

WATER EFFICIENCY IN THE HOME



POST 135

Post Note March 2000

Although the UK has not faced a serious drought since 1995¹, the availability of water resources is still attracting attention. Increasing household numbers and changes in lifestyles are raising demand, especially in some parts of the country. While this could be tackled by providing new supplies, it is Government policy that demand should be managed. One key aspect of this is encouraging the efficient use of water in the home.

This briefing note examines the techniques for increasing domestic water efficiency and discusses the issues raised.

WHY CONSERVE WATER?

Over the last ten years, parts of the UK have experienced several severe droughts, in particular between 1988 and 1992, and again in 1995. Such events seriously inconvenience domestic water users, but demand has been rising for many decades anyway, and is likely to continue over the next two decades (**Figure 1**), driven by changes in lifestyle and demographics. Droughts exacerbate this trend. Faced with this increase, two options arise:

- Meeting demand with new supplies
- Managing demand to avoid new supplies.

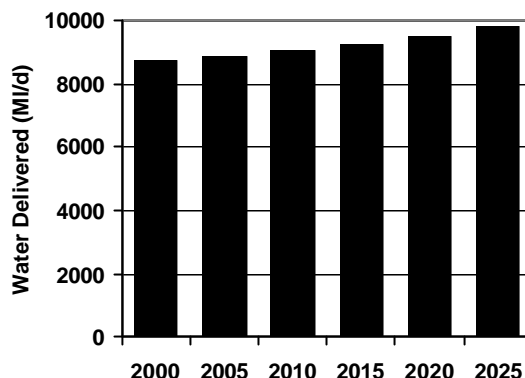
There is considerable public, regulatory and government pressure to avoid the significant impacts of new supplies, where local opposition to specific schemes can be strong. There is strong emphasis on making the most cost-effective use of the water that is already available. Safeguarding water resources is thus seen as a key element in the government's 'sustainable development' policy². This includes avoiding the waste of water by reducing leakage and maximising its efficient use by homes and businesses.

WATER EFFICIENCY TECHNOLOGIES

Domestic Water Consumption

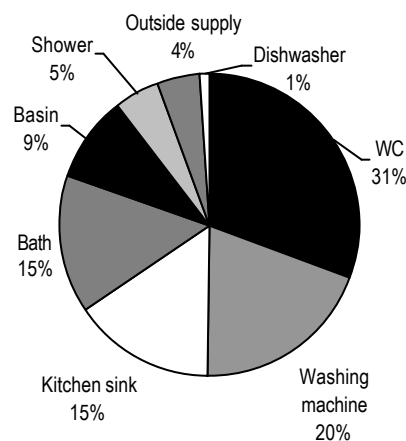
Figure 2 shows the pattern of water usage in the home, averaged from data collected from a survey³ by Anglian Water from 1993 to 1998. Over a year, the greatest uses (60%) are for personal hygiene (WCs, baths, showers and basins), followed by washing machines and dishwashers (21%), kitchen taps (15%) and outside taps (4%).

FIGURE 1 PROJECTED 'BASELINE' DOMESTIC WATER DEMAND IN ENGLAND AND WALES



Source: Data provided by water companies, and reported by Environment Agency

FIGURE 2 DOMESTIC WATER CONSUMPTION AVERAGED OVER ONE YEAR



Source: Anglian Water

Consumption rises by around 10% in the warmer months (May to August), when outdoor use increases to over 25% of monthly consumption. The SoDCon³ survey also found that per capita consumption decreases with increasing household size (see **Table 1** over). For instance, in a single-person household, per capita water consumption is 40% greater than in a two-person household, 73% greater than in a 4-person household and over twice that in households of 5 or more people.

This is important as much of the projected growth in the number of households over the coming decades is expected to be from an increase in single-person households. It is here that efforts to manage demand would be most effective.

¹ See POST Report No. 71 "The 1995 Drought" and POST Report "Dealing with Drought", February 1993.

² "A Better Quality of Life. A strategy for sustainable development for the UK". Cm 4345, May 1999.

³ The annual Survey of Domestic Consumption (SoDCon) which measures consumption in 3000 homes in the Anglian Water region, with every appliance and activity monitored in a 'golden 100' homes.

TABLE 1 HOUSEHOLD SIZE AND WATER CONSUMPTION

Household Size	1	2	3	4	5	6	7	8
Consumption (litres/head/day)	211	154	130	122	103	103	108	54

Source: Anglian Water SoDCon Survey

Achieving Efficiency

Water efficiency in the home can be achieved by **reducing non-essential consumption** and/or by **avoiding waste**. Many water-saving technologies are available (**Box 1**). Ofwat⁴ monitors the activities of water companies in promoting water efficiency. Its 1998-99 report stated that such activities have increased significantly since 1996-97, and that companies should now focus on *“activities which are demonstrably cost-effective and will have an enduring effect”*. Ofwat's Director General (DG) has asked companies to set out plans giving customers access to cistern devices and providing advice to households, schools, hospitals and other community premises. Furthermore, the DG stated that *“the promotion of efficient water use should be complemented by efficient pricing”*.

ISSUES

Matching Supply and Demand

Since 1988/89 (**Figure 3**), the total volume of water supplied (for all uses) has decreased by 7%, principally from efforts to reduce leaks after the 1995 drought (and the public and political concerns raised then) and reduced commercial consumption. Nevertheless, the water companies predict that this trend will continue only until 2004/5, when further leakage control could become uneconomic⁵. The volume of water supplied is then expected to be static until around 2010 and then to rise again as domestic consumption continues to increase.

Another response to the 1995 drought was that the Environment Agency required all water companies in England and Wales to prepare plans for their water resources until 2025. These plans were submitted in 1999, and since then, the Agency has concluded that (with one small exception), all the plans *“provide a suitable basis for water supply planning.”* They included targets for the impacts of companies' water efficiency programmes. Nevertheless, the Agency found that *“few such targets are explicit ... suggesting that companies are still not giving sufficient priority to this issue.”*

⁴ Ofwat is the Office of the Director General for Water Services – the economic regulator of the water industry.

⁵ Ofwat, the EA and the DETR are examining the scope for further reduction.

BOX 1 INCREASING WATER EFFICIENCY

WCs – most WCs use 9 litres of water for each flush. By-laws introduced in 1994 reduced this for new installations to no more than 7.5 litres per flush, and regulations introduced in 1999 reduced this further to 6 litres (for new installations from 2001). There are methods available to reduce the volume of water used in flushing toilets, such as 'Hippo the Water Saver' (a simple plastic bag inserted into the cistern that holds back some water when it is flushed). Dual-flush WCs can also reduce consumption, and waterless WCs and urinals are also available.

Domestic Appliances – Manufacturers have developed models that are more energy and water-efficient. Typical washing machines consume 65 litres per wash, but less than 55 litres is achievable. Dishwashers are available that reduce consumption by 20%. Similarly, some washing machines can 'sense' the size of the washing load, and adjust their water consumption accordingly.

Taps – The use of a spray-nozzle can reduce consumption by 60-70%. Similarly, tap controls can reduce consumption (by up to 50%) using, for example, spring-loaded levers, push-top or infra-red controls. By combining such techniques, the savings can be increased further (i.e. up to 85%).

Supply Restrictor Valves – These are plumbing fittings that reduce water flows into domestic appliances, taps and showers. Essentially, the valve works by reducing the diameter of the supply pipe when there is a change in mains pressure, thus giving a constant flow. The result is that, even when the tap is full on, the same flow rate of water is maintained. A valve is also available that can detect leaks and shut off supplies automatically.

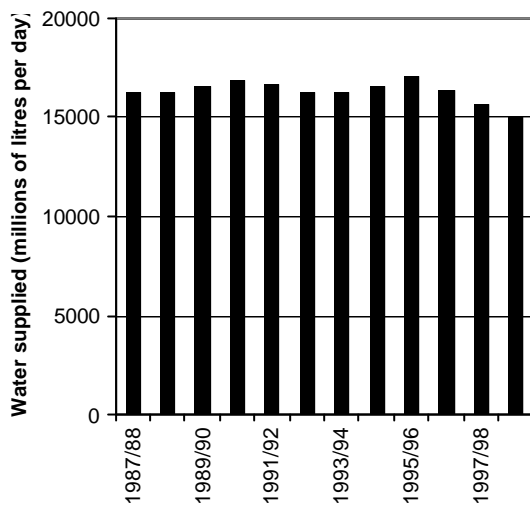
Outdoor Uses – Techniques to help conserve water used outside include water butts, irrigation systems (such as automatic garden watering systems, seep hoses, trickle hoses and drip hoses), and hose attachments such as spray- and spring-loaded nozzles.

Domestic Water Recycling – Water from all activities could, in theory, be recycled. Water from toilets (termed 'blackwater') contains organic materials and human pathogens (bacteria and viruses) and would require advanced biological treatment (akin to a sewage treatment works). Techniques such as membrane bioreactors have been shown to provide a high level of treatment for domestic blackwater. However, these devices are still being developed. In contrast, however, water from elsewhere in the house (termed 'greywater') has long been used as a source of non-drinking water within the home (especially in Japan, where the tops of WC cisterns often incorporate hand basins that drain into them). Water from kitchen sinks, washing machines and dishwashers may, however, contain food particles, grease and oil that can be difficult to filter and may clog pumps and membranes. Thus, for practical purposes, most greywater systems recycle only water from baths, showers and hand basins. There are at present no standards for the quality of greywater (see Issues in main text).

Rainwater Recycling – In addition to the collection of water in a water butt (see above), rainwater can also be collected from roofs and hard surfaces on individual buildings and across large areas. Intercepting rainwater in this way allows it to be used for many of the above purposes before it is discharged to the sewer, and helps to reduce peak loading on sewers and sewage works during storms. Mains use can thus be reduced.

One high-profile example of the use of water efficient technologies is at the **Millennium Dome** in London. Here, rainwater from the 100,000m² roof is collected, treated (through reedbeds) and reused for toilet and urinal flushing. The system also uses greywater from handbasins in the toilet blocks and groundwater from under the Dome site. The project is also investigating water efficient technologies and the effect of educational messages on people's behaviour towards water conservation in the lavatory blocks.

Source: Environment Agency

FIGURE 3 TOTAL VOLUME OF WATER SUPPLIED IN ENGLAND AND WALES

Source: Environment Agency

The Agency points to many examples of good practice, and suggests that all water companies could adopt these. However, many have suggested that simply 'encouraging' good practice in water efficiency is not sufficient, and that more targeted measures may be necessary. Options may include:

- Ensuring that **prices and tariff structures reflect the desire to encourage water efficiency**. This would be most effective where supplies are metered, to give consumers a price signal. However, it is sometimes argued that the provision of sufficient clean water is a right, and controlling supply through cost is sometimes presented as a form of rationing, which may be resisted.
- Setting up a **Water Efficiency Best Practice Programme (WEBPP)** – such as for energy, environmental technology⁶ and construction.
- Setting up a **Water Savings Trust (WST)** – as already exists for energy efficiency. However, unlike energy efficiency, the need for water efficiency varies across the country, so that work should ideally be funded mainly in 'water stressed' areas. Similarly, given the current low level of metering, (less than 20% nationally), it is difficult to identify where the benefits might accrue.

While much use is made of the results of the SoDCon survey published by Anglian Water, this is limited to a sample of homes in the Anglian Water region. Other data sources exist, but overall, there are

insufficient data nationally on domestic water consumption to evaluate mechanisms to encourage more efficient water use. To plug this data gap, one option might be for the Department of the Environment Transport and the Regions (DETR) or Ofwat to **require water companies to undertake surveys of domestic water consumption and to report publicly**⁷. This could also form part of the terms of reference for any new mechanisms that may be set up (e.g. a WEBPP or WST).

Status of Water Efficiency Technology

Box 1 showed that there is a wide range of technologies for promoting the efficient use of water, which manufacturers claim can reduce water use. However, many such claims have not been validated by an independent source. Similarly, although there is anecdotal evidence that these technologies are being used more widely, the Bathroom Association has not been able to collate information from manufacturers on their sales and installation. This represents another gap in the data that would enable policies to encourage water efficiency to be evaluated. Options to address this include **conducting validation trials on a range of technologies** and undertaking a **market survey of water efficient technologies**. These tasks could be conducted by the Environment Agency through its National Water Demand Management Centre (NWDMC), or directly commissioned by Ofwat or DETR. Alternatively, they could form part of the terms of reference for a WEBPP or WST.

Turning to **recycling**, water quality is a key issue. For instance, water for human consumption must meet the standards enforced by the Drinking Water Inspectorate; thus, high levels of filtration and disinfection would be necessary to remove potentially harmful bacteria and viruses. For other uses, however, such as personal hygiene, clothes washing, toilet flushing and outdoor uses, lower standards could apply. DETR suggests that, taking a pre-cautionary approach, standards would still need to remain high. In March 2000, the Government endorsed guidance on greywater recycling as prepared by the Water Regulations Advisory Scheme (WRAS)⁸.

Public Acceptance

Regardless of the status of technologies, their potential will not be realised unless customers wish

⁶ Water efficiency by industry already forms part of the work of the Government's Environmental Technology Best Practice Programme.

⁷ The water industry has commissioned a study into increasing the amount and availability of data on consumption.

⁸ "Reclaimed Water Systems (IGN/1)". WRAS is formed from representatives of the water companies.

to acquire them. Studies have shown that many innovations are unsuccessful, in part due to the failure to consider users' needs. Users must be involved in their design. Consideration of future markets for these technologies should include the preconceptions and perceptions of potential customers relating to:

- **odour** – e.g. from waterless urinals or WCs
- **noise** – e.g. from pumps in recycling systems
- **health risks** – e.g. bacteria (*legionella* and *E. coli*)
- **reliability** – e.g. whether the equipment will work and involves little maintenance
- **ease of use** – e.g. the extent to which users will need to acquire new knowledge and skills.

Public awareness and acceptance would be encouraged if **marketing 'resonates' with users**. For instance, there is no point in encouraging water efficiency by advertising cost savings in areas where few households have metered supplies. Although the water industry, government and the regulators agree that **metering can provide a price signal to encourage water efficiency**, the Water Industry Act 1999 restricts water companies' ability to meter their customers. However, from April 2000, customers have a right to opt for a free meter⁹. Ofwat has assumed (in its recent price settlement to 2005) that only 10% of unmetered customers may take up this option by 2005 to reduce their bills. This is despite the companies' own assessments that a greater proportion could readily be metered.

For unmetered supplies, one approach is appeal to consumers' willingness to avoid social, economic and environmental damage from excessive consumption (e.g. under the *Are You Doing Your Bit?* and *Going for Green* environmental campaigns). Another approach might be to encourage the provision of water 'services' (rather than water supplies¹⁰), where a utility is responsible for efficiency measures, and can capture the benefits.

Regulatory Issues

The government is proposing legislation to encourage water companies to increase the efficient use of water in their own undertakings. However, although there is emerging a body of good practice in domestic water efficiency, the Environment Agency considers that this message is still not being taken seriously enough by most water companies, especially with regard to planning future supplies in

the face of projected rising demand. One approach could be to increase the use of regulation to further encourage water efficiency. So far, this has concentrated on setting standards for maximum WC flush volumes (and the use of dual-flush and valve-type WCs). It also applies via the general duties on the regulators. There could be further **statutory limits on water consumption**. Some concerns have been raised regarding this, related to possible damage to markets for existing products; possible trade barriers within the EU single market; and whether this is necessary across the whole country (as only some areas are vulnerable to 'water stress').

To guide its own actions on water conservation, the Environment Agency has recently begun to develop its water resources strategy. It has sought views on a range of issues, including domestic consumption and water efficiency. In the context of this briefing, a key question arising is **whether there should be quantitative targets for water efficiency**. To set such targets more information about water consumption, and the local balance between supply and demand would be needed. A follow-on question is that of who should be responsible for setting such targets. The strategy is due to be published in December 2000.

The uptake of technologies to increase efficiency has been slow; particularly water recycling systems. One approach to encourage their wider use has been to install systems serving several dwellings (e.g. in new or refurbished flats or housing developments¹¹). An important issue in promoting water recycling is that consumers currently take for granted the safety of mains supply, and so for recycled water systems, they would need to have confidence that they present no risk to public health. An issue arises therefore over **whether there should be quality standards for the recycling of water**. DETR sees no need for this at present and hopes that the recent WRAS guidance provides the necessary confidence.

Overall, DETR considers that water companies should be responsible for encouraging water efficiency, and sees little scope for further regulation at present. However, this issue could be addressed in the forthcoming Water Bill.

Parliamentary Copyright 2000. Parliamentary Office of Science and Technology, 7 Millbank, London SW1P 3JA, tel: [020] 7219 2840. See also www.parliament.uk/post/home.htm

⁹ and to opt out again in the first year.

¹⁰ As in the energy market following deregulation. It is possible, therefore, following the proposal to introduce common carriage of water in pipelines shared between several suppliers, that such a market could develop in water services.

¹¹ This is more cost-effective than retrofitting existing dwellings. Most benefit may be gained where increased housing demand corresponds to water shortages – e.g. a recent housing development at Heybridge in Essex.