LOW FLOW WATER FITTINGS

Will people accept them?

Josephine Prior, John Griggs, Mindy Hadi and Steven Brown

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Registered Office: Bucknalls Lane, Garston, Watford, Herts WD25 9XX

BRE Trust
Garston, Watford WD25 9XX
Tel: 01923 664743
Email: secretary@bretrust.co.uk
www.bretrust.org.uk

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PREFACE

Growth in water demand is becoming unsustainable. Average household demand has risen by about 55% in the past 25 years and continues to rise at 1% per year. Taps account for about 34% of the water supplied in England and Wales.

This project concentrated on low flow taps because so little is known about how taps are used, and what matters in tap performance. The chief objection to low flow fittings is the extra time required to carry out most ordinary tasks. This is evident from:

- an experiment with the BRE low flow water fittings test rig at Insite09
- a focus group study
- a literature review.

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JP, JG, MH and SB
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1 INTRODUCTION AND BACKGROUND

This report describes work carried out with funding from the BRE Trust to examine whether or not people will accept the introduction of low flow water fittings to domestic buildings. It is aimed at:

- policymakers responsible for making decisions on regulations relating to water flow rates in domestic buildings
- practitioners and students of the construction industry, including architects, surveyors, quantity surveyors, planners and engineers
- manufacturers, installers and retailers of water fittings and appliances
- building developers
- owners of portfolios of domestic buildings, such as local authorities and other registered social landlords.

The report includes:

- an examination of European and UK policy
- a literature review of public attitudes and behaviour regarding water use
- an experiment using a specially designed test rig to test public opinion about low flow water fittings
- the results of a focus group
- the results of a survey of manufacturers and installers
- identification of organisations and schemes promoting water conservation in the UK
- conclusions and recommendations.

1.1 WATER RESOURCES AND USE

It is clear from the European and national policy context that water conservation and quality have been of increasing concern throughout Europe for the last 30 years. The literature review (Section 3) shows that many thousands of pounds have been invested in research into water use. The lion's share of this funding has been put into trying to find out how much water people use, but without measuring it. There have been many opinion surveys on whether or not people think water efficiency is important, and on the kinds of choice they make when choosing water fittings. Many of the existing predictions of future water use are based on extrapolation and computer modelling of WRc Identi*flow*, which itself relies on a small database of real measurements. The original data from the Anglian Golden 100 (Clarke *et al*, 2009), which form the basis of many of the predictions, are not available for independent study.

Population growth and competing uses (domestic, agricultural and industrial) have put water resources under increasing strain (European Environment Agency, 2010). In the UK concern is growing that demand for wholesome water will soon exceed supply, particularly in south-east England. European and UK policy, legislation and regulation have evolved steadily over the last 35 years in response to increases in demand. Between 1976 and 2006 the numbers of areas and people affected by droughts rose by nearly 20%. The droughts of 2003 affected a third of EU land and 100 million people (European Commission, 2007). Since 1973 almost all UK environmental legislation has been driven by or developed closely with the European Community (EC) or international bodies (House of Lords, 2006). In 2010 the UK government introduced for the first time in Building Regulations a limit of 125 litres/person/day on the design water consumption for new domestic buildings (DCLG, 2010b).

Sixty per cent of the water supplied in England and Wales is used for domestic purposes, amounting to an estimated 9.2 billion litres/day (MTP, 2008a) across all buildings (see Table 1).

Of the total estimated domestic water consumption in all buildings, 27% is for WCs, 24% is for baths and showers, and 34% is for basin taps (21%) and kitchen taps (13%) together. Taps are used for so many activities, including drinking, cooking, bathing and cleaning, that it is difficult to define necessary water consumption. It is now widely recognised that that the total volume of water consumed by a tap is determined largely by the user (MTP, 2008c; Griggs and Burns, 2009; AECB, 2009; Cheng *et al*, 2011).

Although low flow taps and restrictors may help to reduce water consumption, low flow rates can be a nuisance for tasks requiring a large volume of water, such as filling a kettle, saucepan, bucket or bath. The time taken to fill a vessel will depend on the tap flow rate (Gaze *et al*, 2008). In a study to monitor the water use in dwellings built to Code for Sustainable Homes and EcoHomes standards (Cheng *et al*, 2011), researchers found that in some CSH homes, where low flow taps

Table 1: **Total estimated domestic water consumption (all buildings in England and Wales)**

Product type	Total domestic water consumption per day (megalitres)	Percentage of total domestic water consumption in all buildings	Percentage of total water supplied
WCs	2518	27	16
Urinals	74	<1	<1
Basin taps	1934	21	13
Baths/showers	2183	24	14
Kitchen taps	1236	13	8
Domestic washing machines	841	9	5
Domestic dishwashers	95	1	<1
Outdoor use	354	4	2
Total	**9235**	**100**	**60**

Column entries may not sum to their column totals, because of rounding errors.
Source: *Domestic water consumption in domestic and non-domestic properties.* BNWAT22 (MTP, 2008a)

were fitted at kitchen sinks and wash hand basins, the bath taps (unrestricted) were sometimes used for filling containers that would normally be filled at either a basin or a sink. Such behaviour could pose a health risk if the water supplying the bath has been artificially softened, or is not wholesome for any other reason.

The literature review revealed both a drive to develop low flow taps to meet Code for Sustainable Homes standards and a gap in knowledge concerning their acceptability to users. It turns out that very few measurements of real water use have been made, and even fewer of these include measurements of individual appliances (microcomponents) (see Section 4, Appendix B and Appendix C). The largest study involving microcomponent data is the Anglian Golden 100 (Clarke *et al*, 2009). The dataset was not available for this study.

The work in this study has concentrated on low flow taps because so little is known about how people use taps, how much water they use, or what is important in tap performance. The new work carried out for this report was a mixture of measurement and opinion gathering.

1.2 BACKGROUND TO THE RESEARCH

In 2008 BRE Global submitted a proposal to the BRE Trust for research funding to determine whether or not people would accept the introduction of low flow rate water fittings and appliances to domestic buildings. Evolving policy and regulation had reached the point where manufacturers and developers were beginning to invest significantly in very low flow water fittings. This was prompted by the introduction of the first version of the Code for Sustainable Homes in 2006 (DCLG, 2008b) with its mandatory minimum standards for predicted water consumption per dwelling, calculated using a prescribed method (DCLG, 2008a). In order to achieve the highest ratings under this version of the Code, developers felt compelled to install very low flow taps and showers. Measurements carried out in unoccupied homes built to these standards on the BRE Innovation Park indicated the likely impracticality of using very low flow taps for certain tasks (Gaze *et al*, 2008).

An independent review of the early CSH water calculator found that it was overestimating water consumption. The overestimation made it difficult for developers to achieve the CSH water targets and encouraged the use of fittings that turned out to be unacceptable to users.

A new water calculator was therefore introduced in later versions of the Code, which estimated water consumption in line with average UK estimated levels of 150 litres/person/day. The new water calculator increased the scope for developers to meet CSH targets, and reduced the pressure on designers to specify very low flow fittings (DCLG, 2009; replaces DCLG, 2008a). The new water calculator was introduced for both the Code for Sustainable Homes and the Building Regulations Part G covering sanitation, hot water safety and water efficiency (DCLG, 2010b). The uncertainty about users' responses to low flow fittings remained though, and the BRE Trust agreed it would be useful to carry out work to establish the current state of knowledge, and make some measurements to consolidate and extend this knowledge.

1.3 FINDING YOUR WAY THROUGH THE REPORT

The work is in two parts. Part 1 (Sections 2 to 4) establishes what is known already. Part 2 (Sections 5 to 9) describes the new work carried out by BRE, analyses the results, draws conclusions and makes recommendations.

Part 1 begins with a summary of European and UK policies, legislation and regulations on the supply and use of wholesome water. This is followed by a literature review of current knowledge, covering a broad range of domestic water use topics.

Section 2 sets out the European and UK national policy context (see Table 2). It includes a brief description of European legislation, UK legislation and the regulatory framework. A long-range (to 2030) water strategy has been developed by the Department for Environment, Food and Rural Affairs (Defra), following public consultation (Defra, 2008a). UK policymakers have paid particular attention to water used by WCs. This is described in some detail. Voluntary instruments such as BREEAM (www.breeam.org) and the Code for Sustainable Homes (DCLG, 2006, 2010a) also contribute to water efficiency. BREEAM and the Code provide ratings based on objective assessment of a wide range of environmental impacts (including water consumption) associated with buildings. BREEAM ratings are: Outstanding, Excellent, Very Good, Good and Pass. Code ratings are expressed as levels from 1 to 6, where 6 represents the best performance. Developers earn credits for building design and performance that reduce total water demand when compared with the levels set by legislation and regulation.

Section 3 reviews the literature on estimating domestic water consumption, professional and public opinions on water efficiency, the effectiveness of marketing, the ways in which water efficiency might be delivered at a large scale, the potential effects of low water use fittings on local drainage and the cost of compliance with the Code for Sustainable Homes. The detail of the review is given in Appendix B. The review is presented under 10 topics:

- Estimating domestic water consumption
- Professional attitudes to water economy and water-efficient appliances
- Public attitudes to water economy and water-efficient appliances
- Personal bathing habits
- The effectiveness of water efficiency marketing campaigns
- Creating water efficiency on a large scale
- Water-efficient behaviour
- Water use standards
- The cost of compliance with the Code for Sustainable Homes
- Low flow water fittings and drainage networks.

The section also includes a list of barriers to, and enablers of, water-efficient behaviour.

Section 4 lists the organisations with a remit to promote water conservation in the UK, and describes the role of the water supply companies in England and Wales.

Part 2 (Sections 5 to 10) covers the new work carried out for this project at BRE. The literature review revealed both a drive to develop low flow taps to meet Code for Sustainable Homes standards and a gap in knowledge concerning their acceptability to users. Three separate approaches to gathering new knowledge were taken, using a mixture of measurements and opinion gathering. An opportunity arose to conduct an experiment with members of the public at the BRE Insite09 exhibition held in June 2009. A low flow water fittings test rig was designed and built to test opinion on using low flow rates for simple everyday tasks. The following month a small focus group of local people was held on low flow taps, which included the low flow water fittings test rig. This was followed by a telephone survey of manufacturers and installers of water fittings and appliances.

Section 5 covers the design and operation of the BRE low flow water fittings test rig, and the statistically designed experiment to test the reactions of the public when carrying out common tasks at very low flow rates. Section 6 describes the focus group study and Section 7 the telephone survey of manufacturers and installers of water fittings and appliances. Sections 8, 9 and 10 respectively analyse results, draw conclusions and make recommendations based on both the findings of the new work carried out for this project by BRE, and the work reported in the literature review.

Three appendices are included:

A Glossary of terms
B Summary of the literature review
C Summary of studies by water companies between 1997 and 2009.

LOW FLOW WATER FITTINGS
Will people accept them?

Prompted by increasing concern in the UK that the demand for wholesome water will soon begin to exceed supply, particularly in South East England, BRE conducted a study of the likely public response to the introduction of low flow water fittings in domestic buildings. This included:

- an experiment using a specially designed test rig to measure public reactions to low flow water fittings
- a focus group
- a survey of manufacturers and installers
- a literature review of public attitudes and behaviour regarding water use.

The results of the study increase our understanding of the barriers to and enablers of water-efficient behaviour.

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