of conventional and water saving taps

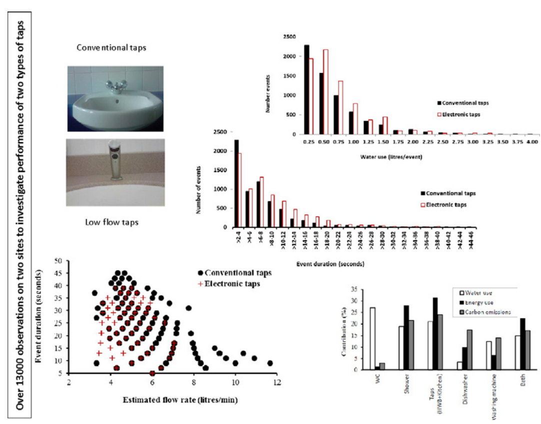
A.M. Fidar, F.A. Memon *, D. Butler

Centre for Water Systems, College of Engineering, Mathematics and Physical Sciences, University of Exeter, EX4 4QF, United Kingdom

HIGHLIGHTS

- An analysis of 13000 high resolution observations on water tap use at two sites
- Water consumption via water saving taps is slightly higher than the conventional taps
- Strong link b/w the duration of flow and the volume discharged from taps
- Flow rate has very limited/no impact on the actual water consumption
- Almost 80% of tap use appears to be for the delivery of hot water

GRAPHICAL ABSTRACT



ARTICLE INFO

Article history:
Received 1 June 2015
Received in revised form 4 August 2015
Accepted 5 August 2015
Available online xxxx

Editor: D. Barcelo

Keywords:
Event duration
Low flow rates
Taps
Water efficiency
Energy consumption
Carbon emissions
Micro-components

ABSTRACT

The rapid pace of urbanisation comes with considerable environmental implications including pressures on already stressed limited water resources. In urban areas, most of the water use is associated with water consumption in buildings. The second largest use of water is via taps. It is often assumed that water taps with *low flow* rates can contribute to reduced per capita water consumption. However, this is based on very little evidence. This paper presents the synthesis of a 13,000 high resolution observations made to investigate the actual water consumption of innovative (water saving) electronic taps and conventional mixer taps. High resolution flow-meters and data loggers were fitted into two washrooms in two different buildings of a higher education institution to record the water use through the basin taps. The recorded data provided information on duration, frequency of use and volume of water consumption per use. The data was helpful in identifying trends in hot and cold water use and therefore can be useful in estimating energy for producing hot water and associated greenhouse gas emissions. Analysis of the observed data suggests that the low flow taps have greater mean water consumption per event than the conventional taps and water consumption is more influenced by user behaviour rather than the technology.

* Corresponding author.
E-mail addresses: afidar2@gmail.com (A.M. Fidar), f.a.memon@exeter.ac.uk (F.A. Memon), d.butler@exeter.ac.uk (D. Butler).

http://dx.doi.org/10.1016/j.scitotenv.2015.08.024
0048-9697/© 2015 Published by Elsevier B.V.

1. Introduction

Water is one of the world's most precious resources and is crucial for sustaining life. However, while water resource is arguably constant in quantity, pressures on the resource are set to increase (Defra, 2008) as its demand is rising. Rapid population increase, especially in urban areas, increasing household number, changes in life style and climate change are believed to be the main factors that are driving water demand (EA, 2009a).

Water demand management is viewed increasingly by governments, agencies and water utilities, not only as a potential means of aiding the security of the future water supplies, but also as a tool to reduce the resulting environmental implications (Beal and Stewart, 2014). Reducing water consumption saves energy either directly on site at household level or offsite at water abstraction, treatment and distribution points. For example, using less water at household level reduces the amount of energy needed to abstract the water, process at a treatment plant, pump it from a storage tank and heat it at home. It also saves the energy required to treat it at a wastewater treatment plant and pump it for disposal.

In the UK, for example the concept of the water demand management or water efficiency is progressively gaining recognition and has led to a number of initiatives established by the government to promote efficient and sustainable water use. For example, in England and Wales, the twin track approach, which seeks a balance of resource development and demand management, is considered as necessary to maintain supplies in the future and to help improve resilience against climate change (EA, 2009a). With such approach, options that reduce demand rather than increase resources are considered first, as they provide benefits for adapting to and limiting the extent of climate change and the principles of sustainable development. Similarly, the government's Future Water (Defra, 2008) aims reducing per capita consumption of water to an average of 130 l per person per day by 2030, or possibly even 120 l per person per day depending on new technological developments and innovation.

A microcomponent-based approach is a favoured water demand management strategy, widely proposed and sometimes implemented. For example, as part of Preston Water Efficiency Initiative, new dual flush toilets and low flow showers were installed into a number of dwellings, while water efficient urinals and push taps were fitted into a school and leisure centre (Boarder, et al., 2009). It was reported that the installation of dual flush toilet and low flow showers had resulted in 25% water saving. UK water service providers are required to use microcomponent data in demand forecasts and planning (EA, 2009b; Ball et al., 2003). Similarly, the importance of water efficient technologies in reducing domestic water consumption is expected to be reflected in the revised Building Regulations, via the inclusion of New National Technical Standards (SES, 2015). Water efficiency levels will also be part of independent certification schemes such as Home Quality Mark (HQM) (BRE, 2015). Additionally, in an effort to encourage businesses to invest in water saving and water quality improvement technologies, the UK government introduced in 2001 an Enhanced Capital Allowance scheme (HMR&C, 2014). The Scheme enables businesses to claim 100% first year capital allowances on investments in technologies and products that improve sustainable water use.

Fig. 1. (a) Electronic tap, (b) conventional mixer tap, and (c) thermostatic mixer valve.