

# Water Performance of Buildings

## BACKGROUND PAPER – STAKEHOLDER CONSULTATION

European Commission, DG Environment  
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## Chapter 1: Problem Definition

### 1.1 Introduction

Water scarcity and droughts (WS&D) increasingly affect many regions of Europe<sup>1</sup>, with climate change and population growth predicted to still worsen the issue. In recognition of the acuteness of the WS&D issues in the European Union (EU), the European Commission (EC) adopted a Communication (2007) which provides a fundamental and well-developed first set of policy options for future action. This communication indicates that at least 20% of water is wasted due to inefficiency and estimates that in some regions, up to 30% of the volume of water consumed in buildings could be saved.

Water is used by all sectors of society and the economy (Figure 1), as well as by the environment. The energy sectors returns most of the abstracted water to a water body, while in other sectors it is not the case. The public water supply represents 21% of the total water use, and buildings account for the major use.

The EC is exploring the ways in which the EU can address WS&D with the Blueprint expected to be released end of 2012, as a milestone and contribution to the Resource Efficiency Roadmap.

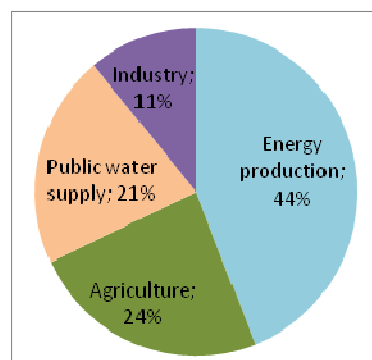


Figure 1: Water abstraction per sector in the EU (%)

All water using sectors will be addressed in the preparatory work. This document presents the identified preliminary impacts that would result from implementing selected policies in the building sector, with the aim to reduce pressure on water bodies.

The main objective of the initiative related to improving the water efficiency in buildings is to reduce the water abstracted for use in buildings, to promote water savings and stop the wastage as well as to improve synergies among the initiatives across the EU and to facilitate the comparability of the building's performance.

A public consultation is conducted to gather the opinion of the public, stakeholders and experts about the proposed policy options and the relevancy to implement water policies in the building sector.

- This document includes some specific questions on which the Commission is seeking Stakeholders' input. The replies should be sent to the email address below. Please note that you do not need to reply all questions.
- If you would like to raise any particular issues concerning water efficiency in buildings please describe it briefly and send it also to the following email address:

[ENV-BuildingsWE@ec.europa.eu](mailto:ENV-BuildingsWE@ec.europa.eu)

<sup>1</sup> EEA, 2009, Water resources across Europe — confronting water scarcity and drought

## 1.2 Water use in the building sector

The building sector includes the residential buildings and the non-residential buildings that are connected to the municipal water supply (Industrial and agricultural facilities are out of the scope of this study). More than 165 million buildings exist in the EU<sup>2</sup>, with more than 99% of the buildings (in number) being residential.

The building sector is a part of the construction sector. In 2008, the construction sector had around 3.3 million enterprises that together generated value added of EUR 604 400 million and employed 15.0 million persons<sup>3</sup>. It accounted for 9.1% of non-financial business economy value added in 2007<sup>4</sup>. The construction of buildings contributed around one third of the sector's value added and employment in the EU-27<sup>3</sup>.

With increasing population and urbanisation in the EU, and predicted impacts of climate change, increasing efficiency is key to reducing our pressure on ecosystems.

### Question group 1:

- **Knowing that the public water supply represents 21% of the total water use in the EU, and buildings account for the major use, do you consider that targeting buildings is an efficient means to reduce the pressure on water bodies? If not, please explain why not.**

### 1.2.1 Residential and non-residential buildings

Residential buildings include single-family house (53%), multi-family buildings (less than 8 floors, 37%) and high-rise buildings (9 floors and higher, 10%)<sup>5</sup>. The majority of water used in residential buildings is for: personal washing (showers and baths, accounting for about 35% of the use), toilet flushing (25%), washing clothes (14%), dish washing (8%), drinking and cooking (5%), room cleaning, garden irrigation and car wash (5%) and other uses (8%)<sup>6</sup>. The water use in residential buildings depends mainly on the number of people residing there. Current water use in the EU is around 160 L/person/day (see Figure 4) in residential buildings. However, reducing the residential use to about 140-150 L/person/day or lower is done in certain MS and could be extended across the EU.

<sup>2</sup> JRC, 2011, Development of European Ecolabel and Green public procurement criteria for Office Buildings, draft report

<sup>3</sup> Eurostat, Key figures on European Business, 2011 edition, available from:

[http://epp.eurostat.ec.europa.eu/cache/ITY\\_OFFPUB/KS-ET-11-001/EN/KS-ET-11-001-EN.PDF](http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-ET-11-001/EN/KS-ET-11-001-EN.PDF)

<sup>4</sup> Eurostat, Key figures on Europe, 2011 edition, available from

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<sup>5</sup> 2005 data, the percentages reflect the distribution of the residential building stock in the EU-25, Source: JRC, 2008, Environmental Improvement Potentials of Residential Buildings (IMPRO-building)

<sup>6</sup> JRC, Ecotapware, Task 2: Economic and market analysis and Task 3: User behaviour, 2011, First Interim Report, Draft.

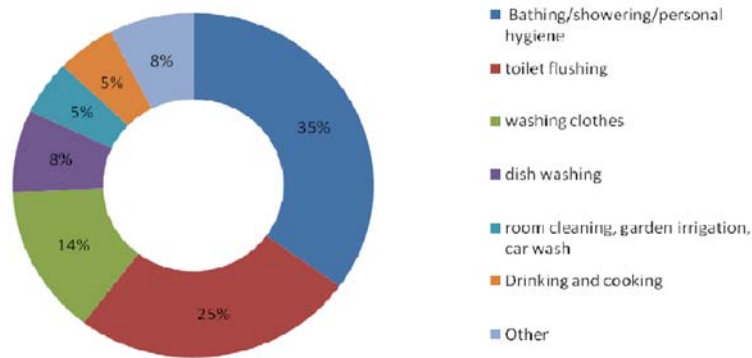


Figure 2 Residential water use in the EU

In the non-residential sector, different types of buildings will use different amounts of water. Most buildings (e.g. in the food and drink sector, retail, education, health and social work, recreation, culture and sport, public administration and defence, etc.) will mostly use water for WC and urinals (70- 95% of the use<sup>6</sup>). In hotels, however, the situation will be much more similar to the water use in the residential sector. The majority of the water used in the non-residential sector is used by office buildings. The water use in non-residential buildings depends mainly on the living surface area (number of square meters) of the building.

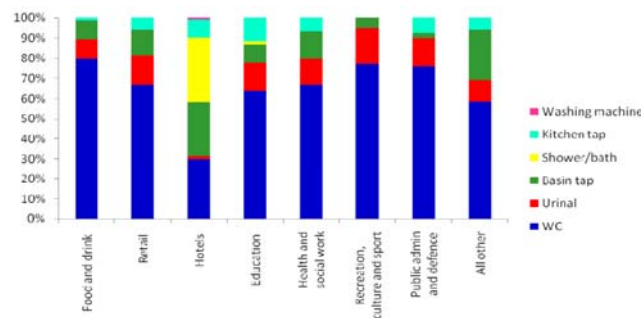


Figure 3: Non-residential water use per type of sector in the UK<sup>7</sup>

From existing EUREAU data<sup>8</sup>, residential water use is 73% of total water use in buildings, and 23% for non-residential buildings.

**Question group 2:**

- Do you consider that targeting only residential buildings or only non-residential buildings would bring better results?
- Do you thin that targeting buildings in general would be the best option?
- Do you have further data to specify the share of water used in residential vs. non-residential buildings?

<sup>7</sup> JRC (2010) Scoping document Identification of suitable water-using product groups for the development of EU Ecolabel and GPP criteria

<sup>8</sup> EUREAU Statistics Overview on Water and Wastewater in Europe 2008 (Edition 2009)

### 1.2.1 New, to be refurbished and existing buildings

For the purposes of this impact study buildings are categorised new, to be refurbished and existing buildings.

New buildings are considered those that are still in a planning stage when the study is carried out. Refurbished/to be renovated buildings is being used for buildings undergoing “major renovation” as defined in Directive 2010/31<sup>9</sup>. An assumption of 40-year lifetime of buildings is made, resulting in about 2.5% of building stock per year being considered new or to be renovated in the EU for the following calculations and population growth being used to take into account new buildings being built. Existing buildings are those that are standing and major changes are not planned at the time of the assessment.

Some of the modifications to be made in a building are best included at the design scale, thus it must be taken into account when planning or proposing modifications. When planning new buildings ensuring that the pipe system allows separating potable water, greywater and recycled water is relatively easy, while installing new pipes in an existing building may be technically impossible. Similarly for changing specific water-using products (WuP) such as toilets, the changes require relatively high efforts compared to changing a showerhead, or even a washing machine.

#### Question group 3:

**Would you suggest a different definition for the building categories for the purposes of EU wide measures?**

**Would you suggest different building categories than the ones identified? If yes, how would you define those?**

**Do you consider that targeting only existing buildings, only to be refurbished buildings or only new buildings or rather a combination of these would bring better results than measures for buildings in general?**

**Do you have further data to specify the assumptions of building lifetime/growth rate of the building sector finer than population growth?**

### 1.2.2 Initiatives regarding water in the building sector

Many initiatives are currently in place in the EU and beyond to improve the environmental performance of the building sector. Initiatives about green buildings include in the UK the BREEAM scheme, in Germany the DGNB, in France HQE, and beyond the EU, LEED (in USA and Canada) and Green Star (Australia).

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<sup>9</sup> Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the Energy Performance of Buildings (recast). Art .2 ‘major renovation’ means the renovation of a building where: (a) the total cost of the renovation relating to the building envelope or the technical building systems is higher than 25 % of the value of the building, excluding the value of the land upon which the building is situated; or (b) more than 25 % of the surface of the building envelope undergoes renovation;

Regulations are also in place in several MS and national Governments have announced public procurements to enhance their own buildings (in the non-residential sector a high share of the buildings are generally owned or used by the Governments). In this regard, the fact that a building is publicly or privately owned may influence the number of buildings that are being certified. Through a public procurement, a specified share of the buildings will be certified, while the private sector may also make procurements, but this will impact a lower number of buildings. Green buildings generally target a range of environmental sectors, including energy issues, but also water issues. In the energy sector, the EU has also implemented the Energy Performance of Buildings Directive (2002, recast in 2010).

The initiatives targeting buildings generally include a mixture of areas such as monitoring leakages more closely, installing high-performance water-using products, reusing or harvesting water, etc.

### 1.3 Challenges in water use in buildings

Water scarcity, droughts, floods and water quality problems affect most European river basins, and many are transboundary and cover the majority of the European territory. Even though the challenges related to water are mostly felt on the regional or even local level, similar problems occur in different regions throughout Europe and EU wide initiatives could create an opportunity for finding common solutions.

The issue of water management is both local and seasonal and links to water quality issues. Indeed, water is both less available and more used in the summer, and even more so in Southern Europe, both an area of low rainfalls and high tourism. Other EU areas are also water scarce due to low rainfalls and because the demand for water exceeds the supply (e.g. South-Eastern UK). Water quantity and quality are closely linked as more water used in buildings will result in more wastewater being released.

Additionally, most uses of water are related to energy use. Indeed, before arriving in the public supply system, water is pumped and purified. In the building, before being used, water is heated where relevant, and pumped to higher levels in buildings. Lastly, once it has been used wastewater is pumped and treated. Increasing only the water performance of a building is not sufficient to reduce these effects, the total amount of water used must be reduced (if a more efficient device is used for a longer time, the total water used is higher than a less efficient device used for less time), or the amount of times the water is used must be increased (as this will reduce the pumping step, usually requires less treatment, etc.).

Lastly, water is a resource that should not be wasted, both for “ethical” reasons, for ensuring that ecosystems continue functioning, and support human activities, and for economic reasons, as reductions in energy and other resources occur by reducing water uses (see previous paragraph). Inefficiently used water in buildings becomes lost, whether in the building itself through leaks (in that case it can even cause damages to the building), or by becoming wastewater.

From these considerations, the main aim of any policy targeting a better management of water quantities in the EU is to reduce pressure on water bodies, especially in water scarce areas and at specific times of the year (i.e. reducing peak consumption). However, reducing water use in

buildings will also contribute to reducing global energy and financial costs, through reducing the need for pumping, heating and treating water. Such knock-on effect will be relevant throughout the EU and targets all building types. In order to reach this goal two types of measures are available: reducing water use or reusing water.

Finally, targeting buildings means targeting all EU citizens, through their usage of water, and may result in savings in other areas at the same time, by raising awareness on the issue of water quantities and its tight links to other areas, improving sustainability in general.

#### Question group 4:

- Are the challenges appropriately formulated?
- Are key elements missing?

## 1.4 Options for reducing pressure on water bodies

While initiatives have been taken to increase the water performance of buildings (see section 1.2.2), progress in uptake of the measures is still low. This is linked to a low awareness of water quantity issues, with water considered an abundant good, and prices generally not reflecting its value. This leads to low attention given to water wastage, including through leaks, leaving taps open, or choosing inefficient WuP or buildings because of low awareness.

The first type of measures will address the reduction of the water use. In buildings, this will go through improving behaviours, improving the efficiency of WuP or improving the performance of buildings. Behaviours are important as several flushes of toilets or longer showers will have important impacts on the amounts of water used in buildings, including when efficient WuP are used.

The second type of measure will address the use alternative sources of water, including harvesting rainwater or recycling wastewater. This reduces potable water consumption, but requires that technically pipes are separated and that the water is used only for adapted uses, for instance for toilet flushing or gardening.

#### Question group 5:

- Do you think that other options should be envisaged in priority?

## 1.5 Parties affected

Building constructors are the first parties that will be affected by the implementation of policies, as they will have to innovate to increase water efficiency of the buildings, especially if minimum requirements are set through a legally-binding tool. However, in the case of voluntary public procurements by the government, de facto a constructor will have to provide buildings meeting the requirements to enter that market.

Another party that will be impacted is the manufacturing sector, for manufacturers of WuP. Similarly, innovations will be required to increase water efficiency, depending on the level of requirement.

Innovation however also allows entering new markets, and may provide jobs.

The owners of the buildings will be affected, as they may have to improve buildings when being refurbished, or when changing the WuP in the buildings. Tenants will also play a role in changing certain types of WuP. The distribution of costs between tenant and owners is important to take into account, as most investments will be made by the owner while the tenant will gain the benefits of reduced water bills. In the EU, about 50% of residential buildings in the EU are owner-occupied (40.3% in Germany to 71% in the UK<sup>10</sup>).

The population at large will improve behaviour and make more informed choices in terms of the water efficiency of the products and buildings it uses.

Lastly, auditors, verifiers and plumbers will benefit from such schemes, as verifications of compliance for labels or requirements will apply and plumbers will install of WuP or water harvesting/recycling systems.

### Question group 6:

- Do you think that other parties will also be affected and/or that other impacts will happen to certain parties?

## 1.6 Drivers of water use

An important driver of water use in buildings is the behaviour of the people using water in the building. As shown above, the main water uses are linked to toilets and personal hygiene (in all types of buildings), thus several flushes of toilets or longer showers will have important impacts on the amounts of water used in buildings. The use of efficient water devices plays a role in reducing this usage, for instance by choosing the volume of flushing water or by reducing the water flow in showers. Using alternative water sources such as non-potable water sources (rainwater or greywater) is another solution to reducing pressure on water bodies. The quality of such water must be in line with its use, for instance it can be used for toilet flushing or gardening. It is important to note, however, that installation of a water-saving device by itself will reduce the

<sup>10</sup> See [www.eracobuild.eu/fileadmin/documents/Final\\_Report\\_Erabuild\\_Susren\\_050208.pdf](http://www.eracobuild.eu/fileadmin/documents/Final_Report_Erabuild_Susren_050208.pdf)

water use to a certain extent and the consumer behaviour plays an important role in achieving its desired potential.

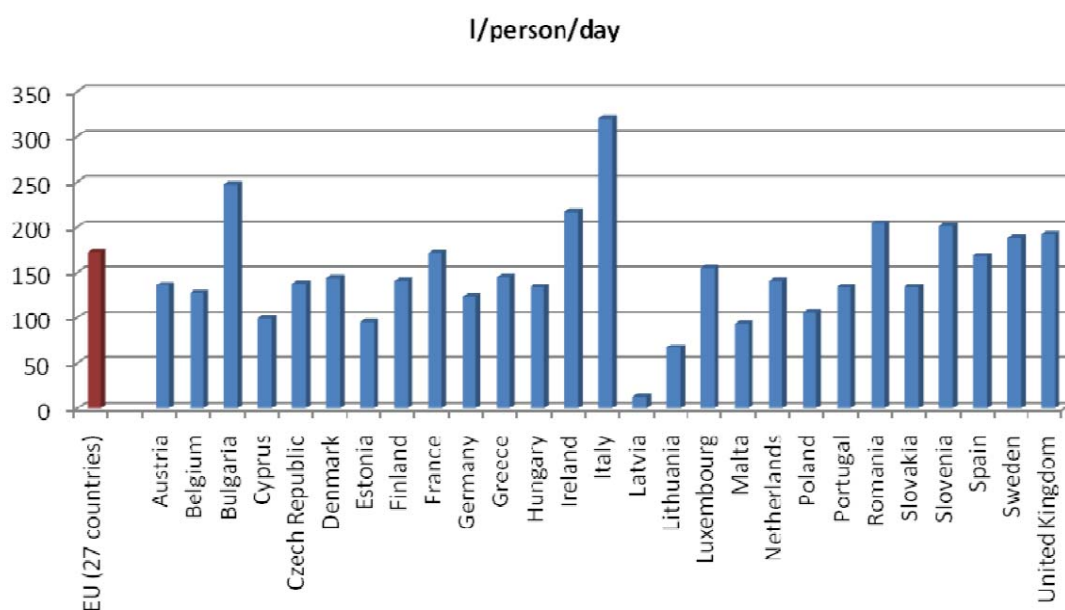
## 1.7 Presentation of current water uses and factors that could influence future uses

In order to gauge the scale of water savings that potential policy options might realise in each of the EU member states a model of water use was constructed. The starting point for the baseline scenario is the current patterns of water use in buildings across the EU 27<sup>11</sup>.

These consumption patterns include the effect the differing levels of water product efficiency and any cultural/behavioural differences that exist between countries. These current water use patterns also implicitly include the effect any water efficiency policies that are already in place.

Five countries, France, Italy, Germany, Spain and the UK account for 49% of total municipal water demand, but this is to be expected as 41% of the EU-27 population resides in these countries.

Figure 4<sup>12</sup>: Residential water use in the EU and MS



Having established current water consumption patterns the next step is to develop an understanding of how water use patterns are expected to change in the future compared to a baseline against which the impacts of a range of policy options can be determined.

<sup>11</sup> This information is provided in the JRC report "Identification of suitable water-using product groups for the development of EU Ecolabel and GPP criteria: Scoping Document, Aurélien Genty, Andreas Uihlein and Oliver Wolf, March 2010

<sup>12</sup> JRC, Ecotapware, Task 2: Economic and market analysis and Task 3: User behaviour, 2011, First Interim Report, Draft. The very low value for Latvia seems to be an outlier, which can probably be attributed to statistical inconsistencies.

The key factors that are likely to influence water use patterns in the future are:

- The number of building occupants<sup>13</sup> (linked to population projections)
- Changes in the demand for water services (e.g., an increase in the typical number of showers taken)
- Changes in the efficiency of water using products (including typical efficiency expectations in the future and typical lifetime of WuP)
- Behavioural changes in response to greater awareness/desire to make water savings (e.g., not leaving taps running, mending leaks, taking shorter showers)
- Spread of voluntary measures to “green” buildings
- Requirements implemented at national or EU levels

With a simple population growth expected, without any further changes, the current water use at EU level of 129 887 Mm<sup>3</sup> in 2010 is expected to rise to 159 620 Mm<sup>3</sup> in 2050. With a simple population growth expected, without any further changes, the current water use at EU level, 129 887 Mm<sup>3</sup> in 2010 is expected to rise to 159 620 Mm<sup>3</sup> in 2050. However, in order to provide a valid baseline against which to assess the effect of potential policy options other factors listed above should be taken into account.

It would be desirable to model changes in water demand patterns and in the behavioural changes relating to water efficiency. However, there is not sufficient information available to assess how these are likely to change in the future, and in any case, these factors are inherently difficult to predict. .

#### Question group 7:

- **Are there any particular issues that you recommend to be considered when developing the baseline scenario?**
- **Do you know other factors that need to be considered when assessing *future water demand* patterns in the public water uses and most particularly concerning buildings?**
- **Could you suggest other important factors that need to be considered when assessing *future public water supply* scenarios that are influencing buildings' water supply?**

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<sup>13</sup> For the domestic sector the typical number of occupants per household will also have a secondary impact as for some activities that are primarily communal e.g., cooking, water consumption per capita is likely to be higher were household size is lower.

## 1.8 Link to other EU actions and EU right to act

Recent studies show that competing demands for scarce water resources may lead to an estimated 40% global water supply shortage by 2030. Climate change is affecting all MS, and river basins will have to face reduced water availability in different parts of the EU, even if Southern MS are the most impacted already and will continue to be.

Therefore, to achieve water resources protection and sustainable water management, a more sustained effort is necessary by all decision-makers, users and stakeholders at all levels.

All sectors need to contribute to water saving efforts in the EU and as identified in the introduction; the option to explore a policy for improving the water performance and water use in buildings is in the framework of the Blueprint to be released end of 2012. The Water Framework Directive includes in its purposes the “[promotion of] sustainable water use based on a long-term protection of available water resources”. Daughter Directives are also important for the use of water in buildings, including the Drinking water Directive and the Wastewater Directive. The Resource Efficiency Roadmap<sup>14</sup> reaffirms the requirement of the WFD and includes milestones regarding water, including “good status – quality, quantity and use – of waters attained in all EU river basins in 2015”.

The EU policies listed show the involvement of the EU in water quantity issues and ways to deal with them at EU level, however there is no EU wide imitative as regards water efficiency in buildings. Several initiatives in certain MS have been identified that show that national actions are already in place (raising awareness, requiring efficient WuPs and as voluntary “green” building schemes) and taking increasing importance. However, for the moment, while moves towards a common building scheme are said to be occurring, no scheme seems to be achievable in the short term. Efforts to implement an eco-label for buildings also show difficulties for the moment.

Geographic patterns show, illustrating the impacts of WS&D mainly in Southern MS and specific river basins, in which actions are clearly required and may be implemented by local or national authorities alone. However, reduced water use will be beneficial in the whole EU, through the knock-on effect on energy and financial cost reductions and reduced pollution by reducing wastewater.

Water is a common resource, with many river basins being shared among several MS. Therefore water management is not a marginal issue; nor is it limited to a few Member States. The transboundary characteristics of water and the challenges that lie ahead require a holistic and integrated approach which can best be tackled on the European level. There are little incentives for some to become more water efficient (especially those upstream) if other MS do not pursue a similar objective. Additionally, while efforts and initiatives have been progressing about water quality thanks to the WFD, overall not sufficient progress has been achieved by the MS regarding water quantity management since the adoption of the WS&D policy. Initiatives at MS level are increasing, but are not harmonised and are fragmented across the EU.

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14 Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, COM(2011) 571 Final, Roadmap to a Resource Efficient Europe, 20 September 2011, available from [http://ec.europa.eu/environment/resource\\_efficiency/pdf/com2011\\_571.pdf](http://ec.europa.eu/environment/resource_efficiency/pdf/com2011_571.pdf)

Buildings are often regarded as a local matter, with buildings being stationary. However, seeing the importance of the construction sector in the internal EU market EU action would have added value compared to isolated efforts by each MS. In order to reduce obstacles in the internal market, EU action would be required so that technical requirements are harmonised, at building level, but also at product level. Manufacturers of WuP generally sell their products in more than one MS, and would benefit from similar technical requirements across the EU. Similarly, with a common scheme on water efficiency in buildings, constructors that work throughout the EU will only be required to implement one scheme. Also for small and medium sized companies working in the EU this may be beneficial as a new market will emerge with opportunities. A targeted EU action would thus foster new action and complement MS initiatives.

#### Question group 8:

- **According to you what would be the added value of putting in place an EU initiative on water efficiency in buildings?**
- **Binding or non-binding measures would help better in achieving the EU wide objectives? If you have any concrete recommendation, please describe.**
- **Should measures be differentiated among different regions (river basins) of Europe depending on the water scarcity situation?**

## Chapter 2: Description of the policy options

### 2.1 Identification and selection of the main policy options

Existing initiatives on the water performance of buildings in the EU-27 and beyond were screened in order to set a comprehensive mapping of potential schemes. This overview resulted in the identification of 24 potential policy options.

A preliminary assessment of those options was conducted, based on several criteria:

- Technical feasibility
- Potential for water savings
- EU applicability
- Potential risks
- Costs of investments

This enabled to filter out the options which showed less potential and better define 3 policy levels - Horizontal Policies, Product, and Building level policies - on which to focus the detailed impact assessment.

Regarding the Product and Building levels, different policy instruments are further investigated based on progressively stricter implementing measures: voluntary scheme, mandatory scheme and minimum requirements. The influence of accompanying those measures by information and education campaigns as well as financial incentives is also investigated. The good dissemination is also a key element to ensure the success of financial incentive schemes, thus the option looks at implementing financial measures as well as information campaigns. This first part describes the policy levels with their main advantages and issues, and the following part assesses the impacts of each policy level, per policy instrument.

### 2.2 Horizontal Policies (H)

#### 2.2.1 Water metering / smart-metering (H1)

Water metering in buildings provides information on the user of water in terms of how much water he/she consumes. The consumer is then likely to become more engaged in monitoring its water use, leading to more efficient water use, but also more active involvement in the identification of leaks. The metering of water consumption seems to be in place in many EU Member States and is reported to be also strongly linked to water pricing discussions that recently took place in AT, BG, BE, EE, ES, NL, SE and UK, or that are still under development (CY,

CZ, IE, RO and SK)<sup>15</sup>. In the UK, metering is already implemented in certain regions, and work is under way to meter water in more regions. Ireland will be implementing meters in the country in a near future.

One third of households in England and Wales pay by meter. Water company investment plans suggest this will rise to 50% by 2015. Under the current approach 80% of households in England and Wales will have a meter by 2030, as households choose to opt for a meter. Research shows that 57% of customers support metering as being the fairest basis to charge (to avoid that two identical homes pay the same whereas their occupancy rates differ) and 77% of customers would be happy to be charged for the water used as measured.

The implementation of smart water meters, which collect real-time water use information, is also shown to help customers address their water uses and help water businesses manage their network more efficiently, by detecting leakages efficiently.

Advantages	Raises consumer awareness Fair pricing, based on actual consumption and efforts by consumers
Issues	Costs of implementing meters in areas where they are not used Change in tariff scheme with metering

## 2.2.2 Water pricing and cost strategy (H2)

Water prices are often estimated to be too low compared to the actual value of water. The WFD requires to better price water to reflect its true costs (Art. 9: water-pricing policies provide adequate incentives for users to use water resources efficiently [...]). An option is to adapt water tariffs by raising the price of water (possibly including block tariffs to ensure access to water at a fair price for legitimate uses). This would provide a price signal to push consumers to reduce their water use and influence the return on investment for installing devices. Additionally, pricing policies could be based on other measures than the volume of water used. Utility companies generally are financed by their customers who pay on a volume basis. The need to change to an economic model where a service, advising on how to reduce water consumptions (including better monitoring and performance advice) is now recognised by many water utility companies, so that reduction in water uses benefits both the consumer and the water company. This aspect is currently further investigated in the UK with the "Combining Water and Energy Efficiency" project, in which the Energy Saving Trusts - a non-profit organisation jointly funded by the British Government and the private sector - offers water efficiency advice and customer engagement programmes via telephone calls, mail, organisation of events and home visits<sup>16</sup>.

Besides, financial incentives are a way to encourage the use of efficient WuP, the construction of green buildings, the setting-up of metering systems or water reuse/recycling schemes, etc. and in

<sup>15</sup> Third Follow-up Report to the Communication on water scarcity and droughts in the European Union, 2011 Report from the Commission to the European Parliament and the Council.

<sup>16</sup> Combining Water and energy Efficiency, 2011, Energy Saving Trust and Waterwise.

effect can be used as an accompanying measure for any of the policy options assessed. The aim is to provide a price signal to water users and reduce the return on investment time. They allow for flexibility, but provide less certainty about the uptake.

Advantages	<p>Provide price signals and influence the return on investment</p> <p>Financial incentives enable more flexibility in decision and may foster quicker uptake of water-efficient schemes.</p>
Issues	<p>Price elasticity of water is low, impacts on different social categories must be taken into account</p> <p>Moving to a new economic model entails challenges</p> <p>Negative rebound effects must be anticipated as much as possible.</p>

### 2.2.3 Awareness Raising and Education (H3)

Awareness-raising and education is very important for water use, as everyone uses water and the sum of these uses is a part of the pressure put on water resources. It may target a wide public, with people changing behaviours in all types of buildings (their home, office, factory, etc.) both in their own country and abroad. Awareness-raising and educational campaigns may be:

- sent through different channels: flyers sent to households, phone calls, signs in public bathrooms, web-based communication; through initial or occupational education, or public campaigns;
- to different types of public, with differing interests, motivations, and approaches to policy issues: general public, potential users, children, environmental groups, regulators and/or regulating agencies, home owners associations, educational institutions, political leaders, business/academic/community leaders, etc.
- highlighting different aspects: improving consumption habits and disseminating best practices, explaining the benefits of water-efficient products/retrofits or of water reuse/recycling, improving leak detection, inform about green building schemes, etc.
- be implemented by a wide range of stakeholders, including the State, local authorities, companies, etc.

The types of channels/messages need to be adapted to the types of buildings: tips on the water bill will be useful to reduce residential use, while in e.g. offices or shopping malls messages in the bathrooms to raise awareness on the quantity of water used for washing hands will be relevant.

The involvement of the private sector is for instance illustrated in the UK for energy savings. With the Green Deal, the Department of energy and climate change is now considering the possibility to involve big retailing companies in the “information market” because these companies are in direct contact with the consumers, have an enormous amount of data on consumer behaviour

and have the capacity to run massive campaigns to promote more environmentally-friendly behaviours. However, a question of independence remains for each of these companies.

Campaigns are already in place in many countries, and many school programmes include educational messages linked to water. These companies can also include the delivery of key messages by drinking water supply or wastewater authorities through phone calls and mailing, the inclusion of water tips in billing statements, provision of water saving curriculum materials for schools, etc<sup>17</sup>. In particular, in Australia, education was consistently named as the major influence for improving water conservation awareness<sup>18</sup>. Such campaigns in the long run seem to have a positive impact, but it takes time to change mentalities. Germany started water saving campaigns in school in the 80's and 90's and only nowadays a real impact can be seen.

Examples of messages sent through awareness-raising campaigns:

- Shortening shower time from 8 to 3 minutes can save about 63 % of water<sup>19</sup>.
- Turning off the tap while brushing your teeth in the morning and at bedtime can save up to 30 L of water per day, which equals about 900L a month.
- Detecting and fixing a leak could save up to 200 000 L/yr/household<sup>20</sup>, etc.

As a stand-alone measure, awareness-raising carries great potential for water savings. Yet, it is also a crucial tool to associate to the implementation of initiatives increasing water efficiency.

Advantages	<p>The issues of water-efficiency and water scarcity can benefit from EU scale campaigns.</p> <p>Many lessons from the energy efficiency sector can be adapted and campaigns on environmental awareness can target several areas, including but not limited to water use.</p>
Issues	<p>It is difficult to predict direct impacts of such measures, as it depends on uptake, level of participation, public targeted and messages delivered.</p> <p>Awareness-raising may take a long time before delivering results (e.g. school campaigns)</p>

## 2.2.4 Summary Table

The following table identifies which policy would be more relevant/feasible for different building types. The "+" identify options comparatively more relevant/feasible, with "+++" more relevant/feasible than "+". Policy options H1 and H3 seem more promising, especially when

17 [www.watergy.org/resources/tipsheets/municipal.php](http://www.watergy.org/resources/tipsheets/municipal.php)

18 [www.water.vic.gov.au/saving/home/watersmart/watersmart-program-executive-summary-south-east-water](http://www.water.vic.gov.au/saving/home/watersmart/watersmart-program-executive-summary-south-east-water)

19 [www.terrapass.com/blog/posts/get-out-of-the-shower](http://www.terrapass.com/blog/posts/get-out-of-the-shower)

20 [www.watergy.org/resources/tipsheets/home.php](http://www.watergy.org/resources/tipsheets/home.php)

targeted at new or to be renovated buildings. With regard to (H2), more coordination at water utilities and consumer organisations is needed in order to ensure an efficient and accepted water pricing strategy. Results of a water pricing policy will largely depend on the price setting chosen.

Horizontal Policies	Residential			Non-residential		
	Existing	To be renovated	New	Existing	To be renovated	New
H1 – Water Metering*	++	+++	+++	++	+++	+++
H2 – Water Pricing and Cost Strategy	+	+	+	+	+	+
H3 – Awareness Raising and Education*	++	+++	+++	++	+++	+++

\* Metering is slightly more easily done in to be renovated and new than in existing buildings, and awareness-raising may be even more important in those buildings because it was identified for energy that residents use more energy because they feel since it is more efficient they do not need to be as careful as in less efficient buildings.

#### Question group 9:

- What are the pros and cons of implementing the horizontal policies identified?
- Do you think that a combination of these policies would reach better results? If yes, which combinations would you recommend?
- Do you think that only certain buildings should be targeted by these policies? If so, which ones and why?

## 2.3 Product-level policies (P)

Water-using products (WuP) are products that use water to fulfil their intended basic function. WuP include toilets, urinals, showers, taps, washing machines, dishwashers and air conditioning. An increasing number of WuP present on the market offer improved water efficiency compared to conventional products, such as dual flush toilets, faucet aerators, water-saving showerheads or washing machines. For example, a water-efficient washing machine may use only one-third of

the water used by a conventional model. Likewise, a dual flush toilet can save 30<sup>21</sup> to 170<sup>22</sup> L/property per day<sup>23</sup>.

Fixtures attached to the building (e.g. toilets) may be differentiated from fixtures that may be changed by a resident (e.g. showerheads), as the difficulty for changing them, costs, and lifecycle impacts will be different. Additionally, whether the products use hot or cold water (and whether they heat the water) has impacts on their energy use and CO<sub>2</sub> emissions; and products which efficiency is mostly linked to water (e.g. a tap, showerhead, toilet), or to other criteria (e.g. for a washing machine its washing efficiency and energy use).

Additionally, whether the requirement applies to products placed on the market, fostering that the devices are bought when they need to be changed (end of their lifecycle) has different impacts than if the devices are required to be changed at a certain date in all buildings for instance.

### 2.3.1 Voluntary Labeling (P1)

Product labelling better informs the consumers of the water performance of a device and allows the comparison with models, fostering consumer's choice. An example of such voluntary labelling in the EU is the eco-label, for which work is under way for eco-labelling taps and showerheads. The uptake rates and penetration in the market of the products can be enhanced by voluntary labelling, but does not necessarily mean that the efficient products will be bought more. Two types of labelling schemes may be implemented, endorsement labelling, such as the eco-label, where the information given is whether or not the product meets the standard; or comparative labelling, which involves a scale, with products performing better/worse than others.

In Australia, the WELS Standard AS/NZS6400:2005 Water-efficient products rating and labelling<sup>24</sup> requires products to meet certain water efficiency standards to be labelled, with e.g. 25% of water savings generated for showers. Standards exist for tap equipment, flow controllers, toilets, etc. Another example, is the Energy star label in the USA, mainly implemented for energy saving purposes, but which considers a current Water factor for washing machines <7.5gal/cycle/ft<sup>3</sup>, to be reduced in 2011 to 6.55 gal/cycle/ft<sup>3</sup>.

Advantages	Information of the consumer Let the consumer choose according to its preferences and needs
Issues	Possibly only already performing products would use the label

<sup>21</sup> [www.waterwise.org.uk/images/site/Policy/evidence\\_base/evidence%20base%20for%20large-scale%20water%20efficiency%20in%20homes%20-%20phase%20ii%20interim%20report.pdf](http://www.waterwise.org.uk/images/site/Policy/evidence_base/evidence%20base%20for%20large-scale%20water%20efficiency%20in%20homes%20-%20phase%20ii%20interim%20report.pdf)

<sup>22</sup> [www.environment.gov.au/settlements/publications/government/pubs/water-efficiency-guide.pdf](http://www.environment.gov.au/settlements/publications/government/pubs/water-efficiency-guide.pdf)

<sup>23</sup> Note that the pressure in the water system may reduce the efficiency of the WuP, and could be an important parameter to include in the standards determining whether WuP are efficient.

<sup>24</sup> [www.waterrating.gov.au/products/index.html](http://www.waterrating.gov.au/products/index.html)

Uncertainty in the predicted water savings is high

### 2.3.2 Mandatory Labeling (P2)

A mandatory labelling could be envisaged so that full comparison is ensured in the market stock. For some of the energy-using products, mandatory labelling is already in place (ratings from A to F), and a similar label for water could be envisaged. In that case, all products would be labelled, while in the case of voluntary labelling only some products will be identified.

Advantages	All products labelled. Let the consumer choose according to its preferences and needs.
Issues	Costs linked to labelling Common scheme for labelling to implement Uncertainty in the predicted water savings is high

### 2.3.3 Minimum water efficiency requirements for water-using products (P3)

Water-efficiency requirements for different types of WuP could apply to products that will be placed on the market in the future, with the purpose of progressively removing the most inefficient products. The efficiency of WuPs is already considered in existing or developing standards and could be expanded in the EU to further categories of WuP. This would ensure that the least performing products are not available on the market at all. Examples of standards and future requirements that are being worked on are presented in Table 1 below.

**Table 1 - Overview of standardisation schemes**

Coverage	Framework	Requirements
EU	Ecodesign Directive (ongoing work by JRC)	Preparatory studies for potential requirements for certain categories of WuP (showerheads and taps).
	Implemented standardisation	Standards for sanitary tapware (not specifically targeting water efficiency): EN 1111, EN 1112, EN 1113, EN 200, EN 816, EN 817, EN 1286, EN 1287
USA	Energy Policy Act (Epack) 1992	Water-efficiency Standards for commercial and residential toilets, for residential bathroom faucets and showerheads.

	Energy Independence and Security Act of 2007	Standards for residential dishwashers <sup>25</sup> : <ul style="list-style-type: none"> <li>■ Standard models (around 60 to 75 cm-wide): WF ≤ 28.6L/cycle</li> <li>■ Compact models (around 45cm-wide): WF ≤ 19.8 L/cycle</li> </ul>
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Advantages	Future savings can be predicted Ecodesign Directive can be used to implement minimum performance requirements Progressive approach possible, targeting some WuP first, and requiring the changes only when needed
Issues	Need to consider the innovative potential left to the industry Higher costs for the end-users (such costs may in the longer-term be reduced due to innovations being spread), for manufacturers to innovate and to the administration to ensure full compliance.

### 2.3.4 Summary Table

Toilets and showerheads seem to be the WuPs to be addressed in priority, given their high shares in the residential (toilets + showerheads) and non-residential (toilets) water use patterns.

More generally, product level policies are expected to achieve better outcomes when accompanied by informative and financial measures and when more stringent regulation is adopted (from voluntary to mandatory labeling and then minimum requirements).

Product level policies		Taps		Showerheads		Toilets		Dishwashers		Washing Machines	
		Res.	Non-R.	Res.	Non-R.	Res	Non-R.	Res.	Non-R.	Res.	Non-R.
P1 Voluntary Labelling	P1	+	(+)	++	+	++	+++	+	(+)	+	(+)
	P1 + info c.	++	+	+++	++	+++	+++	+	+	+	+
	P1 + info c.	+++	++	+++	+++	+++	+++	++	++	++	++

<sup>25</sup> As of January 1, 2010  
 Standard models: WF ≤ 6.5 gallons/cycle  
 Compact models: WF ≤ 4.5 gallons/cycle

	+ fin. inc.										
P2 Mandatory Labelling	P2	++	+	+++	++	+++	+++	+	+	+	+
	P2 + info c.	++	+	+++	++	+++	+++	+	+	+	+
	P2 + info c. + fin. inc.	+++	++	+++	+++	+++	+++	++	++	++	++
P3 Minimum requirements	P3	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++
	P3 + info c.	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++
	P3 + info c. + fin. inc.	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++

Legend: Res = residential buildings, Non-R = non-residential buildings, info c. = information campaigns, fin. inc = financial incentives. The "+" identify options comparatively more relevant/feasible, with "+++" more relevant/feasible than "+", and in brackets (), when the WuP is not that relevant for the sector.

#### Question group 10:

- What are the pros and cons of implementing the product policies identified?
- Do you think that a combination of these policies would reach better results? If yes, which combinations would you recommend?
- Do you think that only certain buildings should be targeted by these policies? If so, which ones and why?

## 2.4 Building-level policies (B)

Similar to the options identified on minimum water requirements for WuP, this option introduces a minimum water performance requirement at the building level. This performance may be measured compared to the per capita use of the building (most relevant for residential buildings), per square meter (most relevant for non-residential buildings), or according to other indicators. Considering the building level allows a better understanding of the whole system's water use and may be more relevant to target those areas with most potential in a given building or geographic area. This scale leaves flexibility in the implementation of water efficient measures to comply with the requirement and foster synergies throughout the building.

The auditing of a building, without labelling scheme, already provides information that can be used as awareness-raising, by providing information on how much water is used. Rating then adds the information on whether the standard is met, or comparing buildings together (depending on the labelling scheme).

### 2.4.1 Voluntary water performance rating/auditing of buildings (B1)

Rating and auditing are tools that allow communicating about a performance against defined standards and comparing performances. The building owner can rate the building (self-rating), or a third party can conduct an audit of the way the building was rated, for objectivity purposes. Rating will provide a grade or notation to the building, while auditing will ensure that the data communicated by the building owner are exact.

The implementation of this policy option would provide a European rating or audit scheme, such as the eco-label being discussed, that would include a number of indicators or requirements that a building would have to fulfil, concerning water performance, but possibly also covering other environmental issues. The scheme could be mandatory (option B3) or voluntary (option B2, e.g. the eco-label). Many options are available for the indicators to be included in the scheme, including calculated or measured indicators, total water use, water use per square meter, number of water efficient devices, etc.

Many initiatives involving voluntary labelling are already in place at national level. Examples of existing schemes include HQE (France), BREEAM (UK), LEED (US), NABERS (Australia) and DGNB (Germany). Initiatives are in place to harmonise or investigate potential compatible links and could be further promoted to build a common European scheme<sup>26</sup>. Such scheme would bring a European added-value, by implementing the same basic improvement requirements throughout the EU. This scheme could build on the methodology and lessons learnt from well-established schemes, for example related to energy, of which scale and indicators could be adapted for water savings purposes. The indicators could be chosen at EU level, to harmonise the rating throughout the EU, with national scales (or river basin scales), which would depend on the building stock (new vs. old buildings, types of buildings) and water scarcity issues in the country.

The aim of rating/audit schemes is to primarily inform buyers or renters of the performance of buildings, so that they can choose more efficient buildings. A building owner would also have to take such schemes in consideration when renovating/refurbishing his buildings. For the buyer/renter, the information may be interesting as it might reduce their water and energy costs, or environmentally responsible buyers or renters may choose the building for its performances. For companies, renting or constructing labelled buildings is a way to show their environmental responsibility and enhance their image.

Rating or auditing alone will not lead to enhanced water performance as it only provides information on the current state of the building. This information then needs to be analysed to identify the areas in which improvements can be made and potential savings would then depend on the tenant or owner's willingness to integrate improvement options. With efficient information campaigns, the demand for buildings with a good WPB rating may lead to incentives to upgrade buildings. The rating/audit scheme would then need to be included in a continuous improvement process, informed by the rating/audit scheme in order to deliver improved water

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<sup>26</sup> Deutsche Bank Research, 2010, Green buildings A niche becomes mainstream

performances. The implementation of voluntary schemes can also be supported by green public procurements, leading to de facto minimum requirements to enter that market (see option B4).

Advantages	<p>A robust and transparent informative scheme can be set up and harmonised at EU scale.</p> <p>Such a policy option will foster awareness raising.</p>
Issues	<p>No commitment to actual improvement is ensured through only water rating. It is then difficult to measure its direct impacts in terms of water savings</p> <p>Voluntary schemes risk being only implemented by the already “best in class”</p> <p>Rating schemes are generally based on the potential of the building to deliver savings, without ensuring that this potential is reached (behaviour issue)</p>

## 2.4.2 Mandatory water performance rating/auditing of buildings (B2)

Instead of a voluntary scheme, a similar scheme could be implemented as a mandatory measure. This would follow the example of the energy performance rating of buildings<sup>27</sup>, from A to G<sup>28</sup> that is in place in France within the implementation of the Energy Performance of Building Directive (EPBD). Such scheme could be extended to integrate data on water consumption.

Advantages	<p>A robust and transparent informative scheme can be set up and harmonised at EU scale.</p> <p>All buildings are considered and rated</p> <p>Such a policy option will foster awareness raising.</p>
Issues	<p>No commitment to actual improvement is ensured through only water rating. It is then difficult to measure its direct impacts in terms of water savings</p> <p>Rating schemes are generally based on the potential of the building to deliver savings, without ensuring that this potential is reached (behaviour issue)</p>

<sup>27</sup> information communicated to all new buyers or renters

<sup>28</sup> For an A rating the building must consume <50 kWh/m<sup>3</sup>/year, for B, between 51 and 90, for C between 91 and 150, for D between 151 and 230, for E between 231 and 330, for F between 331 and 451 and G is above 451 kWh/m<sup>3</sup>/year.

### 2.4.3 Minimum water performance requirements of buildings (B3)

The aim of minimum performance requirements is to set a threshold below which it is considered that a building is not efficient “enough”. This policy would result in banning the worst water-performing buildings. It differs from the water rating/auditing approach which encourages water-efficient buildings to be certified and to set the example, with unknown uptake rates (a building owner/constructor can choose to enter the scheme or not, and then to use the data to improve or not). These minimum requirements are still flexible as they allow constructors or owners to choose higher standards that must apply. It thus improves water performance of buildings directly. A definition of the water performance of buildings, linked to number of occupants, square meters, or other factors would be required, and the setting of a target for minimum performance. This target could be adapted for different countries or river basins, depending on the local situations, according to a common system that rates each country/river basin.

In the case of green public procurement that requires a voluntary standard to be met (e.g. the French government decided to have 20% of its new buildings certified HQE), a de facto minimum requirement applies, as to enter the market of governmental buildings, certified buildings must be constructed.

Minimum requirements can be difficult to set, as a relevant threshold must be found. It requires a good knowledge of current performance and identification of a timeframe and improvement possibilities. They also in general apply more easily for new buildings than existing ones. While new buildings will add to the total water use of the area, implementing minimum requirements means that the new buildings will use less water than they would have if built with other standards.

Advantages	Minimum performance is ensured and directly results in less water used compared to the baseline scenario
Issues	<p>Difficulties to achieve a standard at EU level, differentiations depending on climatic zones could be suggested</p> <p>Monitoring the compliance of such policy option can lead to administrative burden</p> <p>Difficult to implement on existing buildings</p>

### 2.4.4 Certification scheme for water reuse and harvesting (B4)

Through water reuse and harvesting, non-potable water sources can substitute potable water for specific uses in buildings, where the lower water quality does not affect consumer’s health (e.g.

toilet flushing or gardening). Water reuse relates to collecting and reusing greywater<sup>29</sup>, i.e. wastewater generated from domestic activities such as laundry, dishwashing, and bathing. Water harvesting relates to rainwater that can be collected and stored from roofs, impermeable surfaces and tanks. While these options are interesting to use water more than once and reduce pressure on water bodies, the implementation of the scheme may lead to negative energy/treatment/CO<sub>2</sub> impacts. Water reuse and harvesting also encompass a number of environmental and sanitary risks that call for suitable controls from national health and environment authorities. Regulations are already in place in certain MS, more or less stringent (e.g. in France limited possibilities exist, while in Belgium it encourages further these systems).

Rainwater harvesting benefits must also be considered in terms of whether enough rain will be available in the country. The harvesting will also only use as much water as is stored, possibly not being best fitted to deal with peak demand. For both systems, the scale at which it should be implemented must be considered, as for isolated buildings a building-system may be useful, while in urban areas a community-system may be better fitted. Indeed, in the UK, the greywater yield of an average house (about 92 L/person/day) is far sufficient to meet its non-potable water demand of 52 L/person/day. On the contrary, with a greywater yield of about 4 L/employee/day, offices require conventional water supply to meet their non-potable water demand of 9.5L/employee/day). Thus systems that combine the yields of different types of buildings and redistribute them could be most relevant in urban areas.

Rainwater harvesting and greywater recycling are likely to be increasingly used in new buildings under construction, following their success in a growing number of commercial and residential development projects. For example, in Berlin, rainwater utilisation systems were successfully introduced as part of a large scale urban re-development, the DaimlerChrysler Potsdamer Platz<sup>30</sup>. Rainwater falling on the rooftops (32,000 m<sup>2</sup>) of 19 buildings is collected in a 3,500m<sup>3</sup> tank. In Tokyo, more than 750 private and public buildings have introduced rainwater collection and utilisation systems. Regarding greywater reuse, in Spain, some local authorities now require new buildings to have water reuse systems installed as part of a strategy to deal with water shortages<sup>31</sup>.

Voluntary schemes to implement water reuse/harvesting schemes would allow for a better implementation of the systems, reducing sanitary risks and ensuring from an architectural point of view that the system is adapted to the building and area. However, it would leave the door open to non-labelled systems, that may be less efficient. Mandatory labelling could ensure that the systems meet specifications that are defined by the label, therefore providing better information to the consumer. The option to implement minimum requirements seems however to be most interesting to ensure that sanitary risks and architectural issues are well taken into account and the systems deliver their full potential. In that case, only authorised systems could be put on the market, and possibly only be installed by certified plumbers.

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29 "Grey" water must be distinguished from "black" water, which contains human waste.

30 UNEP, Rainwater Harvesting And Utilisation: Environmentally Sound Approach for Sustainable Urban Water Management: An Introductory Guide for Decision-Makers. Newsletter and Technical Publication. Available at: [www.unep.or.jp/ietc/publications/urban/urbanenv-2/9.asp](http://www.unep.or.jp/ietc/publications/urban/urbanenv-2/9.asp) [Accessed on 01/09/2011]

31 Domènech, L. and Saurí, D. (2010). Socio-technical transitions in water scarcity contexts: Public acceptance of greywater reuse technologies in the Metropolitan Area of Barcelona. *Resources, Conservation and Recycling*. 55: 53-62. [ec.europa.eu/environment/integration/research/newsalert/pdf/218na4.pdf](http://ec.europa.eu/environment/integration/research/newsalert/pdf/218na4.pdf)

Advantages	<p>The use of lower water quality for non-potable uses offers some relief on water abstraction (alternative water sources are used). No or less drinking water is wasted</p> <p>Could be designed at an early stage for new construction plans</p>
Issues	<p>Such policy option needs to be accompanied by targeted campaigns on public perception and education as misuses and sanitary issues may appear</p> <p>Difficult to integrate such systems in existing buildings (technical issues)</p> <p>These systems require standards to be followed, for treatment issues, making sure that pipes are separated, etc</p>

### 2.4.5 Summary Table

Building Level		Residential buildings			Non-residential buildings		
		Existing	To be renovated	New	Existing	To be renovated	New
B <sub>1</sub> – Voluntary Rating	B <sub>1</sub>	(+)	+	+	+	++	++
	B <sub>1</sub> + info c.	+	++	++	+	+++	+++
	B <sub>1</sub> + info c. + fin. inc.	+	++	++	+	+++	+++
B <sub>2</sub> –Mandatory Rating	B <sub>2</sub>	+	++	++	++	+++	+++
	B <sub>2</sub> + info c.	+	++	++	++	+++	+++
	B <sub>2</sub> + info c. + fin. inc.	+	++	++	++	+++	+++
B <sub>3</sub> –Minimum	B <sub>3</sub>	-	+	++	-	+	++

Building Level		Residential buildings			Non-residential buildings		
		Existing	To be renovated	New	Existing	To be renovated	New
requirements	B3 + info c.	-	+	++	-	+	++
	B3 + info c. + fin. inc.	-	+	++	-	+	++
B4 - Certification scheme for water reuse and rainwater harvesting	B4	-	(+)	+	-	(+)	+
	B4 + info c.	-	(+)	+	-	(+)	+
	B4 + info c. + fin. inc.	-	(+)	+++	-	(+)	+++

Legend: Info c. = information campaigns, fin. inc = financial incentives. The "+" identify options comparatively more relevant/feasible, with "+++" more relevant/feasible than "+", (+) possibly relevant and "-" showing irrelevant options.

#### Question group 11:

- What are the pros and cons of implementing the building policies identified?
- Do you think that a combination of these policies would reach better results? If yes, which combinations would you recommend?
- Do you think that only certain buildings should be targeted by these policies? If so, which ones and why?

## Chapter 3: Impact assessment of selected policy options

### 3.1 Identification of main impacts

At this stage, the analysis focuses on the main impacts that are identified in the table below. Further impacts will be included in later stages of the impact assessment.

Environmental impacts	Economic impacts	Social impacts
Water use	Capital costs	Public behaviour and acceptance
Energy consumption and carbon emissions	Operation and Maintenance costs	Employment
Wastewater generation and supply issues	Administrative and Enforcement costs	Sanitary and health issues
	Potential side costs	
	Tenant / Owner distribution of costs	

#### Question group 12:

Are there any impact categories and impacts that you particularly recommend to be added to the list?

### 3.2 Environmental impacts

#### 3.2.1 Water use

All the policy options are aimed at saving water, and/or reducing the pressure on water bodies, but each of them will lead to lower or higher reductions in water uses.

- ▶ Horizontal Level Policy (H)
  - ▷ Water metering (H1)

In the UK, water metering is estimated to be able to achieve an average water saving of 10-15% per household (35-52 L/d assuming 147.8 per capita consumption and a 2.36 occupancy rate). This water saving could be further increased with the introduction of "smart" metering and structured

tariffs, for example rising block and seasonal tariffs<sup>32</sup>. The “Fairness on taps” coalition of organisations (2011) estimated average water savings of 25 L/cap/day with metering<sup>33</sup>. A study undertaken in Spain<sup>34</sup> shows that 10% of water savings can be gained with metering via a better localisation of water leakage in the building, leaving the possibility for the landlord as well as for the tenant to directly address the problem. 10% of the residential buildings water consumption in Spanish cities represents 9,760 hm<sup>3</sup>/year. These results seem to be consistent with what has been observed in Austin (Texas) where sub-metered apartments use 15.3% less water than multi-family buildings in 2008<sup>33</sup>.

The assumption is that 10% of water is saved at EU level, for about half of the MS (which do not yet have full implementation of water meters). This improvement in efficiency however occurs only once, once the metering has been put in place.

#### Question group 13:

- How do you consider metering in terms of its potential for water savings in buildings?
- Do you have additional information on the water saving potential directly related to water metering?
- Do you have a more specific view of the extent to which water metering is already implemented in the EU?

#### ▷ Water pricing and cost strategy (H2)

Uncontrolled water use may be explained by a general low valuation of water. Reduced water use could be achieved if water is to be better priced in some Member States. In the EU water tariffs range from 0.962 €/m<sup>3</sup> in Portugal to 5.24€/m<sup>3</sup> in Denmark<sup>35</sup>.

However, social constraints and differences in income levels make it difficult to compare costs, which cannot be influenced much by the EU.

The use of flat rates in buildings may lead to a lack of responsible consumption behaviours. Billing according to real consumptions (for hot water as well as cold water) would enable potential water savings as consumers would have an economic incentive to save water.

Depending on the prices of water, whether block tariffs are implemented etc. water could be saved, but it is unclear what amounts could be saved through that lever.

#### Question group 14:

- How do you consider pricing in terms of its potential for water savings in buildings?

<sup>32</sup> [www.environment-agency.gov.uk/research/library/publications/40731.aspx](http://www.environment-agency.gov.uk/research/library/publications/40731.aspx)

<sup>33</sup> *Fairness on Tap, 2011, Making the case for Metering.*

<sup>34</sup> Cobacho, R. Low flow device in Spain ? How efficient are they in fact ? An accurate way of calculation. Institute for Water Technology. Polytechnic University of Valencia. Spain

<sup>35</sup> JRC, Ecotapware, Task 2: Economic and market analysis and Task 3: User behaviour, 2011, First Interim Report, Draft.

- **Do you have additional information on the water saving potential related to water pricing and individual billing?**
- **Do you have a more specific view of the extent to which water pricing based on real consumption is already implemented in the EU?**

▶ Awareness Raising and Education (H3)

Behavioural issues may reduce the efficiency of most water saving policy measures. An exception is self-regulating washing machines which adapt the amount of water to the weight of clothes loaded into the machine (probably the only WuP which adapts to human behaviour). In most cases, a lower shower flow may be compensated by a longer shower. Likewise, people might feel the need for double flushing in low flush toilets and for cleaning them more frequently. Water efficiency measures would therefore benefit from being accompanied by a communication campaign.

Broad water efficiency campaigns at EU level could improve consumer behaviour, by ensuring that people use the double-flush system, reduce their time under the shower, etc. Overall, everyday life behaviours at the individual scale have great potential in saving water. In Denmark, a campaign targeting unnecessary consumption and habits alone was estimated to allow a reduction in water consumption by up to 15%<sup>36</sup>.

From the Australian experience, awareness-raising about household retrofit and audit services (including installation of water efficient appliances such as showerheads, flow regulators and toilet flush controls and minor leak repair) may contribute to greater household water savings when compared to water saving campaigns focused on buildings with minimal requirements (cutting household's water use to under 150 litres per person per day), and monthly water statements (a document sent to households each month to advise of their recent water consumption and water saving information)<sup>37</sup>.

It is assumed that 3% of water will be saved at EU level.

**Question group 15:**

- **How do you consider awareness-raising and information campaigns in terms of their potential for water savings in buildings?**
- **Do you have additional information on the water saving potential related to specific awareness campaigns?**
- **Do you know studies that further compare the benefits of awareness-raising between types of buildings, or types of campaigns?**

<sup>36</sup> [www.amsmiljo.dk/pdf/Vandbesparelser% 5B1% 5D.pdf](http://www.amsmiljo.dk/pdf/Vandbesparelser%205B1%205D.pdf)  
[www.amsmiljo.dk/om.html](http://www.amsmiljo.dk/om.html)

<sup>37</sup> [www.watergy.org/resources/tipsheets/home.php](http://www.watergy.org/resources/tipsheets/home.php) and [www.watergy.org/resources/tipsheets/municipal.php](http://www.watergy.org/resources/tipsheets/municipal.php)

► Product Level Policy (P) :

Several studies assessed water savings from the implementation of water efficiency options at the product level<sup>38,39,40,41</sup>. 65% of all indoor water use occurs through hygiene and flushing<sup>42</sup>. Bathrooms are therefore a major area for water savings. For example, in the UK, a 6 L/min showerhead to replace a 16 L/min existing showerhead, together with a 4.5 L toilet to replace an old 9 L one, could result in annual savings of 67 m<sup>3</sup> water for a household with a standard occupancy of 2.4 (persons)<sup>43</sup>.

Table 2 summarises key figures for water savings from the literature review.

Table 2 – Potential water savings at product level

WuP	Water savings
Low flush toilets	Use of 3 to 4.5 <sup>44</sup> L/flush instead of 11 to 12; Water saving of 30 <sup>47</sup> to 170 <sup>44</sup> L/property per day  In Australia, 22% of water savings from efficient toilets and urinal compared to conventional ones (in the WELS context) <sup>45</sup> .
Water-saving showerhead	Use of 6 <sup>38</sup> to 7 <sup>43</sup> L/min instead of about 25 (6L/min instead of 16 in the UK <sup>46</sup> ) Water saving of 25.2 L/property/per day <sup>47</sup> Water saving of 8% <sup>39</sup> compared to total household water consumption.
AAA rated dishwasher	Water saving of 5 000L/yr <sup>38</sup> Water saving of 0.2% <sup>39</sup> compared to total household water consumption
AAA rated front-loading washing	Water saving of 90L compared to conventional top loaders, i.e. about 16 000L per family per yr <sup>38</sup> . Water saving from 0.9% <sup>38</sup> compared to total household water

<sup>38</sup> [www.watergy.org/resources/tipsheets/home.php](http://www.watergy.org/resources/tipsheets/home.php) and [www.watergy.org/resources/tipsheets/municipal.php](http://www.watergy.org/resources/tipsheets/municipal.php)

<sup>39</sup> [www.melbourne.vic.gov.au/Environment/SavingWater/Documents/water\\_turning\\_blue.pdf](http://www.melbourne.vic.gov.au/Environment/SavingWater/Documents/water_turning_blue.pdf)

<sup>40</sup> Defra, *Science Report -- Greenhouse gas emissions of water supply and demand management options*

<sup>41</sup> *Results from water efficiency projects in the evidence base Phase II report*

<sup>42</sup> [www.bolius.dk/alt-om/vand/artikel/reducer-din-vandregning/](http://www.bolius.dk/alt-om/vand/artikel/reducer-din-vandregning/)

<sup>43</sup> UK Environment Agency, *Quantifying the energy and carbon effects of water saving – Summary report.*

<sup>44</sup> [www.environment.gov.au/settlements/publications/government/pubs/water-efficiency-guide.pdf](http://www.environment.gov.au/settlements/publications/government/pubs/water-efficiency-guide.pdf)

<sup>45</sup> [www.waterrating.gov.au/products/index.html](http://www.waterrating.gov.au/products/index.html)

<sup>46</sup> UK Environment Agency, *Quantifying the energy and carbon effects of water saving – Summary report.*

<sup>47</sup> [www.waterwise.org.uk/images/site/Policy/evidence\\_base/evidence%20base%20for%20large-scale%20water%20efficiency%20in%20homes%20-%20phase%20ii%20interim%20report.pdf](http://www.waterwise.org.uk/images/site/Policy/evidence_base/evidence%20base%20for%20large-scale%20water%20efficiency%20in%20homes%20-%20phase%20ii%20interim%20report.pdf)

machine	consumption. By 2021 in Australia, 34% of water savings from efficient washing machines compared to conventional ones (in the WELS context) <sup>42</sup>
Faucet aerator	Water savings between 12 and 65L/day at home; reduced flow up to 50% in municipalities <sup>48</sup> Water saving of 7 to 11.6% <sup>49</sup> compared to total household water consumption.

### ◆ Influence of the type of buildings

Potential water savings depend on the type of buildings considered. As regards non-residential buildings, in the USA, water savings are shown to be greater for offices and schools than for restaurants (about 40% greater), and much lower for laundries, hospitals and healthcare facilities (for each, about 6% of the water savings from both offices and schools), since offices, schools and restaurants are high water users<sup>50</sup>. Residential buildings are likely to integrate more WuP, as showers or washing machines are less often found in non-residential buildings (apart from hotels).

Additionally, from the figures given in the introduction, 70 to 95% of the use of water in the non-residential sector is for WC and urinals, thus the changing of such products would result in a high percentage of water savings relative to that type of building. Based on the increased efficiency of toilets: from 11-12 L to 3-4.5L flush (50% improvement), and 80% of water used by toilets, **savings of about 40% are taken as assumption for non-residential buildings.**

In residential buildings, as the highest use results from toilets and showerheads (about 25 and 35% resp.) an increased efficiency in those two types of WuP is considered (same 50% for toilets and 30% improvement for showers). In that case, **savings of about 25% are taken as an assumption.**

Evidently, the introduction of efficient toilets and urinals in new buildings is the easiest to target. In buildings being refurbished, the toilets and urinals can also be changed, with a few more efforts, and in existing buildings, such toilets and urinals can also be introduced, but with quite some work and costs involved, including in terms of resources and energy, to produce the new toilets/urinals and get rid of the old ones. In sum, implementing WuP would reduce the share of water used mostly in non-residential buildings, especially offices and schools, with an easier implementation for new than for existing buildings, and would also include benefits for the residential buildings, where many WuPs can be found, again with an easier implementation for new than for existing buildings.

<sup>48</sup> [www.watergy.org/resources/tipsheets/home.php](http://www.watergy.org/resources/tipsheets/home.php)

<sup>49</sup> Defra, Science Report – Greenhouse gas emissions of water supply and demand management options

<sup>50</sup> EPA, WaterSense program. Available at: [www.epa.gov/WaterSense/about\\_us/what\\_is\\_ws.html](http://www.epa.gov/WaterSense/about_us/what_is_ws.html) [Accessed on 01/09/2011]

In the UK uptake rates between 6% and 22% in general housing<sup>51</sup>, in a programme involving awareness-raising. Hypotheses within this rate are used for the calculations made below.

#### Question group 16:

- Do you consider the potential for water saving in buildings of WuPs significant?
- Do you have views on which WuPs should be targeted in priority to save water? For which reasons?

#### ▷ Voluntary Labelling (P1)

Efficient WuP already exist on the market, and options targeting them can thus be relatively easily implemented. The implementation of a voluntary labelling scheme, such as an eco-label is expected to accelerate the market penetration of these products, by providing supplementary information.

The assumption is a 10% uptake in existing buildings and 20% uptake in new buildings.

#### Question group 17:

- Do you have additional information on the water saving potential related to voluntary labelling of WuPs (i.e. the uptake rate and/or actual savings, beyond the theoretical savings)?
- Do you have a more specific view of the extent to which water-efficient products are already implemented in the EU?

#### *Influence of information campaigns/awareness-raising schemes*

Such campaigns are likely to have a high impact on the uptake rate, as customers who are not aware of the scheme will not be incentivised to buy more efficient products. This is particularly important for voluntary labelling schemes, as not all products will be labelled. This will however depend on the level of choice the customers have: tenants will be less able to change toilets than showerheads and employees will have low impacts on the WuP installed in their offices.

The assumption is a 15% uptake in existing buildings and 35% uptake in new buildings.

#### Question group 18:

- Do you have additional information on the water saving potential related to the well-disseminated implementation of WuPs labels?

<sup>51</sup>[www.waterwise.org.uk/images/site/Policy/evidence\\_base/evidence%20base%20for%20large-scale%20water%20efficiency%20in%20homes%20-%20phase%20ii%20interim%20report.pdf](http://www.waterwise.org.uk/images/site/Policy/evidence_base/evidence%20base%20for%20large-scale%20water%20efficiency%20in%20homes%20-%20phase%20ii%20interim%20report.pdf)

### *Influence of financial incentives added to the information campaign*

Authorities may choose to directly invest in replacement schemes to ensure rapid uptake of water-efficient technologies. In 1985, the city of New York began an ambitious plan to improve water performance in the city. The city offered landlords 290 million dollars worth of grants (currently equivalent to 200 million Euros) as an incentive to update plumbing systems with low-flow toilets, showerheads and faucets. Between 1994 and 1997, the city of New York replaced 1.3 million inefficient toilets saving an estimated 265 to 303 million L/d. In some of the participating buildings, water use has decreased by up to 37%. Complementary financial incentive programmes are still anticipated in New York to help achieve a reduction in consumption by approximately 60 million gallons per day (around 227 000 m<sup>3</sup>/d) over the next 20 years<sup>52</sup>.

This example shows that even without explicit labelling scheme, incentivizing the use of WuP can lead to water savings. In combination with a voluntary labelling scheme that helps customers identify the products that are most efficient, the uptake for the measure is estimate to be even higher than with no accompanying measure or only awareness-raising measures.

The assumption is a 20% uptake in existing buildings and 50% uptake in new buildings.

#### **Question group 19:**

- **Do you have additional information on the water saving potential related to the financial incentives promoting WuP labels?**

#### ▶ Mandatory Labelling (P2)

It is unclear to what extent mandatory labelling will further lead to water savings, compared to voluntary labelling because the information provided is similar.

However, as all products would be labelled, the influence of information campaigns would be reduced, through the fact that customers will more easily identify a label on all products than on a few products only.

The results in terms of water savings is thus expected to be very similar for P2 as a stand-alone measure (and results of adding an information campaign would not lead to big differences) to P1 with information campaigns. It is expected to be slightly higher due to the incentive provided to companies to green their image, thereby proposing more efficient products. Similarly, the addition of financial incentives will increase the uptake by a similar rate than for P1.

Hypothesis are:

- a 15% uptake in existing buildings and 35% uptake in new buildings for P2 (stand-alone) as for P1 with info.
- a 18% uptake in existing buildings and 45% uptake in new buildings for P2 with info (slightly higher uptakes rates than P1 with info).

<sup>52</sup> Alliance Environmental LLC, *Experience and Future Prospect*

- a 22% uptake in existing buildings and 50% uptake in new buildings for P2 with financial incentives (slightly higher uptake rates than P1 with financial incentives)

#### Question group 20:

- **Do you have additional information on the water saving potential related to the implementation of mandatory WuPs labels ?**

#### ▷ Minimum Requirements (P3)

The implementation of minimum requirements will speed up the market penetration of WuP, by banning the most inefficient products, increasing their uptake rate. The speed of the market penetration will depend on the timing at which the minimum requirements are introduced. However, uptake rates are expected to be higher than for P1 and P2.

It is assumed a 15% uptake in existing buildings and 100% uptake in new buildings.

While less efficient products would be banned, awareness-raising campaigns and financial incentive schemes would still allow to increase the water saved, by letting customers choose products that are even more efficient than those minimum rates.

The water saved through these accompanying measures was not calculated, as it depends on the WuP efficiency, but would be higher than in the case of P3 as a stand-alone measure.

#### Question group 21:

- **Do you have additional information on the water saving potential related to the implementation of minimum water performance requirements for WuPs?**
- **Do you have additional information on the water saving potential related to information campaigns in the case of minimum requirements for WuPs?**
- **Do you have additional information on the water saving potential related to financial incentives in the case of minimum requirements for WuPs?**

Product Level Policies			Residential building : 25% savings			Non-residential building: 40% savings			Total Water Savings (%)*
			New	TBR	Existing	New	TBR	Existing	
P1 – Voluntary Labelling	P1	Building Uptake (%)	20	20	10	20	20	10	3
		Savings (%)	5	5	2.5	8	8	4	
	P1 + info c.	Building Uptake (%)	35	35	15	35	35	15	4.5
		Savings (%)	8.75	8.75	3.75	14	14	6	
	P1 + info c. + fin. inc.	Building Uptake (%)	50	50	20	50	50	20	6
		Savings (%)	12.5	12.5	5	20	20	8	
P2 – Mandatory Labelling	P2	Building Uptake (%)	35	35	15	35	35	15	4.5
		Savings (%)	8.75	8.75	3.75	14	14	6	
	P2 + info c.	Building Uptake (%)	45	45	18	45	45	18	5.4
		Savings (%)	11.25	11.25	4.5	18	18	7.2	
	P2 + info c. + fin. inc.	Building Uptake (%)	50	50	22	50	50	22	6.6
		Savings (%)	12.5	12.5	5.5	20	20	8.8	
P3 - Minimum requirements	P3	Building Uptake (%)	100	100	15	100	100	15	5
		Savings (%)	25	25	3.75	40	40	6	
	P3 + info c.	Building Uptake (%)	100	100	>15	100	100	>15	>5
		Savings (%)	25	25	>3.75	40	40	>6	
	P3 + info c. + fin. inc.	Building Uptake (%)	100	100	>15	100	100	>15	>5
		Savings (%)	25	25	>3.75	40	40	>6	

(\*) calculated as [share of residential buildings (=0.73)\*(share of existing buildings (=0.975)\* related savings + share of new buildings (0.025)\* related savings) + share of non-residential buildings (=0.27)\*(share of existing buildings (=0.975)\* related savings +share of new buildings (0.025)\* related savings)] Legend: TBR = to be renovated

- ▶ Building Level Policy(B) :
  - ▷ Voluntary rating/auditing for WPB (B1)

Water is addressed in several national green building (voluntary) certification programmes and while it may account for only a small part of the overall assessment, there are points or credits to be earned by targeting water use reduction and increasing water efficiency.

Within the HQE programme in France, the reduction of water use can vary from 5 to 45%. By 2010, 535 buildings or operations (part of a building) have been certified<sup>53</sup>. Since 2008, the State aims to have 20% of its new constructions certified HQE or HPE<sup>54</sup>.

The Pacific Northwest National Laboratory (PNNL) researchers estimated that water savings from the widespread use of green building schemes in the USA could offset the annual water use of more than 500 000 people (0.16% of the US population) by 2015, and 1.9 million people (0.6% of the US population) by 2030 (assuming an average use of 33 600 gal/cap/yr - around 127 m<sup>3</sup>/cap/yr).

The WaterSense Commercial and Institutional Certification Programme in the USA foresee a potential 40% reduction in water use in the USA, with<sup>55</sup>:

- Office buildings: 43 338,240 gal/yr<sup>56</sup> (around 164 000 m<sup>3</sup>/yr)
- Schools: 37 798 766 gal/yr (around 143 000 m<sup>3</sup>/yr)
- Restaurants: 15 640 869 gal/yr (around 59 000 m<sup>3</sup>/yr)
- Laundries: 4 887 771 gal/yr (around 18 500 m<sup>3</sup>/yr)
- Healthcare facilities: 4 887 771 gal/yr (around 18 500 m<sup>3</sup>/yr)
- Hospitals: 3 258 514 gal/yr (around 12 000 m<sup>3</sup>/yr)

Likewise, the NABERS scheme in Australia has been shown to save around 220,000 m<sup>3</sup> of water per year for a 1 star-certified non-residential building (e.g. retail centres, hospitals and schools)<sup>57</sup>.

The number of certifications in the UK from the BREEAM programme evolved from about 500 certifications in 2004 to about 3 000 certification in 2009 for commercial buildings<sup>58</sup>. BREEAM has also rated more than 100 000 residential buildings in total<sup>58</sup>. Based on these numbers, an assumption is made that each year 500 commercial buildings and 15 000 residential buildings are rated in the UK. Extrapolated to the EU-27, that would represent a 1% uptake per year in commercial buildings, and a 0.05 %uptake per year in residential buildings.

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<sup>53</sup> Certivea webpage, [www.certivea.fr/ressource/data/presse/Communiqu-de-Presses-Janvier-20\\_45.pdf](http://www.certivea.fr/ressource/data/presse/Communiqu-de-Presses-Janvier-20_45.pdf)

<sup>54</sup> High Energetic Performance, label from the Code of Construction and Housing that inspired the HQE

<sup>55</sup> Building Design + Construction, 2009, Green Buildings + Water Performance

<sup>56</sup> 1 US gallon is equivalent to around 3.79

<sup>57</sup> Clark, M. (2008) Conference and NABERS Overview. BENCHMARK Conference, 8 May 2008, Sydney, Australia. Available at: [www.abgr.com.au/page.aspx?cid=638&site=1](http://www.abgr.com.au/page.aspx?cid=638&site=1) [Accessed online 28/03/2011]

<sup>58</sup> Deutsche Bank Research, 2010, Green buildings A niche becomes mainstream

In case a European voluntary scheme, such as an eco-label, is implemented, the numbers could be raised to a 2% uptake in commercial buildings and 0.2% uptake in residential buildings, as for the moment schemes exist only in the UK, Germany and France and even considering that the German scheme is currently spreading in Benelux and Eastern countries.

Based on the HQE numbers of 5-45% water saved, an estimate of 25% is taken as assumption. The water savings would thus be 0.5% for all non-residential buildings and 0.05% for residential buildings.

#### *Influence of information campaigns*

Again, for voluntary labelling the influence of information campaigns is very important, so that people are aware of what the label means. For residential buildings it may influence the choices of tenants, and for commercial buildings, in the case of companies that wish to show their environmental responsibility, the label must be known to ensure that their image is indeed recognised as green. Additionally, the information campaign may build trust about the scheme.

The assumption is that the water savings would thus increase to reach 1% for all non-residential buildings and 0.1% for residential buildings.

As a different type of initiative, in the UK, water savings of 11 L/d per household were observed after the distribution of self-auditing packs. This saving is just over 3% of total household water use. Whether this level of water saving can be sustained in the future is unknown<sup>59</sup>. Such auditing packs are between a voluntary rating initiative and an awareness-raising initiative, but could be useful in improving water performances of buildings. Similarly, providing information on the potential water use of a building, based on the products and systems installed and an average consumption rate, compared with the real consumption of the building could make people aware of their water use and result in further water savings, through avoiding negative rebound effects of consumption compared to the theoretical performance of the building.

#### *Influence of financial incentives*

Similarly, by using financial incentives the use of voluntary labelling and thus the reduction in water used will be increased by financial incentives, such as tax abatement for companies that construct or lease green buildings, etc.

It is assumed that the water savings would be 1.5% for all non-residential buildings and 0.15% for residential buildings compared to the baseline.

#### **Question group 22:**

- **Do you have additional information on the water saving potential related to the implementation of voluntary building certification schemes?**
- **Do you have a more specific view of the extent to which such schemes are already implemented in the EU?**
- **Do you have further information on the potential uptake of such schemes in the EU, depending on the types of buildings?**

<sup>59</sup> UK Environment Agency, *Quantifying the energy and carbon effects of water saving – Summary report*.

▷ Mandatory rating/auditing for WPB (B2)

Instead of a voluntary rating, a mandatory rating could be implemented, as in the case of the EPBD. As in the case of products, the move to a mandatory rating is expected to increase the awareness of the public more easily than for voluntary labelling. However, as seen in the case of the EPBD, information campaigns may be required to ensure that the public understands the meaning of the scheme. Additionally, negative publicity has decreased public trust in the scheme, resulting in reduced benefits from the scheme than expected.

The results in terms of water savings is thus expected to be very similar than for B2 (25% for residential and non-residential buildings) but the uptake rates of improved buildings will be increased.

While the labelling is mandatory, it does not mean that all buildings will improve their water efficiency (those that do not will only be rated with low grades). Hypotheses are:

- 2% uptake for improvement in existing buildings and 5% uptake for improvement in new buildings for B2 (stand-alone).
- 4% uptake for improvement in existing buildings and 10% uptake for improvement in new buildings for B2 with info.
- 8% uptake for improvement in existing buildings and 20% uptake for improvement in new buildings for B2 with financial incentives.

**Question group 23:**

- **Do you have additional information on the water saving potential related to the implementation of mandatory building certification schemes?**
- **Do you have a more specific view of the extent to which such schemes are already implemented in the EU?**
- **Do you have further information on the potential uptake of such schemes in the EU, depending on the types of buildings?**

▷ Minimum Requirements for WPB (B3)

Minimum requirements would be implemented for new and to be renovated buildings, targeting only a small part of the buildings in the EU, but reducing the water used compared to constructing buildings that are lower performers. In addition, while the improvement may seem low since it targets a low number of buildings, it will increase in time with more buildings being built or refurbished, bringing higher benefits in the longer-term.

In that case the assumption is an uptake of 100% by new and to be renovated buildings of the potential water saved for residential and non-residential buildings. However, as the minimum requirements would have to be set at a reasonable threshold, in order to not strongly affect the current stock, 10% water savings are foreseen for all buildings.

**Question group 24:**

- **Do you have additional information on the water saving potential related to the implementation of minimum requirements for building certification schemes?**
- **Do you have a more specific view of the extent to which such schemes are already implemented in the EU?**

▷ Certification scheme for rainwater harvesting and greywater recycling (B4)

Water reuse and rainwater harvesting do not reduce the amount of water used every day by households. Yet, they carry significant potentials for reduced pressure on ecosystems by reducing the abstraction of freshwater from surface and groundwater sources (i.e. freshwaters). Rainwater harvesting could save 20 to 50% of the total potable water use in a standard home, whereas greywater recycling could save 5 to 35%, as seen in the UK experience<sup>60</sup>. The environmental benefits and drawbacks of rainwater harvesting and greywater recycling highly depend on the type of building considered (e.g. existing vs. new building, demand share for non-potable water); its location (low, medium or high rainfall zone), and the system installed (e.g. direct feed<sup>61</sup> vs. header tank<sup>62</sup> for rainwater harvesting; or e.g. small and large membrane-bioreactors, short-retention systems, small biological systems vs. multimedia filters for greywater reuse).

The potential greywater yield highly varies between average households, hotels, schools or offices and is not always adapted to the daily water demand of these buildings<sup>63</sup>. For instance, in the UK, the greywater yield of an average house (about 92 L/person/day) is more than sufficient to meet its non-potable water demand of 52 L/person/day. On the contrary, with a greywater yield of about 4 L/employee/day, offices require conventional water supply to meet their non-potable water demand of 9.5L/employee/day). Thus, the water saved in each type of building will be different. In the USA<sup>64</sup>, up to 95% of water could be reused in offices and about 75% in schools, commercial centres and stadiums. In comparison only up to 50% water reuse was observed in residential areas. Water savings from rainwater harvesting and greywater recycling are particularly interesting in areas at risk of water shortages but also present a number of other environmental benefits (such as for irrigation purposes in Cyprus).

So, as assumption, 20% reduction in residential buildings and 40% in non-residential buildings will be considered (if connected to a general supply, greywater can be mostly used for toilets which account for 80% of use).

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<sup>60</sup> Defra, Science Report - Greenhouse gas emissions of water supply and demand management options

<sup>61</sup> In a direct feed system, 100 per cent of the water for the non-potable end uses connected to the rainwater system is pumped from the rainwater tank.

<sup>62</sup> In a header tank system, only 20 – 40 per cent of non-potable demands met by harvested rainwater are pumped and the rest is supplied without additional energy use and carbon emissions above those for mains supply.

<sup>63</sup> Defra, Energy and carbon implications of rainwater harvesting and greywater recycling

<sup>64</sup> Edward A. Clerico, Alliance Environmental LLC. Experience and Future Prospect

[www.AllianceEnvironmentalLLC.com](http://www.AllianceEnvironmentalLLC.com)

The systems are expected to be introduced voluntarily in buildings, with the help of a voluntary, or mandatory labelling, or minimum requirements for putting the systems on the market and/or installing them. The uptake is expected to be slightly higher when implemented with minimum requirements than with mandatory or voluntary labelling, mainly because of the trust that would build from implementation of the systems, through which people would be more likely to implement the systems. Additionally, the systems are much more likely to be implemented in new buildings, as the technical difficulties to change the pipes in an existing building to implement the system would be quite complicated, and even more so if a community-scale system is implemented.

The assumption taken is thus to have a 2% uptake of such systems in existing buildings and a 20% uptake in new buildings.

These hypotheses lead to 0.8% water saved in existing non-residential buildings, 0.4% in existing residential buildings, 8% in new non-residential buildings, and 4% in new residential buildings. That would represent around 800 Mm<sup>3</sup> of savings per year at EU level. With slightly higher rates when going from voluntary labelling to minimum requirements and when adding awareness-raising campaigns and financial incentives, more savings could be foreseen, although it is difficult to directly measure their impacts.

**Question group 25:**

- **Do you have additional information on the potential for uptake of greywater harvesting and water reuse (at EU level or in certain countries)?**
- **Do you have additional information on the water saving potential related to greywater harvesting and water reuse?**

### 3.2.2 Summary table

Building Level Policies			Residential building : 25% savings			Non-residential building: 40% savings			Total Water Savings (%)*
			New	TBR	Existing	New	TBR	Existing	
B1 – Voluntary Rating/auditing	B1	Building Uptake (%)	0.2	0.2	0.2	2	2	2	0.17
		Savings (%)	0.05	0.05	0.05	0.5	0.5	0.5	
	B1 + info c.	Building Uptake (%)	0.4	0.4	0.4	4	4	4	0.34
		Savings (%)	0.1	0.1	0.1	1	1	1	
	B1 + info c. + fin. inc.	Building Uptake (%)	0.6	0.6	0.6	6	6	6	0.51
		Savings (%)	0.15	0.15	0.15	1.5	1.5	1.5	
B2 – Mandatory Rating/auditing	B2	Building Uptake (%)	5	5	2	5	5	2	0.52
		Savings (%)	1.25	1.25	0.5	1.25	1.25	0.5	
	B2 + info c.	Building Uptake (%)	10	10	4	10	10	4	1.04
		Savings (%)	2.5	2.5	1	2.5	2.5	1	
	B2 + info c. + fin. inc.	Building Uptake (%)	20	20	8	20	20	8	2.08
		Savings (%)	5	5	2	5	5	2	

Building Level Policies			Residential building : 25% savings			Non-residential building: 40% savings			Total Water Savings (%)*
			New	TBR	Existing	New	TBR	Existing	
B3 - Minimum requirements	B3	Building Uptake (%)	100	100	5	100	100	10	1.5
		Savings (%)	10	10	1.25	10	10	2.5	
	B3 + info c.	Building Uptake (%)	100	100	5	100	100	10	1.5
		Savings (%)	10	10	1.25	10	10	2.5	
	B3 + info c. + fin. inc.	Building Uptake (%)	100	100	5	100	100	10	1.5
		Savings (%)	10	10	1.25	10	10	2.5	
B4 - Rainwater Harvesting and Reuse	B4	Building Uptake (%)	20	20	2	20	20	2	0.62
		Savings (%)	4	4	0.4	8	8	0.8	

(\*) calculated as [share of residential buildings (=0.73)\*(share of existing buildings (=0.975)\* related savings + share of new buildings (0.025)\* related savings) + share of non-residential buildings (=0.27)\*(share of existing buildings (=0.975)\* related savings +share of new buildings (0.025)\* related savings)]

### 3.2.3 Energy consumption and carbon emissions

Energy is embedded in the water used in buildings, through the energy required to pump the water from a water body, pump it until the required floor of the building, and (where relevant) heating the water; but also for treatment after use.

According to the Waterwise programme<sup>65</sup>:

- 0.747 tCO<sub>2</sub>eq is saved per ML of water saved (when distinction between hot or cold)
- 8 tCO<sub>2</sub>eq are saved per ML of hot water saved
- 44,000 kWh of energy is saved per ML of hot water saved

In households (i.e. residential buildings), 90-96%<sup>66,67</sup> of GHG emissions from water use actually come from water heating. Heating water is also considered as a strong energy consumer in the USA (with 15%-30% of the household energy demand)<sup>68</sup>. Thus, water- efficient retrofit devices that save hot water (e.g. tap aerators, low flow shower heads) can save more CO<sub>2</sub> than cold water retrofits (such as dual flush WC retrofits)<sup>66</sup>. Yet, in the UK, the current framework for reducing water use in new homes (principally the Code for Sustainable Homes) considers hot and cold water uses to be equivalent.

CO<sub>2</sub> emissions can considerably vary depending on the heating system used (gas, oil, electric system, LPG, solid energy source have different CO<sub>2</sub> factors<sup>69</sup>). Thus, the total GHG emissions associated with the end uses of water was found to be around 2 100kg CO<sub>2</sub>eq per household per year for a continuous energisation gas storage hot water service compared to around 7,100 kg CO<sub>2</sub>eq per household per year for an off-peak energisation electric storage hot water service. More attention is generally set on the energy savings that can be achieved through reduced water consumption. The United Nations Framework Convention on Climate Change (UNFCCC) is currently working on a methodology targeting demand-side energy efficiency activities for installation of water saving devices from a Clean Development Mechanism (CDM, i.e. one of the Kyoto mechanisms) perspective.

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<sup>65</sup> [www.waterwise.org.uk](http://www.waterwise.org.uk)

<sup>66</sup> UK Environment Agency, *Quantifying the energy and carbon effects of water saving – Summary report*.

<sup>67</sup> D J M Flower, V G Mitchell, G P Codner? *Urban Water Systems: Drivers of Climate Change?* <sup>1</sup>Institute for Sustainable Water Resources & eWater CRC, Department of Civil Engineering, Monash University, Victoria; Available at: [www.hidro.ufcg.edu.br/twiki/pub/ChuvaNet/13thInternationalConferenceonRainwaterCatchmentSystems/Flower.pdf](http://www.hidro.ufcg.edu.br/twiki/pub/ChuvaNet/13thInternationalConferenceonRainwaterCatchmentSystems/Flower.pdf)

<sup>68</sup> Around 4% of the US electricity production is actually dedicated to the supply, transport, heating and treatment of water and wastewater (it reaches 19% for California only).

<sup>69</sup> Defra (2008), "Greenhouse gas (GHG) conversion factors for company reporting". Available at: [www.defra.gov.uk/environment/business/envrp/conversion-factors.htm](http://www.defra.gov.uk/environment/business/envrp/conversion-factors.htm), accessed 13/11/08

▶ Horizontal Level Policy(H)

▷ Water metering (H1)

Moving to full water metering across England and Wales could potentially reduce annual emissions by 1.1 to 1.6 million tCO<sub>2</sub>eq/yr from current levels<sup>70</sup>. Moreover, achieving full household water metering could deliver a significant emission reduction, equivalent to 27-40% of the Carbon Reduction Commitment (CRC) target. Indeed, the Government's CRC is a new emissions trading scheme covering large organisations in the public and private sectors including water companies and it aims to deliver emissions reductions of 4 million tCO<sub>2</sub>eq/yr by 2020. The CRC targets business and public sector organisations which are significant energy users but do not currently participate in other emission trading schemes or climate change agreements.

As it is expected that the use phase of water meters will be predominant in their Life-cycle Assessment, carbon emissions related to the manufacturing of such devices and their installation are to be considered neglected compared to the savings induced by the reduction of water use.

▷ Water pricing and cost strategy (H2)

Changing the water prices and cost strategy will lead to energy savings and emission reductions directly linked to the amounts of water saved, and especially of hot water saved.

▷ Awareness Raising and Education (H3)

Raising awareness will lead to energy savings and emission reductions directly linked to the amounts of water saved, and especially of hot water saved.

**Question group 26:**

- Do you any data that would support/contradict the assumption made in H1?
- Do you have any data to qualify further H2 and H3?

▶ Product Level Policy (P)

In addition to the reduction in GHG emissions due to water savings, the manufacture, installation and operation of water efficient products generally present decreasing **average incremental carbon costs (AICC)** compared to conventional products, except for the installation of new white goods in existing homes. The Waterwise programme concludes to a range of between 0.031 and 0.187 kgCO<sub>2</sub>eq/property/day of carbon emissions saving as a result of the water efficiency retrofitting projects (considering a UK carbon factor). The main difference in carbon cost between these options can be attributed to product manufacturing, which involves high emissions.

In new residential (luxurious) buildings, the observed trend to install fancy showering systems with higher flow rates may actually lead to more hot water use. As most of the GHG emissions come from water heating, and despite the potential use of water-efficient devices such as dual

<sup>70</sup> Defra – *The Greenhouse Gas Implications of Future Water Resources Options*

flush toilets, the CO<sub>2</sub> emissions from water use in new luxurious houses are not significantly lower than in existing houses.

The following table summarises average incremental carbon costs resulting from the setting of different WuP, based on a Defra study<sup>71</sup>.

Water-efficient products	Existing homes	New homes
Toilets	Decrease of AICC by 7% for displacement devices (e.g. cistern) and 1% for low flush toilets <sup>72</sup>	Reductions of AICC of 8% <sup>73</sup>
Shower, bath and taps	Decrease of AICC by 1-7% in existing home (because of carbon footprint included as one-off retrofit cost). Increase of AICC for bath due to high one-off retrofit cost for replacement.	Decrease of AICC by 2-12%. Lower emissions also due to less hot water use in the home.
White goods (dishwashers, washing machines)	Increase of AICC by 30% mainly due to one-off retrofit cost and manufacturing cost (this does not take into account the full energy efficiency gains offered by new machines).	Decrease of AICC by 3%

For example, in the UK, a 6 L/min showerhead to replace a 16 L/min existing showerhead, together with a 4.5 L toilet to replace an old 9 L one, could result in annual savings of 67 m<sup>3</sup> water, i.e. 371 kg CO<sub>2</sub> for a household with a standard occupancy of 2.4 (persons)<sup>74</sup>. In Spain, the average urban household is an apartment of 95 m<sup>2</sup> area, with 3 occupants. The average water consumption of that household is about 330 L/household/d. Based on preliminary assumptions from the Technical University of Valencia (i.e. 10% reduction in the consumption for faucets and showers), annual water savings of 7.2 m<sup>3</sup> for that household (6% reduction in water volume) could be foreseen, including 2.4 m<sup>3</sup> for hot water. Assuming that water is pumped to a 5th floor-flat from a private open reservoir (and not directly from the network pipes), the pumping energy saved per year due to those water savings is around 0.3 kWh whereas thermal energy savings are assessed to 125 kWh, each year. Therefore, mechanical energy (i.e. for transport) that is saved due to water-saving actions is significantly lower than the thermal energy (i.e. for heating)<sup>75</sup>; and

<sup>71</sup> Defra, Science Report -- Greenhouse gas emissions of water supply and demand management options

<sup>72</sup> The carbon cost of low flush toilet is relatively high due to embedded carbon costs in manufacture. Net emission are however still negative

<sup>73</sup> The carbon footprint ignores the "sunk" carbon costs because the devices are installed in every home not for water efficiency purposes

<sup>74</sup> UK Environment Agency, Quantifying the energy and carbon effects of water saving – Summary report.

<sup>75</sup> Communication with Technical University of Valencia

special attention to heating and cooling systems is recommended for any potential WPB policy development.

Whatever the type of policy instrument used to implement the product level policies, i.e. Voluntary Labelling (P<sub>1</sub>), Mandatory Labelling (P<sub>2</sub>), or Minimum Requirements (P<sub>3</sub>), the energy and emission savings will be linked to the water saved, and especially the hot water saved. According to the assumption of introducing efficient toilets in non-residential buildings and both toilets and showerheads in residential buildings, the energy and carbon costs of non-residential buildings would be higher, because of the manufacturing and implementation of new toilets, with few reductions in carbon costs as it is cold water; while in residential buildings the savings from the shower would better balance the costs.

Accompanying these policy instruments by awareness-raising and financial incentives are expected to introduce the devices more rapidly, and could focus on the energy-water nexus, highlighting synergies and fostering global approaches, in order to increase behavioural changes that will bring both higher water and higher energy savings. Additionally, awareness-raising could couple energy and water savings, through changing behaviours, but information campaigns promoting efficient products and financial incentives would increase the change of devices, increasing the carbon costs (depending on when the devices are changed, i.e. carbon is saved if the device was going to be changed in any case).

As it is expected that the use phase of water-using products will be predominant in their Life-Cycle Assessment, carbon emissions related to the manufacturing of such devices and their installation are to be considered neglected compared to the savings induced by the reduction of water use.

#### Question group 27:

##### ■ Do you have any data that would support/contradict this assumption?

#### ► Building Level Policy

##### ▷ Building level WPB approach (B<sub>1</sub>, B<sub>2</sub> and B<sub>3</sub>)

Adopting a building-level WPB approach (whether through voluntary rating/auditing (B<sub>2</sub>), mandatory rating/auditing (B<sub>3</sub>), or minimum requirements (B<sub>4</sub>)) would enable to ensure side energy savings and make potential synergies with energy performance schemes. In 2008, a General Services Administration survey revealed that the LEED-certified office buildings performed 29% better on energy use than the national and regional averages from a Commercial Buildings Energy consumption Survey<sup>76</sup>. Minimum requirements would gain energy and carbon by the water savings, but also would require modifications in existing buildings that would result in energy and carbon costs; for new buildings a few more carbon costs could be incurred, but are expected to be counterbalanced during the lifecycle of the building.

<sup>76</sup> *Building Design + Construction, 2009, Green Buildings + Water Performance*

The energy and carbon saved would be linked both to the water saved and the need to introduce new products and systems. Thus, carbon would be saved in new buildings, and possibly in to be renovated buildings, while the carbon costs would be higher in existing buildings.

Awareness-raising on building approaches could enhance the reduction in energy and carbon costs, by leading to an increased knowledge of e.g. what the theoretical potential of the building is vs. its real consumption.

#### Question group 28:

##### ■ Do you have any data that would support/contradict this assumption?

#### ▷ Certification Scheme for Rainwater harvesting and greywater recycling (B4)

An integrated approach is needed in order to determine the potential environmental benefits and drawbacks of rainwater harvesting and greywater recycling. These include:

	Greywater reuse	Rainwater harvesting
Benefits	in specific cases (such as in new buildings or during major refurbishment, and in combination with other water-efficiency initiatives), reduction of CO <sub>2</sub> production or a lower carbon footprint as a result of less energy consumption	reduction of CO <sub>2</sub> production or a lower carbon footprint as a result of less energy consumption
Drawbacks	Increased energy consumption and GHG emissions to manufacture, install, operate (e.g. pumping, treatment) and ensure maintenance of the system (incl. additional treatment):	
	Increase of average incremental carbon cost by 20 to 40% based on 30% savings <sup>77</sup> Footprints for the installation of small greywater systems, applicable to the average home, range from 0.5 -2.8 tonnes of CO <sub>2</sub> <sup>78</sup> . Other sources mention: - 1.0 to 3 <sup>79</sup> kWh/m <sup>3</sup> to produce clean water from wastewater	Increase of average incremental carbon cost by 30 to 60% based on 20% savings <sup>77</sup> Footprints for the installation of the larger systems applicable to non-domestic and multi-residential buildings range from 13 to 47 tonnes of CO <sub>2</sub> <sup>78</sup> . In the UK, operational energy use for rainwater harvesting systems ranges between 0.6 and 5 kWh/m <sup>3</sup> <sup>80</sup>

<sup>77</sup> Defra, Science Report - Greenhouse gas emissions of water supply and demand management options

<sup>78</sup> Defra, Energy and carbon implications of rainwater harvesting and greywater recycling

<sup>79</sup> German greywater standard (FBR 2005)

<sup>80</sup> Defra, Science Report - Greenhouse gas emissions of water supply and demand management options

	Greywater reuse	Rainwater harvesting
	compared to 0.48 kWh/m <sup>3</sup> from groundwater and 0.62 to 0.87 kWh/m <sup>3</sup> from wastewater treatment <sup>78</sup>	

Specific systems are more applicable to residential buildings than to offices, such as the low level treatment systems for greywater reuse (e.g. short retention systems). Likewise, different biological and bio-mechanical systems apply to single residential dwellings, commercial buildings or multi-use buildings. These systems have different operational energy and carbon intensities<sup>62</sup>. For greywater reuse, the latter range from 0.6 kWh/m<sup>3</sup> for short-retention to 3.5 kWh/m<sup>3</sup> for small membrane bioreactors. For rainwater harvesting, the latter range from 1.0 kWh/m<sup>3</sup> for direct feed to 1.5 kWh/m<sup>3</sup> for header tank.

Both the retrofitting of household rainwater harvesting and greywater recycling results in increased GHG emissions in existing homes, whereas their installation in new homes, alongside with other water efficiency measures, shows net carbon benefits<sup>81</sup>. Likewise, community-scale systems are shown to be more carbon-efficient than individual households. The impact of greywater use on energy consumption depends of several factors, including embodied factors (e.g. water tank, component replacement and maintenance) and operational factors (the energy intensity of current water supply, wastewater treatment)<sup>82,83</sup>. In this context, greywater reuse presents higher carbon costs than rainwater harvesting, up to one third higher (0.6 kWh per day for a standard home)<sup>81</sup>.

In sum, carbon is saved if such systems are implemented in new buildings, and possibly in to be renovated buildings, while the carbon costs increase in existing buildings, whether residential or not. Greywater reuse presents higher carbon costs than rainwater harvesting.

#### Question group 29:

- Do you have any data that would support/contradict this assumption?

### 3.2.4 Wastewater generation and supply issues

The information presented below is relevant for all policies targeting reduction of water use:

- ▶ Impact on sewer flow

<sup>81</sup> Defra, *Science Report - Greenhouse gas emissions of water supply and demand management options*

<sup>82</sup> Pacific Institute (2010), *Overview of greywater reuse: the potential of greywater systems to aid sustainable water management*. November 2010. Available at: [www.pacinst.org/reports/greywater\\_overview/greywater\\_overview.pdf](http://www.pacinst.org/reports/greywater_overview/greywater_overview.pdf) [Accessed on 01/09/2011]

<sup>83</sup> Defra, *Energy and carbon implications of rainwater harvesting and greywater recycling*

Reducing water used in buildings could adversely affect the sewer collection systems and may cause blockages or other operational problems and potentially lead to property flooding. As the most relevant wastewater discharges to drain/sewer come from the toilets, solid movement would be significantly reduced with the lower flush volume that is promoted in water-efficient schemes. It is also likely that the problem will be most apparent in drains taking very little flow, such as those serving either a single property or a few single occupancy properties<sup>84</sup>. If the solids fail to be removed by subsequent flushes, there is a risk of sewer blockage. However, some technical solutions exist, where effluents are collected at the building exit and are only released in the wastewater network when the collected amount would ensure a sufficient flow. Besides, the volume of wastewater that reaches the treatment plants, if less water is discharged, may be lower than the design volume of the plant. In that case, the plant would then operate inefficiently. Indirect effects also include increased sewer retention times with a greater tendency for anaerobic conditions to develop during periods of low flow. That could cause odour problems<sup>85</sup>.

However, with new buildings to be constructed, the water amounts could still be sufficient, and as stated above technical solutions exist. In new urban areas, the problem would not occur.

► Effect on treatment process performance

Reductions in per capita potable water demand could result in a change in the average wastewater content that is received at treatment plants, with increased biological oxygen demand (BOD), Suspended Solids (SS) and ammonia levels. Indeed, due to lower flow, more concentrating effects would be observed in the effluent to be treated. Such changes might have an effect on the performance of treatment processes.

► Supply

Networks designed for lower demands of drinking water may not be capable of fully responding to peak consumption period<sup>86,87</sup>. As this would only apply to newly designed systems, the impact is expected to be low.

### 3.2.5 Other environmental impacts

In the case of greywater reuse and rainwater harvesting, other environmental benefits include reductions in main water demand and volumes, reduced rainwater run-off, and increased 'resilience' to water shortages from on-site collection and storage<sup>83</sup>. The environmental impact assessment of these systems is therefore complex and must be site-specific.

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<sup>84</sup> *publications.environment-agency.gov.uk/PDF/SCHO0208BNQU-E-E.pdf*

<sup>85</sup> *Less water to waste: Impact of reductions in water demand on wastewater collection and treatment systems, 2008, Environment Agency.*

<sup>86</sup> Kay Chambers, John Creasey and Leith Forbes (2004), 3 - Design and operation of distribution networks. 2004 World Health Organization. Safe Piped Water: Managing Microbial Water Quality in Piped Distribution Systems. Edited by Richard Ainsworth. ISBN: 1 84339 039 6. Published by IWA Publishing, London, UK.].

<sup>87</sup> EUREAU (2011), Working Group Microbiological Quality, Eureau-Commission Position Paper on water re-use and other alternative resources at home: rainwater harvesting and greywater recycling for domestic purposes. July 2011

**Question group 30:**

- Are there major environmental impacts that should be added? Which ones?
- Do you have data that would further quantify the wastewater/supply issue or other environmental impacts?

## 3.3 Economic impacts

In addition to these environmental benefits, the large scale implementation of the policy options can result in costs, but also financial advantages by reducing the water and energy bills.

**Question group 31:**

- Are there major economic impacts that should be added? Which ones?
- Do you have data to further quantify the economic impacts presented below?

### 3.3.1 Capital costs

- ▶ Horizontal Level Policy (H)
  - ▷ Water metering (H1)

In 1985, the city of New York began an ambitious plan to install water meters in every residential building. The city paid for most of the costs of installing water meters ranging from \$400 to more than \$40,000 per building depending on its size (around 280 to 2,800€). By the end of September 2000, more than half a million meters had been installed.

In the UK, a strategy to install meters systematically, rather than one-by-one, has the potential to reduce installation costs by up to 50% (saving £1.5 billion) via economies of scale.

The capital costs of metering will be borne by the owners of buildings.

With the assumption that about half of the MS must introduce meters, around 15 billion euros are foreseen based on the information in the UK.

- ▷ Water pricing and cost strategy (H2)

No specific capital costs are expected.

- ▷ Awareness Raising and Education (H3)

Implementing awareness-raising and education campaigns has a cost, which depends on the public targeted, messages sent, etc. The campaigns are expected to result in lower costs for customers that reduce their water use through changed behaviours.

The costs will be borne by the government or other entity paying for the campaign.

► Product Level Policy (P)

The changing of products results in costs both for buying the device and for installing it (e.g. by a plumber). Building owners will pay for the installation of fixed fixtures (taps, toilets), while users may change other types of devices (showerheads, washing machines, dishwashers) and bear those capital costs.

An Australian study stated that the most frequently mentioned barrier to install efficient appliances in households was financial<sup>88</sup>. According to an economic newspaper from Germany<sup>89</sup>, the replacement of existing showerheads, toilets and faucets with more water-efficient ones to achieve 30% water reduction would cost 400€ per flat owner, i.e. more than 10 billion Euros for the whole of Germany. Water savings and costs of implementation will vary greatly depending on the level of use, the specific water savings measures, the plumbing arrangements and the architectural finishes, etc. The Waterwise programme shows a wide variation in the cost of retrofitting per property, which ranges from 46€ to 270€ per property. This might make the replacement of water-using products by more efficient ones a costly effort. However, the cost efficiency of the measure depends on the associated savings and the payback time. Another study<sup>90</sup> estimates a cost of 500€ per household for the installation of a combination of water-efficient appliances, including a AAA showerhead, a drip irrigation system for the garden, flow restrictors and water-efficient front loading washing machines.

To reduce the cost, in general it is advantageous to make refitting as a part of a refurbishment programme<sup>91</sup>, or to introduce them directly in new buildings (both for non- and residential buildings).

Many mechanisms can introduce financial incentives, with differing costs and results:

- Tax abatements can be used at national level to promote the purchase of water-efficient products. Financial incentives have been tested in the UK, with the Enhanced Capital Allowances (ECA) scheme. The scheme is managed by Defra and enables businesses to claim 100% first year capital allowances (i.e. tax relief) on investments in technologies and products that encourage sustainable water use. Businesses are then able to deduct the whole cost of their investment from their taxable profits of the period during which they make the investment.
- The objective is to encourage businesses to invest in water-efficient technologies and provide key information to accompany them in their decision process. Indeed, the water-efficient technologies that are supported by the ECA scheme are listed to inform businesses of which efficient fixtures are targeted. It includes washing machines, flow controllers, leakage detection equipment, meters and monitoring equipment, rainwater harvesting equipment, small scale

<sup>88</sup> [www.water.vic.gov.au/saving/home/watersmart/watersmart-program-executive-summary-central-highlands-water](http://www.water.vic.gov.au/saving/home/watersmart/watersmart-program-executive-summary-central-highlands-water)

<sup>89</sup> [economicsnewspaper.com/policy/german/water-consumption-eu-savings-plan-could-cost-billions-of-german-e-18590.html](http://economicsnewspaper.com/policy/german/water-consumption-eu-savings-plan-could-cost-billions-of-german-e-18590.html)

<sup>90</sup> [www.melbourne.vic.gov.au/Environment/SavingWater/Documents/water\\_turning\\_blue.pdf](http://www.melbourne.vic.gov.au/Environment/SavingWater/Documents/water_turning_blue.pdf)

<sup>91</sup> [www.environment.gov.au/settlements/publications/government/pubs/water-efficiency-guide.pdf](http://www.environment.gov.au/settlements/publications/government/pubs/water-efficiency-guide.pdf)

slurry and sludge dewatering equipment, vehicle wash water reclaim units, water efficient industrial cleaning equipment and water management equipment for mechanical seals. The categories and technologies are expected to be reviewed on an annual basis, based on satisfactory methods of certification and identification, proven cost-effectiveness and costs to the UK Government.

- Waterwise favours a tax reduction on water-efficient kits across the EU. A financial mechanism is perceived as an effective way to deliver water-efficiency improvements but it will require both clarity and exposure.
- NYC, in its water saving plan, also offered landlords 290 million dollars worth of grants (currently equivalent to 200 million Euros) as an incentive to update plumbing systems with low-flow toilets, shower heads and faucets. Between 1994 and 1997, the city of New York replaced 1.3 million inefficient toilets
- The Living Victoria Water Rebate Programme in Australia rewards inhabitants for their efforts to be water efficient around the home, garden and small business by providing rebates on a range of water efficient products and appliances

#### ► Building Level Policy (B)

##### ▷ Building level WPB approach (B2, B3 and B4)

Implementing labelling or minimum requirements will incur costs while building or refurbishing the building to meet the standards, and for the certifier to verify compliance.

A water audit for a 10-floor office building in the USA would cost around 5 000\$ (around 3 560€) according to an American consultancy. Green Star and LEED cost between 4 000 € for buildings smaller than 2 000 m<sup>2</sup> and 24 000 € for 50 000 m<sup>2</sup> and more<sup>92</sup>.

Costs will also be incurred by building the certification scheme. A large-scale rollout allows for certification schemes to capture economies of scale. However, a one-size-fits-all scheme cannot work because different types of commercial and institutional buildings have technologies and operating systems that are specific to their activities. This results in the need to adapt the certification systems and therefore higher costs. Several certification initiatives do offer specific building schemes to target specific building usage (e.g. LEED for home (with 15 water credits to be awarded), LEED for new construction (10 water credits), LEED for commercial interiors (11 water credits), LEED for schools (11 water credits), BREEAM New Construction, BREEAM refurbishment, etc). Therefore, a certification programme at EU level would require the development of parallel schemes to ensure a good coverage of the types of buildings.

#### ◆ Influence of the type of owner

The costs of paying for the certification, modifying/designing the building so that it meets the standards of the certification scheme will be borne by the owner or constructor of the building.

<sup>92</sup> *BIO Intelligence Service, 2009, Water Performance of Buildings, DG ENV*

Consequently, green certifications generally tend to be relevant for public authorities, major corporations and owners of real estate with rather long investment horizons. Indeed, certification schemes will allow them to communicate on their environmental performance, and result in benefits, worth the costs. For private property or homeowners, the additional costs of achieving better environmental performance and thereby fulfilling a minimum requirement may significantly affect the household's financial burden.

#### ◆ Impact on the building value

A survey on the UK financial and business services sector showed that tenants would be willing to pay 10% more rent if the building was designed and constructed more efficiently<sup>93</sup>. That is consistent with the fact that green buildings may contribute to economic benefits for the owner with increased occupancy rates (+8%)<sup>94</sup>, higher rents (+6%) and higher building values (+35%)<sup>95</sup>. For the moment no evidence of increased rents were identified in real cases.

#### ▷ Certification scheme for rainwater harvesting and greywater reuse (B4)

The implementation of rainwater harvesting and greywater recycling induce additional costs<sup>96,97</sup> linked to the manufacture, installation and maintenance of the systems<sup>98</sup>, borne by the building owner/constructor. The building and operating costs are likely to decrease with technological improvements. Implementing rainwater harvesting and greywater recycling in existing buildings could be more expensive than integrating them directly in the construction of new houses. Costs would also be associated with the implementation of certification of systems for recycled/harvested water. The implementation cost for such scheme would be relatively low, by requiring the verification only of the harvesting/reuse system. Integrating water reuse or harvesting criteria within existing building certification schemes is financially interesting, due to sparing the fixed costs of certification.

Financial incentives can push the use of such systems, but can be quite costly. For example, in Victoria (Australia), eligible households who have purchased and installed a rainwater tank between 1 July 2011 and 30 June 2013 are eligible for a rebate of up to 1,000 AUD (around 760€). Rainwater tanks must have a minimum volume of 2 000 litres and be connected to toilet and/or laundry made at time of installation. The programme also lists non treatment and treatment greywater systems that are eligible for rebates<sup>99</sup>. Through the Australian National Rainwater and Greywater Initiative, as part of the Water for the Future Initiative, household rebates of \$500 (i.e.

<sup>93</sup> Deutsche Bank Research, 2010, *Green buildings, a niche becomes mainstream*.

<sup>94</sup> Fuerst, Franz and Patrick McAllisters, 2009, *An investigation of the Effect of Eco-Labeling on Office Occupancy Rates*. Real Estate and Planning Working Papers. Reading University.

<sup>95</sup> Fuerst, Franz and Patrick McAllisters, 2009, *New evidence on the Green Building Rent and Price Premium*. Real Estate and Planning Working Papers. Reading University

<sup>96</sup> Jeslin Kaduvinal Varghese (2007), *Effects of the Implementation of Grey Water Reuse Systems on Construction Cost and Project Schedule*. , B-tech, Kerala University, India ; Chair of Advisory Committee: Dr. Charles W. Graham. August 2007. Available at: [repository.tamu.edu/bitstream/handle/1969.1/ETD-TAMU-1447/KADUVINAL-VARGHESE-THESIS.pdf?sequence=1](http://repository.tamu.edu/bitstream/handle/1969.1/ETD-TAMU-1447/KADUVINAL-VARGHESE-THESIS.pdf?sequence=1) [Accessed on 31/08/2011]

<sup>97</sup> Edward A. Clerico, Alliance Environmental LLC. *Experience and Future Prospect*

<sup>98</sup> They require large tanks, normally underground, for storing intercepted rainwater, coupled with a treatment unit (filter) and pump, header tank (in loft) and separate pipework.

<sup>99</sup> [www.water.vic.gov.au/saving/home/greywater/rebates](http://www.water.vic.gov.au/saving/home/greywater/rebates)

370€) for new greywater systems purchased after January 2009 have been offered<sup>100</sup>. Financial incentives can also make overall costs for alternative waters more attractive than conventional waters.

### 3.3.2 Operation and Maintenance costs

#### ▶ Horizontal Level Policy (H)

##### ▷ Water metering (H1)

In the UK, the installation of water metering may lead to an increased price of water services to consumers due to the initial and replacement costs<sup>101</sup>. Yet in the longer term an increase in demand-side savings will mean that less water has to be treated and can lead to reduced consumption and costs for consumers. In the absence of defined carbon reduction targets, which can inform on the regulation, some water utilities had their meter installation programmes cut back by the Water Services Regulation Authority in England and Wales (OFWAT) within the framework of the 2009 Price Review. In the face of rising energy prices, water metering alone could reduce customers' water and energy bills by between £40 and £160 per year in the UK (around 45 and 182€)<sup>102</sup>.

According to a study in Spain<sup>103</sup> 10% of water savings can be gained thanks to metering, which means in residential buildings 9 760 hm<sup>3</sup>/year, i.e. 206 M€/year (considering a 21,100 €/hm<sup>3</sup> price for water in Spain in 2009). Since the average household is 3 persons, the potential savings in Spanish urban households could be 19€/year/household. This potential economic saving emphasizes the importance of accurate metering, and can be used to make a point to consumers who fear that such measures could result in an increase of the price of water.

The benefits in terms of reduced water and energy bills will benefit the tenant

##### ▷ Water pricing and cost strategy (H2)

Pricing water and changing cost strategies will result in higher costs for consumers that continue to use the same amounts of water (unless under the volumes of a block tariff). Consumers that reduce their water use could have lower bills in the medium-term.

##### ▷ Awareness raising and education (H3)

Operating and maintenance costs may be reduced by better awareness of water usage, through flagging earlier potential leaks, and better maintaining pipes by aware users, thus raising daily operational costs but reducing high costs linked to bigger repairing operations.

<sup>100</sup> Pacific Institute (2010), *Overview of greywater reuse: the potential of greywater systems to aid sustainable water management*. November 2010. Available at: [www.pacinst.org/reports/greywater\\_overview/greywater\\_overview.pdf](http://www.pacinst.org/reports/greywater_overview/greywater_overview.pdf) [Accessed on 01/09/2011]

<sup>101</sup> [www.ciwem.org.uk/policy-and-international/current-topics/water-management/regulation-for-a-sustainable-water-industry.aspx](http://www.ciwem.org.uk/policy-and-international/current-topics/water-management/regulation-for-a-sustainable-water-industry.aspx)

<sup>102</sup> *The greenhouse gas implications of future water resources Options – Defra* [www.environment-agency.gov.uk/research/library/publications/40731.aspx](http://www.environment-agency.gov.uk/research/library/publications/40731.aspx)

<sup>103</sup> Cobacho, R. Low flow device in Spain ? How efficient are they in fact ? An accurate way of calculation. Institute for Water Technology. Polytechnic University of Valencia. Spain

The benefits in terms of reduced water and energy bills will benefit the tenant, but maintenance costs of bigger repairs will also benefit the owner.

► Product Level Policy (P)

When efficient WuPs are implemented, the water costs would be reduced. For example, while investment costs will incur (currently simple water saving showerheads cost about £35), in the UK, changing a showerhead and toilet, could result in annual savings of 67 m<sup>3</sup> water, that is £225 for a household with a standard occupancy of 2.4 (persons)<sup>104</sup>.

An Australian study<sup>105</sup> mentions a payback time of about 7 years through savings in the water bill, based on a cost of 500€ per household for the installation of a combination of water-efficient appliances, including a AAA showerhead, a drip irrigation system for the garden, flow restrictors and water-efficient front loading washing machines. .

Adding to the costs of the water saved, savings in the energy costs will also apply. In the Waterwise programme, the cost of energy saved in the trials thus ranges from 1.5 to 50.3 € property/year<sup>106</sup>.

Those reductions in costs will benefit the tenants.

Depending on the policy instrument used (P<sub>1</sub>, P<sub>2</sub>, P<sub>3</sub>), the costs will be different. Indeed, through voluntary and mandatory labelling schemes, the customers decide whether to introduce products in their buildings, deciding whether it is cost-effective for them or not. In the case of minimum requirements, the costs will be imposed to customers, but on the long-term, through the competition occurring between constructors, the costs are expected to decrease over time.

Awareness-raising campaigns will induce costs. They will help the customers decide whether the products are cost-efficient for them, but are not expected to raise costs.

Financial incentives will have an important impact on financial return on investment, and will thus highly impact the decisions to introduce products or not, but are also costly.

► Building Level Policy (B)

► Building level WPB approach (B<sub>1</sub>, B<sub>2</sub> and B<sub>3</sub>)

In terms of return on investment, costs premiums for obtaining a LEED certification in silver or platinum levels are respectively around 2 and 6.5% of the life-cycle costs (LCC) (i.e. costs over the whole lifetime of the buildings, including construction, use, refurbishment and end-of-life). The net value of the related savings over 20 years - with a discount rate of 5% - is over 3 times larger than the minimum initial cost of 2% of the LCC<sup>107</sup>. Setting minimum requirements comparable to a silver LEED certification would then be in compliance with adopting a lowest life-cycle cost approach (as promoted in the Ecodesign Directive).

<sup>104</sup> UK Environment Agency, *Quantifying the energy and carbon effects of water saving – Summary report*.

<sup>105</sup> [www.melbourne.vic.gov.au/Environment/SavingWater/Documents/water\\_turning\\_blue.pdf](http://www.melbourne.vic.gov.au/Environment/SavingWater/Documents/water_turning_blue.pdf)

<sup>106</sup> [www.waterwise.org.uk/images/site/Policy/evidence\\_base/evidence%20base%20for%20large-scale%20water%20efficiency%20in%20homes%20-%20phase%20ii%20interim%20report.pdf](http://www.waterwise.org.uk/images/site/Policy/evidence_base/evidence%20base%20for%20large-scale%20water%20efficiency%20in%20homes%20-%20phase%20ii%20interim%20report.pdf)

<sup>107</sup> *Building Design + Construction, 2009, Green Buildings + Water Performance*

Besides, utility charges, which are usually among the most costly expenses for buildings, are considered lower than usual in green buildings. McGrawHill Construction<sup>108</sup> finds overall operating costs to be lower by 8-9% for green buildings compared to conventional ones.

If audits are required to confirm the rating of the building, the costs will be borne by the owner, or by the tenant (if included in the maintenance costs of the building). Water bills reductions will benefit the tenant.

▷ Certification scheme for rainwater harvesting and greywater reuse (B4)

The costs for treating wastewater and producing non-potable reuse water is in the range of 1.36€ to 2.04€ per m<sup>3</sup>, depending on system size<sup>109</sup>. The operational costs of regular audits to confirm the functioning of the system will be borne by the building owner, but could possibly be borne by the occupier through the operational costs of the building paid by the tenants. The tenants will benefit from reduced water bills.

Eureau – the European Federation of National Associations of Water - expressed uncertainties regarding the expected decrease in water consumption due to the use of alternative water sources on drinking water prices. Supply of alternative water sources for non-drinking use, leading to lower drinking water consumption, may increase (drinking water) prices due to the high fixed costs of drinking water supply.

For instance, in Japan, the economics have been shaped to promote water conservation and reuse. Indeed, the national government has generally subsidized 50% of the capital cost for large scale water reuse facilities, so that the average cost for non-potable reuse water is \$0.83/m<sup>3</sup> (around 0.6€/m<sup>3</sup>) whereas potable water supply ranges between \$1.08/m<sup>3</sup> to \$3.99/m<sup>3</sup> (0.75 to 2.8 €/m<sup>3</sup>)<sup>109</sup>. The economics favour water reuse in all cases.

In sum, the installation and lifecycle of the implementation of such systems would be costly, but could be counterbalanced by reduced costs of water from the general supply network.

### 3.3.3 Administrative and enforcement costs

To ensure the good enforcement of the labels and building certification schemes and ensure the compliance with potential minimum requirements, public authorities have to face some administrative cost. Those costs will be higher in case of minimum requirements, than for mandatory labelling, and lower for voluntary labelling (which still involves some control).

### 3.3.4 Potential side costs

To address the possibility of sewer blockages and other operational problems due to lower wastewater volumes, changes in the design of drainage systems can be suggested such as the

<sup>108</sup> McGrawHill Construction, 2006, *Green Building Smartmarket Report*.

<sup>109</sup> Edward A. Clerico, Alliance Environmental LLC. *Experience and Future Prospect* [www.AllianceEnvironmentalLLC.com](http://www.AllianceEnvironmentalLLC.com)

use of smaller diameter pipes and pipes with steeper gradients. This opens opportunities for new building construction but it would rarely be a cost effective option for existing building areas<sup>110</sup>.

### 3.3.5 Tenant / Owner distribution of costs

There may be a misalignment between owner costs and tenant benefits. Under usual leasing arrangements, landlords pay the capital costs of efficiency measures while many of the benefits of green buildings apply to the user of the property. The implementation of the EPBD has generated high costs for property owners without any benefits and thereby some resentment has been observed. Requirements for water-using products are, however, generally better understood as it has directly visible impacts and would involve a cost for both tenant and owner.

In order to address this issue, “green leases” could be developed. The landlord and the tenant have to agree on how the positive externality of lower operational costs can be internalised by the landlord. However, legal requirements may slow down the return on investment. German tenancy laws for example currently limit net rent increases in residential buildings due to modernisation work to 11% of the costs<sup>111</sup>. Such a constraint impacts the return on investment that a building owner may expect.

This misalignment may be most seen in installing products attached to the building, such as toilets, or rainwater harvesting schemes and for certifying buildings, where the costs of certification and additional construction costs will incur to the owner and benefit the tenant.

Information programmes are not expected to change the situation, except for making “green” rents better accepted by tenants. Well-organised financial incentives however may counterbalance this imbalance.

## 3.4 Social impacts

### Question group 32:

- Are there major social impacts that should be added? Which ones?
- Do you have data to further quantify the social impacts presented below?

### 3.4.1 Public behavior and acceptance

#### ▶ Participation and uptake

Public acceptance of water saving initiatives highly varies between types of housing. In the UK, the Waterwise programme<sup>112</sup> shows uptake rates between 6% and 22% in general housing

<sup>110</sup> *Less water to waste: Impact of reductions in water demand on wastewater collection and treatment systems, 2008, Environment Agency.*

<sup>111</sup> *Deutsche Bank Research, 2010, Green Buildings – A niche becomes mainstream.*

<sup>112</sup> [www.waterwise.org.uk/images/site/Policy/evidence\\_base/evidence%20base%20for%20large-scale%20water%20efficiency%20in%20homes%20-%20phase%20ii%20interim%20report.pdf](http://www.waterwise.org.uk/images/site/Policy/evidence_base/evidence%20base%20for%20large-scale%20water%20efficiency%20in%20homes%20-%20phase%20ii%20interim%20report.pdf)

whereas social housing (i.e. dedicated to lower-classed population) show significantly higher uptake rates (between 45% and 60%). Yet, once involved in a water-efficiency project, 65% and 78% of customers from respectively general and social housing save water. The uptake of water-efficient devices has been shown to depend on the credibility of the body offering the retrofit and the communication about the new water saving equipment. The high uptake rates noted in social housing areas has mostly been due to the involvement of a housing association in the facilitation, planning and execution of water efficiency retrofitting projects. In Victoria, the WaterSmart Behaviour Change Programme actually engaged 18% of the public invited to take part. The Central Highlands Water<sup>113</sup> project showed for example that people with children were more likely to be influenced by marketing communications and a desire to reduce money spent on water. Likewise, the WaterSmart Behaviour Change Programme also showed a greater propensity for the smaller households to make larger reductions in water usage than larger households.

According to the Waterwise programme, only a small proportion of the population accepts to participate and actually commits to water efficiency programmes, which severely limits the water savings achievable. The number of people invited to participate, is higher than the number of people that agree to participate (i.e. uptake rate), which is higher than the number of the households where installation actually takes place and where water savings occur. Projects feedbacks, such as in the City West Water<sup>114</sup> project in Australia, often underline the difficulty to engage target audience and the progressive withdrawals from the project of a share of the population. Survey is an efficient tool to assess the public's perception of a water-saving programme. In particular, it allows to determine if this perception is favourable enough to progress to the conceptual and design stage, and ensures the overall success of the project after implementation<sup>115</sup>.

The case of renters vs. owners is less clear. Depending on projects, renters are said to be more reluctant and less likely to install water saving appliances<sup>116</sup> or to make more significant reductions in their water use compared with owners<sup>117</sup>.

While the receptivity of people engaged in programmes is very variable, according to the Waterwise programme, the proportion of customers that save water in the majority of multi-measure projects is rather predictable, and ranges between 65% and 78%<sup>106</sup>. Likewise, the WaterSmart Behaviour Change project showed, in the Barron Water project, that participants ended up significantly changing their behaviour, with about 52%-93%<sup>118</sup> of them taking showers of four minutes or less in duration and 92% washing full loads of clothing in the washing

<sup>113</sup> [www.water.vic.gov.au/saving/home/watersmart/watersmart-program-executive-summary-central-highlands-water](http://www.water.vic.gov.au/saving/home/watersmart/watersmart-program-executive-summary-central-highlands-water)

<sup>114</sup> [www.water.vic.gov.au/saving/home/watersmart/watersmart-program-executive-summary-city-west-water](http://www.water.vic.gov.au/saving/home/watersmart/watersmart-program-executive-summary-city-west-water)

<sup>115</sup> US EPA, Guidelines for Water Reuse. Chapter 3 Technical Issues In Planning Water Reuse Systems. EPA/625/R-04/108 September 2004. Available at: [www.epa.gov/nrmrl/pubs/625ro4108/625ro4108chap3.pdf](http://www.epa.gov/nrmrl/pubs/625ro4108/625ro4108chap3.pdf) [Accessed 23/08/2011]

<sup>116</sup> [www.water.vic.gov.au/saving/home/watersmart/watersmart-program-executive-summary-central-highlands-water](http://www.water.vic.gov.au/saving/home/watersmart/watersmart-program-executive-summary-central-highlands-water)

<sup>117</sup> [www.water.vic.gov.au/saving/home/watersmart/watersmart-program-executive-summary-city-west-water](http://www.water.vic.gov.au/saving/home/watersmart/watersmart-program-executive-summary-city-west-water)

<sup>118</sup> [www.water.vic.gov.au/saving/home/watersmart/watersmart-program-executive-summary-city-west-water](http://www.water.vic.gov.au/saving/home/watersmart/watersmart-program-executive-summary-city-west-water)

<sup>118</sup> [www.water.vic.gov.au/saving/home/watersmart/watersmart-program-executive-summary-stage-2-yarra-valley-water](http://www.water.vic.gov.au/saving/home/watersmart/watersmart-program-executive-summary-stage-2-yarra-valley-water)

<sup>118</sup> [www.water.vic.gov.au/saving/home/watersmart/watersmart-program-executive-summary-city-west-water](http://www.water.vic.gov.au/saving/home/watersmart/watersmart-program-executive-summary-city-west-water)

<sup>118</sup> [www.water.vic.gov.au/saving/home/watersmart/watersmart-program-executive-summary-south-east-water](http://www.water.vic.gov.au/saving/home/watersmart/watersmart-program-executive-summary-south-east-water)

machine<sup>119</sup>. Regarding the installation of water efficient appliances, 41%-69% also had installed water efficient showerheads in their bathrooms. Yet, only 14%-16% installed water flow restrictors<sup>118</sup>.

▶ Building level WPB approach (B<sub>1</sub>, B<sub>2</sub> and B<sub>3</sub>)

A 2010 study from researchers from Maastricht University<sup>120</sup> suggests that the real estate sector is not yet ready to embrace voluntary efforts to set water measurement standards. The low (20-30%) response rate after contacting 688 real estate entities on sustainability performance indicates that environmental management within the property sector is still in the early stages. The green building market is still emerging.

▶ Rainwater harvesting and reuse systems (B<sub>4</sub>)

A survey performed in Spain<sup>121</sup> after installing greywater reuse systems in 120 households also showed that the public is particularly sensitive to failures of the system. Thus, about a third of the participating households were dissatisfied, because of the unpleasant odour and appearance of the water, system breakdowns and maintenance costs. In order to build trust in these new technologies, the public therefore needs to understand their principles and benefits before their installation. In the Netherlands it seems that problems in distribution systems also hampered the development of this technology.

### 3.4.2 Employment and business opportunities

▶ Horizontal Level Policy (H)

The implementation of pieces of the horizontal policies would lead to increased employment through the installation of water meters and would bring business to information campaign stakeholders.

▶ Product Level Policy (P)

The implementation of product labels and minimum requirements will increase innovation in products, to provide customers with more efficient products. The impact is expected to be higher with minimum requirements, but would also be higher with mandatory labelling, through increased requirement by businesses to appear either as best in class or to have a range of products (e.g. prices and efficiency differences between products).

▶ Building Level Policy (B)

▶ Building level WPB approach (B<sub>1</sub>, B<sub>2</sub> and B<sub>3</sub>)

The development of water labelling schemes or other standard development will bring employment to green building businesses, through the development of the standard and advice to be given to companies to improve their ratings/meet the standards.

<sup>119</sup> [www.water.vic.gov.au/saving/home/watersmart/watersmart-program-executive-summary-barwon-water](http://www.water.vic.gov.au/saving/home/watersmart/watersmart-program-executive-summary-barwon-water)

<sup>120</sup> Kok, Nils, Piet Eichholz, Rob Bauer, Paulo Penada, 2010, Environmental Performance: A Global Perspective on Commercial Real Estate, Maastricht University

<sup>121</sup> Domènech, L. and Saurí, D. (2010). Socio-technical transitions in water scarcity contexts: Public acceptance of greywater reuse technologies in the Metropolitan Area of Barcelona. Resources, Conservation and Recycling. 55: 53-62. [ec.europa.eu/environment/integration/research/newsalert/pdf/218na4.pdf](http://ec.europa.eu/environment/integration/research/newsalert/pdf/218na4.pdf)

The development of water audits and standards will require the education and training of skilled workers. For this purpose, for example Green Plumbers USA proposes that community colleges create a curriculum for “pre-apprentice water auditors”. Graduates would be trained to assist professional water auditors, thus expanding the potential workforce and possibly reducing the cost of water audits. It is considered as a new opportunity to create employment<sup>122</sup>.

However, administrative burden (due to measure implementation, control and monitoring) would also incur.

▷ Rainwater harvesting and reuse systems (B4)

Rainwater harvesting and greywater reuse schemes are expected to result in the training and employment of specialised plumbers, and to increase the business of the companies building those systems.

### 3.4.3 Sanitary and health issues

In theory, reduced water flows can result in more stagnation in pipes, possibly leading to higher sanitary and health risks, but no evidence of this was found. This would apply to any of the policy level and instrument chosen.

The main other sanitary and health issue applies to rainwater harvesting, and more importantly to greywater reuse (B1). Indeed, sanitary issues are linked especially to installation, maintenance and operation of rainwater harvesting and greywater recycling. Low quality of greywater can result in significant health risks, including infectious diseases. Stored rainwater can be contaminated with *Enterococci*<sup>123</sup>.

Likewise, back-wash systems incorporated in the design of a reuse system could result in the contamination of drinking water supplies. Quality issues could also be encountered after the introduction of alternative water supplies because of the stagnation of water in pipes or storage tanks, which encourages biological activity. However, in general the risks associated with these systems are considered low, especially for flushing and gardening uses. Sanitary engineering and preventive medical practices have combined to reach a point where waterborne disease outbreaks of epidemic proportions have been controlled to a great extent. Household rainwater collection systems are becoming more established technology in countries such as Germany and Holland<sup>124</sup>.

Yet, even where the risk is considered low, public perception of this risk is an important barrier to the large scale uptake of greywater reuse solutions. For instance, parents may be afraid that when playing in the garden their child opens the recycled water tap which is outdoor for gardening use and drink from it. Actions to control water quality include health codes,

<sup>122</sup> Kok, Nils, Piet Eichholz, Rob Bauer, Paulo Peneda, 2010, Environmental Performance: A Global Perspective on Commercial Real Estate, Maastricht University

<sup>123</sup> EUREAU (2011), Working Group Microbiological Quality, Eureau-Commission Position Paper on water re-use and other alternative resources at home: rainwater harvesting and greywater recycling for domestic purposes. July 2011

<sup>124</sup> Defra, Science Report — Greenhouse gas emissions of water supply and demand management options

procedures for approval of service, regulations governing design and construction specifications, inspections, and operation and maintenance<sup>125</sup>.

For example, standards for reusing greywater are set in Spain in the Royal Decree 1620/2007, or standard for rainwater harvesting are set in the UK (BSI 8515:2009) and in France (French Decree August 2008). These standards could be used as a mandatory legal basis for the implementation of greywater reuse. In the UK, the frequency of maintenance stated in the literature ranges between 1<sup>126</sup> and 3<sup>127</sup> years.

In order to limit those risks, the option to implement minimum requirements to introduce systems on the market and ensuring that the systems are installed by certified plumbers would be most interesting.

### Question group 33:

- Are there other policy options which you recommend to be covered?
- Do you have any suggestions on how the presented policy options should be combined to bring the best results?

- The replies should be sent to the email address below. Please note that you do not need to reply all questions.
- If you would like to raise any particular issues concerning water efficiency in buildings please describe it briefly and send it also to the following email address:

[ENV-BuildingsWE@ec.europa.eu](mailto:ENV-BuildingsWE@ec.europa.eu)

<sup>125</sup> US EPA, Guidelines for Water Reuse. Chapter 3 Technical Issues In Planning Water Reuse Systems. EPA/625/R-04/108 September 2004. Available at: [www.epa.gov/nrmrl/pubs/625r04108/625r04108chap3.pdf](http://www.epa.gov/nrmrl/pubs/625r04108/625r04108chap3.pdf) [Accessed 23/08/2011].

<sup>126</sup> UK Code of practice BS8515:2009

<sup>127</sup> Roebuck R., et al (2006)]