

# Beyond the minimum requirement: policy-led strategies for increasing water efficiency in buildings

CREATING VALUE WITH WATER USERS

EPSRC/Defra Policy Fellowship  
Executive Summary

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**March 2011**

## INTRODUCTION

Efficiency in the consumption and use of water in domestic buildings is vital for protecting water resources for the future. About half of the water put into supply by water companies are to meet domestic demand alone and the demand from this sector continuous to rise year on year.

Water efficiency is the optimised use of water commensurate to need it focuses on reducing waste during water processes. By understanding water customers and need, efficient use can be achieved through behaviour, technology and infrastructure efficiency.

This study started with exploring the interfaces between stakeholders, processes and products was needed and the constraints imposed by the nature of the industry. In essence, who does what, why and to what end. Also, it was necessary to explore relationships and dependencies i.e. the impact of policy decisions on the water industry or related industries, processes, people and products (output and throughput) and where the gaps are on issues of buildings and the built environment. In addition, existing evidence supporting regulatory measures and strategies were explored to identify what is actually known.

The research was stakeholder focussed and started with policy makers who are at the top of the spectrum. The final stages of the study focussed predominantly on water users - attitudes, behaviours and choice with the view to exploring how to increase value and promote positive change. This was achieved without dissociating from the original objective of explores innovative ways to effectively reduce the waste of water in buildings. Finally, through conceptual mapping of algorithmic rules implemented in an information system, a means of delivering demand transformation, increased user awareness and responsibility is proposed. This is aimed at facilitating a policy approach that is not entirely reliant on minimum standards and targets, but instead facilitates flexibility and creativity.

The study concluded with a number of policy and general recommendations some of which addressed findings on the need to improve the value relationship with customers and the level of awareness and involvement in the water efficiency debate.

### Aim

To further explore the interfaces between active and passive processes: information, technological and user processes for optimising water systems in buildings and urban environments on one hand and socio-psychological constructs on the other.

### Objectives

The research objectives are enumerated below:

1. Through documentary review, to identify and map policy factors for promoting water efficiency and waste water reduction in the built environment
2. Using the existing expert base, to identify information, technological and infrastructural routes to transforming water *supply* and user *demand* in buildings, domestic buildings in particular.
3. Conduct user studies to triangulate routes to transforming demand starting with measuring social constructs and user awareness (e.g. drawing parallels from DEFRA report 2006 the effectiveness of user feedback on energy consumption) and transformation (change) through visibility and feedback (OFWAT – A good deal for water 2004)
4. To propose an integrated decision approach for the creation of value for and by water users through improved engagement and customised interactions.

### Research scope

- Policy factors and processes
- Water demand and supply
- Wastewater processes – alternative water supply
- Built environment constraints
- Water efficiency technologies and user uptake

- Transforming demand – user perceptions and processes
- Information technologies (toolkit for co-creation)
- Facilitating feedback - monitoring and implementation policy measures

## Research limitations

The main limitation to the study was the amount of time allocated for the fellowship. The other challenge was the availability of integrated, conclusive evidence to support the study on water efficiency especially customer-side data. There are also conflicting results on alternative water supply, evidence supporting the effectiveness of water saving fittings, customer perceptions and preferences etc. These are probably due to differences in data collection methods, methods of analysis, how findings are presented, and the context within which it is presented. This led to some difficulty in achieving one of the objectives identified at the beginning of the fellowship. Therefore, one recommendation is that some synthesis of methods is definitely required.

## BACKGROUND

Like energy, water is a strategic and critical resource<sup>1,2</sup> and has been considered to be of more importance than some energy sources e.g. crude oil. The impact of climate change on energy supply is well documented; some 20% of the increase in water scarcity in the coming decades will be caused by climate change<sup>3</sup>. With a 5°C increase in temperature compared to 1999 levels; it is likely that hundreds of millions of people will be exposed to increased water stress<sup>4</sup>. About 1.1 billion people around the globe lack sufficient access to safe drinking water<sup>5</sup>. According to current evidence, parts of the UK are already under considerable water stress<sup>6</sup>.

The quantity of water used by households in the UK increased by 55% in the last 25 years<sup>7</sup>, although some of this increase has been attributed to population growth, the prevalence of domestic technologies such as washing machines, power showers etc. Availability of water is geographically diverse. In England for example, the Lake District is the wettest with average annual totals exceeding 2000 mm. However, all of East Anglia, much of the Midlands, eastern and north-eastern England, and parts of the south-east, receive less than 700 mm a year<sup>8</sup>.

At present, about half the water put into supply is to meet household demand. The highest rates of consumption are in several water supply areas in the South East of England where household water use for unmetered properties is more than 170 litres per person per day<sup>9</sup>. About 37% of properties are metered, mostly voluntary or enforced to high discretionary users, business users are almost universally metered. Current projections suggest water savings of 10-15% through metering. In metered properties, average consumption was 13 per cent less than in unmetered homes<sup>10</sup>.

Nevertheless, public perception of water as a natural resource does not always correlate with evidence on water availability. Some research suggests that water issues often come to the fore of public life, after risk events such as flood or prolonged droughts. Studies in England, UK suggest that the extent of awareness seems to differ according to areas at risk. A study of public perception in South East England, an area of water stress, found that members of the public had a good awareness of the water shortages in 2006 (after a period of drought) concluding that consumers are willing to change their behaviour if a threat is obvious or to protect the environment<sup>11</sup>. This study also concluded that public behaviour can be influenced by effective communication through recognised government bodies such as the Environment Agency. This is further reinforced by a survey

<sup>1</sup> Koehler, A. 2008. Water use in LCA: managing the planet's freshwater resources, *Int J Life Cycle Assess* (2008) 13:451–455

<sup>2</sup> The Pacific Institute. 2009. Water scarcity and climate change: Growing risks for businesses and investors, A Ceres Report, February 2009. Online: <http://www.ceres.org/Document.Doc?id=406>, 24 January 2011

<sup>3</sup> United Nations (UN). 2006. The United Nations World Water Development Report 2: Water—a shared responsibility, p 46. Accessible at: <http://unesdoc.unesco.org/images/0014/001454/145405E.pdf>

<sup>4</sup> Stern, N.H. 2007. *The Economics of Climate Change. The Stern Review*. Cabinet Office, HM Treasury.

<sup>5</sup> United Nations (UN). 2006. The United Nations World Water Development Report 2: Water—a shared responsibility, p 46. Accessible at: <http://unesdoc.unesco.org/images/0014/001454/145405E.pdf>

<sup>6</sup> Environment Agency .2008. Water resources in England and Wales - current state and future pressures, Bristol: Environment Agency, December.

<sup>7</sup> Defra. 2008. Future water: The Government's water strategy for England, HMSO: Norwich.

<sup>8</sup> UK Met office. 2010. UK climate summaries, <http://www.metoffice.gov.uk/climate/uk/>

<sup>9</sup> Environment Agency .2008. Water resources in England and Wales - current state and future pressures, Bristol: Environment Agency, December.

<sup>10</sup> Environment Agency .2008. Water resources in England and Wales - current state and future pressures, Bristol: Environment Agency, December.

<sup>11</sup> Dessai, S. and Sims, C. 2010. Public perception of drought and climate change in southeast England, *Environmental Hazards*, 9 (2010) 340–357.

conducted by Waterwise East and Savills, which found that once informed of the advantages, potential home buyers are more positive about water efficient fittings and are willing to pay more for a water efficient home<sup>12</sup>.

Water efficiency, as opposed to water conservation, is the optimised use of water commensurate to need which is not based on objective indicators but subjective need. The focus here is on the technical and not 'allocative' efficiency of water<sup>13</sup>. Technical efficiency comprises user efficiency, water recycling and reuse as well as supply efficiency. Water efficiency is marginally different from water conservation, in that it acknowledges essential water use. Therefore, water efficiency does not advocate the reduction of water consumption to the extent detrimental to consumer health or welfare. Instead, an understanding of customer behaviour and need is realised and through behaviour, technology and infrastructure efficiency, waste is eliminated. "What is important is not the amount of money spent on 'public' services, but the amount of wellbeing people derive from it"<sup>14</sup>. This is the first challenge for policy making especially in domestic buildings. On one hand are the challenges on effectively managing water resources and on the other, the challenges of providing reasonable stimulus to bring these issues to the forefront of public life. The proposed changes to the building regulations go some distance in setting an 'objective' target. However, one demerit is that this approach does not directly relate to the subjectivity of daily life.

Water efficiency is about the essential and appropriate supply and use of the right amount and type of water for necessary functions for which it is intended. At present, waste in water occurs both within the home and through supply infrastructure. About 25 per cent of total leakage is lost from customers' pipes supplying water into the home. The majority of water companies are now at what they calculate to be their Sustainable Economic Level of Leakage (SELL). This is the level at which the cost of further reducing leakage exceeds the cost of producing water from another source. The level of leakage permitted is currently regulated by Ofwat (the water industry financial regulator).

A joined up approach is required from various stakeholders, particularly building users for water efficiency objectives to be realised. Water users will be required to adopt positive behaviour and adapt new and innovative technologies to reduce the waste of water in the buildings if the expected levels of reduction in water consumption are to be achieved.

### Creating value for water users through policy

Promoting sustainability (including the sustainable use of water) 'requires multiple policy and institutional strategies in a sophisticated mix...ones that unsettle and disturb the existing institutional system'<sup>15</sup>. Conventional policy responses to environmental problems can be broken down into three governance mechanisms<sup>16</sup>:

- Attempting to modify practices directly through regulations, incentives and penalties targeting human activities;
- Relying on market forces, either by assuming that the invisible hand of the market will resolve the problem, or by adjusting market forces through fiscal policies;
- Raising awareness through the dissemination of information.

These mechanisms rely on a specific relationship to *knowledge*. Data, information and scientific knowledge are supposed to inform all steps of policy development: define the problems, establish the means and rules, assess policy implementation and revise and adapt the policy content<sup>17</sup>.

There are various ways of meeting the increasing demand for evidence-based policy-making, and for data and scientific evidence which are the essential knowledge base for technological decision-making. Studies have shown that there is a need to create stabilised frameworks of understanding so as to effect change over ever-widening scales. Importantly, they also show how this

<sup>12</sup> Waterwise East. 2009. Households' attitudes to water economy and water efficient appliances, Briefing notes, Waterwise East and Savills research, Online: <http://www.water-efficient-buildings.org.uk/wp-content/uploads4TQ//2009/01/waterwisebriefingnotespring2009.pdf>, 25 January 2011

<sup>13</sup> Global Water Partnership (GWP) Technical Committee. 2004. Catalyzing Change: A handbook for developing integrated water resources management (IWRM) and water efficiency strategies, Online: [http://www.unwater.org/downloads/Catalyzing\\_change-final.pdf](http://www.unwater.org/downloads/Catalyzing_change-final.pdf) 24 January 2011.

<sup>14</sup> Larson, S. 2010. Understanding barriers to social adaptation: are we targeting the right concerns?, *Architectural Science Review*, Volume 53, Number 1, 2010, pp. 51-58(8)

<sup>15</sup> R. Connor and S. Dovers, *Institutional Change for Sustainable Development*, Edward Elgar Publishing, Cheltenham (2004)..p. 227

<sup>16</sup> Ison et al., 2007 R.L. Ison, N. Röling and D. Watson, Challenges to science and society in the sustainable management and use of water: investigating the role of social learning, *Environ. Sci Policy* 10 (6) (2007), pp. 499-511.

<sup>17</sup> European Environment Agency, 2003 European Environment Agency, EEA Strategy 2004-2008, Office for Official Publications of the European Communities, Luxembourg (2003).

might be done while closing the gap between policy efforts and what happens at local levels, and between the stabilised, authoritative frameworks of meaning and the diverse meaning that different stakeholders give to action and data<sup>18</sup>.

However, an empirical knowledge approach to policy making is insufficient in its own mandate. An approach that includes deliberate effort to co-construct knowledge is required. Policy makers can help facilitate the process. Facilitation is understood here as a combination of skills, activities and tools used to support and guide learning processes among multiple interdependent stakeholders. Its main role is to bring about systemic change in complex situations for achieving concerted action. It is about the management of deliberative processes and social interactions that help the stakeholders involved to better understand 'what they are doing' (first order learning), and 'why they are doing what they do' (second order learning)<sup>19,20</sup>.

The nature of the water industry in England substantially influences the manner by which policy is formulated and implemented. The water sector is however not unique in its market structure; the public transport sector offers a useful basis for comparison and learning. Public transportation has been considered as a "public good" with a natural monopoly, which functions through an internal cost orientation rather than an external market orientation<sup>21,22</sup>. Public transport services are offered based on the premise that the operators of public transport create value-in-exchange, which is then extracted by increasing the variety of ticket services, improving the efficiency and punctuality of traffic services, and enhancing travel comfort. Similarly to the water sector in England, there is an emerging paradigm of value in public transport and this is co-created with passengers as value-in-use<sup>23</sup> *in the customers' own context*. According to this paradigm, service becomes "... a perspective on value creation rather than a category of market offering"<sup>24</sup> p. 118. This understanding fundamentally alters the traditional premise of value-in-exchange as the basic principle, replacing it with the co-creation of experience as the essential basis of value, with individual customers assuming a central role in the co-creation of such experiences<sup>25</sup>.

The recommendations as a result of this study focus on the value paradigm derived from studies e.g. of the study of Swiss public transport systems<sup>25</sup>, which found that value can be co-created with customers through; Customer engagement, Self-service, Customer experience, Problem-solving, Co-designing.

Co-creation, in policy offers a number of benefits:

- It makes political decisions more transparent
- Increases the social acceptability of policies
- Encourages the adoption of policy measures
- Ensures that policies are relevant and adaptable on local, natural and social levels<sup>26</sup>.

There is a caveat: co-creation of value for policy making, as in product development, requires open processes and systems which is truly inclusive, transparent and responsive in order to engender the active participation of customers and the perception of value in return. Transparency, dialogue, participation and engagement of all the stakeholders are necessary to achieve success. Co-creation for policy making will not work without the willingness for all parties to be transparent and open<sup>27</sup>. This however is dependent on societal and policy arrangements and the extent to which, as a result of the shared learning process, they are open to the necessity or potential for change.

<sup>18</sup> Steyaert, P., Jiggins, J., 2007. Governance of complex environmental situations through social learning: a synthesis of SLIM's lessons for research, policy and practice. *Environ. Sci. Policy* 10 (6), 575–586

<sup>19</sup> Groot and Maarleveld, 2000 Groot, A., Maarleveld, M., 2000. Demystifying Facilitation in Participatory Development. Gatekeeper Series No. 89. IIED, London.

<sup>20</sup> Steyaert, P., Jiggins, J., 2007. Governance of complex environmental situations through social learning: a synthesis of SLIM's lessons for research, policy and practice. *Environ. Sci. Policy* 10 (6), 575–586

<sup>21</sup> Knutsson, S. (2003), "Valuing rider quality in Swedish special transport services new findings", *Journal of Public Transportation*, Vol. 6 No.3, pp.65-84.

<sup>22</sup> Künneke, R.W. (1999), "Electricity networks: how 'natural' is the monopoly?", *Utilities Policy*, Vol. 8 No.2, pp.99-108.

<sup>23</sup> Vargo, S.L., Lusch, R.F. (2008), "Service-dominant logic: continuing the evolution", *Journal of the Academy of Marketing Science*, Vol. 36 No.1, pp.1-10.

<sup>24</sup> Edvardsson, B., Gustafsson, A., Roos, I. (2005), "Service portraits in service research: a critical review", *International Journal of Service Industry Management*, Vol. 16 No.1, pp.107-21.

<sup>25</sup> Gebauer, H., Johnson, M. and Enquist, B. (2010), Value co-creation as a determinant of success in public transport services: A study of the Swiss Federal Railway operator (SBB), *Managing Service Quality*, Vol. 20 No. 6, 2010, pp. 511-530

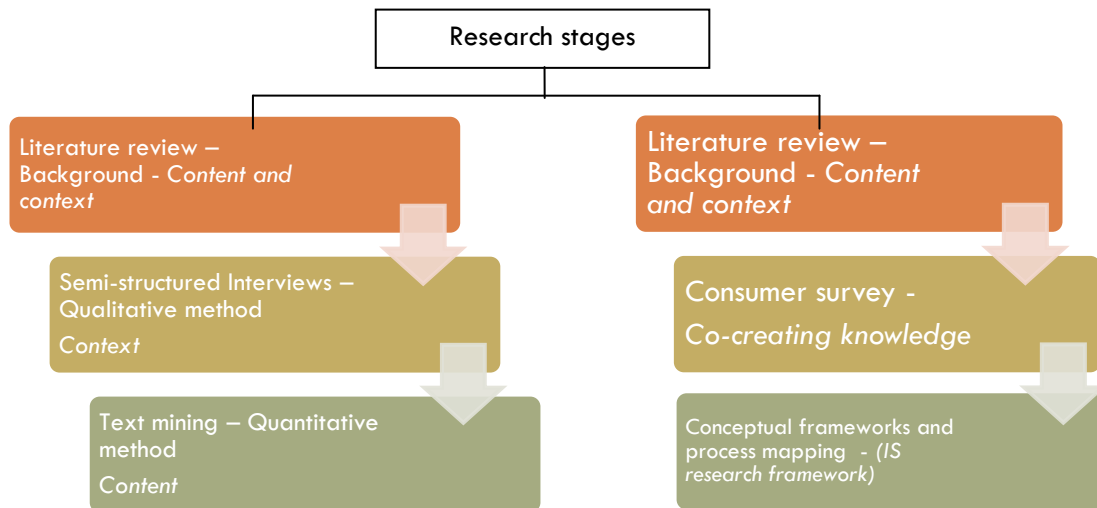
<sup>26</sup> Steyaert, P., Jiggins, J., 2007. Governance of complex environmental situations through social learning: a synthesis of SLIM's lessons for research, policy and practice. *Environ. Sci. Policy* 10 (6), 575–586

<sup>27</sup> Steyaert, P., Jiggins, J., 2007. Governance of complex environmental situations through social learning: a synthesis of SLIM's lessons for research, policy and practice. *Environ. Sci. Policy* 10 (6), 575–586

It is also worth emphasising that the customer is not always a co-creator of value. In the context of the water industry in England, engaging with customers to co-create value will not necessarily translate to increased competitiveness or increased perception of the quality of customer service or the quality of water - after all, the standards for the latter is determined by non-marketable factors e.g. Public health.

## RESEARCH METHODOLOGY

A mixed methodology approach was utilised for the research, starting with literature review to gain an understanding of the current policy and the strategies/measures. Other methods included interviews, text mining, user surveys, conceptual frameworks and process mapping.



**Fig 1 Triangulation of findings was important for reliability & validity**

Based on a critical research approach, literature review was also used to refine knowledge as well as develop sharper and more insightful questions about the topic. The interviews, as a qualitative tool deals with interpretive epistemology and helped to provide further insights and understanding of the ‘problem’ setting by examining narrative, text-based data. The interview was a very good way of assessing people’s perceptions, meanings, and definitions of situations and constructions of reality<sup>28</sup>. A semi-structured approach was used to conduct the interviews, with the specific use of open-ended questions. In an open ended interview, the interviewer poses a question and then allows the subjects to answer as they wish. The interviewer may probe for more details but does not set the terms of the interview. This allows a less constrained interaction between the interviewer and the interviewee. The sources used for the policy review are detailed in Table 1 below. These interviews were recorded and the transcripts were processed using a standard text coding and analysis tool.

Numerical data was extrapolated using text coding and analysis techniques which is used to translate textual information into quantifiable data. Text-analytic methods cover a spectrum between the completely algorithmic and the exploratory and this is ideal for this type of research.

A quantitative approach was employed for the second stage of the research. A nationwide user survey was commissioned to explore some socio-psychological variables. With this method, it was possible to survey the perception of respondents across the UK. The survey was disseminated online through a market survey company. Data from the survey was analysed to produce the decision algorithm presented in the detailed report, findings from the survey also informed the recommendations presented here.

<sup>28</sup> Punch, K.F. 2005. Introduction to Social Research: Quantitative and Qualitative Approaches, London: Sage Publications.

**Table 1 Sources for policy review**

Secondary sources		Primary sources	
Defra	Future Water	Over view	Mike Walker
Cave Review	Independent Review of Competition and Innovation in Water Markets: Final report		
Defra		Water efficiency	Peter Jiggins
EU	Water framework directive	WFD	Rory Wallace
Anna Walker	Independent review of charging for household water and sewerage services	Charging and competition	Rob Canning , Jen and David Jones
CLG	Building regulations, Code Water Calculator review etc	CLG representative	Nick Park
CLG/LA - Planning	PPS25 - Development and flood risk		
UKWIR/INDEPEN	Collaboration for Innovation in the UK Water Sector: Roundtable Event Summary		-
Cranfield University	Study on water performance of buildings	Academia (Water quality/treatment)	Huw Taylor
OFWAT	Service and Delivery Performance		-
EA	Water resource strategy for England and Wales	Demand management (water efficiency)	Jonathan Dennis, Sarah Harrison ( <i>interview excluded from analysis</i> )
	Water resources in England and Wales - current state and future pressures		
EA/NHBC Science report	Energy and carbon implications of rainwater harvesting and greywater recycling		
Southern Water	Water Resource Management Plan	Water company representative	Meyrick Gough
Wessex Water	Water Resource Management Plan		Luke DeVial
Anglia Water	Water Resource Management Plan, Parliament release: Anglia Golden 100		-
Waterwise	Waterwise- Water efficiency in new developments: A best practice guide etc		Nicci Russell , Joanne Zygmunt
Others:	Various		

## POLICY RECOMMENDATIONS

### General

1. Develop a sustainable data/evidence system especially on household consumption. This can be used to create knowledge which can then be utilised to create value with water customers.
  - a. An integrated and credible consumer data will also be beneficial to water companies for setting innovative tariffs to reward fair use.
2. Policy makers should provide clear guidance and standards for water saving fittings and products. This may be through certification, accreditation or labelling schemes. To this end, performance metrics are required and these can be deployed by revising existing regulations or standards.
3. Water recycling and reuse should be encouraged. Clear policy guidance should be provided on this.
4. Monitor and control growth in water demand by deploying appropriate technologies for improving the capacity of consumers to adapt and change behaviour. Information systems are a ready solution.
5. Water efficiency regulations should cover existing domestic buildings as well as new build.
6. Promote retrofitting to improve water efficiency and give appropriate incentives.
7. Introduce overall performance ratings for the combination of measures used to achieve water efficiency in a building



(contrary to the criticisms against the CSH water calculator, a building systems approach, not component approach is still preferred as long as it is implemented holistically in line with the highlighted steps)

8. Invoke some market factors. Utilise evidence base to introduce customisable tariffs to reflect water consumptions and real savings due to behaviour change and adaptation of technology.
9. Encourage speedy development to commercialisation processes of new technologies for water efficiency (starting with clearly defined guidelines on health, safety and performance by the government)

## Details

### 1. Water demand

- Implement integrated solutions; non-coordinated measures can sometimes work against each other. However, more research/evidence is needed to ensure that the theoretical water demand correlates with what exists in reality.
- Apply maximum flow rates to taps/showers etc based on real performance studies.
- Develop a system to penalise waste without penalising essential water use.

### 2. Water supply

- If customers are going to be charged for the amount used, water companies should be charged for the amount they abstract (including a catchment coefficient for environmental impact etc) and not based on licensed capacity which is equivalent to the rateable value for customers.
- Reinvest abstraction fees locally to support catchment management schemes.
- Facilitate licensing trading to relieve pressure on stressed sources.

### 3. Alternative water supply

- Encouraging water recycling and reuse is a good approach to reducing demand of potable supply even if it will not be ideal in all cases. Therefore, a singular authoritative policy/regulatory guideline is required on this issue.
- The policy position should be based on a comprehensive, life-cycle approach.

### 4. Water efficiency

- Subjective, non-integrated or coherent evidence raises more questions than answers. A robust methodology is required. Also, a long term, continuous evidence culture should be utilised.
- There is a need to reduce ambiguity and assumptions in occupancy and user behaviour data and establish perpetuating studies of actual building use and consumption.
- Similarly, solutions and measures on water efficiency should not be based on short term objectives for immediate results. Measures should be implemented based on the ability to deliver long term sustained solutions.
- Placing the burden of responsibility for demand-side water efficiency on water companies reinforces the passivity, lack of ownership and responsibility of domestic water users in the efforts to reduce demand. This can be rebalanced through increasing choice and engagement on the supply/service interface and by co-designing value and offering value-in-exchange. \*Survey findings for metered and non-metered properties show that most customers will prefer to be rewarded through tariffs if they reduce consumption and adopt water saving technologies. There is no motivation to change if there will be no savings on bills.

### 5. People and Behaviour

- The strategy should be to first Advise, Incentivise, then Regulate. Public campaigns in whatever form should however avoid sound bites or sensationalism but should instead present information needed to make intelligent choice.
- Consider a targeted regional or localised approach in line with available water resources and the extent of change required to reduce stress. The additional benefit, based on studies on climate change scepticism and detachment, is avoiding the public dissociation that occurs when problems that has no direct or localised impact or consequences.
- Do technological interventions change behaviour in the long term? There is very little evidence to provide an answer to this. However, delivering technologies for customers should consider customer needs, choice and preferences conjunctively as this is more likely to lead to behaviour transformation.
- Promote strategies that enhance the DIY culture and socially induced fitting/equipment replacement or building



retrofitting/renovation cycles e.g. kitchen upgrades.

- Promote strategies that change the perception of the quality and performance of water efficient products.

## 6. *Technology*

- Water saving devices and technologies are effective as an entity but may be less effective in certain context or for transforming demand and changing behaviour. Therefore, they should not be presented as the ultimate quick fix solution.
- Investment cost and payback for new technologies is still an issue for most customers and there is a need for a transparent approach to help customers make intelligent choices.
- Customised integrated solutions (a combination of measures) will be more effective for the efficient use of water by households. Recommendations of water saving technologies should therefore be based on building and household audit this will aid an optimised and customised solution that is most suitable for the customer (See Appendix 2).

## 7. *Buildings*

- Include technical guidelines for dual supply systems in the regulatory framework
- Apply life-cycle, post-occupancy analysis to the new regulatory measures to ensure their impact in the medium to long term.

## 8. *Initiatives/ Measures/Schemes*

- It will be beneficial to have one standardised labelling/certification scheme across the water efficiency technologies range.
- Target professional certification/accreditation schemes e.g. plumbers. This is not only good for planners and developers but can be used to inform and educate the public.
- Consolidate measures/initiatives e.g. labelling schemes; WRAS schemes etc.
- Avoid introducing new measures without a strategy for monitoring and measuring impact of existing ones.

## 9. *Metering and tariffs*

- If possible, consider metering with certain exceptions instead of metering in certain cases.
- Integrating metering with innovative tariffs which rewards change of behaviour and gives incentives for adopting water saving technologies will increase adoption and improve public perception.
- Use metering as another means to collect evidence – effectiveness of water efficiency measures and water saving technologies. It is an opportunity to monitor demand information for future forecasting/decisions, better interactions with customers, opportunities to promote water efficiency, as well as option to deploy minimum water allowance to a property and charge for the rest.

## 10. *Water companies*

- If policy and regulation are flexible, water companies should aim to offer increased flexibility to customers through discounts for improved water efficiency in homes or adoption of technologies.
- Increase transparency of billing.
- For monitoring and feedback purposes, water companies should be encouraged to standardise data collection practices and share knowledge and best practice.
- It is good to integrate water efficiency information in bills. However, this should be useful information to aid intelligent choice, and not sound-bites. For example: the message 'save water, save energy' will be more effective if linked with how it affects the customer and what choices/changes can they make to deal with it.

## 11. *Climate/ Environment*

- Water risks; e.g. floods, droughts, help to improve awareness or change perception of water issues. However, if not presented holistically and transparently, it can evoke a negative response.
- Present standardised argument linking water consumption with energy consumption and for better visibility include in communications with customers e.g. bills.

- The polluter pays principles should start with water companies at the beginning of the supply chain to customers at the end of the chain. Fairness and transparency should be a two-way process and this can be prompted through policy.
- These recommendations should be flexible and allow flexibility for localised, catchment approach rather than a national approach. Decisions should be devolved as much as possible within a nationalised framework to ensure standards are adhered to.

## Customer recommendations

### 1. Awareness of water issues

- Majority of water customers have somewhat aware of water issues usually linked to risk events and climate change. However, customers have less awareness of the impact of their choices and behaviour on water resource issues.

### 2. Change of behaviour

- Most customers will prefer to change behaviour by taking shorter showers or turning off taps or simply use less water before they will consider the use of water efficient technologies. This should be considered when designing and presenting water efficiency messages or measures.
- Customers prefer a reward/incentive approach for the control of their water usage leaning towards a “carrot” method of water conservation rather than a stick method of increased fees and penalties for non compliance.

### 3. Water meter usage

- The adoption of water meters can be attributed to the ownership factor; a lot of people live in rented properties. Or the negative perception that water meters imply increased bills. \*Survey sample showed that only 36% of respondents have a water meter which is close the 37% figure quoted previously.
- There is need for increased transparency from water companies to help the perception of fairness and increase the uptake of water meters.

### 4. Suitable water technologies

- Most customers concur that water saving technologies of all varieties are both good for the environment and will help save water.
- When customers choose to retrofit water saving technologies, the most likely option is to install a low flush WC and the lowest uptake was reusing grey water.
- Cost is the most delimiting factor for adopting water efficiency technologies, followed by the little or no savings on water bills.
- For alternative water technologies, there was also the perception of health risks.
- Lack of awareness was also a major issue on the adoption of water saving technologies.
- Most customers are open to the idea of water saving technologies. \*In the study conducted, some 56% would still recycle rain water.
- Non-invasive technologies that are simple to understand, use and are commonly available in the market are often preferred to the technically complex technologies which will require major retrofitting.

### 5. Restrictive factors for saving water and adopting technologies

- **In order of priority**
  - I. Cost was the most prohibitive factor for adopting water saving technologies.
  - II. Age of existing buildings
  - III. Lack of space, disruption and time to implement.
- Policy guidance is required for existing domestic buildings – especially to tackle displaced ownership in rented properties. \*In the survey, majority said they will like to make changes to improve water efficiency of their homes but cannot without the landlord’s permission and willingness to implement change.
- The lack of incentive to adopt new technologies. Homeowners and building users will generally like to see efforts made in changing behaviour, using less water and adopting technologies reflected in water tariffs and bills.

## 6. Choosing water saving technologies

- The choice of water saving technology will vary depending on individual preferences and the household factors. A one-size-fits-all approach should be avoided; see earlier recommendations on building and household audits.  
\*Some study respondents prefer water saving technologies that does not require a lot of time and effort to get used to it or require “playing with gadgets and switches constantly. Others wanted smart/intelligent systems to keep them aware of usage and opportunities to save, and another group preferred switches/ valves they could change themselves to reflect their variable usage.
- Majority do not want government imposed systems or methods.

## 7. Saving water in the home

- Most customers are confident that they conserved some water, and are aware that they need to do more. The extent of what is required and the means to do it needs to be effectively communicated in a manner that is relevant and useful for the customers

## 8. Effectiveness of water saving policy

- Most customers will still prefer to receive free or subsidised products and fittings.
- However, customers would also like fairer water and sewerage charges with additional benefits such as savings on bills if water efficiency improvements are made.
- The response for metering was less conclusive.

## 9. Research

- A longitudinal study is required to completely understand the complexity and nuances surrounding customer issues and the behaviour and response to water efficiency measures. Short term studies will be less effective for the complexities involved.
- This in turn requires a long term view in policy making which may not be possible.

## Information systems recommendations

Information systems provide an opportunity to implement blue-sky solutions for promoting water efficiency. Although, some of these concepts are impractical if the limits of the current water system are taken into consideration. Examples of blue-sky solutions include:

1. Distributive water information networks in buildings to support dual supply systems. This can be an AI system which operates and maintains a micro water supply network system in domestic and non-domestic buildings.
2. ‘Virtual tanking’ – linked to tariff systems. This can be used to monitor and allocate supply and demand thresholds based on a system-based understanding of socio-occupancy factors.
3. Water equity trading – can be scaled up for abstraction trading or scaled down and linked to tariff systems. Water is attributed a virtual value/currency and traded. Equity holdings can be used to introduce value concepts to water, thereby empowering and not penalising the user/customer
4. Intelligent feedback systems – a variation of ‘smart meters’ which enable data capture for intelligent mapping of social-occupancy factors (based on an evidence-based methodology) and identification of an optimised efficiency threshold for each household.

## SUMMARY

This summarises the fellowship activities and findings. Detailed discussions, analysis and findings can be found in the main report which can be obtained from Defra.

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## Appendix 2: Towards customising technological solutions and policy measures in buildings

The table below presents findings from a survey sample of 393 respondents. There is however, scope for scaling up.

Building type	Technology deployment preference	Policy preference
Apartment/Flat	Respondents living in apartments appear to prefer a technological deployment approach which is enforced through some compliance code or standard, supported by information and advice on how to comply and use water effectively.	Respondents living in apartments appear to prefer a fair tariff and billing system which incentivises change of behaviour and technology adoption. This should be supported by transparent, accessible information to make positive choices.
Bungalow	The more mature (age-wise) respondents living in bungalows appear to prefer a technological deployment approach which affords them some degree of control, supported by information and advice on how to comply and use water effectively.	Respondents living in bungalows appear to prefer to explore alternative water sources. Apart from this, policy preferences vary and include a fair tariff and billing system which incentivises change of behaviour and technology adoption free and subsidised fittings and products all supported by transparent, accessible information to make positive choices.
Maisonette	Respondents living in maisonettes appear to prefer a technological deployment approach which requires less input from them, supported by an information system or mechanism provided by the government, water companies or through tools such as smart or intelligent meters.	Respondents living in maisonettes appear to prefer a fair tariff and billing system which incentivises change of behaviour and technology adoption. They also support the provision of free or incentivised products and fittings including technologies that facilitate alternative water supply and lastly, transparent, accessible information to make positive choices.
Detached house	Respondents living in detached houses appear to prefer lights-out technological deployment approach supported by options of some degree of control over how much is saved based on their essential water use and how much can be saved, based on their performance expectations especially of fittings and products.	Respondents living in detached houses appear to prefer to receive free or subsidised products" followed by a fair tariff and billing system which incentivises change of behaviour and technology adoption. This should be supported by transparent, accessible information to make positive choices.
Semi-detached house	Respondents living in semi-detached houses appear to prefer lights-out technological deployment approach supported by options of some degree of control over how much is saved based on their essential water use and an information system e.g. smart meters that provides data on how much is being used and how much can be saved.	Respondents living in semi-detached houses appear to prefer to receive free or subsidised products" followed by a fair tariff and billing system which incentivises change of behaviour and technology adoption. This should be supported by transparent, accessible information to make positive choices.
Terraced house	Respondents living in terraced houses also prefer the lights-out technological deployment approach supported by an information tool which tells households how much they are using and how much can be saved or particularly, when they start to waste water. Some also prefer the option to vary their water consumption based on essential water use and performance expectations from fittings and products.	Respondents living in terraced houses also prefer to receive free or subsidised products" followed by a fair tariff and billing system which incentivises change of behaviour and technology adoption. They will then prefer a policy approach that makes alternative water sources accessible and affordable supported with information for positive choice to make behavioural changes and adopt water efficient technologies.

### Appendix 3: Customer Views on saving water

- \* I believe that saving water is not so much about using new advanced gadgets/devices - although some devices can help to some extent. The need is for a change in behaviour through transforming attitudes, perceptions and values.
- \* My answer is not there. It's 'I already try to save as much water as possible and I cannot install devices because this is a rented property'.
- \* I would love to install a variety of water saving measures as I recognise the importance of conserving water. However since I live in a rented property I am unable to make decisions on plumbing and appliances.
- \* It is very hard when you are a tenant of a property to implement big changes can only save water by turning off taps, taking showers, using eco wash on washing machine etc but no fundamental changes. Believe all properties should be fitted with a meter. But also believe strongly in harnessing rain water and new technologies but investment/grants needed by government and water companies and landlords need to be forced to make changes
- \* None of the above, I do save water where I can but as I am a tenant I cannot fit technologies into the house.
- \* It is only during hot weather periods or droughts that most people think very much about water use in this country. There is a need for greater awareness and water saving features being presented as standard, rather than optional extras. There is a need for mindset change, but also ways to make people do things without really realising that they are.
- \* I would but I am a tenant and have next to no say in water saving measure implementation other than my own behavioural response
- \* I desperately want a water meter but the council says it's not possible due to the way my ex council house is built. This infuriates me as I had one at my previous property and it saved me a lot of money. I don't think the council really cares (Three Rivers).
- \* Further water saving equipment has prohibitive costs (i.e. rainwater harvesting) yet is very suitable to our lifestyle and household. Readily available grants or subsidies for the less 'common' household would help
- \* People rarely think they waste water. But they need (myself included) to know better how much water is actually consumed by different water uses. Using less should also be rewarded rather than penalising excess. Better to reward the virtues of thrift than condemn the vice of excess. People need to see that metering water use should be the norm in this country
- \* I don't own the flat in which I live and installing technology to save water is therefore my landlord's responsibility. I am careful to save water by not leaving taps running while brushing my teeth etc.
- \* I do my best, but am appalled at the waste by the water companies in leaks and bad management.
- \* I don't know a lot about water saving issues or the need to save water. I need to know more and need educating on the issues and the need to save water. I also don't understand all the technologies/equipment that are available for saving water and would need to know more so that I can make an informed decision. I'm not likely to undertake the research myself due to personal time constraints and higher priorities and so this information needs to be drawn to my attention. I'm generally keen on the idea of living a 'greener' life and so would adopt greener ways of living if they were presented. For example, our council introduced recycling and food waste recycling and I participate in it with enthusiasm.
- \* I signed up for a free water saving device for my shower only to be told once I'd received it (in 2 layers of plastic wrapping) that I couldn't use it because our shower is electric. The size of the toilet we now have means that I can't use the water hippo in the cistern either. We're bombarded by suggestions of ways to save electricity but suggestions about saving water usage seem to have either been lost or slow to permeate.



- \* Government did a scheme on insulating houses, where someone visited your house, advised what you could do and you get a voucher to get the work done at a fixed reduced price. This was really popular in our area. Something similar on saving water would be great.
- \* I conserve water where possible, but as a tenant, I'm unable to install different washing machines etc
- \* I can't afford to upgrade dishwasher etc to water saving one until they break, too expensive to buy new ones. I know that there is more to do but tips given out by government/water companies are all very simple, would imagine a lot of people are already doing them. There must be more that we can all do.
- \* I do what I can given the pressures of family life and try to encourage others to save water.
- \* I feel maybe better to do washing up in a bowl which when emptied into plugged sink, allows me to wash to floor with it. Filling washing machine to sensible capacity should reduce number of times need to use it. We have hand basins in bedrooms and so even a shower is not necessary every day; we have no baths only 2 shower units.
- \* Living in a flat means we can't have a water meter. So there's little incentive that way to save water. We're also restricted as tenants as some things are the landlord's prerogative. Otherwise, we try not to be wasteful but that's about it
- \* The best way to save water is to implement recycling. Rainwater is probably the easiest method followed by grey water but both are costly to implement in existing houses. The CSH should be forcing developers to implement these products into all new developments but from experience this does not seem to be happening. Easy to implement ideas are no brainers which everyone should be doing. Everyone should be forced to go on a meter too - and most don't realise they could save a lot of money by doing so.
- \* Whilst water is obviously a finite resource it is my belief that there is enough water in the UK system to go around providing enough investment is made in water capturing, storage and distribution without having to resort to drastic water saving methods.
- \* This is another person's property, not mine.
- \* Better start effectively and efficiently saving water globally right now, before too late.
- \* I guess the most effective way of saving water is by a change in behaviour (which might take generations to achieve). Although I think in UK is a difficult goal due to the low tariffs and the characteristics of its climate.
- \* I am open to it but need to know in simple terms what to do. Much of what has been mentioned in here is not widely known - I've no idea what sponges in washing machines are!
- \* Older properties converted into flats that share a common water source would be difficult to meter surely? Having water saving taps (which I was unaware of when refurbishing two years ago) as standard and having to pay extra for anything else would encourage their use. There are so many things householders can do to help the environment that having integrated information with regard to water, energy, waste etc. would be the most helpful so research requirements are not so extensive.
- \* I won a water butt in a competition a few years ago. My tip was that as our boiler was upstairs when one ran the hot water in the kitchen, to collect it in a bowl until the water came through hot. Turn off the tap and put the cold/lukewarm water in the water butt in the garden
- \* I won a competition for a water butt in an Eco magazine a few years ago. In our house, the boiler is in the upstairs bathroom so when one uses water in the kitchen sink, it takes time for the hot water to come so we collect the cold water in a bowl which we put in a water butt outside the kitchen door. We therefore do not waste water and save on our water costs. (by meter)
- \* I want to save water but after a busy day at work saving water isn't the first thing on my mind. Water is really important but it's only seen as important when it's not available because of disruption.



**NOTES**