

## JRC SCIENTIFIC AND POLICY REPORTS

# Developing an evidence base on flushing toilets and urinals. Preliminary report

Key findings

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## ABBREVIATIONS

### List of acronyms

|        |   |
|--------|---|
| ANQIP  | – Portuguese National Association for Quality in Building Installations |
| AS     | – Australian Standard   |
| ASME   | – American Society of Mechanical Engineers                              |
| BAT    | – Best Available Technology   |
| BMA    | – Bathroom Manufacturers Association in the United Kingdom              |
| BNAT   | – Best Not Yet Available Technology                                     |
| CSA    | – Canadian Standards Association  |
| EN     | – European standard   |
| EU     | – European Union  |
| EU27   | – The 27 Member States of the European Union                            |
| GPP    | – Green Public Procurement  |
| ISO    | – International Organization for Standardization                        |
| LCA    | – Life Cycle Analysis   |
| MEEuP  | – Methodology for the Ecodesign of Energy-using Products                |
| MS     | – Member State  |
| NZS    | – New Zealand Standard  |
| PAH    | – Polycyclic Aromatic Hydrocarbon                                       |
| SME    | – Small or Medium Enterprise  |
| US EPA | – United States Environmental Protection Agency                         |
| WC     | – Water Closet  |
| WELL   | – Water Efficiency Label  |
| WELS   | – Water Efficiency Labelling and Standards Scheme                       |
| WEPLS  | – Water Efficient Product Labelling Scheme                              |

**Units**

|                |   |
|----------------|---|
| cm             | – Centimetre                                |
| dB(A)          | – A-weighted decibel (sound pressure level) |
| eq.            | – equivalent                                |
| g              | – Gram                                      |
| kg             | – Kilogram                                  |
| kWh            | – Kilowatt hour                             |
| l              | – Litre                                     |
| m <sup>3</sup> | – Cubic metre                               |
| mg             | – Milligram                                 |
| MJ             | – Megajoule                                 |
| mm             | – Millimetre                                |
| ng             | – Nanogram                                  |
| s              | – Second                                    |
| I-TEQ          | – International Toxic Equivalent Quantity   |



# 1 INTRODUCTION

The EU Ecolabel<sup>1</sup> is an element of the European Commission's action plan on Sustainable Consumption and Production and Sustainable Industrial Policy<sup>2</sup> adopted on 16 July 2008. This is a voluntary scheme established to encourage manufacturers to produce goods and services that are environmentally friendlier. The EU Ecolabel flower logo facilitates consumers and organisations (i.e. public and private purchasers) to recognise the best environmentally performing products and making environmentally conscious choices more easily. A product (good or service) awarded with this label must meet high environmental and performance standards. The EU Ecolabel covers a wide range of products, and its scope is constantly being widened. The consultation of experts and all interested parties is a key point in the process of establishing the criteria.

Green Public Procurement (GPP) is defined in the Commission Communication on Public procurement for a better environment<sup>3</sup> as “a process whereby public authorities seek to procure goods, services and works with a reduced environmental impact throughout their life cycle when compared to goods, services and works with the same primary function that would otherwise be procured.” GPP is a voluntary instrument, which public authorities can use to provide industry with incentives for developing and marketing environmentally sounder products.<sup>4</sup>

The EU Ecolabel and GPP criteria have been developed in parallel in the framework of the project.<sup>5</sup>

The primary goal of establishing EU Ecolabel and GPP criteria for flushing toilets and urinals is to increase their water efficiency during operation, as water consumption in the use phase has been identified to contribute most to the environmental impact caused by this product group. Further, other aspects related to the product's life cycle, which improvement can bring environmental benefits, are also considered.

Establishing ecological criteria for flushing toilets and urinals and promoting appropriately the awarded products, if accepted by a wider range of producers and users, will contribute to greener product purchases, which shall reduce the consumption of water. Besides, this should also result in other environmental benefits, like lower water pollution and eutrophication (in relation with wastewater), energy saving and lower related air emissions (in relation with water supply, wastewater treatment and product production), lower resource consumption and potentially higher resource efficiency management (in relation with product materials, longevity and recyclability issues), etc. Finally, the environmentally friendlier products should also bring private and public customers direct cost savings (e.g. lower water bills).

The following Preliminary Report presents background information on flushing toilets and urinals, which is used when setting the EU Ecolabel and GPP criteria. Section 2 gives the project background. Section 3 presents the scope and the main definitions for the product group. Section 4 reports the main results of the economic and market analysis, Section outlines the user behaviour and Section 6 gives an overview of main labelling schemes. Section 7 shows the main environmental impacts for the base cases and life cycle costs are presented in Section 8. BAT and BNAT are reviewed in Section 9 and Section 10 gives an estimation of improvement potential derived from the information presented in previous sections.

<sup>1</sup> EU Ecolabel website: [http://ec.europa.eu/environment/ecolabel/about\\_ecolabel/what\\_is\\_ecolabel\\_en.htm](http://ec.europa.eu/environment/ecolabel/about_ecolabel/what_is_ecolabel_en.htm)

<sup>2</sup> *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions – on the Sustainable Consumption and Production and Sustainable Industrial Policy Action Plan*, COM (2008) 397, available at: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2008:0397:FIN:en:PDF>

<sup>3</sup> *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions – Public procurement for a better environment*, COM (2008) 400, available at: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2008:0400:FIN:EN:PDF>

<sup>4</sup> GPP website: [http://ec.europa.eu/environment/gpp/what\\_en.htm](http://ec.europa.eu/environment/gpp/what_en.htm)

<sup>5</sup> The final results of the study are available at the project's website: <http://susproc.jrc.ec.europa.eu/toilets/>



## 2 PROJECT BACKGROUND

The European Commission's Directorate General for the Environment has initiated a project directed towards developing a joint evidence base for the EU policy making in the area of water-using products. This study is being carried out by the Joint Research Centre's Institute for Prospective Technological Studies (JRC-IPTS) and the AEA consultancy, in cooperation with all interested parties. All the results are presented on a dedicated website: <http://susproc.jrc.ec.europa.eu/toilets>

The purpose of this pilot project is to develop the EU Ecolabel and Green Public Procurement criteria for flushing toilets and urinals. In addition, the evidence base gathers information and data to assist the potential future development of other environmental policy instruments such as Implementing Measures under the Ecodesign Directive<sup>6</sup>. However, Implementing Measures for flushing toilets and urinals are not developed as part of this project now but might be introduced in the future.

In the framework of the criteria development process two open working group meetings took place:

- 1<sup>st</sup> open working group meeting held on 18<sup>th</sup> October 2011 in Brussels, Belgium,
- 2<sup>nd</sup> open working group meeting held on 6-7<sup>th</sup> June 2012 in Seville, Spain.

The purpose of these meetings was the presentation of the study results and an in-depth discussion with all interested parties. The discussion and stakeholders' feedback received during the meetings and additionally in a written form along the open consultation phase aided in drafting the proposed EU Ecolabel criteria.

The following tasks have been performed in the frame of the project:

- 1) Scoping,
- 2) Product definition,
- 3) Economic and market analysis,
- 4) User behaviour,
- 5) Base case assessment,
- 6) Best Available Technology (BAT) and Best Not Yet Available Technology (BNAT).

The main findings of each task are addressed in the present report establishing the basis for EU Ecolabel criteria for flushing toilets and urinals<sup>7</sup>.

An important outcome of the environmental assessment of flushing toilets and urinals is that the main environmental impact is the consumption of water during the use phase. Establishing EU Ecolabel criteria to award water efficient products is expected to result in environmental benefits of water saving, and consequently reducing environmental impacts caused particularly by water consumption, water pumping, wastewater treatment, etc.

Two key elements appear to affect the water (and related energy) consumption of flushing toilets and urinals: their design and the user behaviour. The influence of design on water consumption is quite obvious since flushing toilets and urinals generally use, when flushed, a predetermined (fixed) quantity of water, which varies from product to product. User behaviour is also a crucial aspect and must be without any doubts emphasised. The user behaviour analysis<sup>8</sup> carried out showed how the average water consumption differs among the EU Member States (MS). Also the consumption between citizens of one single country may vary

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<sup>6</sup> Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products (recast).

<sup>7</sup> Further information on the project may be found at: <http://susproc.jrc.ec.europa.eu/toilets>

<sup>8</sup> Task 2: Economic and market analysis & Task 3: User Behaviour, available at: <http://susproc.jrc.ec.europa.eu/toilets/stakeholders.html>

very significantly. A number of parameters play a key role in these observed variations, including cultural aspects. User behaviour is also connected with their environmental consciousness. It can be seen that user behaviour is a very complex issue and assumptions had to be made in the frame of the study. This needs to be taken into account when analysing the project's results.

### 3 DEFINITION AND SCOPE OF FLUSHING TOILETS AND URINALS

The scope and definitions of the product group ‘flushing toilets and urinals’ are based on the available national and international classifications, standards and legal acts. The proposed definitions and scope for the product group further rely on stakeholders’ feedback given through the questionnaires, the discussions conducted at the 1<sup>st</sup> and 2<sup>nd</sup> open working group meetings and all the written comments received. The preliminary definitions<sup>9</sup> have been revised in the light of this feedback and the current version is presented below.

#### 3.1 Product group scope

The product group ‘flushing toilets and urinals’ shall comprise: flushing toilet equipment including toilet suites, toilet receptacles and toilet flushing systems, and urinal equipment including urinal suites, urinals, flush-free urinals and urinal flushing systems as defined below. The product group shall cover products for both domestic and non-domestic use.

The following products shall be excluded from the product group ‘flushing toilets and urinals’:

- (a) toilet seats and covers, only when placed on the market and/or marketed independently from a flushing toilet or urinal equipment (i.e. when placed on the market and/or marketed as stand-alone item);
- (b) toilet equipment which does not use water, use water and chemicals and water for flushing, and toilets that require energy to aid the flushing system

As a matter of fact, toilet and urinal suites and flush-free urinals are the functioning units and as such represent the core of the scope. Nevertheless, there is a need for including in the product group both suites/one-piece products and independent equipment such as toilet receptacles, urinals and flushing systems, which make functioning units only when combined. The rationale is explained below.

Flushing systems and receptacles (toilet receptacles or urinals) can be sold either jointly as a suite (combination) or a one-piece product (with integral flushing system) or independently as stand-alone items. It is worth noting that the market structure (sales of stand-alone items vs. suites/one-piece) widely differs from one MS to another and the whole spectrum of market shares between stand-alone items and suites can be observed across the EU. Based on stakeholder information, as extreme cases, all flushing toilets are sold in the UK as suites/one-piece whereas in Germany 95 % of flushing toilet market is reported to be made of stand-alone items (separate flushing systems and receptacles). At the EU level, it is estimated that about one third of flushing toilets and urinals are sold as a suite/one-piece while the remaining of the market (about two thirds) consists of separate receptacles and flushing systems. As a consequence and in order not to discard two thirds of the market, stand-alone items, in addition to suites/one-piece, need also to be considered for being included in the scope. However, we may ask which stand-alone items should be in the scope, having in mind that the aim is to achieve water saving.

Indeed, most of the environmental impact of flushing toilets and urinals comes from water consumption in the use phase, i.e. water flushing. The flushing part (flushing system) of the whole appliance (functioning unit) is then of the utmost importance to be considered when devising the EU Ecolabel criteria for this product group. Nevertheless, stand-alone toilet receptacles and urinals also contribute to the water saving objective. If a receptacle is not designed to perform properly with a low water flush, its combination with a low water consumption flushing system will generally result in extra flushing (users will be forced to flush twice or three times to do the job), thus defeating the purpose of saving water. In addition, when stand-alone items are purchased, feedback from manufacturers indicates that

<sup>9</sup> Presented in the Technical Background Reports for the 1<sup>st</sup> open working group meeting and available at the project’s website: <http://susproc.jrc.ec.europa.eu/toilets/stakeholders.html>

the receptacle is always chosen first (because of design preferences) and then matched to a suitable flushing system. As a result, both flushing systems and receptacles need to be in the scope. In particular, stand-alone receptacles should be ecolabelled for the two following reasons: low water consumption flushing systems shall be combined with low-flush receptacles to achieve the water saving objective; and for purchasers interested in ecolabelled products and buying separately flushing systems and receptacles, signalling which receptacles are ecolabelled is the key.

It should be noted that some other schemes like the Australian/New Zealand WELS apply the same strategy with addressing both suites and stand-alone items in the same product group.

In terms of exclusion, stand-alone toilet seats and covers (sold separately) are not included in the scope of the product group since they cannot contribute to any water saving. Nevertheless, toilet seats and covers when sold together with the receptacle are included in the scope because in that case they make part of the product. In addition, toilet equipment which does not use water exclusively for flushing are excluded because the focus of the project is the achievement of water saving from the traditional water flushing toilets. Other toilet equipment (e.g. chemical toilets, vacuum toilets) are considered as niche products which meet special needs.

### 3.2 Product definitions

The following definitions shall apply for product group 'flushing toilets and urinals':

- (1) 'flushing toilet equipment' means either a toilet suite, a toilet receptacle or a toilet flushing system.
- (2) 'toilet suite' means a sanitary appliance combining into a functioning unit a flushing system and a toilet receptacle for receiving and flushing away human waste (urine and faeces) and directing it into a drainage system.
- (3) 'toilet receptacle' means a sanitary appliance for receiving and flushing away human urine and faeces and directing it into a drainage system.
- (4) 'urinal equipment' means either a urinal suite, a urinal, a flush-free urinal or a urinal flushing system.
- (5) 'flushing urinal equipment' means either a urinal suite, a urinal or a urinal flushing system.
- (6) 'urinal suite' means a sanitary appliance combining into a functioning unit a flushing system and a urinal for receiving and flushing away urine and directing it into a drainage system.
- (7) 'urinal' means a sanitary appliance for receiving urine and water used for flushing and directing both into a drainage system.
- (8) 'slab urinal' means a sanitary appliance with or without flushing system comprising a floor channel and a slab or sheet fixed to a wall, for receiving urine and water used for flushing and directing both into a drainage system.
- (9) 'flush-free urinal' means a sanitary appliance for receiving urine and directing it into a drainage system, which functions without water.
- (10) 'flushing system' means, for both flushing toilet and flushing urinal equipment, either a flushing cistern with integral warning pipe connection – or a device deemed to be a no less effective device and inlet/outlet devices, or a pressure flush valve.
- (11) 'water-saving device' means a flushing device that permits a part of the full flush volume to be delivered either as double-action mechanisms (interruptible) or double-control mechanisms (dual flush).

- (12) 'full flush volume' means the total volume of water discharged from the flushing system during a flush cycle.
- (13) 'reduced flush volume' means the part of the full flush volume of water discharged by a water-saving device during a flush cycle no greater than two thirds of the full flush volume.
- (14) 'average flush volume' means the arithmetic average of one full flush volume and three reduced flush volumes calculated by following the methodology described in Appendix 1 to the Decision<sup>10</sup>.
- (15) 'on-demand flush control' means a flushing device of a sanitary appliance, which can be operated either manually by the user through a handle, lever, button, foot pedal or any equivalent flush actuator, or by a sensor detecting the use of the sanitary appliance.
- (16) 'adjusting device' means a device which allows the full flush volume and, if relevant, the reduced flush volume of a flushing system to be adjusted.

The defined terms include each category of flushing toilet equipment and urinal equipment covered, the different flush volumes referred to and the specific devices mentioned in the labelling requirements.

To define the toilet receptacle category, the wording 'toilet receptacle' has been preferred to 'WC pan' because the former is more general than the latter, even if WC pan – defined in EN 997 as bowl-shaped appliance for reception and flushing away of human solid and liquid excrement – is from far the most widespread type of toilet receptacles.

The different classes (and types) of equipment are not specifically defined given that the requirements are not differentiated by class (or type). Nevertheless, a statement at the beginning of the Annex to the Decision defining the criteria has been added to clarify the issue of classes and types, which stipulates: "In test standards, toilet suites, toilet receptacles, urinals and flushing systems are distinguished by class or type, or both. The relevant class(es) and/or type(s) of the product shall be declared to the competent body assessing the application and all the tests to be performed shall be done for each class and/or type declared by the applicant according to the relevant standard."

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<sup>10</sup> OJ L 229, 9.11.2013



## 4 ECONOMIC AND MARKET ANALYSIS OF FLUSHING TOILETS AND URINALS IN THE EU

### 4.1 Introduction

This section presents the main results on the economic and market analysis of flushing toilets and urinals in the EU. In particular, it gives an overview of product stock, annual sales and market shares<sup>11</sup>.

It is important to know the size of the EU flushing toilet and urinal market in terms of stock and annual sales and the market trends, so that the potential impacts of any improvement can be quantified. As far as possible, this information is split across domestic and nondomestic (both public and private) settings.

The current stock and annual sales of toilets and urinals are presented with projections to 2030 and breaking down the calculations into a number of contributing categories:

- domestic dwellings
- office buildings (in which public and private businesses operate)
- tourist locations (hotels and the like)
- educational establishments (primary and secondary schools, universities, etc.)
- hospitals
- prisons

Other categories like railway stations and airports have also been considered but sensitivity tests revealed that the expected numbers of toilets and urinals for those categories were negligible. Therefore, it was decided not to include any further categories.

Regarding all the figures presented below, they result from model estimations rather than official statistics. Indeed, the official EU statistics on toilets and urinals are aggregated with other sanitaryware products (like baths, showers-baths, sinks and wash-basins), so that isolating information on toilets and urinals is not reliable. Under these circumstances, it was decided to build models to estimate the stock and sales figures, which means that each calculation relies on a model which combines a number of assumptions and datasets. However, all the estimates should be taken with caution given the level of uncertainty associated with the assumptions incorporated in the assessment methodology.

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<sup>11</sup> More details can be found in: Market analysis & Consumer behaviour report, available online: [http://susproc.jrc.ec.europa.eu/toilets/docs/Tasks%202&3\\_Market%20analysis%20and%20User%20behaviour.pdf](http://susproc.jrc.ec.europa.eu/toilets/docs/Tasks%202&3_Market%20analysis%20and%20User%20behaviour.pdf)

## 4.2 EU stock of toilets and urinals

### 4.2.1 EU toilet stock

The domestic and nondomestic toilet stock figures in each EU MS (Member State) are presented in Table 1 for 2011 (the shares are shown in Table 2). In addition, the estimated toilet stock volumes which may be under the scope of public procurement (stock in public buildings) are also shown in both tables (column 'Public'). Toilets are meant in the tables as any type of toilets.

Table 1: Estimated toilet stock by EU MS and contributing categories in 2011 (in millions)

| Country               | Domestic     | Offices     | Tourism     | Hospitals    | Education   | Prisons      | TOTAL        | Public <sup>1)</sup> |
|-----------------------|--------------|-------------|-------------|--------------|-------------|--------------|--------------|----------------------|
| <b>Austria</b>        | 6.3          | 1.3         | 0.8         | 0.016        | 0.06        | 0.002        | <b>8.4</b>   | 0.3                  |
| <b>Belgium</b>        | 5.4          | 1.7         | 0.3         | 0.019        | 0.11        | 0.002        | <b>7.6</b>   | 0.4                  |
| <b>Bulgaria</b>       | 3.0          | 1.1         | 0.2         | 0.011        | 0.05        | 0.003        | <b>4.3</b>   | 0.2                  |
| <b>Cyprus</b>         | 0.3          | 0.2         | 0.1         | 0.001        | 0.01        | 0.000        | <b>0.6</b>   | 0.0                  |
| <b>Czech Republic</b> | 4.3          | 3.9         | 0.4         | 0.019        | 0.08        | 0.005        | <b>8.7</b>   | 0.7                  |
| <b>Denmark</b>        | 3.6          | 0.9         | 0.3         | 0.005        | 0.05        | 0.001        | <b>4.9</b>   | 0.2                  |
| <b>Estonia</b>        | 0.6          | 0.2         | 0.1         | 0.002        | 0.01        | 0.001        | <b>0.9</b>   | 0.0                  |
| <b>Finland</b>        | 3.0          | 0.9         | 0.2         | 0.009        | 0.05        | 0.001        | <b>4.1</b>   | 0.1                  |
| <b>France</b>         | 26.4         | 10.2        | 4.8         | 0.108        | 0.52        | 0.015        | <b>42.0</b>  | 3.6                  |
| <b>Germany</b>        | 65.7         | 7.6         | 2.9         | 0.168        | 0.61        | 0.019        | <b>77.0</b>  | 2.1                  |
| <b>Greece</b>         | 4.4          | 3.5         | 0.7         | 0.013        | 0.09        | 0.003        | <b>8.6</b>   | 0.6                  |
| <b>Hungary</b>        | 3.9          | 2.3         | 0.3         | 0.019        | 0.08        | 0.004        | <b>6.6</b>   | 0.4                  |
| <b>Ireland</b>        | 2.4          | 0.4         | 0.2         | 0.006        | 0.05        | 0.001        | <b>3.1</b>   | 0.1                  |
| <b>Italy</b>          | 26.1         | 16.2        | 3.7         | 0.054        | 0.41        | 0.013        | <b>46.5</b>  | 2.8                  |
| <b>Latvia</b>         | 0.9          | 0.3         | 0.0         | 0.004        | 0.02        | 0.002        | <b>1.2</b>   | 0.1                  |
| <b>Lithuania</b>      | 1.6          | 0.5         | 0.0         | 0.006        | 0.03        | 0.002        | <b>2.2</b>   | 0.1                  |
| <b>Luxembourg</b>     | 0.2          | 0.1         | 0.1         | 0.001        | 0.00        | 0.000        | <b>0.4</b>   | 0.0                  |
| <b>Malta</b>          | 0.1          | 0.1         | 0.0         | 0.001        | 0.00        | 0.000        | <b>0.3</b>   | 0.0                  |
| <b>Netherlands</b>    | 15.0         | 2.2         | 1.0         | 0.017        | 0.14        | 0.004        | <b>18.4</b>  | 0.2                  |
| <b>Poland</b>         | 13.9         | 6.1         | 0.5         | 0.061        | 0.36        | 0.023        | <b>21.0</b>  | 1.2                  |
| <b>Portugal</b>       | 4.2          | 4.0         | 0.4         | 0.009        | 0.08        | 0.003        | <b>8.6</b>   | 0.7                  |
| <b>Romania</b>        | 7.0          | 2.0         | 0.2         | 0.035        | 0.17        | 0.008        | <b>9.4</b>   | 0.5                  |
| <b>Slovakia</b>       | 2.0          | 0.2         | 0.1         | 0.009        | 0.05        | 0.002        | <b>2.5</b>   | 0.1                  |
| <b>Slovenia</b>       | 0.7          | 0.4         | 0.1         | 0.002        | 0.02        | 0.000        | <b>1.2</b>   | 0.1                  |
| <b>Spain</b>          | 34.6         | 11.7        | 2.6         | 0.038        | 0.32        | 0.017        | <b>49.2</b>  | 2.0                  |
| <b>Sweden</b>         | 5.7          | 2.4         | 0.8         | 0.009        | 0.09        | 0.002        | <b>9.0</b>   | 0.4                  |
| <b>United Kingdom</b> | 35.7         | 6.9         | 2.0         | 0.052        | 0.61        | 0.022        | <b>45.3</b>  | 1.5                  |
| <b>EU27</b>           | <b>277.0</b> | <b>87.1</b> | <b>22.9</b> | <b>0.694</b> | <b>4.08</b> | <b>0.155</b> | <b>392.0</b> | <b>18.4</b>          |

<sup>1)</sup> Estimated stock in public buildings.

In 2011, the total EU27 toilet stock is estimated at around 392 million units, including 277 million domestic toilets (70.7 %) and 115 million nondomestic toilets (29.3 %), mainly in office buildings (87 million, or 22.2 %) and tourist accommodations (23 million, or 5.8 %). In addition, it is estimated that about 18 million (4.7 %) units are potentially under the scope of public procurement. From Table 1 and Table 2, we can note that the number of prison toilets (EU total of 155 thousand units, 0.04 %) are insignificant compared to the other categories.

Table 2: Estimated toilet stock by EU MS and contributing categories in 2011 (in %)

| Country               | Domestic    | Offices     | Tourism    | Hospitals  | Education  | Prisons    | TOTAL        | Public <sup>1)</sup> |
|-----------------------|-------------|-------------|------------|------------|------------|------------|--------------|----------------------|
| <b>Austria</b>        | 74.4        | 14.9        | 9.7        | 0.2        | 0.7        | 0.0        | <b>100.0</b> | 3.3                  |
| <b>Belgium</b>        | 71.3        | 22.6        | 4.5        | 0.2        | 1.4        | 0.0        | <b>100.0</b> | 4.7                  |
| <b>Bulgaria</b>       | 69.2        | 25.6        | 3.7        | 0.3        | 1.1        | 0.1        | <b>100.0</b> | 4.7                  |
| <b>Cyprus</b>         | 50.4        | 34.0        | 14.3       | 0.2        | 1.1        | 0.0        | <b>100.0</b> | 5.7                  |
| <b>Czech Republic</b> | 49.8        | 44.1        | 4.9        | 0.2        | 0.9        | 0.1        | <b>100.0</b> | 7.6                  |
| <b>Denmark</b>        | 73.3        | 18.8        | 6.7        | 0.1        | 1.0        | 0.0        | <b>100.0</b> | 3.8                  |
| <b>Estonia</b>        | 70.1        | 22.2        | 5.9        | 0.2        | 1.4        | 0.1        | <b>100.0</b> | 4.7                  |
| <b>Finland</b>        | 73.2        | 20.6        | 4.6        | 0.2        | 1.3        | 0.0        | <b>100.0</b> | 3.4                  |
| <b>France</b>         | 62.8        | 24.3        | 11.4       | 0.3        | 1.2        | 0.0        | <b>100.0</b> | 8.5                  |
| <b>Germany</b>        | 85.4        | 9.8         | 3.7        | 0.2        | 0.8        | 0.0        | <b>100.0</b> | 2.8                  |
| <b>Greece</b>         | 50.9        | 40.0        | 7.9        | 0.2        | 1.0        | 0.0        | <b>100.0</b> | 6.9                  |
| <b>Hungary</b>        | 59.0        | 35.0        | 4.4        | 0.3        | 1.3        | 0.1        | <b>100.0</b> | 6.1                  |
| <b>Ireland</b>        | 78.4        | 13.4        | 6.5        | 0.2        | 1.5        | 0.0        | <b>100.0</b> | 3.3                  |
| <b>Italy</b>          | 56.1        | 34.8        | 8.0        | 0.1        | 0.9        | 0.0        | <b>100.0</b> | 6.0                  |
| <b>Latvia</b>         | 69.7        | 26.6        | 1.6        | 0.3        | 1.6        | 0.2        | <b>100.0</b> | 5.2                  |
| <b>Lithuania</b>      | 71.8        | 24.9        | 1.4        | 0.3        | 1.6        | 0.1        | <b>100.0</b> | 5.1                  |
| <b>Luxembourg</b>     | 56.6        | 26.5        | 15.9       | 0.3        | 0.8        | 0.0        | <b>100.0</b> | 4.8                  |
| <b>Malta</b>          | 43.7        | 42.8        | 12.2       | 0.3        | 0.9        | 0.0        | <b>100.0</b> | 7.3                  |
| <b>Netherlands</b>    | 81.4        | 12.1        | 5.6        | 0.1        | 0.8        | 0.0        | <b>100.0</b> | 1.1                  |
| <b>Poland</b>         | 66.5        | 28.9        | 2.5        | 0.3        | 1.7        | 0.1        | <b>100.0</b> | 5.8                  |
| <b>Portugal</b>       | 48.4        | 46.0        | 4.5        | 0.1        | 1.0        | 0.0        | <b>100.0</b> | 7.7                  |
| <b>Romania</b>        | 73.8        | 21.6        | 2.4        | 0.4        | 1.8        | 0.1        | <b>100.0</b> | 5.0                  |
| <b>Slovakia</b>       | 82.6        | 9.4         | 5.7        | 0.4        | 1.9        | 0.1        | <b>100.0</b> | 3.1                  |
| <b>Slovenia</b>       | 61.5        | 32.0        | 4.9        | 0.2        | 1.4        | 0.0        | <b>100.0</b> | 6.0                  |
| <b>Spain</b>          | 70.2        | 23.7        | 5.3        | 0.1        | 0.6        | 0.0        | <b>100.0</b> | 4.1                  |
| <b>Sweden</b>         | 63.6        | 26.3        | 8.9        | 0.1        | 1.0        | 0.0        | <b>100.0</b> | 4.9                  |
| <b>United Kingdom</b> | 78.9        | 15.2        | 4.4        | 0.1        | 1.3        | 0.0        | <b>100.0</b> | 3.4                  |
| <b>EU27</b>           | <b>70.7</b> | <b>22.2</b> | <b>5.8</b> | <b>0.2</b> | <b>1.0</b> | <b>0.0</b> | <b>100.0</b> | <b>4.7</b>           |

<sup>1)</sup> Estimated stock in public buildings.

The 2030 projections for EU27 toilet stock are presented by contribution categories in Table 3.

Table 3: Projections for the EU27 toilet stock by contributing categories (in millions)

| Categories       | 2011         | 2030         | Variation (%) | Annual growth rate (%) |
|------------------|--------------|--------------|---------------|------------------------|
| <b>Domestic</b>  | 277.0        | 294.9        | 6.4           | 0.33                   |
| <b>Offices</b>   | 87.1         | 92.3         | 5.9           | 0.30                   |
| <b>Tourism</b>   | 22.9         | 24.5         | 7.2           | 0.36                   |
| <b>Hospitals</b> | 0.7          | 0.7          | -5.2          | -0.28                  |
| <b>Education</b> | 4.1          | 4.1          | -0.5          | -0.03                  |
| <b>Prisons</b>   | 0.2          | 0.2          | 5.2           | 0.27                   |
| <b>TOTAL</b>     | <b>392.0</b> | <b>416.6</b> | <b>6.3</b>    | <b>0.32</b>            |

From Table 3, we can see that the EU27 toilet stock of main contributing categories (domestic, offices and tourism) is expected to rise slowly by 2030 (range of 0.3-0.4 %/year), while for less contributing categories the toilet stock is foreseen to remain about stable (education) or even to decrease slightly (hospitals). All in all, the total EU27 toilet stock is expected to increase annually by about 0.3 %, with around 417 million units installed in 2030 (6.3 % increase over the two decades).

#### **4.2.2 EU urinal stock**

The domestic and nondomestic urinal stock figures in each EU MS are presented in Table 4 for 2011 (the shares are shown in Table 5). Again, the estimated urinal stock volumes which may be under the scope of public procurement (stock in public buildings) are also shown in both tables (column 'Public'). Urinals are meant in the tables as any type of urinals.

Table 4: Estimated urinal stock by EU MS and contributing categories in 2011 (in millions)

| <b>Country</b>        | <b>Domestic</b> | <b>Offices</b> | <b>Tourism</b> | <b>Hospitals</b> | <b>Education</b> | <b>Prisons</b> | <b>TOTAL</b> | <b>Public<sup>1)</sup></b> |
|-----------------------|-----------------|----------------|----------------|------------------|------------------|----------------|--------------|----------------------------|
| <b>Austria</b>        | 0               | 0.6            | 0.004          | 0.000            | 0.02             | 0.000          | <b>0.6</b>   | 0.1                        |
| <b>Belgium</b>        | 0               | 0.9            | 0.002          | 0.000            | 0.04             | 0.000          | <b>0.9</b>   | 0.2                        |
| <b>Bulgaria</b>       | 0               | 0.5            | 0.001          | 0.000            | 0.02             | 0.000          | <b>0.5</b>   | 0.1                        |
| <b>Cyprus</b>         | 0               | 0.1            | 0.000          | 0.000            | 0.00             | 0.000          | <b>0.1</b>   | 0.0                        |
| <b>Czech Republic</b> | 0               | 1.9            | 0.002          | 0.000            | 0.03             | 0.000          | <b>1.9</b>   | 0.3                        |
| <b>Denmark</b>        | 0               | 0.4            | 0.002          | 0.000            | 0.02             | 0.000          | <b>0.5</b>   | 0.1                        |
| <b>Estonia</b>        | 0               | 0.1            | 0.000          | 0.000            | 0.00             | 0.000          | <b>0.1</b>   | 0.0                        |
| <b>Finland</b>        | 0               | 0.4            | 0.001          | 0.000            | 0.02             | 0.000          | <b>0.4</b>   | 0.1                        |
| <b>France</b>         | 0               | 5.0            | 0.023          | 0.001            | 0.17             | 0.000          | <b>5.2</b>   | 1.7                        |
| <b>Germany</b>        | 0               | 3.6            | 0.013          | 0.001            | 0.20             | 0.000          | <b>3.8</b>   | 0.9                        |
| <b>Greece</b>         | 0               | 1.7            | 0.003          | 0.000            | 0.03             | 0.000          | <b>1.8</b>   | 0.3                        |
| <b>Hungary</b>        | 0               | 1.2            | 0.001          | 0.000            | 0.03             | 0.000          | <b>1.2</b>   | 0.2                        |
| <b>Ireland</b>        | 0               | 0.2            | 0.001          | 0.000            | 0.02             | 0.000          | <b>0.2</b>   | 0.0                        |
| <b>Italy</b>          | 0               | 8.0            | 0.018          | 0.000            | 0.14             | 0.000          | <b>8.2</b>   | 1.3                        |
| <b>Latvia</b>         | 0               | 0.2            | 0.000          | 0.000            | 0.01             | 0.000          | <b>0.2</b>   | 0.0                        |
| <b>Lithuania</b>      | 0               | 0.3            | 0.000          | 0.000            | 0.01             | 0.000          | <b>0.3</b>   | 0.0                        |
| <b>Luxembourg</b>     | 0               | 0.1            | 0.000          | 0.000            | 0.00             | 0.000          | <b>0.1</b>   | 0.0                        |
| <b>Malta</b>          | 0               | 0.1            | 0.000          | 0.000            | 0.00             | 0.000          | <b>0.1</b>   | 0.0                        |
| <b>Netherlands</b>    | 0               | 1.1            | 0.005          | 0.000            | 0.05             | 0.000          | <b>1.1</b>   | 0.1                        |
| <b>Poland</b>         | 0               | 3.0            | 0.003          | 0.000            | 0.12             | 0.000          | <b>3.1</b>   | 0.5                        |
| <b>Portugal</b>       | 0               | 2.0            | 0.002          | 0.000            | 0.03             | 0.000          | <b>2.0</b>   | 0.3                        |
| <b>Romania</b>        | 0               | 1.0            | 0.001          | 0.000            | 0.05             | 0.000          | <b>1.1</b>   | 0.2                        |
| <b>Slovakia</b>       | 0               | 0.1            | 0.001          | 0.000            | 0.02             | 0.000          | <b>0.1</b>   | 0.0                        |
| <b>Slovenia</b>       | 0               | 0.2            | 0.000          | 0.000            | 0.01             | 0.000          | <b>0.2</b>   | 0.0                        |
| <b>Spain</b>          | 0               | 5.7            | 0.012          | 0.000            | 0.11             | 0.000          | <b>5.8</b>   | 0.9                        |
| <b>Sweden</b>         | 0               | 1.2            | 0.004          | 0.000            | 0.03             | 0.000          | <b>1.2</b>   | 0.2                        |
| <b>United Kingdom</b> | 0               | 3.4            | 0.009          | 0.000            | 0.20             | 0.000          | <b>3.6</b>   | 0.7                        |
| <b>EU27</b>           | <b>0</b>        | <b>42.8</b>    | <b>0.108</b>   | <b>0.006</b>     | <b>1.36</b>      | <b>0.001</b>   | <b>44.3</b>  | <b>8.3</b>                 |

<sup>1)</sup> Estimated stock in public buildings.

The domestic stock of urinals has been estimated to be negligible, so that all urinals will be assumed to be nondomestic in the project. In 2011, the estimated total EU27 stock of urinals

is about 44.3 million units, mainly in office buildings (42.8 million or 96.6 %). In addition, it is estimated that about 8.3 million (18.7 %) units are potentially under the scope of public procurement. From Table 4, we can note that the number of urinals in hospitals and prisons, and to a certain extent in tourist accommodations, is insignificant compared to the other categories.

Table 5: Estimated urinal stock by EU MS and contributing categories in 2011 (in %)

| Country               | Domestic   | Offices     | Tourism    | Hospitals  | Education  | Prisons    | TOTAL        | Public <sup>1)</sup> |
|-----------------------|------------|-------------|------------|------------|------------|------------|--------------|----------------------|
| <b>Austria</b>        | 0.0        | 96.1        | 0.6        | 0.0        | 3.3        | 0.0        | <b>100.0</b> | 18.9                 |
| <b>Belgium</b>        | 0.0        | 95.8        | 0.2        | 0.0        | 3.9        | 0.0        | <b>100.0</b> | 17.4                 |
| <b>Bulgaria</b>       | 0.0        | 96.9        | 0.2        | 0.0        | 2.9        | 0.0        | <b>100.0</b> | 16.3                 |
| <b>Cyprus</b>         | 0.0        | 96.8        | 0.0        | 0.0        | 2.2        | 0.0        | <b>100.0</b> | 15.1                 |
| <b>Czech Republic</b> | 0.0        | 98.5        | 0.1        | 0.0        | 1.4        | 0.0        | <b>100.0</b> | 15.9                 |
| <b>Denmark</b>        | 0.0        | 96.1        | 0.4        | 0.0        | 3.7        | 0.0        | <b>100.0</b> | 17.5                 |
| <b>Estonia</b>        | 0.0        | 95.7        | 0.0        | 0.0        | 4.3        | 0.0        | <b>100.0</b> | 18.1                 |
| <b>Finland</b>        | 0.0        | 95.7        | 0.2        | 0.0        | 4.1        | 0.0        | <b>100.0</b> | 13.7                 |
| <b>France</b>         | 0.0        | 96.2        | 0.4        | 0.0        | 3.3        | 0.0        | <b>100.0</b> | 31.5                 |
| <b>Germany</b>        | 0.0        | 94.3        | 0.3        | 0.0        | 5.3        | 0.0        | <b>100.0</b> | 23.0                 |
| <b>Greece</b>         | 0.0        | 98.2        | 0.2        | 0.0        | 1.6        | 0.0        | <b>100.0</b> | 16.0                 |
| <b>Hungary</b>        | 0.0        | 97.5        | 0.1        | 0.0        | 2.4        | 0.0        | <b>100.0</b> | 16.3                 |
| <b>Ireland</b>        | 0.0        | 92.6        | 0.5        | 0.0        | 6.9        | 0.0        | <b>100.0</b> | 19.0                 |
| <b>Italy</b>          | 0.0        | 98.1        | 0.2        | 0.0        | 1.7        | 0.0        | <b>100.0</b> | 16.0                 |
| <b>Latvia</b>         | 0.0        | 95.8        | 0.0        | 0.0        | 4.2        | 0.0        | <b>100.0</b> | 16.8                 |
| <b>Lithuania</b>      | 0.0        | 95.9        | 0.0        | 0.0        | 4.1        | 0.0        | <b>100.0</b> | 17.3                 |
| <b>Luxembourg</b>     | 0.0        | 98.0        | 0.0        | 0.0        | 2.0        | 0.0        | <b>100.0</b> | 15.7                 |
| <b>Malta</b>          | 0.0        | 98.6        | 0.0        | 0.0        | 1.4        | 0.0        | <b>100.0</b> | 15.5                 |
| <b>Netherlands</b>    | 0.0        | 95.4        | 0.4        | 0.0        | 4.2        | 0.0        | <b>100.0</b> | 6.3                  |
| <b>Poland</b>         | 0.0        | 96.0        | 0.1        | 0.0        | 3.9        | 0.0        | <b>100.0</b> | 17.2                 |
| <b>Portugal</b>       | 0.0        | 98.5        | 0.1        | 0.0        | 1.4        | 0.0        | <b>100.0</b> | 15.8                 |
| <b>Romania</b>        | 0.0        | 94.7        | 0.1        | 0.0        | 5.2        | 0.0        | <b>100.0</b> | 18.5                 |
| <b>Slovakia</b>       | 0.0        | 87.3        | 0.8        | 0.0        | 11.9       | 0.0        | <b>100.0</b> | 21.4                 |
| <b>Slovenia</b>       | 0.0        | 96.9        | 0.0        | 0.0        | 3.1        | 0.0        | <b>100.0</b> | 16.8                 |
| <b>Spain</b>          | 0.0        | 98.0        | 0.2        | 0.0        | 1.8        | 0.0        | <b>100.0</b> | 16.0                 |
| <b>Sweden</b>         | 0.0        | 97.2        | 0.3        | 0.0        | 2.5        | 0.0        | <b>100.0</b> | 16.7                 |
| <b>United Kingdom</b> | 0.0        | 94.0        | 0.3        | 0.0        | 5.7        | 0.0        | <b>100.0</b> | 18.4                 |
| <b>EU27</b>           | <b>0.0</b> | <b>96.7</b> | <b>0.2</b> | <b>0.0</b> | <b>3.1</b> | <b>0.0</b> | <b>100.0</b> | <b>18.7</b>          |

<sup>1)</sup> Estimated stock in public buildings.

The 2030 projections for EU27 urinal stock are presented by all contribution categories in Table 6.

Table 6: Projections for the EU27 urinal stock by contributing categories (in millions)

| Categories   | 2011         | 2030         | Variation (%) | Annual growth rate (%) |
|--------------|--------------|--------------|---------------|------------------------|
| Domestic     | 0            | 0            | 0.0           | 0.00                   |
| Offices      | 42.79        | 45.32        | 5.9           | 0.30                   |
| Tourism      | 0.11         | 0.12         | 7.3           | 0.37                   |
| Hospitals    | 0.01         | 0.01         | - 5.4         | - 0.29                 |
| Education    | 1.36         | 1.35         | - 0.4         | - 0.02                 |
| Prisons      | 0.00         | 0.00         | 4.9           | 0.25                   |
| <b>TOTAL</b> | <b>44.26</b> | <b>46.80</b> | <b>5.7</b>    | <b>0.29</b>            |

From Table 6, we can see that the EU27 urinal stock of the major contributing category (offices) is expected to rise slowly by 2030 (0.3 %/year), while the other significant category (education) is foreseen to remain about stable. All in all, the total EU27 urinal stock is expected to increase annually by about 0.3 %, with around 46.8 million units installed in 2030 (5.7 % increase over the two decades).

**4.2.3 Total EU stock shares for toilets and urinals**

As a summary, Figure 1 shows the total EU stock shares for both toilets and urinals, broken down into the six categories identified in the study. As already underlined before, commercial urinals and domestic toilets are the main categories.

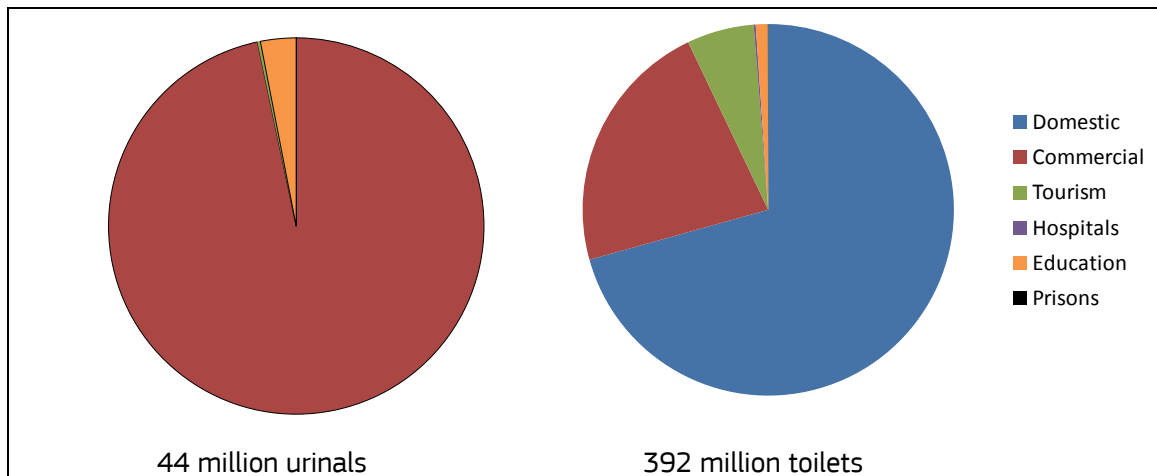


Figure 1: EU stock shares of urinals (on left) and toilets (right) in 2011

## 4.3 EU annual sales of toilets and urinals

### 4.3.1 EU toilet annual sales

The domestic and nondomestic toilet annual sales in each EU MS are presented in Table 7 for 2011. In addition, the estimated annual public procurement of toilets (which might be under the GPP scope) is also shown in the table (column 'Public'). Public procurement includes direct product purchases but also purchase through building purchases and renovation. Toilets are meant in the table as any type of toilets.

Table 7: Estimated 2011 toilet sales by EU MS and contributing categories (in thousands)

| Country               | Domestic      | Offices      | Tourism      | Hospitals   | Education  | Prisons    | TOTAL         | Public <sup>1)</sup> |
|-----------------------|---------------|--------------|--------------|-------------|------------|------------|---------------|----------------------|
| <b>Austria</b>        | 328           | 84           | 55           | 0.9         | 4          | 0.1        | <b>472</b>    | 18                   |
| <b>Belgium</b>        | 318           | 115          | 23           | 1.1         | 6          | 0.1        | <b>463</b>    | 23                   |
| <b>Bulgaria</b>       | 162           | 73           | 11           | 0.6         | 3          | 0.1        | <b>250</b>    | 13                   |
| <b>Cyprus</b>         | 15            | 13           | 6            | 0.0         | 0          | 0.0        | <b>34</b>     | 2                    |
| <b>Czech Republic</b> | 219           | 257          | 29           | 1.1         | 5          | 0.2        | <b>510</b>    | 43                   |
| <b>Denmark</b>        | 176           | 61           | 22           | 0.3         | 3          | 0.0        | <b>262</b>    | 12                   |
| <b>Estonia</b>        | 28            | 13           | 3            | 0.1         | 1          | 0.1        | <b>45</b>     | 2                    |
| <b>Finland</b>        | 166           | 57           | 13           | 0.5         | 3          | 0.0        | <b>239</b>    | 14                   |
| <b>France</b>         | 1,409         | 679          | 326          | 6.2         | 30         | 0.7        | <b>2,451</b>  | 130                  |
| <b>Germany</b>        | 3,354         | 504          | 194          | 9.6         | 35         | 1.0        | <b>4,097</b>  | 114                  |
| <b>Greece</b>         | 236           | 231          | 46           | 0.8         | 5          | 0.1        | <b>518</b>    | 38                   |
| <b>Hungary</b>        | 195           | 155          | 20           | 1.1         | 5          | 0.2        | <b>376</b>    | 28                   |
| <b>Ireland</b>        | 124           | 27           | 13           | 0.4         | 3          | 0.0        | <b>167</b>    | 6                    |
| <b>Italy</b>          | 1,275         | 1,081        | 254          | 3.1         | 23         | 0.7        | <b>2,636</b>  | 179                  |
| <b>Latvia</b>         | 45            | 23           | 2            | 0.2         | 1          | 0.1        | <b>71</b>     | 4                    |
| <b>Lithuania</b>      | 73            | 36           | 2            | 0.3         | 2          | 0.1        | <b>113</b>    | 7                    |
| <b>Luxembourg</b>     | 11            | 7            | 4            | 0.0         | 0          | 0.0        | <b>21</b>     | 1                    |
| <b>Malta</b>          | 7             | 9            | 2            | 0.0         | 0          | 0.0        | <b>19</b>     | 0                    |
| <b>Netherlands</b>    | 759           | 148          | 70           | 1.0         | 8          | 0.2        | <b>987</b>    | 29                   |
| <b>Poland</b>         | 683           | 403          | 36           | 3.5         | 21         | 1.1        | <b>1,147</b>  | 78                   |
| <b>Portugal</b>       | 202           | 264          | 26           | 0.5         | 5          | 0.2        | <b>497</b>    | 44                   |
| <b>Romania</b>        | 372           | 135          | 16           | 2.0         | 10         | 0.4        | <b>535</b>    | 29                   |
| <b>Slovakia</b>       | 99            | 15           | 9            | 0.5         | 3          | 0.1        | <b>127</b>    | 5                    |
| <b>Slovenia</b>       | 40            | 26           | 4            | 0.1         | 1          | 0.0        | <b>71</b>     | 5                    |
| <b>Spain</b>          | 1,768         | 778          | 176          | 2.2         | 18         | 0.8        | <b>2,743</b>  | 250                  |
| <b>Sweden</b>         | 283           | 157          | 54           | 0.5         | 5          | 0.1        | <b>499</b>    | 28                   |
| <b>United Kingdom</b> | 1,940         | 460          | 134          | 3.0         | 35         | 1.1        | <b>2,573</b>  | 98                   |
| <b>EU27</b>           | <b>14,285</b> | <b>5,809</b> | <b>1,549</b> | <b>39.8</b> | <b>234</b> | <b>7.8</b> | <b>21,925</b> | <b>1,201</b>         |

<sup>1)</sup> Estimated public procurement.

In 2011, the total EU27 toilet annual sales are estimated at around 21.9 million units, including 14.3 million domestic toilets and 7.6 million nondomestic toilets, mainly for office buildings (5.8 million) and tourist accommodations (1.5 million). In addition, it is estimated that about 1.2 million units are purchased by public administration.

The 2030 projections for EU27 toilet annual sales are presented by contribution categories in Table 8.

Table 8: Projections for the EU27 toilet annual sales by contributing categories (in thousands)

| <b>Categories</b> | <b>2011</b>   | <b>2030</b>   | <b>Variation (%)</b> | <b>Annual growth rate (%)</b> |
|-------------------|---------------|---------------|----------------------|-------------------------------|
| <b>Domestic</b>   | 14,285        | 15,213        | 6.5                  | 0.33                          |
| <b>Offices</b>    | 5,809         | 6,153         | 5.9                  | 0.30                          |
| <b>Tourism</b>    | 1,549         | 1,661         | 7.3                  | 0.37                          |
| <b>Hospitals</b>  | 40            | 38            | - 5.4                | - 0.29                        |
| <b>Education</b>  | 234           | 233           | - 0.4                | - 0.02                        |
| <b>Prisons</b>    | 8             | 8             | 0.0                  | 0.00                          |
| <b>TOTAL</b>      | <b>21,925</b> | <b>23,306</b> | <b>6.3</b>           | <b>0.32</b>                   |

From Table 8, we can see that the EU27 toilet annual sales for the main contributing categories (domestic, offices and tourism) are expected to rise slowly by 2030 (range of 0.3-0.4 %/year), while for less contributing categories the sales are foreseen to remain stable (education) or even to decrease slightly (hospitals). All in all, the total EU27 toilet annual sales are expected to increase annually by about 0.3 %, with around 23.3 million units sold in 2030 (6.3 % increase over the two decades).

#### **4.3.2 EU urinal annual sales**

The domestic and nondomestic urinal annual sales in each EU MS are presented in Table 9 for 2011. In addition, the estimated annual public procurement of urinals (which might be under the GPP scope) is also shown in the table (column 'Public'). Public procurement includes direct product purchases but also purchase through building purchases and renovation. Urinals are meant in the table as any type of urinals.



Table 9: Estimated 2011 urinal sales by EU MS and contributing categories (in thousands)

| Country               | Domestic | Offices      | Tourism    | Hospitals   | Education   | Prisons      | TOTAL        | Public <sup>1)</sup> |
|-----------------------|----------|--------------|------------|-------------|-------------|--------------|--------------|----------------------|
| <b>Austria</b>        | 0        | 31           | 0.2        | 0.01        | 0.9         | 0.001        | <b>32</b>    | 6                    |
| <b>Belgium</b>        | 0        | 42           | 0.1        | 0.01        | 1.6         | 0.001        | <b>44</b>    | 8                    |
| <b>Bulgaria</b>       | 0        | 27           | 0.0        | 0.00        | 0.7         | 0.001        | <b>27</b>    | 4                    |
| <b>Cyprus</b>         | 0        | 5            | 0.0        | 0.00        | 0.1         | 0.000        | <b>5</b>     | 1                    |
| <b>Czech Republic</b> | 0        | 95           | 0.1        | 0.01        | 1.2         | 0.002        | <b>96</b>    | 15                   |
| <b>Denmark</b>        | 0        | 22           | 0.1        | 0.00        | 0.7         | 0.000        | <b>23</b>    | 4                    |
| <b>Estonia</b>        | 0        | 5            | 0.0        | 0.00        | 0.2         | 0.000        | <b>5</b>     | 1                    |
| <b>Finland</b>        | 0        | 21           | 0.0        | 0.00        | 0.8         | 0.000        | <b>22</b>    | 3                    |
| <b>France</b>         | 0        | 252          | 1.1        | 0.04        | 7.8         | 0.005        | <b>261</b>   | 82                   |
| <b>Germany</b>        | 0        | 182          | 0.7        | 0.06        | 9.1         | 0.006        | <b>191</b>   | 43                   |
| <b>Greece</b>         | 0        | 87           | 0.2        | 0.00        | 1.3         | 0.001        | <b>88</b>    | 14                   |
| <b>Hungary</b>        | 0        | 57           | 0.1        | 0.01        | 1.2         | 0.001        | <b>59</b>    | 9                    |
| <b>Ireland</b>        | 0        | 10           | 0.0        | 0.00        | 0.7         | 0.000        | <b>11</b>    | 2                    |
| <b>Italy</b>          | 0        | 400          | 0.9        | 0.02        | 6.1         | 0.004        | <b>407</b>   | 65                   |
| <b>Latvia</b>         | 0        | 8            | 0.0        | 0.00        | 0.3         | 0.001        | <b>8</b>     | 1                    |
| <b>Lithuania</b>      | 0        | 13           | 0.0        | 0.00        | 0.5         | 0.001        | <b>14</b>    | 2                    |
| <b>Luxembourg</b>     | 0        | 3            | 0.0        | 0.00        | 0.1         | 0.000        | <b>3</b>     | 0                    |
| <b>Malta</b>          | 0        | 4            | 0.0        | 0.00        | 0.0         | 0.000        | <b>4</b>     | 1                    |
| <b>Netherlands</b>    | 0        | 54           | 0.2        | 0.01        | 2.1         | 0.001        | <b>57</b>    | 3                    |
| <b>Poland</b>         | 0        | 150          | 0.1        | 0.02        | 5.4         | 0.007        | <b>156</b>   | 26                   |
| <b>Portugal</b>       | 0        | 98           | 0.1        | 0.00        | 1.3         | 0.001        | <b>99</b>    | 16                   |
| <b>Romania</b>        | 0        | 50           | 0.1        | 0.01        | 2.4         | 0.003        | <b>52</b>    | 9                    |
| <b>Slovakia</b>       | 0        | 5            | 0.0        | 0.00        | 0.7         | 0.001        | <b>6</b>     | 1                    |
| <b>Slovenia</b>       | 0        | 10           | 0.0        | 0.00        | 0.3         | 0.000        | <b>10</b>    | 2                    |
| <b>Spain</b>          | 0        | 286          | 0.6        | 0.01        | 4.7         | 0.005        | <b>292</b>   | 46                   |
| <b>Sweden</b>         | 0        | 58           | 0.2        | 0.00        | 1.3         | 0.001        | <b>60</b>    | 10                   |
| <b>United Kingdom</b> | 0        | 168          | 0.5        | 0.02        | 9.1         | 0.007        | <b>177</b>   | 32                   |
| <b>EU27</b>           | <b>0</b> | <b>2,140</b> | <b>5.4</b> | <b>0.25</b> | <b>60.7</b> | <b>0.050</b> | <b>2,207</b> | <b>407</b>           |

<sup>1)</sup> Estimated public procurement.

Again, the annual sales of domestic urinals have been estimated to be negligible, so that all urinals will be assumed to be sold for nondomestic premises. In 2011, the total EU27 urinal annual sales are estimated at around 2.2 million units, almost exclusively for office buildings (2.1 million). In addition, it is estimated that about 0.4 million units are purchased by public administration. From Table 9, we can note that the number of urinals sold for hospitals and prisons as well as for tourist accommodations is insignificant compared to the other categories.

The 2030 projections for EU27 urinal annual sales are presented by contribution categories in Table 10.

Table 10: Projections for the EU27 urinal annual sales by contributing categories (in thousands)

| <b>Categories</b> | <b>2011</b>  | <b>2030</b>  | <b>Variation (%)</b> | <b>Annual growth rate (%)</b> |
|-------------------|--------------|--------------|----------------------|-------------------------------|
| <b>Domestic</b>   | 0            | 0            | 0.0                  | 0.00                          |
| <b>Offices</b>    | 2,140        | 2,267        | 5.9                  | 0.30                          |
| <b>Tourism</b>    | 5            | 6            | 7.3                  | 0.37                          |
| <b>Hospitals</b>  | 0            | 0            | - 5.3                | - 0.28                        |
| <b>Education</b>  | 61           | 60           | - 0.4                | - 0.02                        |
| <b>Prisons</b>    | 0            | 0            | 4.0                  | 0.21                          |
| <b>TOTAL</b>      | <b>2,207</b> | <b>2,333</b> | <b>5.7</b>           | <b>0.29</b>                   |

From Table 10, we can see that the EU27 urinal annual sales for the major contributing category (offices) are expected to rise slowly by 2030 (0.3 %/year). The total EU27 urinal annual sales follow the same pattern and are expected to increase annually by about 0.3 %, with around 2.3 million units sold in 2030 (5.7 % increase over the two decades).

#### 4.4 Public and private toilets and urinals in the EU

From the figures presented in previous sections, it is possible to derive the estimated shares of public and private toilets and urinals in the EU, both in terms of stocks and sales. The results are presented in Table 11 at the EU level.

Table 11: EU27 private vs. public toilets and urinals, in terms of stock and sales, 2011 (in %)

|       | Product | Private | Public | All   |
|-------|---------|---------|--------|-------|
| Stock | Toilets | 95.3    | 4.7    | 100.0 |
|       | Urinals | 81.3    | 18.7   | 100.0 |
| Sales | Toilets | 94.5    | 5.5    | 100.0 |
|       | Urinals | 81.6    | 18.4   | 100.0 |

As a matter of facts, toilets are mostly (about 95 %) installed and purchased for private purpose (households and private businesses). However, the sales for public buildings, even though marginal in share terms (about 5 %), represent a significant amount of products in absolute terms (about 1.2 million units) due to the large toilet market volumes. Regarding urinals, the situation is different since almost one fifth of urinals are installed and purchased for public building. This is related to the fact that urinals are installed and sold for non-domestic purpose only (almost no domestic urinals) while buildings in public ownership represent a significant fraction of non-domestic buildings (for instance, 15 % of office buildings are estimated to be public in the EU). In absolute terms, urinal sales for public buildings (0.4 million units) are lower than for toilets but remain a significant market.

## 4.5 EU market shares and trends of toilets and urinals

### 4.5.1 Toilet market shares and trends

Based on stakeholders' feedback gathered through the first questionnaire, the following EU toilet market shares for the different types of toilets have been derived:

- 91 % for water closets (WCs)
- 5 % for macerating toilets
- 3 % for flushing squat toilets
- 1 % for other toilets

As a result, the market shares of flushing toilets (including WCs, flushing squat toilets and macerating toilets) represent at least 99 % of the toilet market. Note that from the stakeholder consultation, it has not been possible to identify differences between the domestic and non-domestic premises. It may be assumed that a similar breakdown would apply in either setting, though, for squatting toilets, the situation might be quite different across the EU, as Southern European countries use this design more than the Northern countries in non-domestic premises.

When focusing on the flushing toilet market, the stakeholder consultation has shown that:

- For WCs: more than 50 % are equipped with dual flush and about 85 % are manually operated;
- For flushing squat toilets: more than 95 % are equipped with a single flush and 99 % are manually operated;
- For stand-alone facilities: 100 % are equipped with a single flush and 50 % are manually operated while 50 % are sensor operated; and
- For other types of flushing toilets: they are entirely using a single flush mechanism that is operated manually.

When looking at the market trend for WCs (representing more than 90 % of toilet market), it appears that the most common unit for domestic market is a 6/4-litre dual flush (full flush/reduced flush). Other dual flush systems available on the market includes 6/3 litres, 5/3 litres, 4.5/2.6 litres and 3.5/2 litres. In the non-domestic market, single flush systems of 4 and 3.5 litres are more common, for example in public buildings, where dual flush systems have been found to be not a workable solution (it seems that the public does not know how to use them properly and does not actually use the reduced flush volume as expected). It is interesting to compare these market trends with the average consumption of WCs already installed (stock). For instance, in the UK, the current average WC flush is estimated at 9 litres.

### 4.5.2 Urinal market shares and trends

The available information on urinals is more limited compared to toilets. All data gathered and analysed is related to non-domestic urinals only. Again, based on the feedback gathered from stakeholders through the first questionnaire, the following approximate EU urinal market shares for the different types of urinals have been derived:

- 80 % for single urinals
- 10 % for stall urinals
- 5 % for slab urinals
- 5 % for flush-free urinals

As a result, the market shares of flushing urinals (including single, stall and slab urinals) represent at least 95 % of the urinal market.

Flushing urinals may use three different types of flushing mechanisms: manual handle (flush activated by the user through a button, hand lever or foot lever), timed flush (flush operated automatically at regular intervals, generally servicing a number of urinals) and sensor flush (flush operated automatically by an infrared presence sensor). When asked about the type of flushing mechanisms flushing urinals were equipped with, the following estimates were calculated:

- For single urinals: 53 % are sensor operated;
- For stall urinals: 35 % are sensor operated; and
- For slab urinals: 98 % are sensor operated.

Note that flush-free urinals do not require a flushing mechanism but have generally a maintenance schedule flush.

In terms of market trends, the most popular flushing urinals in Europe are time and sensor flushed urinals, with sensor flush being the most common in newer installations. The typical flushing urinals currently installed use between 1.5 and 3 litres of water per flush while flush-free urinals do not use water (except for cleaning purpose). In general, urinals are commonly known to be less water intensive than standard WC units (with a typical 6-litre flush) and are a favoured option to install in male toilets.



## 5 USER BEHAVIOUR

As a matter of fact user behaviour data are scarce and very heterogeneous. Data collection was limited and this section summarise the main results on user behaviour<sup>12</sup>.

The work identifies the information provided by current product labels to users, how consumer behaviour can be influenced, and what manufacturers are doing to better inform consumers. It also considers usage patterns by the end users. The main conclusions from the research are: The typical lifetime of a domestic toilet is 12.5 years, 17.5 years for a non-domestic toilet, and 22.5 years for urinals. In general, this is limited not by the product durability but by the drive to refurbish facilities periodically;

- A typical standard flushing toilet has a flush volume of 6 litres, with 6/3 litres the most common dual-flush combination;
- Domestic flushing toilets are used about 7.75 times per day; non-domestic flushing toilets 25 times per day; and urinals about 40 times per day.

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<sup>12</sup> More details can be found in: Market analysis & Consumer behaviour report, available online: [http://susproc.jrc.ec.europa.eu/toilets/docs/Tasks%20&3\\_Market%20analysis%20and%20User%20behaviour.pdf](http://susproc.jrc.ec.europa.eu/toilets/docs/Tasks%20&3_Market%20analysis%20and%20User%20behaviour.pdf)





## 6 ANALYSIS OF ECOLABELLING SCHEMES ON FLUSHING TOILETS AND URINALS

### 6.1 Introduction

The EU Ecolabel Regulation<sup>13</sup> advises to take into consideration "criteria established for other environmental labels, particularly officially recognised, nationally or regionally, EN ISO 14024 type I environmental labels, where they exist for that product group so as to enhance synergies".

As the development of the EU Ecolabel criteria aims at harmonising the existing schemes, an analysis of the main national and international schemes covering the product group under study has been conducted in order to see which aspects they are covering. The scheme review includes ecolabels on toilets, urinals and flushing systems but also on buildings and services like tourist accommodation, which may state specific criteria for toilets, urinals or flushing systems. This work constitutes a basis for further consideration of the EU Ecolabel criteria development process.

The following sections do not give an exhaustive overview of all existing schemes, but rather presents different approaches on the basis of a few chosen examples, in order to support the discussion on the criteria which could potentially be considered for the EU Ecolabel and GPP criteria<sup>14</sup>.

A brief description of European and non-European ecolabel schemes, which refer explicitly to flushing toilets and urinals and are considered as most relevant in the current criteria development process, is given below. The selected schemes include EU Ecolabel for tourist accommodation and campsite services, Blue Angel, WELL (Water Efficiency Label) recently developed by the European Valve Manufacturers Association, WEPLS (Water Efficient Product Labelling Scheme) operated by the UK Bathroom Manufacturers Association, WaterSense label from the US Environmental Protection Agency and the Australian/New Zealand WELS (Water Efficiency Labelling and Standards) scheme. The Catalan Ecolabel (Emblem of guarantee of environmental quality) in Spain and the Portuguese water efficiency scheme operated by the National Association for Quality in Building Installations (ANQIP) are also been included in the selection below.

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<sup>13</sup> Regulation (EC) No 66/2010 of the European Parliament and of the Council of 25 November 2009 on the EU Ecolabel.

<sup>14</sup> More information on European and non-European legislation and ecolabel schemes on toilets and urinals, may be found at: [http://susproc.jrc.ec.europa.eu/toilets/docs/Task\\_1\\_Product%20definition.pdf](http://susproc.jrc.ec.europa.eu/toilets/docs/Task_1_Product%20definition.pdf)

## 6.2 Pass/fail ecolabelling schemes

### 6.2.1 EU Ecolabel for tourist accommodation and campsite services

The goal of the project was to develop EU Ecolabel criteria for the new product group: flushing toilets and urinals. Some related requirements already exist through the EU Ecolabel for tourist accommodation service and campsite service. In both cases, the following criterion related to urinals has to be met: “All urinals shall be fitted with either automatic (timed) or manual flushing systems so that there is no continuous flushing.” In addition to mandatory criteria, the award is based also on a point score system with optional criteria. Regarding flushing toilets and urinals, the optional criteria for both accommodation and campsite services are:

- At least 95 % of WCs shall consume 6 l per full flush or less;
- All urinals shall use a waterless system or have a manual/electronic flushing system, which permits single flushing of every urinal only when used.

As a result, EU Ecolabel for tourist accommodation and campsite services does not specify mandatory requirements for flushing toilets but includes an optional criterion on the maximum flush volume (6 l). For urinals, both the mandatory and the optional requirements concern the flush control device, though without specifying any maximum flush volume.

### 6.2.2 Blue Angel

Blue Angel<sup>15</sup>, the German Ecolabel, is a pioneer environment-related label set up in 1978. Though toilets and urinals are not covered as a functional unit, the Blue Angel defines criteria for water-saving flushing boxes<sup>16</sup> (flushing cisterns). To get the label, beyond to conform to DIN 19542 German Standard, the flushing cisterns shall meet the following requirements:

- The flushing box shall be equipped with devices to reduce the flushing-water volume or to interrupt the flushing pursuant to DIN 19542, section 3.2.4.
- The possibility to save water shall be appropriately indicated on the flushing box, e.g. by providing the box with an inscription or an adhesive label. And the Operating and Installation Instructions shall include easily comprehensible instructions for water-saving adjustment and operation.
- The maximum flushing-water volume shall not exceed 9 litres and the minimum amount of flushing water per uninterrupted flushing shall not fall below 6 litres. The flushing boxes shall be equipped with adjusting devices which allow an adjustment of the flushing-water volume depending on the type of the closet (within the 6 l - to - 9 l range). The flushing box shall be adjusted ex works to a water quantity of 6 litres.
- As far as plastics are concerned the respective material identification data according to EN ISO 11469 shall be indicated on the flushing box and its components.
- The flushing boxes must not exceed the value of the fitting-noise-level Lap for the characteristic flow or flow pressure of 20 dB(A), measured pursuant to EN ISO 3822, Parts 1 and 4. As regards the upper limits of flow and flow pressure listed in EN ISO 3822, Part 1, for the individual fittings, this value may be exceeded by up to 5 dB(A).

In brief, the Blue Angel criteria for flushing cisterns include maximum (9 l) and minimum (6 l) flush volumes, default water flush setting (6 l), water saving device (e.g. stop button,

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<sup>15</sup> See for more information: <http://www.blauer-engel.de/en/index.php>

<sup>16</sup> Criteria available at: [http://www.blauer-engel.de/downloads/vergabegrundlagen\\_en/e-UZ-032.zip](http://www.blauer-engel.de/downloads/vergabegrundlagen_en/e-UZ-032.zip)

economy button), user information (user manual, operating instructions directly on the product), plastic marking and maximum noise level (Level of Acoustic Pressure of 20 dB(A)).

### 6.2.3 Catalan Ecolabel

Catalan Ecolabel “Distintiu de Garantia de Qualitat Ambiental” (Emblem of guarantee of environmental quality) in Spain awards among others water saving products, including WCs and toilet retrofit devices. The criteria<sup>17</sup> are detailed below.

Regarding toilet retrofit devices for water saving (added to the flushing cistern), they should allow for saving at least 30 % of the nominal flush.

For WCs, in addition to be compliant with UNE 67001 Spanish Standard, the following requirements apply:

- WCs use a maximum of 6 litres of water per flush.
- WCs have a dual flush device or a device that allows interrupting the water flow.
- Operating instructions of the flush device have to be displayed on the cistern.
- The average volume of water of a total discharge plus four reduced discharges has to be less than or equal to 3.6 l.
- The flushing cistern must not exceed the value of the fitting-noise-level Lap for the characteristic flow or flow pressure of 20 dB(A), measured pursuant to EN ISO 3822, Parts 1 and 4.

Catalan Ecolabel requirements for WCs are of the same type as the Blue Angel ones for flushing cisterns and include maximum (6 l) and average (3.6 l) flush volumes, water saving device (e.g. stop button, economy button), user information (operating instructions directly on the product) and maximum noise level (Level of Acoustic Pressure of 20 dB(A)).

### 6.2.4 WaterSense

The WaterSense<sup>18</sup> labelling scheme in the USA is a partnership program by the U.S. Environmental Protection Agency which awards water efficient products. Flushing toilets and flushing urinals are covered by this voluntary labelling scheme.

The WaterSense criteria for tank-type toilets<sup>19</sup> (WC with cistern) set an average effective flush volume (4.8 l), flush performance requirements (full test media removal) and, for toilets equipped with unpressured cisterns (gravity toilets), cistern requirements (regarding the fill valve and cistern capacity) and maximum flush volumes after field adjustment (6.4 l for single flush and 7.6/5.3 l for full/reduced dual flush). For flushing urinals<sup>20</sup>, the criteria include maximum flush volume (1.9 l with a possible adjustment no more than  $\pm 0.4$  l) and flushing device requirements (non-hold-open design actuator<sup>21</sup>, spare parts not interchangeable with less effective ones). In addition for both product groups, there are also requirements for product marking (regarding the flush volumes). Furthermore, information on the product's packaging, marking, or instructions provided with it should support the consumers in using the products appropriately, i.e. not to override the rated flush volume. Also the maintenance instruction shall explain how to return the product to its rated flush volume.

<sup>17</sup> Criteria available at: <http://www.gencat.cat/eadop/imagenes/5460/09196123.pdf>

<sup>18</sup> See for more information: <http://www.epa.gov/WaterSense/>

<sup>19</sup> Criteria available at: [http://www.epa.gov/WaterSense/docs/revised\\_het\\_specification\\_v1.1\\_050611\\_final508.pdf](http://www.epa.gov/WaterSense/docs/revised_het_specification_v1.1_050611_final508.pdf)

<sup>20</sup> Criteria available at: [http://www.epa.gov/WaterSense/docs/urinal\\_finalspec508.pdf](http://www.epa.gov/WaterSense/docs/urinal_finalspec508.pdf)

<sup>21</sup> This means that even if the flushing system actuator is maintained in the flush position, the flushing system will not deliver more than the maximum flush volume allowed.

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Note that any fixture, flushing device and functioning unit have to conform to the requirements defined in all appropriate US standards (see the WaterSense specifications for tank-type toilets and flushing urinals for a full standards compliance list).

## 6.3 Rating ecolabelling schemes

### 6.3.1 WELL (Water Efficiency Label)

The WELL (Water Efficiency Label) scheme<sup>22</sup> is a new European ecolabel that has been developed by EUnited Valves (European Valve Manufacturers Association). This rating scheme aims to provide a classification system which assesses the water and energy consumption of sanitary fittings produced in the EU. WC and urinal flush systems are among the product groups covered by this ecolabel.

In general, the WELL scheme classifies the toilet and urinal flush system unit and the control buttons rather than the overall toilet and urinal. WC and urinal flush systems are evaluated according to the following same three evaluation criteria<sup>23</sup>: volume (flush volume), flush program and hygiene. For each criterion a product can be awarded with a maximum of 2 stars. In total a maximum of 6 stars can be achieved for non-domestic products (six classes from 1 to 6 stars are defined) and 4 stars for domestic appliances (four classes from 1 to 4 stars).

The single criteria are briefly described below.

#### Precondition

To be classified by the WELL scheme, any contact-free valve has to fulfil the requirements of EN 15091, any non-contact-free flush valve the requirements of EN 12541, and any flushing cistern the requirements of EN 14055.

In addition, the WC and urinal flush performance must be assessed based on EN 997 and EN 13407, respectively.

#### Volume (flush volume)

For WC flush systems, they are given 1 star when the flushing systems are suitable for WC bowl type 6 according to EN 997 with a nominal flush water volume (fixed or adjustable) of 6 l. They are given 2 stars when the flushing systems are suitable for WC bowl types 5 and 4 according to EN 997 with a nominal flush water volume (fixed or adjustable) of 5 or 4 l.

For urinal flush systems, they are given 1 star when the flush volume (fixed or adjustable) is 2 l or less. They are given 2 stars when the flush volume (fixed or adjustable) is 1 l or less.

The abovementioned flush volumes are presented in Table 12.

Table 12: WELL scheme classification regarding maximum flush volume

|                                 | WC flush systems |         | Urinal flush systems |         |
|---------------------------------|------------------|---------|----------------------|---------|
|                                 | 1 star           | 2 stars | 1 star               | 2 stars |
| <b>Maximum flush volume (l)</b> | 6                | 4 or 5  | ≤ 2                  | ≤ 1     |

#### Flush program

This criterion refers to the flush program in place. Regarding WCs, the system is given 1 star in case of undefined flush with minimum volumes (achieved through a start/stop button for flushing cisterns or a brief actuation of the flush valve for flush valves). The system receives 2 stars in case of defined minimum volume flush (2 volume flush, economy button).

<sup>22</sup> See for more information: <http://www.well-online.eu/>

<sup>23</sup> Criteria available at: [http://www.well-online.eu/config/media/files/169\\_WELL%20Klassifizierungsscheme.pdf](http://www.well-online.eu/config/media/files/169_WELL%20Klassifizierungsscheme.pdf)

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For urinals, the system is given 1 star when there is an individual control for each urinal. In non-domestic premises, the system can be given 2 stars in case of flush program controlled by user frequency.

The abovementioned flush programs are presented in Table 13.

Table 13: WELL scheme classification regarding flush program

|                      | WC flush systems                     |                              | Urinal flush systems          |  |
|----------------------|--------------------------------------|------------------------------|-------------------------------|--|
|                      | 1 star                               | 2 stars                      | 1 star                        | 2 stars (non-domestic only)            |
| <b>Flush program</b> | Undefined flush with minimum volumes | Defined minimum volume flush | Individual control per urinal | User frequency dependent flush program |

### Hygiene

This criterion covers the hygiene related to the actuation of the flush system. For both WC and urinal flush systems, 1 star is given for contact-free actuation and 2 stars for contact-free actuation with stagnation flush. Note that neither domestic WCs nor domestic urinals are concerned by this criterion for the 2-star award.

The abovementioned hygiene criterion is presented in Table 14.

Table 14: WELL scheme classification regarding hygiene

|                | WC flush systems           |  | Urinal flush systems   |  |
|----------------|----------------------------|--|------------------------|--|
|                | 1 star (non-domestic only) | 2 stars (non-domestic only)                  | 1 star                 | 2 stars (non-domestic only)                  |
| <b>Hygiene</b> | Contact-free actuation     | Contact-free actuation with stagnation flush | Contact-free actuation | Contact-free actuation with stagnation flush |

### Summary

The WELL is a rating scheme on flush systems which sets maximum flush volumes in nominal terms for both WCs and urinals (one star: 6 l and 2 l, respectively; two stars: 5 l and 1 l, respectively). For WC flush systems, minimum flush volumes are also mentioned under the flush program, which should be achieved through water saving devices: interruptible (one star) or two-volume (two stars) flush device. For urinal flush systems, it is important that there is a control per urinal (one star) and adapted to the user frequency (two stars). Regarding public appliances (both WCs and urinals), the scheme also takes into account hygiene issues with acknowledging the need for contact-free flushing (one star) with anti-stagnation flush (two stars).

### 6.3.2 WEPLS - The Water Efficient Product Labelling Scheme

The WEPLS<sup>24</sup> (Water Efficient Product Labelling Scheme) is a UK voluntary rating scheme from the UK Bathroom Manufacturers Association (BMA) open to companies manufacturing and selling their products within the UK. It covers among others WC suites, flushing cisterns and urinal controllers (urinal flushing systems).

<sup>24</sup> See for more information: <http://www.water-efficiencylabel.org.uk/>

WC suites, flushing cisterns and urinal controllers are assessed according to their water consumption. The scheme also assumes that the products fulfil all respective UK regulatory requirements (e.g. the maximum flush volume cannot exceed 6 l for WC suites and WC cisterns). WC suites and flushing cisterns have to comply with EN 997 (Class 2) and EN 14055 (Class 2), respectively.

WC suites and flushing cisterns are rated based on the average flush volume (in case of dual flush it consists of one full flush and three reduced flushes). Five classes have been defined: 3.5 l or less, 4.5 l or less, 5.5 l or less, 6 l or less and greater than 6 l (note that the last class “greater than 6 l” is not allowed in the UK). To get the label (water efficient product), the average flush volume should be no greater than 4.5 l (eligible classes are 4.5 l or less and 3.5 l or less). The exact average flush volume is displayed on the label.

Regarding urinal flushing systems, there is no rating and all UK compliant products (maximum flush volume: 1.5 l/flush for pressure flush valves; 10 l/hour for automated urinal cisterns serving one urinal; 7.5 l/hour/urinal for automated urinal cisterns serving more than one urinal) can get the label.

### 6.3.3 ANQIP (National Association for Quality in Building Installations)

The National Association for Quality in Building Installations (ANQIP) operates in Portugal a water efficiency labelling scheme<sup>25</sup>. Toilets and urinals are not covered as a functional unit but criteria exist for flushing cisterns<sup>26</sup>.

The water efficiency of the flushing cisterns is rated from E (lowest class) to A++ (highest class) taking into account the maximum flush volume and the presence of water saving devices. The details of flushing cistern criteria with the related classes are given in Table 15. In addition, flushing cisterns have to conform to EN 14055.

Table 15: ANQIP water efficiency rating scheme for flushing cisterns

| Labelling class | Nominal volume (l) | Maximum flush volume (tolerance in l) | Water saving device | Shorter flush (tolerance in l) |
|-----------------|--------------------|---------------------------------------|---------------------|--------------------------------|
| <b>A++</b>      | 4.0                | 4.0 – 4.5                             | Dual flush          | 2.0 – 3.0                      |
| <b>A+</b>       | 5.0                | 4.5 – 5.5                             | Dual flush          | 3.0 – 4.0                      |
| <b>A+</b>       | 4.0                | 4.0 – 4.5                             | Interruptible flush | ---                            |
| <b>A</b>        | 6.0                | 6.0 – 6.5                             | Dual flush          | 3.0 – 4.0                      |
| <b>A</b>        | 5.0                | 4.5 – 5.5                             | Interruptible flush | ---                            |
| <b>A</b>        | 4.0                | 4.0 – 4.5                             | None                | ---                            |
| <b>B</b>        | 7.0                | 7.0 – 7.5                             | Dual flush          | 3.0 – 4.0                      |
| <b>B</b>        | 6.0                | 6.0 – 6.5                             | Interruptible flush | ---                            |
| <b>B</b>        | 5.0                | 4.5 – 5.5                             | None                | ---                            |
| <b>C</b>        | 9.0                | 8.5 – 9.0                             | Dual flush          | 3.0 – 4.5                      |
| <b>C</b>        | 7.0                | 7.0 – 7.5                             | Interruptible flush | ---                            |
| <b>C</b>        | 6.0                | 6.0 – 6.5                             | None                | ---                            |
| <b>D</b>        | 9.0                | 8.5 – 9.0                             | Interruptible flush | ---                            |
| <b>D</b>        | 7.0                | 7.0 – 7.5                             | None                | ---                            |
| <b>E</b>        | 9.0                | 8.5 – 9.0                             | None                | ---                            |

<sup>25</sup> See for more information: <http://www.anqip.pt/>

<sup>26</sup> Criteria available at: <http://www.anqip.com/images/stories/comissoes/0802/ETA0804-2.pdf>

### 6.3.4 WELS (Water Efficiency Labelling and Standards scheme)

The Water Efficiency Labelling and Standards scheme<sup>27</sup> is an Australian and New Zealand mandatory scheme which sets criteria for rating the water efficiency and/or performance of certain products covered by the Australian/New Zealand AS/NZS 6400 Standard. Lavatory (WC) and flushing urinal equipment are covered by the mandatory scheme.

The water efficiency of products is rated from zero (lowest level) to six (highest level) stars taking into account different criteria. WC equipment is assessed based on the average flush volume. Criteria for urinal equipment include the maximum flush volume and flush control device. All the details of product criteria with the related classes are given in Table 16. Note that the value for the main criterion (maximum or average flush volume) is displayed on the label.

Table 16: Australian/New Zealand water rating label for WCs and urinals

| Labelling class | WCs                      |                                      | Flushing urinals   |
|-----------------|--------------------------|--------------------------------------|--|
|                 | Average flush volume (l) | Maximum flush volume (l)             | Flush control requirements                               |
| 0 stars         | Not allowed              | $4.0 < Q_2 \leq 5.0$<br>or $Q = 2.5$ |  |
| 1 Star          | $4.5 < Q \leq 5.5$       | $Q_2 \leq 4.0$                       | On-demand (manual, sensor) or programmable <sup>1)</sup> |
| 2 Stars         | $4.0 < Q \leq 4.5$       | $2.0 < Q \leq 2.5$                   | On-demand (manual, sensor) or programmable <sup>1)</sup> |
| 3 Stars         | $3.5 < Q \leq 4.0$       | $1.5 < Q \leq 2.0$                   | On-demand (manual, sensor) or programmable <sup>1)</sup> |
| 4 Stars         | $3.0 < Q \leq 3.5$       | $1.0 < Q \leq 1.5$                   | Programmable <sup>1)</sup>                               |
| 5 Stars         | $2.5 < Q \leq 3.0$       | $Q \leq 1.0$                         | Programmable <sup>1)</sup>                               |
| 6 Stars         | $Q \leq 2.5$             | $Q \leq 1.0$                         | Programmable <sup>1)</sup> with urine-sensor             |

NOTE: Q represents the flush volume for single equipment (toilet or urinal); Q<sub>2</sub> represents the flush volume for two stalls or equivalent width (1200 mm) of continuous wall.

<sup>1)</sup> Programmable (Smart-demand operation): Sensor operated to control a predetermined flush cycle, with smart logic that detects users and controls programmable delay and flushing modes of the device (it takes into account user frequency).

In addition, the equipment needs to comply with performance requirements and be marked in accordance with the following appropriate standards: AS/NZS 1172.1 for WC pans, AS 1172.2 for WC cisterns, AS/NZS 3982 for urinals, ATS 5200.004 for urinal cisterns, ATS 5200.020 or ATS 5200.021 for flushing valves and ATS 5200.030 for solenoid valves. Note that noncompliant WC equipment is not allowed while noncompliant urinal equipment is allowed but the product is granted 0 stars. Furthermore, urinals are also rated 0 stars when having an adjustable activation device with a sensitivity field greater than 300 mm from the front of the urinal, or a flushing control mechanism that flushes more than two stalls or equivalent width (> 1200 mm) of continuous wall.

<sup>27</sup> See for more information: <http://www.waterrating.gov.au/about/index.html>



## 6.4 Conclusions

As expected, the flush water efficiency is the key issue covered in all schemes for flushing toilets and urinals. In practice, the major point is the upper limit of flush volume for both flushing toilets and urinals. The water flush volume not to exceed may be defined as a maximum limit value (maximum flush volume) or an average limit value (average flush volume), generally expressed in litre per flush, though it can be in litre per time unit for nondomestic uses. These maximum or average flush volumes are presented in Table 17 for flushing toilets, Table 18 for urinals and Table 19 for flushing systems. In case of rating schemes, which set different classes and associated values, the value range is indicated. Note that additional schemes and regulatory requirements (not presented above but reviewed in project Task 1 report on product definition<sup>28</sup>) have also been included in the tables to give a broader overview of the benchmark values used across the world.

Table 17: Maximum and average flush volumes set for flushing toilets in legislation and ecolabels

| Legislation / Ecolabel   | Maximum flush volume (l/flush) | Average flush volume (l/flush) |
|--|--------------------------------|--------------------------------|
| <b>EU countries</b>  |                                |                                |
| EU Ecolabel for tourist accommodation and campsite services  | 6                              |                                |
| Ecolabels for tourist accommodation services (Austria, Denmark, Finland, Iceland, Latvia, Luxembourg, Netherlands, Norway, Slovakia, Spain, Sweden)        | 6                              |                                |
| National building regulations (Ireland)  | 6                              |                                |
| Local building regulations (Avigliana and Sassari, Italy)  | 6                              |                                |
| Local building regulations (Alcobendas, Camargo, Getafe, Madrid, Sant Cugat del Vallès, San Cristóbal de Segovia, and the Principality of Asturias, Spain) | 6                              |                                |
| Local building regulations (Castro Urdiales, Spain)  | 7                              |                                |
| Catalan Ecolabel for WCs (Spain)   | 6                              | 3.6                            |
| Catalan Ecolabel for office building (Spain)   | 6                              |                                |
| Government Buying Standards (UK)   |                                | 4.5                            |
| WEPLS (UK)   |                                | 3.5 – 6 <sup>1)</sup>          |
| <b>Non-EU countries</b>  |                                |                                |
| WELS (Australia, New Zealand)  |                                | 2.5 – 5.5 <sup>1)</sup>        |
| Regional building code (British Columbia, Canada)  | 6                              |                                |
| Eco Mark programme (Japan)   | 6.5                            |                                |
| Green Mark scheme (Taiwan)   | 6                              |                                |
| Green label (Thailand)   | 6                              |                                |
| Energy Policy Act 1992 (USA)   | 6.1 <sup>2)</sup>              |                                |
| WaterSense (USA)   |                                | 4.8 <sup>3)</sup>              |
| <b>Worldwide</b>   |                                |                                |
| International Green Key label (accommodation)  | 6                              |                                |

NOTE: for any further information and references, please refer to Draft report – Task 1: Product definition.

<sup>1)</sup> Range of limit values (rating schemes).

<sup>2)</sup> Except for blowout toilets: 13.2 l.

<sup>3)</sup> Maximum flush volume allowed for gravity toilets after field adjustment: 6.4 l for single flush and 7.6 for dual flush.

<sup>28</sup> Draft report – Task 1: Product definition, available at: <http://susproc.jrc.ec.europa.eu/toilets/stakeholders.html>

**Table 18: Maximum flush volumes and flow rates set for urinals in legislation and ecolabels**

| <b>Legislation / Ecolabel</b>                     | <b>Maximum flush volume (l/flush)</b> | <b>Maximum flow rate</b> |
|---|---------------------------------------|--------------------------|
| <b>EU countries</b>                               |                                       |                          |
| Ecolabel for tourist accommodation (Luxembourg)   |                                       | 4 l/min                  |
| <b>Non-EU countries</b>                           |                                       |                          |
| WELS (Australia, New Zealand)                     | 1 – 2.5 <sup>1)</sup>                 |                          |
| Regional building code (British Columbia, Canada) | 1.9                                   |                          |
| Eco Mark programme (Japan)                        | 2.5                                   |                          |
| Water Efficiency Labelling Scheme (Singapore)     | 0.5 – 1.5 <sup>1)</sup>               |                          |
| Energy Policy Act 1992 (USA)                      | 3.8                                   |                          |
| WaterSense (USA)                                  | 1.9 <sup>2)</sup>                     |                          |

NOTE: for any further information and references, please refer to Draft report - Task 1: Product definition.

<sup>1)</sup> Range of limit values (rating schemes).

<sup>2)</sup> 2.3 l with taking into account the possible field adjustment.

**Table 19: Maximum flush volumes and flow rates set for flushing systems in legislation and ecolabels**

| <b>Legislation / Ecolabel</b>                      | <b>WC flushing system</b>       |                                 | <b>Urinal flushing system</b>   |                          |
|--|---------------------------------|---------------------------------|---------------------------------|--------------------------|
|  | <b>Maximum flush volume (l)</b> | <b>Average flush volume (l)</b> | <b>Maximum flush volume (l)</b> | <b>Maximum flow rate</b> |
| <b>EU countries</b>                                |                                 |                                 |                                 |                          |
| WELL (European countries)                          | 4 – 6 <sup>1)</sup>             |                                 | 1 – 2 <sup>1)</sup>             |                          |
| Blue Angel on flushing boxes (Germany)             | 9                               |                                 |                                 |                          |
| ANQIP water efficiency labelling scheme (Portugal) | 4 – 9 <sup>1)</sup>             |                                 | 4 – 9 <sup>1)</sup>             |                          |
| National water supply regulations (UK)             | 6                               |                                 | 1.5                             | 10 l/hour <sup>2)</sup>  |
| WEPLS (UK)   |                                 | 4.5                             | 1.5                             | 10 l/hour <sup>2)</sup>  |
| <b>Non-EU countries</b>                            |                                 |                                 |                                 |                          |
| WELS (Australia, New Zealand)                      |                                 | 2.5 – 5.5 <sup>1)</sup>         | 1 – 2.5 <sup>1)</sup>           |                          |
| Water Efficiency Labelling Scheme (Singapore)      | 3.5 – 4.5 <sup>1)</sup>         |                                 | 0.5 – 1.5 <sup>1)</sup>         |                          |
| Green label (Thailand)                             |                                 |                                 |                                 | 1.5 l/15s                |

NOTE: for any further information and references, please refer to Draft report - Task 1: Product definition.

<sup>1)</sup> Range of limit values (rating schemes).

<sup>2)</sup> 7.5 l/hour/urinal for urinal cisterns serving more than one urinal.

From the three tables above, when considering only the highest demanding level for rating schemes, the maximum flush volumes range from 3.5 to 9 l (with a central value around 6 l) for flushing toilets and from 0.5 to 4 l (with a central value around 1.5 l) for urinals. The values of the average flush volumes for flushing toilets range from 2.5 to 4.8 l (with a central value around 4.5 l).

In addition to maximum flush volumes (or flow rates), minimum flush volumes (or flow rates) are sometimes also defined. For instance, the Blue Angel for flushing cisterns set a minimum flush volume of 6 l. The WELL mentioned for WC cisterns the need for a minimum flush volume but does not set any values. In the UK legislation (Water Supply (Water Fittings) Regulations 1999<sup>29)</sup>, it is worth mentioning that a minimum flow rate of 1.2 l/second has to be achieved for any flushing valves.

<sup>29)</sup> Water Supply (Water Fittings) Regulations (1999), Statutory Instrument 1999 No. 1148, The Stationery Office Limited, United Kingdom. Available at: [http://www.dwi.gov.uk/stakeholders/legislation/ws\(fittings\)regs1999.pdf](http://www.dwi.gov.uk/stakeholders/legislation/ws(fittings)regs1999.pdf)

Some requirements on the flush control are often included in the ecolabel criteria in reference to product water efficiency. For WC flushing systems, the requirements generally result in the use of water saving devices like interrupting flush or dual flush devices (see e.g. Blue Angel, Catalan Ecolabel, WELL and ANQIP). Regarding urinal flushing systems, the requirements may consist of the use of water saving devices like on-demand (manual or automatic) flush control devices (EU Ecolabel, WELS), including urine-sensing devices (WELS) and non-hold-open design actuators (WaterSense), but may also address the flush program itself: independent flush control device for each urinal (EU Ecolabel, WELL, WELS) and user frequency dependent flush program (WELL, WELS).

Apart from the water efficiency, other criteria include flush performance (WaterSense), user information (Blue Angel, Catalan Ecolabel, WaterSense), maximum noise level (Blue Angel, Catalan Ecolabel) and product marking (Blue Angel, WELS, WaterSense). For nondomestic uses, hygiene is also included in one scheme (WELL).

In any case, products have to conform to any appropriate standards and all schemes specify how the requirements to fulfil have to be tested (either with reference to a standard or with an ad hoc methodology described in the criteria document).



## 7 LIFE CYCLE ANALYSIS OF FLUSHING TOILETS AND URINALS

### 7.1 Introduction

The EU Ecolabel and GPP criteria shall be determined on a scientific basis considering the whole life cycle of products. In the frame of the project five base cases have been defined: standard flushing toilet (WC), flushing squat toilet, single flushing urinal, trough flushing urinal and flush-free (waterless) urinal. An environmental evaluation of the product's life cycle impacts (with the EcoReport tool) has been completed for the five base cases<sup>30</sup>. The results should be considered as approximation due to data scarcity, in particular, on the product material composition, Nevertheless, the analysis allows the identification of the main issues that contribute to the environmental impacts, as summarised below<sup>31</sup>.

### 7.2 Highlights on life cycle analysis of flushing toilets

Table 20 presents a summary of the different impacts caused by a typical WC sold on the market (dual flush 6/4 l) across the life cycle phases (for any impact, results are given in % of the impact over the whole life cycle). Note that the results for squat flushing toilet show the same trends<sup>31</sup>. From the analysis of flushing toilets, the production and use phases appear to be of high relevance, accounting for a high percentage across most of the impact categories (distribution phase only pops up first for Particulate Matter and end-of-life phase ranks first for Persistent Organic Pollutants only).

Table 20: Impact summary for a WC

| Parameter                             | Unit                   | Production | Distribution | Use  | End of Life |
|---------------------------------------|------------------------|------------|--------------|------|-------------|
| <b>Other Resources &amp; Waste</b>    |                        |            |              |      |             |
| Total Energy (GER)                    | MJ                     | 23 %       | 13 %         | 38 % | 25 %        |
| of which, electricity (in primary MJ) | MJ                     | 11 %       | 0 %          | 59 % | 30 %        |
| Water (process)                       | ltr                    | 0 %        |              | 69 % | 31 %        |
| Water (cooling)                       | ltr                    | 63 %       |              | 5 %  | 32 %        |
| Waste, non-haz./ landfill             | g                      | 29 %       | 10 %         | 37 % | 24 %        |
| Waste, hazardous/ incinerated         | g                      | 23 %       | 9 %          | 44 % | 23 %        |
| <b>Emissions (Air)</b>                |                        |            |              |      |             |
| Greenhouse Gases in GWP100            | kg CO <sub>2</sub> eq. | 30 %       | 14 %         | 27 % | 28 %        |
| Acidification, emissions              | g SO <sub>2</sub> eq.  | 19 %       | 13 %         | 42 % | 26 %        |
| Volatile Organic Compounds (VOC)      | g                      | 22 %       | 13 %         | 36 % | 29 %        |
| Persistent Organic Pollutants (POP)   | ng i-Teq               | 27 %       | 8 %          | 27 % | 38 %        |
| Heavy Metals                          | mg Ni eq.              | 43 %       | 16 %         | 10 % | 31 %        |
| PAHs                                  | mg Ni eq.              | 56 %       | 8 %          | 2 %  | 34 %        |
| Particulate Matter (PM, dust)         | g                      | 24 %       | 61 %         | 1 %  | 14 %        |
| <b>Emissions (Water)</b>              |                        |            |              |      |             |
| Heavy Metals                          | mg Hg/20               | 60 %       | 0 %          | 3 %  | 37 %        |
| Eutrophication                        | g PO <sub>4</sub>      | 64 %       | 1 %          | 18 % | 17 %        |

Note - sign of contribution (impact or benefit) is ignored in the colours and %, which just reflect relative magnitude.

<sup>30</sup> The user behaviour data used for the base cases are those presented in Section 5.

<sup>31</sup> Details of the Life Cycle Analysis (LCA) are available online at: [http://susproc.jrc.ec.europa.eu/toilets/docs/Task\\_4\\_Base%20Case%20Assessment.pdf](http://susproc.jrc.ec.europa.eu/toilets/docs/Task_4_Base%20Case%20Assessment.pdf)

### 7.3 Highlights on life cycle analysis of urinals

Table 21 shows a summary of the different impacts of a representative single flushing urinal across the life cycle phases (for any impact, results are given in % of the impact over the whole life cycle). The results for flushing trough and flush-free urinals show the same trends<sup>31</sup>. As in the case of flushing toilets, the analysis shows that the production and use phases are also the main contributors to various environmental impacts of urinals, with these two phases accounting for a high percentage across most of the impact categories.

Table 21: Impact summary for a single flushing urinal

| Parameter                             | Unit                   | Production | Distribution | Use  | End of Life |
|---------------------------------------|------------------------|------------|--------------|------|-------------|
| <b>Other Resources &amp; Waste</b>    |                        |            |              |      |             |
| Total Energy (GER)                    | MJ                     | 7 %        | 2 %          | 71 % | 21 %        |
| of which, electricity (in primary MJ) | MJ                     | 1 %        | 0 %          | 77 % | 21 %        |
| Water (process)                       | ltr                    | 0 %        |              | 69 % | 31 %        |
| Water (cooling)                       | ltr                    | 40 %       |              | 31 % | 29 %        |
| Waste, non-haz./ landfill             | g                      | 10 %       | 2 %          | 67 % | 20 %        |
| Waste, hazardous/ incinerated         | g                      | 6 %        | 2 %          | 72 % | 21 %        |
| <b>Emissions (Air)</b>                |                        |            |              |      |             |
| Greenhouse Gases in GWP100            | kg CO <sub>2</sub> eq. | 12 %       | 3 %          | 62 % | 23 %        |
| Acidification, emissions              | g SO <sub>2</sub> eq.  | 5 %        | 2 %          | 70 % | 22 %        |
| Volatile Organic Compounds (VOC)      | g                      | 5 %        | 1 %          | 72 % | 22 %        |
| Persistent Organic Pollutants (POP)   | ng i-Teq               | 16 %       | 2 %          | 52 % | 30 %        |
| Heavy Metals                          | mg Ni eq.              | 23 %       | 5 %          | 46 % | 26 %        |
| PAHs                                  | mg Ni eq.              | 53 %       | 3 %          | 9 %  | 35 %        |
| Particulate Matter (PM, dust)         | g                      | 41 %       | 30 %         | 3 %  | 25 %        |
| <b>Emissions (Water)</b>              |                        |            |              |      |             |
| Heavy Metals                          | mg Hg/20               | 55 %       | 0 %          | 10 % | 36 %        |
| Eutrophication                        | g PO <sub>4</sub>      | 11 %       | 0 %          | 73 % | 16 %        |

## **7.4 Putting the results into context**

The production and use phases are the key issues for both flushing toilets and urinals. To visualize which impacts are of the main relevance, the corresponding absolute values for one product (one functional unit in LCA terms) are presented in Table 22. These values are put in a broader context and compared with those from other water using products like dishwashers, washing machines, taps and showerheads and other products already studied in the frame of the Ecodesign directive like TV sets and vacuum cleaners. The selected products have been analysed with the same methodology (the MEEuP methodology) and the same tool (EcoReport tool), to enable direct comparison of the results.

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Table 22: Comparison of Environmental Impacts of Various Products

| Product                     | Impact Category | Other Resources & Waste |                                       |                 |                 |                          |                              | Air Emissions              |                          |                                  |                                     |              |           |                               | Water Emissions |                   |
|-----------------------------|-----------------|-------------------------|---------------------------------------|-----------------|-----------------|--------------------------|------------------------------|----------------------------|--------------------------|----------------------------------|-------------------------------------|--------------|-----------|-------------------------------|-----------------|-------------------|
|                             |                 | Total Energy (GER)      | of which, electricity (in primary MJ) | Water (process) | Water (cooling) | Waste, non-haz./landfill | Waste, hazardous/incinerated | Greenhouse Gases in GWP100 | Acidification, emissions | Volatile Organic Compounds (VOC) | Persistent Organic Pollutants (POP) | Heavy Metals | PAHs      | Particulate Matter (PM, dust) | Heavy Metals    | Eutrophication    |
|                             |                 | MJ                      | MJ                                    | ltr             | ltr             | g                        | g                            | kg CO <sub>2</sub> eq.     | g SO <sub>2</sub> eq.    | g                                | ng i-Teq                            | mg Ni eq.    | mg Ni eq. | g                             | mg Hg/20        | g PO <sub>4</sub> |
| Traditional Flushing Toilet |                 | 2,136                   | 690                                   | 121,702         | 346             | 1,767                    | 38                           | 116                        | 409                      | 26                               | 6                                   | 40           | 78        | 1,545                         | 109             | 1                 |
| Flushing Squat Toilet       |                 | 2,262                   | 1,203                                 | 243,178         | 311             | 1,673                    | 38                           | 114                        | 420                      | 33                               | 6                                   | 38           | 70        | 519                           | 116             | 0                 |
| Flushing Single Urinal      |                 | 6,866                   | 5,847                                 | 564,441         | 483             | 4,069                    | 109                          | 304                        | 1,269                    | 136                              | 16                                  | 82           | 70        | 566                           | 115             | 1                 |
| Flushing Trough Urinal      |                 | 12,504                  | 8,641                                 | 1,128,628       | 560             | 11,094                   | 180                          | 579                        | 2,437                    | 228                              | 105                                 | 510          | 109       | 6,658                         | 169             | 7                 |
| Flush-free Urinal           |                 | 1,383                   | 211                                   | 3,204           | 255             | 1,657                    | 40                           | 64                         | 254                      | 5                                | 4                                   | 13           | 23        | 569                           | 23              | 0                 |
| 9-piece Dishwasher          |                 | 32,527                  | 26,744                                | 49,473          | 69,242          | 90,095                   | 2,742                        | 1,516                      | 9,331                    | 27                               | 554                                 | 2,827        | 212       | 1,867                         | 1,822           | 4,636             |
| 12-piece Dishwasher         |                 | 38,736                  | 31,885                                | 52,210          | 83,092          | 107,722                  | 2,718                        | 1,826                      | 11,101                   | 37                               | 669                                 | 4,018        | 322       | 3,697                         | 2,385           | 4,916             |
| 5kg Washing Machine         |                 | 38,100                  | 34,692                                | 153,782         | 91,005          | 109,153                  | 1,325                        | 1,779                      | 10,714                   | 35                               | 655                                 | 3,155        | 360       | 3,612                         | 1,833           | 41                |
| Fridge-Freezer              |                 | 54,739                  | 50,483                                | 4,559           | 135,918         | 147,140                  | 3,993                        | 2,492                      | 14,995                   | 44                               | 764                                 | 2,094        | 1,569     | 4,554                         | 1,348           | 63                |
| 32" LCD TV                  |                 | 28,397                  | 25,719                                | 2,242           | 66,641          | 49,120                   | 7,212                        | 1,281                      | 7,372                    | 26                               | 336                                 | 727          | 377       | 1,965                         | 409             | 15                |
| 42" PDP TV                  |                 | 59,383                  | 55,775                                | 5,118           | 142,134         | 120,881                  | 9,278                        | 2,678                      | 16,267                   | 46                               | 836                                 | 1,675        | 821       | 1,796                         | 858             | 34                |
| 29" CRT TV                  |                 | 26,234                  | 22,997                                | 1,793           | 60,582          | 78,877                   | 7,643                        | 1,191                      | 7,390                    | 235                              | 315                                 | 996          | 1,132     | 2,647                         | 350             | 12                |
| Brass Taps                  |                 | 90,175                  | 90,057                                | 172,438         | 240,143         | 107,563                  | 2,140                        | 3,938                      | 23,240                   | 34                               | 627                                 | 1,639        | 184       | 539                           | 589             | 3                 |
| Steel Taps                  |                 | 90,186                  | 90,069                                | 172,492         | 240,152         | 105,386                  | 2,139                        | 3,941                      | 23,251                   | 34                               | 598                                 | 1,697        | 181       | 542                           | 645             | 5                 |
| Plastic Showerheads         |                 | 88,928                  | 88,841                                | 137,324         | 236,915         | 103,142                  | 2,225                        | 3,883                      | 22,898                   | 34                               | 583                                 | 1,569        | 178       | 537                           | 575             | 3                 |
| Metal Showerheads           |                 | 89,047                  | 88,850                                | 137,326         | 236,954         | 109,179                  | 2,442                        | 3,889                      | 22,974                   | 34                               | 633                                 | 1,685        | 185       | 568                           | 594             | 3                 |
| Upright Vacuum Cleaner      |                 | 9,067                   | 8,062                                 | 882             | 21,612          | 19,088                   | 1,858                        | 409                        | 2,329                    | 6                                | 99                                  | 304          | 57        | 721                           | 130             | 10                |
| Canister Vacuum Cleaner     |                 | 9,151                   | 8,070                                 | 885             | 21,623          | 22,637                   | 1,976                        | 413                        | 2,386                    | 6                                | 96                                  | 311          | 64        | 745                           | 139             | 10                |
| Battery Vacuum Cleaner      |                 | 5,504                   | 4,607                                 | 617             | 12,397          | 13,631                   | 1,500                        | 252                        | 1,370                    | 4                                | 147                                 | 226          | 39        | 624                           | 89              | 8                 |



From Table 22, when comparing the environmental impacts of flushing toilets and urinals with those of other products that have already been modelled for the EU, it appears that:

- Water usage of flushing toilets and urinals is very significant; steps to improve this should be looked for, though it would ever fail to bring the products into line with non-water-using consumer goods such as TVs, fridge freezers and vacuum cleaners. A 4/2-litre dual flush toilet has a process water consumption of over 70,000 litres, exceeding the dishwashers but better than the washing machines;
- Emissions of VOCs associated with flushing toilets and, in particular, flushing urinals, are relatively quite significant, but further examination shows that the source of this is associated with water usage, which is therefore where efforts should be focussed;
- Flushing toilets and urinals are relatively large, resulting in notable particulate emissions during the distribution phase. However, these emissions will be more easily addressed by considering transportation methods than trying to make the products smaller; and
- Other environmental impacts (energy usage, waste generation, greenhouse gas emissions, acidification, POP emissions, heavy metal emissions, PAH emissions and eutrophication) are relatively low/insignificant for flushing toilets and urinals.

Note that the heat loss from flushing toilets and urinals was not found to be a significant environmental impact, unlike the findings of a previous study<sup>32</sup> claiming that heat loss was an important issue.

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<sup>32</sup> Gandy, S., Smith, S., Paton, W., and Aumônier, S. (2009): *Review of Life Cycle Impacts of WCs*, ERM, Defra, London.

## **7.5 Key environmental impacts**

All the facts reported above have been confirmed by the sensitivity analysis carried out through different scenarios modifying the assumptions on water usage, material composition, weight and life time of the product. In conclusion, the single most significant impact of flushing toilets and urinals is clearly water usage. The large volumes of water involved also give rise to a secondary environmental impact, associated with VOC emissions arising from the water usage. Beyond this, the other environmental impact that appears significant is particulates emissions, which arise from moving heavy products around in vehicles. However, the way to mitigate this impact is more likely to lie in improving transport emissions than lightweighting the products, though this is also demonstrated to deliver environmental benefits.

With these findings in mind, the natural conclusion is that toilet and urinal manufacturers wishing to improve the environmental performance of their products should look primarily towards designing systems with reduced water usage during the use phase.

## 8 LIFE CYCLE COSTS

### 8.1 Life cycle cost analysis

The Life Cycle Cost (LCC) of a product includes the total cost supported by the user throughout its lifetime including the purchase, the installation and the maintenance and any other costs directly attributable to owning or using the product. The main results (for domestic and non-domestic traditional flushing toilets, single flushing urinals and flush-free urinals) are reported below<sup>33</sup>. All monetary data refer to €<sub>2011</sub> (2011 prices).

Table 23 presents the results for domestic traditional flushing toilets (cost shares are presented Figure 2) and Table 24 does the same for non-domestic traditional flushing toilets (cost shares in Figure 3).

Table 23: LCC results for a domestic traditional flushing toilet

| Cost Item                                | LCC New Product | Total Annual Consumer Expenditure in EU27 |
|--|-----------------|---|
| <b>D Product price</b>                   | € 245.00        | € 4,888 Million                           |
| <b>E Installation/ acquisition costs</b> | € 100.00        | € 1,995 Million                           |
| <b>G Electricity</b>                     | €               | €   |
| <b>H Water</b>                           | € 451.89        | € 12,895 Million                          |
| <b>I Aux. 1: Toilet Cleaner</b>          | € 47.09         | € 1,344 Million                           |
| <b>L Repair &amp; maintenance costs</b>  | € 40.00         | € 1,141 Million                           |
| <b>Total</b>                             | <b>€ 883.98</b> | <b>€ 22,263 Million</b>                   |

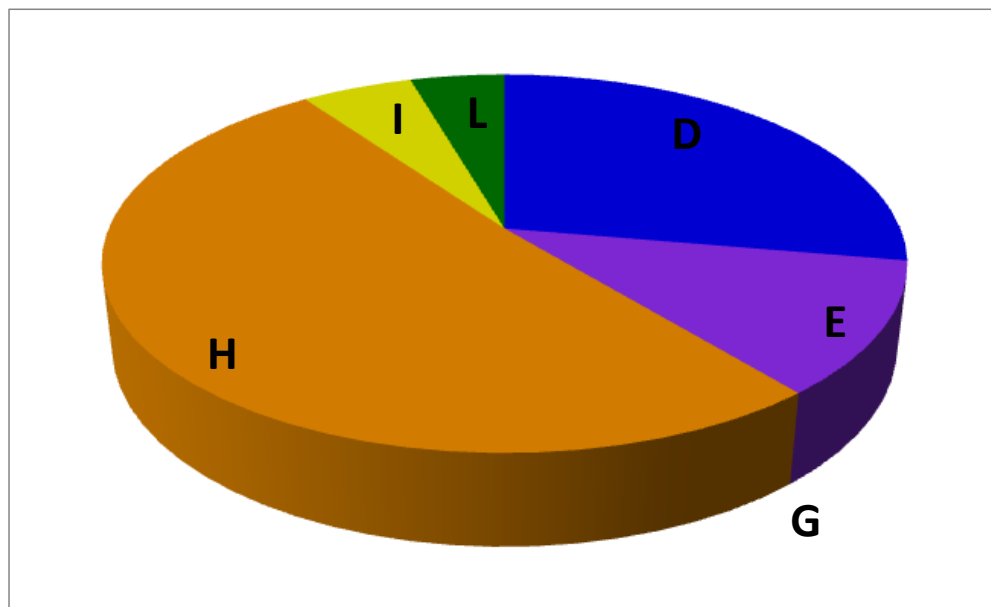


Figure 2: Share of LCC for domestic traditional flushing toilets

<sup>33</sup> Detailed results of the LCC analysis are available online at: [http://susproc.jrc.ec.europa.eu/toilets/docs/Task\\_4\\_Base%20Case%20Assessment.pdf](http://susproc.jrc.ec.europa.eu/toilets/docs/Task_4_Base%20Case%20Assessment.pdf)

Table 24: LCC results for a non-domestic traditional flushing toilets

| Cost Item                                | LCC New Product  | Total Annual Consumer Expenditure in EU27 |
|--|------------------|---|
| <b>D Product price</b>                   | € 245.00         | € 4,888 Million                           |
| <b>E Installation/ acquisition costs</b> | € 100.00         | € 1,995 Million                           |
| <b>G Electricity</b>                     | €                | €   |
| <b>H Water</b>                           | € 2040.81        | € 41,597 Million                          |
| <b>I Aux. 1: Toilet Cleaner</b>          | € 65.92          | € 1,344 Million                           |
| <b>L Repair &amp; maintenance costs</b>  | € 40.00          | € 815 Million                             |
| <b>Total</b>                             | <b>€ 2491.73</b> | <b>€ 50,639 Million</b>                   |

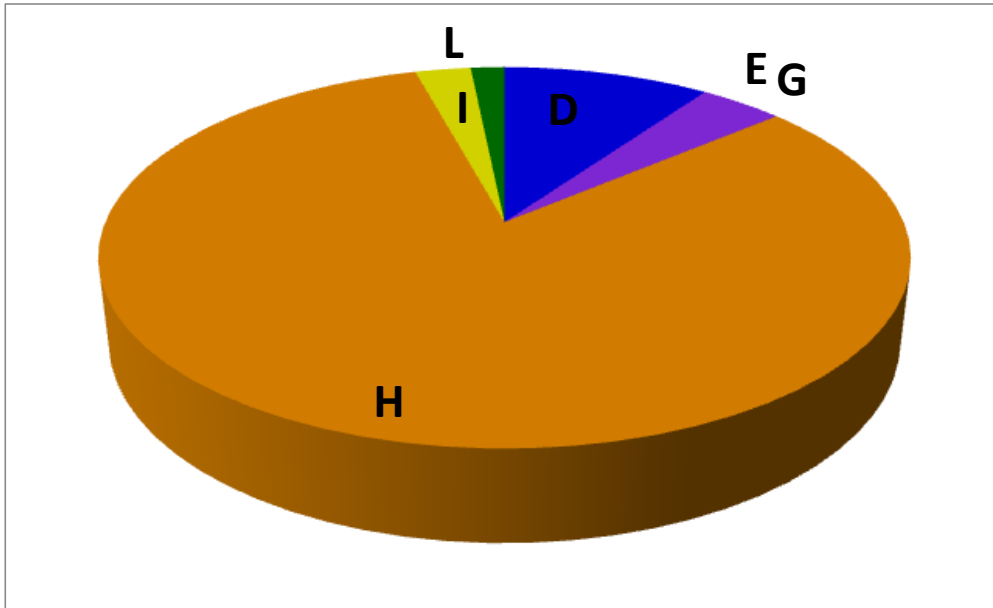


Figure 3: Share of LCC for non-domestic traditional flushing toilets

According to the analysis conducted, over half the lifetime costs of a domestic traditional flushing toilet is associated with the cost of the water it uses (see Table 23 and Figure 2); for non-domestic toilets water usage becomes even more important, with costs rising to over €1820, contributing to over 80 % of the total LCC (see Table 24 and Figure 3).

Squat flushing toilets show similar results (not presented here), though the larger anticipated flush volume of squat toilets means that, over their lifetime, they use more water than the traditional alternatives discussed above, with the result that water consumption contribute even more significantly to the LCC results.

This trend continues with the single and trough flushing urinals. The results for a single flushing urinal are presented in Table 25 (cost shares in Figure 4), with water use continuing to account for large shares of the LCC (about 75 %). There is also the addition of a small cost for the electricity used to run the sensors, but it can be seen that this is a very small contribution to the totals. Results for trough flushing urinals (not presented here) show similar patterns.

Table 25: LCC results for a single flushing urinal

| Cost Item                                | LCC New Product   | Total Annual Consumer Expenditure in EU27 |
|--|-------------------|---|
| <b>D Product price</b>                   | € 375.00          | € 662 Million                             |
| <b>E Installation/ acquisition costs</b> | € 100.00          | € 177 Million                             |
| <b>G Electricity</b>                     | € 35.62           | € 56 Million                              |
| <b>H Water</b>                           | € 2,099.12        | € 3,304 Million                           |
| <b>I Aux. 1: Toilet Cleaner</b>          | € 32.60           | € 51 Million                              |
| <b>L Repair &amp; maintenance costs</b>  | € 200.00          | € 315 Million                             |
| <b>Total</b>                             | <b>€ 2,842.34</b> | <b>€ 4,564 Million</b>                    |

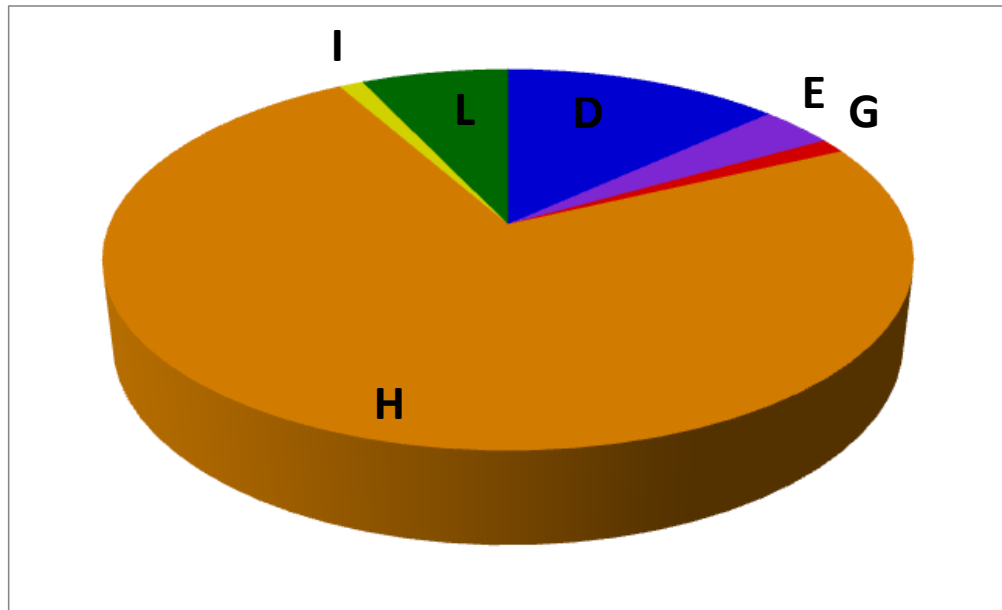


Figure 4: Share of LCC for single flushing urinals

Unsurprisingly, the profile for flush-free urinals is quite different, as shown in Table 26 (cost shares in Figure 5), without the large contribution from water usage, the relative significant of the purchase price, installation costs and repair and maintenance costs become more important.

Table 26: LCC results for flush-free urinals

| Cost Item                                | LCC New Product | Total Annual Consumer Expenditure in EU27 |
|--|-----------------|---|
| <b>D Product price</b>                   | € 325.00        | € 36 Million                              |
| <b>E Installation/ acquisition costs</b> | € 100.00        | € 11 Million                              |
| <b>G Electricity</b>                     | €               | €   |
| <b>H Water</b>                           | € 11.66         | € 1 Million                               |
| <b>I Aux. 1: Toilet Cleaner</b>          | € 48.90         | € 5 Million                               |
| <b>L Repair &amp; maintenance costs</b>  | € 200.00        | € 20 Million                              |
| <b>Total</b>                             | <b>€ 685.56</b> | <b>€ 73 Million</b>                       |

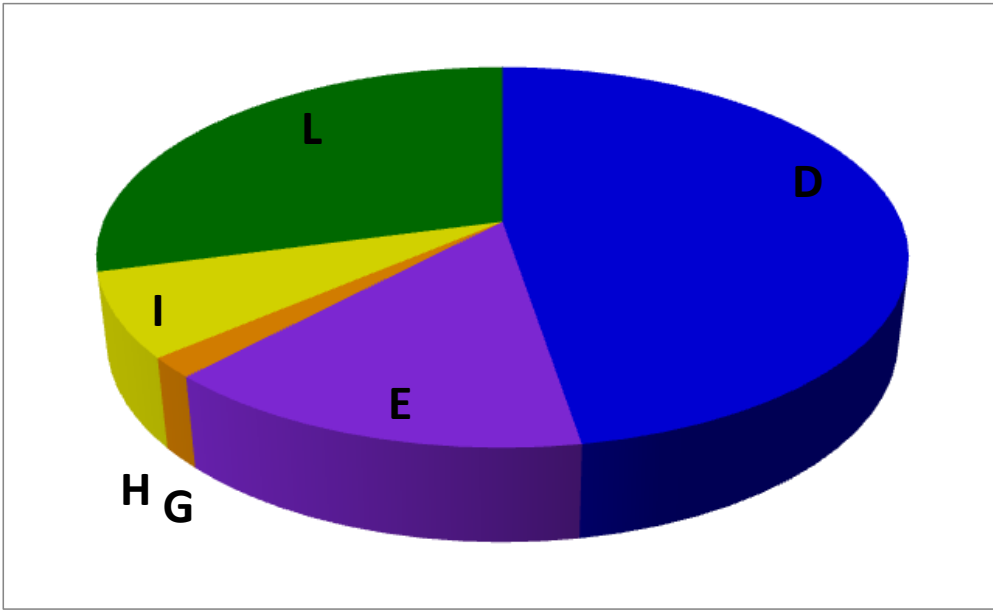


Figure 5: Share of LCC for flush-free urinals

## 8.2 Cost implications of improved performance

Through the LCC analysis, it is possible to estimate possible costs (or savings) associated with product changes. The obvious comparison laid between the baseline traditional flushing toilet and a future possible level of performance that might be stipulated by the EU Ecolabel and the GPP criteria.

As has already been discussed, the most significant intervention likely to arise from the EU Ecolabel and GPP criteria is a reduced level of water usage. A series of increasingly water efficient flush regimes was investigated to demonstrate the associated impact on LCC (where dual flushing is modelled, it is assumed that the ratio will be three reduced flushes for each full flush). Results are shown below for a domestic (Figure 6) and non-domestic (Figure 7) traditional flushing toilet. The percentage of the total costs arising from water usage is indicated directly on the figures.

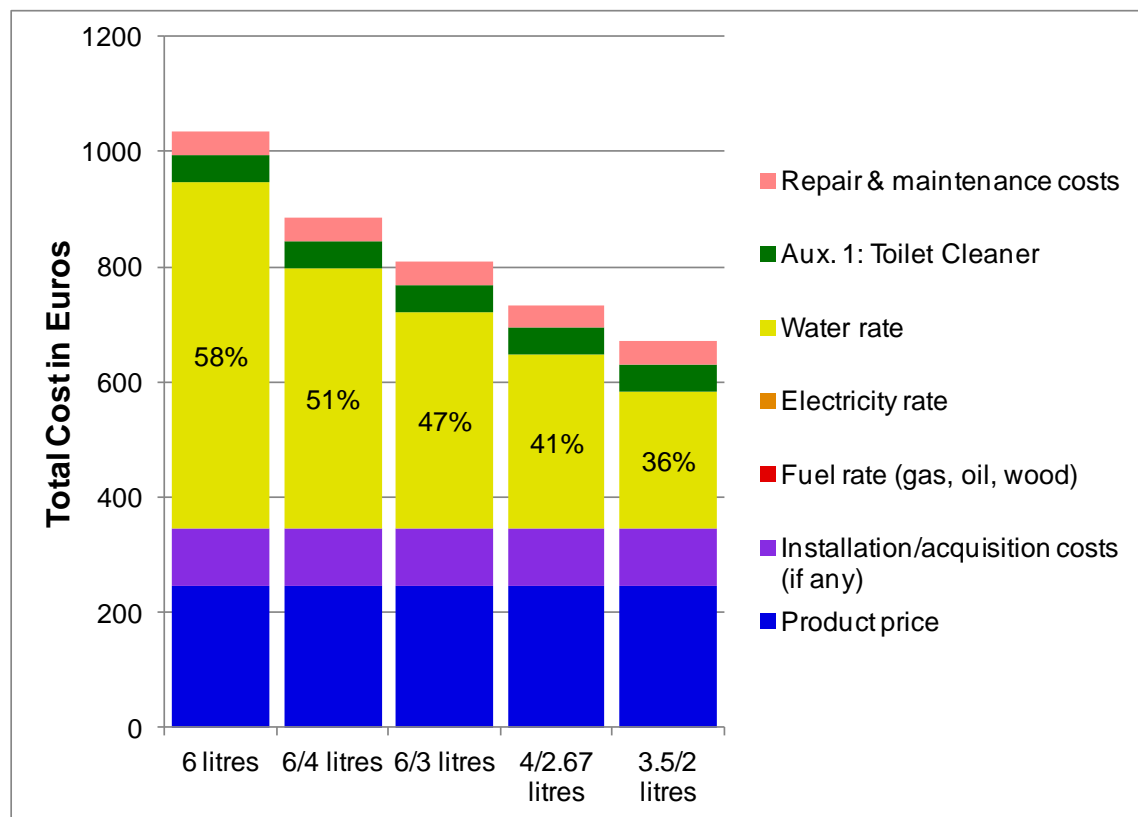


Figure 6: LCC for different domestic traditional flushing toilets

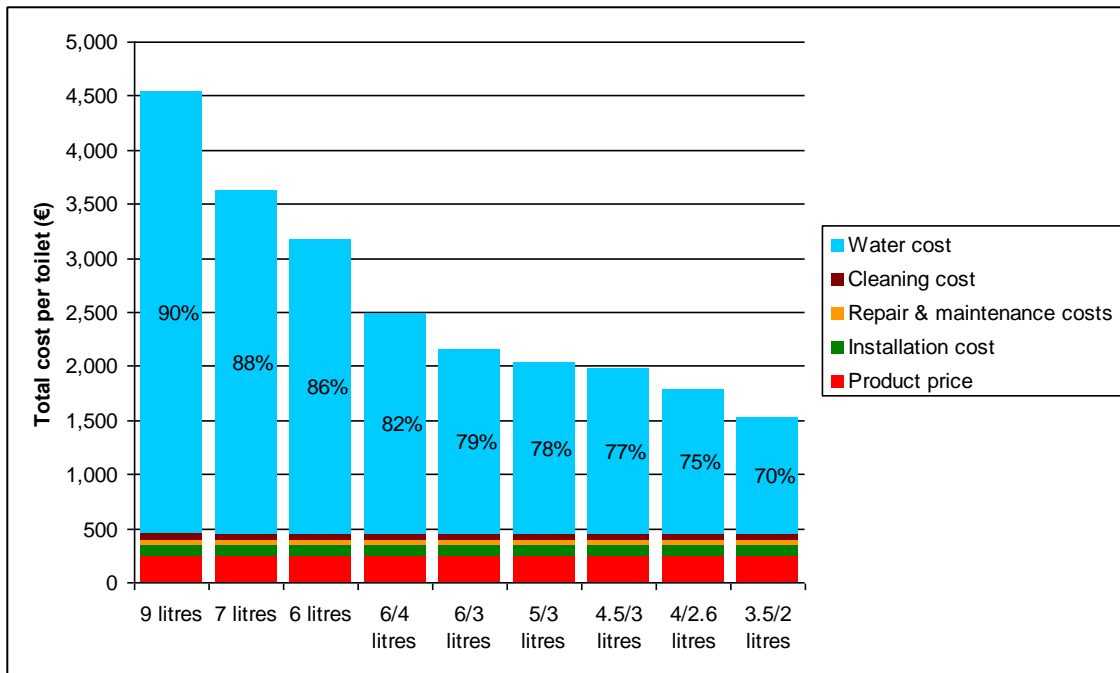


Figure 7: LCC for different non-domestic traditional flushing toilets

As can be seen from Figure 6, the total LCC for a domestic traditional flushing toilet falls from just over €1,000, for a traditional 6-l single flush toilet, to about €670 for the most efficient 3.5/2-l dual flush toilet, with the savings driven exclusively from lower water consumption. In Figure 7, the phenomenon is even amplified for non-domestic flushing toilets. For instance, the total LCC of a 3.5/2-l dual flush non-domestic toilet (around 1,500€) is a bit less than half the total LCC of 6-l single flush toilet (above 3,100 €).

More generally from the LCC analysis, it appears that any intervention that reduces water consumption will also present a cost saving.



## 9 BAT AND BNAT ANALYSIS OF FLUSHING TOILETS AND URINALS

Best Available Technology (BAT) and Best Not Yet Available Technology (BNAT) for flushing toilets and urinals were reviewed, based on the input received from stakeholders and additional research. The research on BAT and BNAT focuses on water usage, identified as a key impact for this product group according to the LCA findings (see Section 7)<sup>34</sup>.

### 9.1 BNAT analysis

Research on BNAT for toilets and urinals revealed little in the way of break-through technologies yet to hit the European markets. Most of the advice from the industry and other stakeholders indicates that the market is mature and well established. The principal development drive is towards smaller flush volumes, and the consensus was that limited further improvement would be possible in that line, beyond what is currently BAT. A reason quoted by a number of consultees was the limitation imposed by wastewater infrastructure that requires a given volume of water to transport wastes effectively. Lower flush volumes would impact transport of such wastes.

Only one technology was identified as BNAT for toilets connecting to conventional drainage systems, and that was the Propelair<sup>35</sup> toilet, currently under development in the UK. This product achieves a very low flush volume (of 1.5 litres) by using a displaced air flushing system. The product is still under development.

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<sup>34</sup> More details can be found at: [http://susproc.jrc.ec.europa.eu/toilets/docs/Task\\_5\\_BAT\\_BNAT.pdf](http://susproc.jrc.ec.europa.eu/toilets/docs/Task_5_BAT_BNAT.pdf)

<sup>35</sup> <http://www.propelair.com/>

## 9.2 BAT analysis

For products already present on the market, the analysis led to the following conclusions on BAT (Table 27):

Table 27: Current BAT water usage levels for flushing toilets and urinals

| Type of Toilet / Urinal |                        | Flush Volumes (Litres / Flush) |            |
|-------------------------|------------------------|--------------------------------|------------|
| Toilets                 |                        | Single Flush                   | Dual Flush |
|                         | Traditional Toilet     | 4                              | 3.5 / 2    |
|                         | Squat Toilet           | 6                              | 6 / 3      |
| Urinals                 | Flushing Single Urinal | 0.5                            |            |
|                         | Flushing Trough Urinal | 1 (per place/person)           |            |
|                         | Flush-free Urinal      | 0                              |            |

When developing EU Ecolabel and GPP criteria, it is also important to understand the technologies currently available on the market, so that criteria can be set at a right level to differentiate the top performing products, typically the top 10-20 % of the market.

Based on estimation and stakeholder feedback, Table 28 presents the market segmentation for domestic flushing toilet sales in the EU27 (on flush volume basis).

Table 28: Market segmentation of domestic flushing toilet sales in EU27

| Toilet design                          | l/flush <sup>1</sup> | 2005 | 2010        | 2015   | 2030 |
|--|----------------------|------|-------------|--------|------|
| <b>12.5-l single flush toilets</b>     | 12.5                 |      |             |        |      |
| <b>7-l to 9-l single flush toilets</b> | 8                    |      |             |        |      |
| <b>6-l single flush toilets</b>        | 6                    | 60 % | <b>55 %</b> | 40.5 % | 0 %  |
| <b>6/3-l dual flush toilets</b>        | 3.8                  | 38 % | <b>43 %</b> | 57.5 % | 96 % |
| <b>5/3-l dual flush toilets</b>        | 3.5                  | 2 %  | <b>2 %</b>  | 2 %    | 3 %  |
| <b>4/2.5-l dual flush toilets</b>      | 2.9                  | 0 %  | <b>0 %</b>  | 0 %    | 1 %  |

<sup>1</sup> Average flush for dual flush toilets is calculated on the basis of one full flush for every three reduced flushes.

For flushing toilets, it is clear that the current BAT water usage level is lower than (or, for squat toilets, equal to) the minimum flush volume of six litres permitted in certain EU countries. Furthermore, the market share data suggests that the 6/3-litre dual flush toilet will become the dominant design on the EU market. It follows that an Ecolabel or GPP maximum flush volume criterion would need to be pitched below the 6/3-litre dual flush toilet, if it is to drive the market to lower flush volumes. It might happen that in certain countries this will be lower than what is legally permitted.

Stakeholders' estimates of market segmentation for flushing urinal sales in the EU27 (on flush volume basis) are presented in Table 29.

Table 29: Market segmentation of flushing urinal sales in EU27

| Urinal design | 2010 | 2015 |
|---------------|------|------|
| 4-l urinals   | 14 % | 10 % |
| 2-l urinals   | 65 % | 50 % |
| 1-l urinals   | 20 % | 35 % |
| 0.5-l urinals | 1 %  | 5 %  |

For flushing urinals, the mainstream is 2.0 l/flush. Stakeholders indicated that they feel 0.5 l/flush for non-siphonic urinals and 1.0 l/flush for siphonic urinals is about as low as they can go for flushing single urinals, to the extent that reducing flush volumes any further will require innovation.



## **10 IMPROVEMENT POTENTIAL OF FLUSHING TOILETS AND URINALS**

### **10.1 Introduction**

Due to the complexity of the user behaviour analysis and the variety of water using habits it is difficult to precisely estimate the water savings which can be achieved through the application of water-efficient products. Preliminary calculations of the improvement potential based on the definition of scenarios integrating the results of the study are presented below.

The comparison between baseline and improvement scenarios allows computing the potential improvement. The baseline scenario represents the scenario of reference in which no specific action is taken. Improvement scenarios, which differ from the baseline scenario, set different product policy options, which may result in environmental improvement compared to the baseline.

## 10.2 Improvement potential based on sales evolution

### 10.2.1 Overview

The improvement potential exercise analyses potential effects of new product policies on the sales of flushing toilets and urinals and the consequences in terms of water saving. Different scenarios are presented below: the baseline scenario and the improvement scenarios. In both types of scenarios, the stock already installed is assumed to be the same; only the consequences of policy options on the replaced stock (renewal due to replacement or building refurbishment) and new stock (new buildings), which represent the sales, is considered.

In all scenarios, the sales are projected and water consumption from this new equipment is computed. The water consumption differential between the baseline and improvement scenarios gives the improvement potential in terms of water saving.

For the calculation, it has been decided that the scenarios start arbitrarily from 2010 onwards because the last known year (from stakeholder input) is 2010 (further years are projections). The improvement potential is estimated over a ten year period (until 2020) and the results are averaged on a yearly basis.

The starting point for setting the scenarios is the market segmentation and the user behaviour.

### 10.2.2 Baseline scenario

The baseline scenario projects business as usual (BAU) evolution where no specific action is taken. As a result, the market shares remain the same as those presented in Section 9.2<sup>36</sup>. In terms of user behaviour, the assumptions are based on the data presented in Section 5 and are the same as the ones used for the LCA (Section 7): domestic flushing toilets are used 7.75 times a day, non-domestic flushing toilets 25 times a day and flushing urinals 40 times a day. For dual flush toilets, they are assumed to be used one full flush for every three reduced flushes. Table 30, Table 31 and Table 32 show market segmentation and user behaviour data for domestic flushing toilets, non-domestic flushing toilets and flushing urinals, respectively (flush-free urinals have not been considered in the scenarios).

Table 30: Market segmentation shares for domestic flushing toilets (BAU scenario)

| Toilet design              | Average Water use <sup>2</sup> |                        | 2010              | 2015              | 2020              |
|----------------------------|--------------------------------|------------------------|-------------------|-------------------|-------------------|
|                            | flush <sup>1</sup> (l)         | (m <sup>3</sup> /year) |                   |                   |                   |
| 6-l single flush toilets   | 6                              | 17.0                   | 55.0 %            | 40.5 %            | 25.7 %            |
| 6/3-l dual flush toilets   | 3.8                            | 10.6                   | 43.0 %            | 57.5 %            | 70.3 %            |
| 5/3-l dual flush toilets   | 3.5                            | 9.9                    | 2.0 %             | 2.0 %             | 3.0 %             |
| 4/2.5-l dual flush toilets | 2.9                            | 8.1                    | 0.0 %             | 0.0 %             | 1.0 %             |
| <b>Total</b>               | -                              | -                      | <b>100.0</b><br>% | <b>100.0</b><br>% | <b>100.0</b><br>% |

<sup>1</sup> Average flush for dual flush toilets is calculated on the basis of one full flush for every three reduced flushes;

<sup>2</sup> Annual water use is based on 7.75 flush/day per domestic product.

<sup>36</sup> Linear interpolation was applied for missing years; for urinals as no data are available after 2015, shares were kept constant after 2015.

Table 31: Market segmentation shares for non-domestic flushing toilets (BAU scenario)

| Toilet design                     | Average flush <sup>1</sup> (l) | Water use <sup>2</sup> (m <sup>3</sup> /year) | 2010           | 2015           | 2020          |
|-----------------------------------|--------------------------------|---|----------------|----------------|---------------|
|                                   |                                |   |                |                |               |
| <b>6-l single flush toilets</b>   | 6                              | 54.8  | 64.7 %         | 58.0 %         | 49.3 %        |
| <b>6/3-l dual flush toilets</b>   | 3.8                            | 34.2  | 33.3 %         | 40.0 %         | 46.7 %        |
| <b>5/3-l dual flush toilets</b>   | 3.5                            | 31.9  | 2.0 %          | 2.0 %          | 3.0 %         |
| <b>4/2.5-l dual flush toilets</b> | 2.9                            | 26.2  | 0.0 %          | 0.0 %          | 1.0 %         |
| <b>Total</b>                      | -                              | -   | <b>100.0 %</b> | <b>100.0 %</b> | <b>49.3 %</b> |

<sup>1</sup> Average flush for dual flush toilets is calculated on the basis of one full flush for every three reduced flushes;

<sup>2</sup> Annual water use is based on 7.75 flush/day per domestic product.

Table 32: Market segmentation shares for flushing urinals (BAU scenario)

| Urinal design        | Flush (l) | Water use <sup>1</sup> (m <sup>3</sup> /year) | 2010           | 2015           | 2020           |
|----------------------|-----------|---|----------------|----------------|----------------|
|                      |           |   |                |                |                |
| <b>4-l urinals</b>   | 4         | 58.4  | 14.0 %         | 10.0 %         | 10.0 %         |
| <b>2-l urinals</b>   | 2         | 29.2  | 65.0 %         | 50.0 %         | 50.0 %         |
| <b>1-l urinals</b>   | 1         | 14.6  | 20.0 %         | 35.0 %         | 35.0 %         |
| <b>0.5-l urinals</b> | 0.5       | 7.3   | 1.0 %          | 5.0 %          | 5.0 %          |
| <b>Total urinals</b> | -         | -   | <b>100.0 %</b> | <b>100.0 %</b> | <b>100.0 %</b> |

<sup>1</sup> Annual water use is based on 40 flush/day per product.

### 10.2.3 Improvement scenarios

Improvement scenarios rely on the implementation of legislation in favour of water-saving products (like the EU Ecolabel, GPP, Labelling, etc.), which is supposed to shift the market towards greener products with increasing the market shares of low-flush products.

As a general assumption, user behaviour is assumed to be the same as in the BAU scenario (water consumption per type of product remains the same). Only the product purchases made by consumers and procurers vary in the improvement scenarios.

In first and second improvement scenarios (ECOLABEL10 and ECOLABEL20, respectively), it is assumed that EU Ecolabel and GPP have been adopted and award 5/3-l dual flush toilets (or below like 4/2.5-l) and 1-l flushing urinals (or below like 0.5-l). In ECOLABEL10, this legislation change (e.g. in 2010) would have shifted hypothetically from 2011 onwards 10 % of the BAU non-ecolabelled product purchases to ecolabelled product purchases. In details, 10 % BAU sales of 6-l flush toilets would not be purchased anymore (from 2011 onwards) and these sales would be replaced instead by 5/3-l dual flush toilets (EU Ecolabel target); 10 % BAU sales of 6/3-l dual flush toilets would not be purchased anymore (from 2011 onwards) and these sales would be replaced again by 5/3-l dual flush toilets; sales of 5/3-l dual flush toilets would then be increased by the aforementioned substitutions; sales of 4/2.5-l dual flush toilets would be kept constant. For urinals, the same principles apply with 10 % BAU sales of 4-l and 2-l flush urinals toilets replaced by 1-l flush purchases and sales of 0.5-l flush urinals being kept constant. In ECOLABEL20, the legislation change is assumed to have shifted hypothetically from 2011 onwards not 10 % but 20 % of the BAU non-ecolabelled product purchases to ecolabelled product purchases.

In third and fourth improvement scenario (RATING10 and RATING20, respectively), it is assumed that a mandatory rating scheme with different water efficiency classes has been set up, where 6-l flush toilets and 4-l urinals represent the lowest class and 4/2.5-l dual flush toilets and 0.5-l urinals the highest class. In RATING10, the legislation change (e.g. in 2010) would have shifted hypothetically from 2011 onwards 10 % of the BAU purchases of a given water efficiency class to the class above. For instance, 10 % BAU sales of 6-l flush toilets

would not be purchased anymore (from 2011 onwards) and these sales would be replaced instead by 6/3-l dual flush toilets; 10 % BAU sales of 6/3-l dual flush toilets would not be purchased anymore (from 2011 onwards) and these sales would be replaced instead by 5/3-l dual flush toilets; etc. For urinals, the same principles apply with e.g. 10 % BAU sales of 4-l urinals replaced by 2-l flush urinals; etc. In RATING20, the legislation change is assumed to have shifted hypothetically from 2011 onwards not 10 % but 20 % of the BAU purchases of a given water efficiency class to the class above.

Table 33 summed up the improvement scenarios by showing the market segmentation shares used in improvement scenarios expressed as a linear combination of BAU market segmentation shares (the variable names of BAU shares are written in bold and italic in the table).

Table 33: Market segmentation shares for improvement scenarios compared to BAU scenario

| Product design                    | BAU <sup>1</sup>     | ECOLABEL10                      | ECOLABEL20                      | RATING10                            | RATING20                            |
|-----------------------------------|----------------------|---------------------------------|---------------------------------|-------------------------------------|-------------------------------------|
| <b>6-l flush toilets</b>          | <b><i>6l</i></b>     | $0.9 \times 6l$                 | $0.8 \times 6l$                 | $0.9 \times 6l$                     | $0.8 \times 6l$                     |
| <b>6/3-l dual flush toilets</b>   | <b><i>6/3l</i></b>   | $0.9 \times 6/3l$               | $0.8 \times 6/3l$               | $0.1 \times 6l + 0.9 \times 6/3l$   | $0.2 \times 6l + 0.8 \times 6/3l$   |
| <b>5/3-l dual flush toilets</b>   | <b><i>5/3l</i></b>   | $0.1 \times (6l + 6/3l) + 5/3l$ | $0.2 \times (6l + 6/3l) + 5/3l$ | $0.1 \times 6/3l + 0.9 \times 5/3l$ | $0.2 \times 6/3l + 0.8 \times 5/3l$ |
| <b>4/2.5-l dual flush toilets</b> | <b><i>4/2.5l</i></b> | <b><i>4/2.5l</i></b>            | <b><i>4/2.5l</i></b>            | $0.1 \times 5/3l + 4/2.5l$          | $0.2 \times 5/3l + 4/2.5l$          |
| <b>4-l urinals</b>                | <b><i>4l</i></b>     | $0.9 \times 4l$                 | $0.8 \times 4l$                 | $0.9 \times 4l$                     | $0.8 \times 4l$                     |
| <b>2-l urinals</b>                | <b><i>2l</i></b>     | $0.9 \times 2l$                 | $0.8 \times 2l$                 | $0.1 \times 4l + 0.9 \times 2l$     | $0.2 \times 4l + 0.8 \times 2l$     |
| <b>1-l urinals</b>                | <b><i>1l</i></b>     | $0.1 \times (4l + 2l) + 5/3l$   | $0.2 \times (4l + 2l) + 5/3l$   | $0.1 \times 2l + 0.9 \times 1l$     | $0.2 \times 2l + 0.8 \times 1l$     |
| <b>0.5-l urinals</b>              | <b><i>0.5l</i></b>   | <b><i>0.5l</i></b>              | <b><i>0.5l</i></b>              | $0.1 \times 1l + 0.5l$              | $0.2 \times 1l + 0.5l$              |

<sup>1</sup> Shares of reference: these refers only to variable names; the exact numbers can be found in Table 30, Table 31 and Table 32 for domestic flushing toilets, non-domestic flushing toilets and flushing urinals, respectively.

### 10.2.4 Main results

With combining these product market shares with the stock figures presented in Section 4.2 and the annual water consumption per product (see Table 30, Table 31 and Table 32), we can estimate the total EU27 water consumption for both BAU and improvement scenarios and then compute the improvement potential (water saving in million m<sup>3</sup>) per scenario over the 10-year period. As the product lifetime is rather long and in any case beyond ten years, the cumulative effect is taken into account over all the years (saving from low-flush flush toilets purchased in first year, also occurs in second year, etc.). Results are presented in Table 34 for the total water saving potential over the 10-year period and in le 36 for the average annual saving.

Table 34: EU27 total water saving potential (in million m<sup>3</sup>)

| Products                             | ECOLABEL10   | ECOLABEL20   | RATING10   | RATING20     |
|--------------------------------------|--------------|--------------|------------|--------------|
| <b>Domestic flushing toilets</b>     | 275          | 550          | 253        | 507          |
| <b>Non-domestic flushing toilets</b> | 611          | 1,222        | 559        | 1,118        |
| <b>Total flushing toilets</b>        | <b>886</b>   | <b>1,772</b> | <b>812</b> | <b>1,624</b> |
| <b>Flushing urinals</b>              | 159          | 319          | 166        | 332          |
| <b>Total</b>                         | <b>1,045</b> | <b>2,090</b> | <b>978</b> | <b>1,957</b> |



Table 35: EU27 average annual water saving potential (in million m<sup>3</sup>/year)le 36: EU27 average annual water saving potential (in million m<sup>3</sup>/year)

| Products                      | ECOLABEL10 | ECOLABEL20 | RATING10  | RATING20   |
|-------------------------------|------------|------------|-----------|------------|
| Domestic flushing toilets     | 27         | 55         | 25        | 51         |
| Non-domestic flushing toilets | 61         | 122        | 56        | 112        |
| <b>Total flushing toilets</b> | <b>89</b>  | <b>177</b> | <b>81</b> | <b>162</b> |
| Flushing urinals              | 16         | 32         | 17        | 33         |
| <b>Total</b>                  | <b>105</b> | <b>209</b> | <b>98</b> | <b>196</b> |

With keeping in mind all the assumptions described above, water saving potential for flushing toilets and urinals (the impacts of flush-free urinals have not been considered in the scenarios) could range from about 1,000 to 2000 million m<sup>3</sup> over the 10-year period, depending on the policy options and the efficiency of the policy options. On average, this represents about 100 to 210 million m<sup>3</sup>/year. We can note that ecolabelling/GPP option and mandatory rating scheme option could produce equivalent results if their target efficiency is similar.

All the results presented above are valid only under the mentioned assumptions and then should be considered with caution. In addition, improvement scenarios have focussed here only on the effect of policy options on the product sales. Nevertheless, the estimation shows clearly the importance of water saving potential.



## **11 CONCLUSION**

This Preliminary Report have presented background information on flushing toilets and urinals, in terms of scope, definitions, economic and market analysis, user behaviour, labelling schemes, life cycle environmental impacts, life cycle costs, BAT and BNAT. Improvement potential has also been estimated based on this background information. A clear conclusion is that water consumption (in the use phase) is the key issue (main environmental impact and source of improvement potential) for this product group.

All these results represent the key information from which the EU Ecolabel and GPP criteria are derived (following step of the project).

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#### Abstract

The Preliminary Report presents background information on flushing toilets and urinals, gathered with the purpose of the EU Ecolabel and GPP criteria development. Section 2 gives the project background information. Section 3 presents the scope and the main definitions for the product group. Section 4 reports the main results of the economic and market analysis, Section 5 outlines the user behaviour, and Section 6 gives an overview of the main labelling schemes. Section 7 shows the main environmental impacts for the base cases, whereas life cycle costs are presented in Section 8. BAT and BNAT are reviewed in Section 9, and finally, Section 10 provides an estimation of improvement potential derived from the information previously analysed.

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