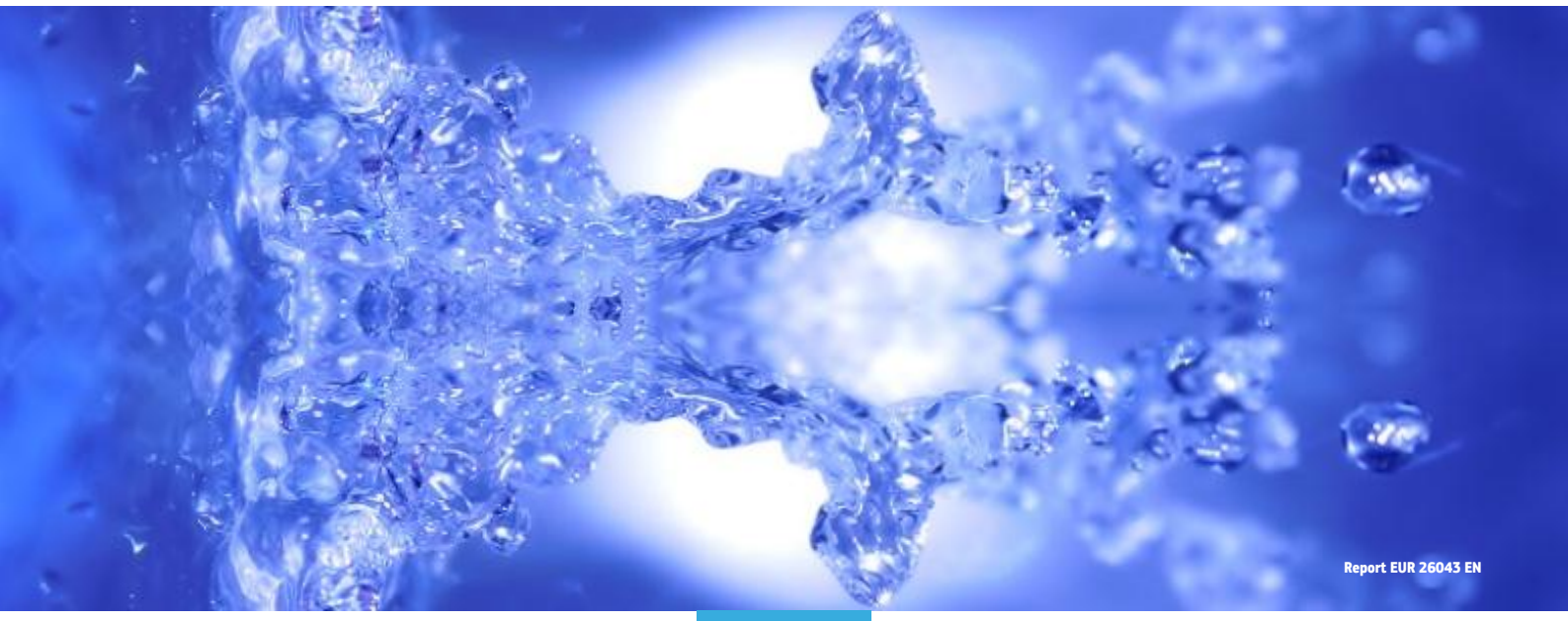
European Commission

JRC SCIENTIFIC AND POLICY REPORTS

Green Public Procurement for Sanitary Tapware - Technical Background Report

Renata Kaps, Oliver Wolf

2013



Report EUR 26043 EN

Joint Research Centre

European Commission
Joint Research Centre
Institute for Prospective Technological Studies

Contact information
Sustainable Production and Consumption (SUSPROC) Unit
Address: Edificio Expo. c/ Inca Garcilaso, 3. E-41092 Seville (Spain)
E-mail: JRC-IPTS-SPC-Secretariat@ec.europa.eu
Tel.: +34 954488318
Fax: +34 954488300

http://susproc.jrc.ec.europa.eu/
http://ipts.jrc.ec.europa.eu

JRC 71117

EUR 26043 EN

ISBN 978-92-79-31485-8 (pdf)

ISSN 1831-9424 (online)

doi:10.2788/57886

Luxembourg: Publications Office of the European Union, 2013

Printed in Spain

Table of contents

Abbreviations

AHWG	– ad-hoc Working Group
ANQIP	– Portuguese National Association for Quality in Building Installations
BAT	– Best Available Techniques
BMA	– Bathroom Manufacturers Association in the United Kingdom
BREF	– Reference Document on Best Available Techniques
CEIR	– European Committee for the Valve Industry
CEN TC	– European Committee for Standardization - Technical Committee
CO_2	– Carbon dioxide
DWD	– Drinking Water Directive
EPA	– United States Environmental Protection Agency
EU	– European Union
GPP	– Green Public Procurement
ISO	– International Standardisation Organisation
kWh	– Kilowatt hour
LCA	– Life Cycle Assessment
l/min	– Litres per minute
MS	– Member State
PAH	– Polycyclic Aromatic Hydrocarbons
POP	– Persistent Organic Pollutants
PM	– Particulate Matter
psi	– Pounds per square inch
s	– Second
UBA	– German Federal Environment Agency
VOC	– Volatile Organic Compounds
WELL	– Water Efficiency Label
TWh	– Terawatt hours = 10^9 kWh

List of Tables

List of Figures

Introduction

Green Public Procurement is a voluntary instrument, which basic concept relies on "having clear, verifiable, justifiable and ambitious environmental criteria for products and services, based on a life-cycle approach and scientific evidence base"[1]. The European Commission has presented so far several sets of recommended GPP criteria for a range of different products and services, which are available at the especially dedicated website:
http://ec.europa.eu/environment/gpp/gpp_criteria_en.htm.

The following Technical Background Report substantiates the proposal of Green Public Procurement criteria developed for the product group of **'Sanitary Tapware'**. It contains also background information on the environmental impacts of sanitary tapware and describes the most important European legislation and labelling schemes relevant for this product group.

[1] http://www.ec.europa.eu/environment/gpp

1 DEFINITION, SCOPE AND BACKGROUND

Definition

This document addresses procurement of water efficient sanitary tapware by public authorities. Within the scope of this product group are included:

1) taps,

2) showerheads,

3) showers.

The definitions of these products, agreed in the criteria development process in the framework of the Ecotapware project[2], are as follows:

"tap" means a directly or indirectly, manually mechanically and/or automatically operated valve from which water is drawn.

"showerhead" means

(a) a fixed overhead or side shower outlet, body jet shower outlet or similar device which may be adjustable, and which directs water from a supply system onto the user; or

(b) a moveable hand held shower outlet which is connected to a tap with a shower hose and can be hung directly on the tap or on the wall with the aid of an appropriate support;

"shower" means a combination of showerhead and interrelated control valves and/or devices packaged and sold as a kit;

Included in the product group is sanitary tapware used typically in public utility buildings like schools, office buildings, hospitals, swimming pools, sport centres, and other for both kind of functionalities: non-domestic and domestic-like ones.

Due to various functionalities and consequently different needs which a single product shall fulfil, for some criteria the category of sanitary tapware has been divided into basin taps, kitchen taps, showerheads and showers.

Additionally, it should be taken into account that some sanitary tapware in public premises may have to fulfil more domestic-like functions (e.g. in rooms in apartments, hotels, students dormitories, etc.), while other will have to respond to needs of multiple users (e.g. public swimming-pools or sport centres, schools, etc.). Due to this fact, additional differentiation of products for multiple users and high frequency use (e.g. in schools, hospitals, swimming-pools, etc., but not e.g. in bathrooms of hotel rooms or dormitories) can be done in reference to some criteria. When appropriate, this will be highlighted later in this report.

[2] For details and accompanying documents please go to the project's website: http://susproc.jrc.ec.europa.eu/ecotapware/.

The GPP criteria do not cover the following kinds of products:

- Bathtub taps,
- External taps,
- Non-domestic special purpose sanitary tapware,
- Taps covered under the GPP criteria set for gardening products and services.

For the purpose of these GPP criteria, the following definitions shall further apply:

"double lever/handle shower" means a shower equipped with separate levers or handles for the control of the supply of cold and hot water;

"electric shower" means a shower equipped with a device to locally heat water for the shower using electrical power;

"non-domestic special purpose sanitary tapware" means sanitary tapware which requires unrestricted water flow in order to fulfil the intended non-domestic function;

“water flow limiting device” means a technical device limiting water flow to a given volume and allowing a higher water flow only where activated by the user for a chosen period of time within a single use;

“maximum available water flow rate” means the highest available water flow rate from the system or individual fitting;

“lowest maximum available water flow rate” means the lowest water flow rate from the system or individual fitting available at full opening of the valve;

"security technical feature" means a device forming part of a sensor controlled sanitary tapware which is used to prevent continuous water flow by stopping the water supply after pre-set time even if there is a person or an object present within the sensor range.

Sanitary tapware components[3]

Taps

There are two main types of mechanisms used in taps available currently at the market; ceramic disc taps and spindle taps. In general, the key components are similar for both types of taps, except for the valve mechanism. The sections below outline these two types of mechanisms and their key components.

Spindle Taps

Previously **spindle taps** were the only type of tap available, therefore their use is common across the EU as they can be used for both high and low pressure systems. The principle on which they operate is simple, with the flow rate controlled by turning the tap head. The tap consists of a spindle with a valve seat attached to the bottom of the spindle. A washer is attached to the end of the valve seat and it is positioned over the hole through which water flows. As the handle is turned it moves the valve seat up or down to adjust the flow. This mechanism is shown in Figure 1.

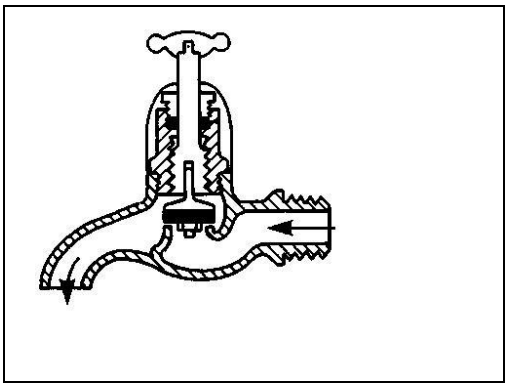


Figure 1: Spindle tap mechanism
(From: http://www.click4bathrooms.com/bathroom-images/bib-tap.JPG)

Spindle taps typically consist of a number of common components which are shown in Figure 2 for a pillar tap:

[3] This section constitutes a part of the Base-case assessment report, available online at: http://susproc.jrc.ec.europa.eu/ecotapware/stakeholders.html.

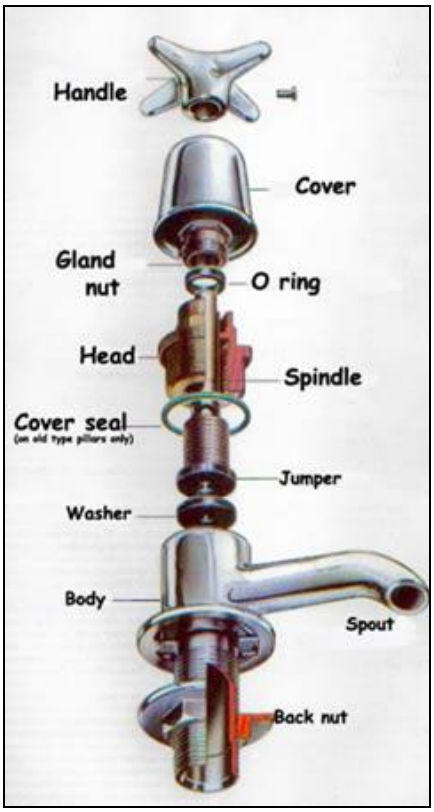


Figure 2: Components of a spindle tap
(From: http://www.diydoctor.org.uk/projects/dripping_tap.htm)

The various parts of the tap are generally robust and hard wearing. During the lifetime of a spindle tap the key components likely to require replacing is the tap washer, o rings or regrinding of the valve seat where this has been eroded[4].

Using a spindle mechanism restricts the type of tap design it can be used with. For example it cannot be used with lever taps, as repetitive turning is required to open and close the tap.

Ceramic Disc Tap

Ceramic disc taps operate differently to spindle taps in that there are two ceramic discs in the body allowing water to flow as they are separated when the handle is turned or lifted. This mechanism means the tap can be turned fully on and off by a quarter turn of the handle. Many components of a ceramic disc tap are the same as those of a spindle tap, however the mechanisms differ. The components of a ceramic disc tap are listed below, with Figure 3 illustrating an example for a single lever mixer tap:

- Spout (A)
- Tap cartridge (see below for further description of this part) (B)
- Handle (C)
- Retaining Screw (D)

[4] http://www.diydoctor.org.uk/projects/dripping_tap.htm

- Screw cover/hot-cold indicator (E)

Figure 3: Components of a ceramic disc tap
(From: http://www.diydoctor.org.uk/projects/ceramic_disc_taps.htm)

The tap cartridge consists of a number of parts itself, these are summarised below and shown in Figure 4:

- Disc retaining washer (A)
- Ceramic discs (B)
- O ring (C)
- Valve retaining nut (D)
- Spindle, on which the handle sits (E)

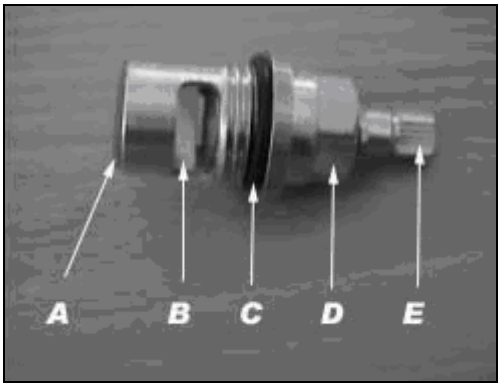


Figure 4: Components of a tap cartridge from a ceramic disc tap
(From: http://www.diydoctor.org.uk/projects/ceramic_disc_taps.htm)

As with spindle taps, ceramic disc taps are designed to be hard wearing. The key component that wears is the ceramic disc; however they are designed to be durable and it is unusual for them to wear out completely and need replacing during the taps lifetime. If the ceramic discs do wear out and need replacing then it is usual for the tap cartridge to be replaced instead of the individual discs.

In general ceramic disc taps require a certain pressure at which to operate in order to provide an acceptable flow rate for the end user. However there is not a single given pressure that can be stated at which ceramic disc taps will operate, as it will also depend on the design of the tap itself, for example the size and alignment of the discs, the diameter of the opening for which water can pass through and the resistance provided.

This means that ceramic disc taps can be designed to operate to low pressures e.g. 0.1 bar as well as higher pressure such as 0.5 bar or 1.0 bar and above, however given that the main low pressure market is the UK and pillar taps are still widely used in the UK in comparison to mainland Europe, the majority of ceramic disc taps are designed for higher pressure systems and not the low pressure systems. The important point to ensure that acceptable water flow rate is achieved is to use a tap that is designed for the pressure system it is to be used with. It is therefore important that the product information states the min and max pressure at which the tap can be used so that the consumer can make an informed choice.

Pillar Taps and Mixer Taps

Further, taps can be also divided into pillar taps and mixer taps.

Pillar taps are mounted on a horizontal surface, have a vertical inlet and a nozzle bent to discharge water in a downwards direction. They are used on basins and on sinks with two-hole installation, and are sold mainly as a pair, designed to control separately hot and cold water flow[5].

Mixer taps mix hot and cold water before it reaches the outlet, allowing for temperature regulation by the end user. Usually, the temperature can be set at any level between the hot water and cold water temperature. Mixer taps can be divided further according to the number of mounting holes that are used to fix the tap to the sanitary fixture or wall. Monobloc mixer taps or single-hole mixer taps only need one mounting hole (Figure 5). Commonly, monobloc mixer taps are single lever mixer taps, however, also double-lever monobloc taps exist. There are also two-hole and three-hole mixer taps that need more mounting holes (Figure 6). For two-hole mixer taps, the outlet is separated from the operating controls. In the case of three-hole mixer taps, the outlet and the operating controls are separated. In general, these taps are double-lever taps.

[5] Market Transformation Programme: BNWAT26: Household tapware – an overview. Market Transformation Programme, DEFRA 2008. Available online at: http://www.mtprog.com/spm/download/document/id/706.

Figure 5: Examples for single lever monobloc (single-hole) mixer taps
Source: A. Uihlein

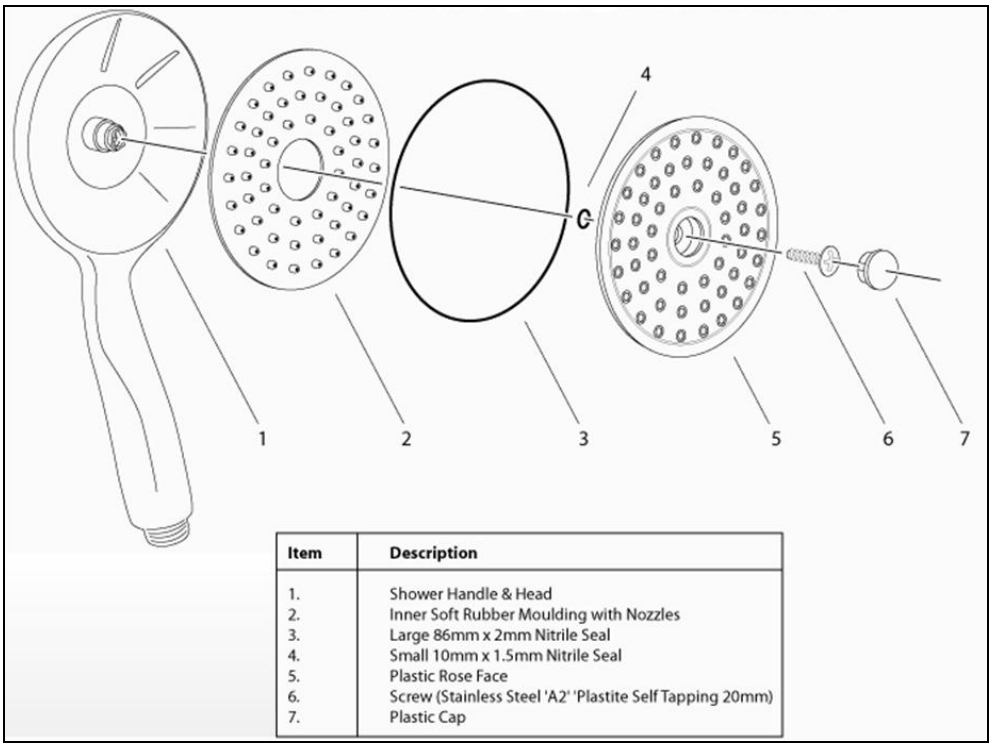
Figure 6: Examples for double lever two-hole (left) and three-hole (right) mixer taps
Source: Baunetz Wissen[6]

[6] Baunetz Wissen. Bad und Sanitär. BauNetz Media GmbH, Berlin. Available online at: http://www.baunetzwissen.de/standardartikel/Bad-und-Sanitaer_Rohranschluesse_172732.html

Showerheads

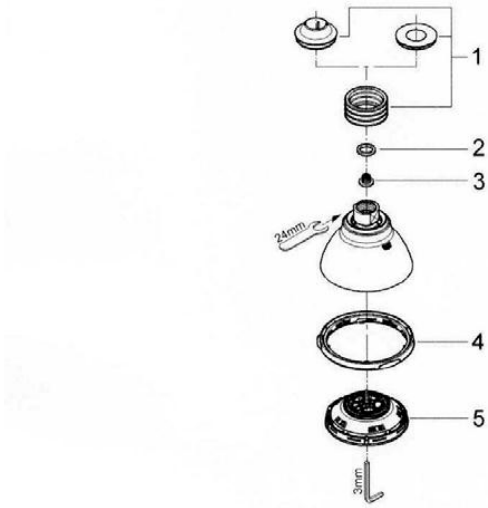
A showerhead delivers water to the end user and is usually connected to the valve via a hose or if wall mounted – a shower arm. There are many different designs and the components vary depending on the type and complexity of the showerhead, for example where they aerate the water or have built in flow regulators.

The components of some example products are shown below (Figure 7 to Figure 9) to provide an indication of the types of components used in showerheads.



Item	Description
1.	Shower Handle & Head
2.	Inner Soft Rubber Moulding with Nozzles
3.	Large 86mm x 2mm Nitrile Seal
4.	Small 10mm x 1.5mm Nitrile Seal
5.	Plastic Rose Face
6.	Screw (Stainless Steel 'A2' 'Plastite Self Tapping 20mm)
7.	Plastic Cap

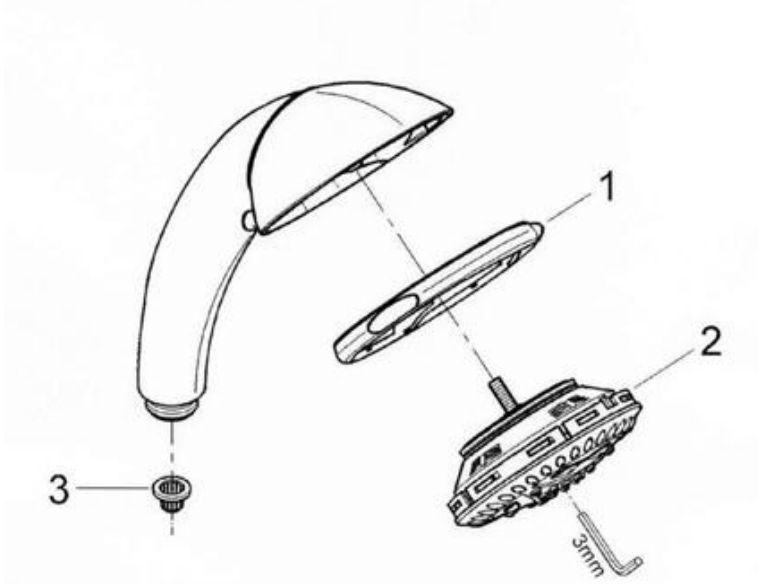
Figure 7: Single spray showerhead
(From: http://www.wayneansell.com/portfolio/hh-336n_diagram_lrg.png)



1 – Bellow, 2 – Sealing Washer, 3 – Strainer, 4 – Adjusting Ring 5 – Spray Faceplate

Figure 8: Head shower

(From: http://www.showerdoc.com/shower-spares/grohe/GROHE-PARENT-37-Grohe- movario-Head-Shower-Champagne-1-2in-28-396)



1 – Adjusting Ring, 2 – Spray faceplate, 3 – Strainer

Figure 9: Handshower

(From: http://www.showerdoc.com/shower-spares/grohe/GROHE-PARENT-32-Grohe-Movario-Handshower-Massage-28-391)

2 MARKET OVERVIEW

The following section presents market overview based on the information obtained from the Eurostat database. The information extracted is aggregated for the whole sanitary tapware market across Europe, and the values referring to public procurement are not separately indicated. Thus, although public procurement is covered by Eurostat, it constitutes only a share of the total values presented below. Additionally, it shall be taken into account that data presented may be incomplete or approximate, due to lacking availability of data on this product group.

In the framework of the Ecotapware project a detailed market analysis for taps and showerheads for the EU 27 was conducted for domestic and non-domestic sectors. Official EU statistics data was collected to analyse the production within the EU and individual member states (MS), to analyse trade (intra and extra EU import and export) and identify the key MS players. In addition, the existing stock was calculated and the estimation of future sales was done. Further, the apparent EU consumption of the sanitary tapware products was calculated based on the formula:

Sales in EU 27 = Production in EU 27 – export to third countries (from EU 27) + imports from third countries (to EU 27)

Detailed results of the analysis done in the framework of the Ecotapware project are available in Economic and Economic and Market Analysis report, accessible at the project's website[7]. Summary of the main points is given below. It should be however remembered that limitations in the transparency of the EU statistics and lack of data in general caused that a number of assumptions had to be made. These are outlined in the appropriate sections of the abovementioned report.

Further, contacts with procurers from several MS did not allow receiving any more exact information on the procurement quantities, neither for single MS, nor for the total EU 27 market, as usually such information is not collected at these levels. Therefore, the below numbers refer to overall EU sanitary tapware market (i.e. including public procurements), but it shall be remembered that public purchasing constitute only a share of them.

[7] Economic and market analysis report, available online at: http://susproc.jrc.ec.europa.eu/ecotapware/stakeholders.html.

Economic and market analysis of the product group of sanitary tapware[7]

Values of estimated total production, import and export of taps and showerheads in 2008 are presented in Table 1.

Table 1: Calculated production, import and export in EU 27 in 2008

	Taps	Showers
	in thousands of units	
Production	164,578	54,859
Import	101,314	33,771
Export	80,468	26,823

Among the biggest producers at the European market are Germany, Italy, Spain and Portugal. According to the results obtained in economic and market analysis intra-EU imports (in kg) represented above 50 % of the overall imports with Germany, France Italy, UK and Spain being the biggest importers. Intra-EU exports represented also above 50 % of all exports (in kg), with Germany, Italy, UK and Spain as the most important exporters.

With regard to extra-EU trade: The largest importer (expressed in weight) to the EU 27 was China, representing above 80 % of all extra European imports. Chinese import constituted above one third of overall European imports (intra and extra). It is interesting to add that this import from China represented above half of total imported amount of sanitary tapware to some MS (e.g. Romania, Poland, Lithuania, Bulgaria and the UK).

The calculated apparent consumption values are presented in Table 2:

Table 2: Apparent consumption in EU 27 in 2008

	Taps	Showers
	in thousands of units	
Apparent consumption	185,424	61,808

In accordance with this simplified analysis, the largest apparent consumption was estimated for Italy (21.6 % of the EU apparent consumption), followed by Germany (9.7 %) and France (8.4 %).

Further, the stock of taps and showers was estimated, based on the assumption presented in the Economic and Market Analysis report. It was calculated separately for the domestic and non-domestic sector. Although, the public procurement stock constitutes a share of the non-domestic stock, it should be remembered that also private premises are covered in this calculations. The main assumptions

used, applicable for public procurement (developed in the framework of the project and based on discussions with stakeholders) are given below:

- For hospitals: Eurostat provides the number of hospital beds across all EU 27. The following assumptions were applied to the number of beds - 1 bathroom with 1 tap and 1 shower for every 4 beds – average across all Member States. For kitchen taps, the assumption is 1 tap for every 75 beds.

- For tourist accommodations and services: Eurostat provides the number of tourism beds across the EU 27. That is the number of beds available in all type of tourism accommodations. The assumptions used here are – 50 % of all beds have one bathroom with one tap and one shower, other 50 % have one bathroom with one tap and one shower for 2 beds. The assumption for kitchen taps is based on 1 tap per 100 beds.

- For education: Eurostat provides the total number of student/pupils (at all levels) enrolled across the EU 27. The following assumptions were applied – on average across the EU there is 1 tap per bathroom, 1 shower and 1 kitchen tap for every 100 student/pupils.

The main results obtained are presented in

Table 3 below. The analysis of the domestic and non-domestic sectors showed that, with regard to the product group of sanitary tapware, the non-domestic sphere represents just 7 % of the stock of taps and 11 % of the shower stock.

Table 3: Stock of taps and showers in the non-domestic sector in EU 27

Stock of	2005	2006	2007	2012	2015	2020
	in units					
Taps	66,580,000	68,177,000	69,810,000	77,951,000	83,513,000	95,041,000
Shower	26,475,000	27,094,000	27,908,000	30,162,000	32,365,000	37,065,000

Finally, futures sales were modelled. For the non-domestic sector it is expected that the sales of taps will increase till the year 2020 by more than 35 % across the EU 27 from approximately 7 million units in 2007 to more than 9.5 million in 2020. With regard to non-domestic sales of showers the expected sales in the EU will increase from approximately 4 million units in 2007 to more than 5.3 million units in 2020.

Nevertheless, the stakeholders' consultation concerning the development of the sanitary tapware market revealed that the current economic climate has resulted in a loss of around 25 % in market value/volume across the majority of bathroom products and manufacturers are not particularly optimistic that this loss in the market will be recovered quickly. Therefore, the above presented values

shall be treated carefully and mid-term estimates in the future are likely to result in more modest figures.

3 KEY ENVIRONMENTAL IMPACTS

The environmental performance of this product group was assessed by applying the EcoReport LCA tool. LCA tools show various potential environmental impacts related directly or indirectly to the product life cycle. In EcoReport, which is a streamlined LCA tool, all life cycle phases of the product from cradle to grave including raw material extraction, production, distribution, use phase, recycling and disposal phase are analysed[8].

For the purpose of the project four typical average products (base-cases) were identified and investigated in line with the methodology followed in the Ecodesign studies. Stakeholders, including the European Committee for the Valve Industry (CEIR), were consulted and supported the project team in the determination of these four base-cases.

In this environmental assessment the focus was put on identifying which product life phases (i.e. production, distribution, use or end of life phase) contribute most to the overall environmental impacts of sanitary tapware and which are the most relevant environmental aspects. The entire analysis and detailed results can be found in the Base-case assessment report (available at the product website[9]). In this report also all necessary assumptions, which were made regarding setting the system boundaries and estimating user behaviour, are given. Main points of analysis and its outcomes are summarised below.

In all base-cases it is identified that for all environmental impact categories the use phase has clearly the highest impact. In particular, consumption of water and energy for water heating is dominating the entire life cycle impact of this product group. The environmental impacts related to the use phase cover more than 95 % of the total impacts and for some categories even more than 99 %.

For each life cycle phase information was collected from available sources, e.g. existing studies, reports and stakeholders' feedback. EcoReport tool was applied with input data for two taps and two showerheads base-cases, provided to the European Committee by the Valve Industry (CEIR), in order to conduct the environmental assessment. Two main resources consumed along the life cycle of taps and showers are water and energy. Their consumption constituted input into the EcoReport tool.

The calculation of water and energy consumption in the use phase strongly depends on user behaviour. A number of assumptions had to be made regarding user behaviour in order to estimate average water and hot water consumption, taking into account the variability across various Member States (The investigation of the influence of end-users was conducted in the framework of User behaviour analysis[10]). The calculation procedure and all assumptions used are presented in detail in section 2.3.3

[8] A detailed analysis and results interpretation of the results of environmental assessment of sanitary tapware products was conducted in the frame of the project's task Base-case assessment. The following section constitutes a part of this report. The complete report is available on the project's website: http://susproc.jrc.ec.europa.eu/ecotapware/stakeholders.html.

[9] For details see Report: Base-case assessment, chapter 2.3 and 3, available on the project's website: http://susproc.jrc.ec.europa.eu/ecotapware/stakeholders.html.

[10] Its results can be found in Report: Market and economic analysis & User Behaviour, available on the project's website: http://susproc.jrc.ec.europa.eu/ecotapware/stakeholders.html.

of the Base-case assessment report[11]. Both domestic and non-domestic use of taps and showers was considered. The main results of calculation of total water consumption per tap and shower are presented below (see Table 4):

Table 4: Calculated domestic and non-domestic annual water consumption per unit

Use Type	Taps	Showers
	litres per tap/shower per year	
Domestic	10,400	13,140
Non-domestic	51,780	12,950

Further, the consumption of hot water was estimated (see Table 5).

Table 5: Calculated domestic and non-domestic annual hot water consumption per unit

Use Type	Taps	Showers
	litres per tap/shower per year	
Domestic	5,825	9,200
Non-domestic	29,000	9,070

And finally, energy consumption for water heating was calculated (seeTable 6).

Table 6: Energy consumption in use phase of sanitary tapware per unit

Use Type	Taps	Showerds
	kWh per tap/shower per year	
Domestic	536	846
Non-domestic	2668	834

The calculated values presented above, together with the Bill of Materials (submitted by CEIR) and the estimated life-times of the products (shown in Table 7) were used as input for the environmental assessment.

Table 7: Life-times of domestic and non-domestic sanitary tapware*

Use Type	Taps	Showers
	years	
Domestic	16	10
Non-domestic	10	7

*The lifetime values are based on average value obtained from the stakeholders' feedback

[11] Report Base-case assessment, available on the project's website: http://susproc.jrc.ec.europa.eu/ecotapware/stakeholders.html.

The impacts are shown for each identified base-case (separately for taps and showerheads). Several environmental impacts were assessed: total energy and electricity consumption, process and cooling water consumption, non-hazardous and hazardous waste generation, greenhouse gases emissions, acidification, emission of volatile organic compounds, polycyclic aromatic hydrocarbons (PAHs), persistent organic pollutants (POPs), particulate matter (PM), emissions of heavy metals to air and water and eutrophication.

The results obtained are presented below. The results show clearly that for the majority of the environmental impact categories the use phase, i.e. consumption of water and energy for water heating, has the highest impact, dominating the entire life cycle impact of this product group. This is explained due to the multiplication of the yearly environmental impacts of the annual use of a tap and/or shower with its life time ranging, as given in Table 7.

Environmental Impact Assessment for taps – Analysis[12]

Setting up the Base-case

To understand where in the product life cycle the impacts occur example products have been used to generate an indication of the life cycle impacts over the different life cycle phases i.e. production, distribution, use, end of life.

As noted above, CEIR have provided information relating to material composition for two example taps, one made mainly of brass and the other – of stainless steel. Although brass chrome-plated taps are understood to be the dominant market type, there is some indication from stakeholders that stainless steel tap sales are growing within the market. In order to compare these two types of taps the information provided by CEIR has been used to undertake the base-case assessment using the EcoReport tool.

These two examples are considered typical products currently available on the market, although it should be noted that some products will use other materials depending on their design or application. A picture of the brass tap product is shown in Figure 10. A picture of the stainless steel base-case was not available from CEIR. It is important to note that CEIR highlighted that stainless steel taps do not constitute a significant share of the market at the current time.

[12] This section constitutes a part of the Base-case assessment report, available on the project's website: http://susproc.jrc.ec.europa.eu/ecotapware/stakeholders.html.

Figure 10: Image of the base-case brass tap

Product Specific Inputs

Bill of Materials

The composition of the brass and stainless steel taps shown in Table 8 uses information provided by CEIR. These bills of material are used to represent both domestic and non-domestic taps.

Table 8: Bill of Materials - Brass Tap and Stainless Steel Tap

Product Type	Material	Weight (g)	Material code in EcoReport
Brass Tap	Brass (Body)	842	31-CuZn38 cast
	Nickel Chrome Plating	2	40-Cu/Ni/Cr plating
	Plastic	63	10-ABS
	Ceramic	21	24-Ferrite[13]
	Zinc	209	
Stainless Steel Tap	Stainless Steel (Body, including handle)	720	25-Stainless 18/8 Coil
	Nickel Chrome Plating	2	40-Cu/Ni/Cr plating
	Plastic	63	10-ABS
	Ceramic	21	24-Ferrite

Volume of packaged product

Limited information has been provided in relation to the volume of the packaged product. Therefore the packaging dimensions/volume for the purchased product has been used as a default. These are summarised in Table 9.

[13] Ceramic does not appear in the EcoReport's list of material. The Product Cases report written by the developers of EcoReport indicates 24 – Ferrite has been used to represent ceramic in other product group e.g. Room Air Conditioners and Central Heating Circulators. The report is available online at: http://ec.europa.eu/enterprise/policies/sustainable-business/ecodesign/methodology/index_en.htm

Table 9: Packaging dimensions and volume for taps

Dimensions (cm)	Volume (m3)
38.5(l)x18(w)x13(h)	0.009009

Use Phase

The inputs for the use phase are shown in Table 10. The same use phase inputs have been used for both the brass and stainless steel tap. The inputs differ for domestic and non-domestic taps.

Table 10: Use phase water and energy inputs for taps

Parameter	Domestic Tap	Non-domestic Tap
Lifetime (years)	16	10
Electricity consumption (kWh/year)	536	2668
Water consumption (m3/year)	10.4	51.8

The inputs for water and energy are based on the assumptions outlined above.

The product life time is based on information gathered during the research for Economic and Market Analysis and User Behaviour.

Environmental Impact Assessment

A summary of the data generated by the EcoReport Tool, based on the inputs described above, is provided in Appendix 2. The impacts per product are illustrated graphically in Figure 11 to Figure 25). The graphs are plotted by base-case type and life cycle phase to illustrate the comparison between the brass and stainless steel taps for the different environmental impact categories, together with commentary as appropriate.

It should be noted that for the majority of the environmental impact categories the use phase clearly has the highest impact, dominating the life cycle impact of the product. The results presented refer to the domestic sector base-case for taps. The same material composition for the non-domestic base-case has been used; therefore the main difference in the results for domestic and non-domestic taps is in relation to water use and energy used for the heating of water. Where these differences have an impact on the results for specific environmental indicators it has been highlighted below in the discussion of the results.

Resources and Waste

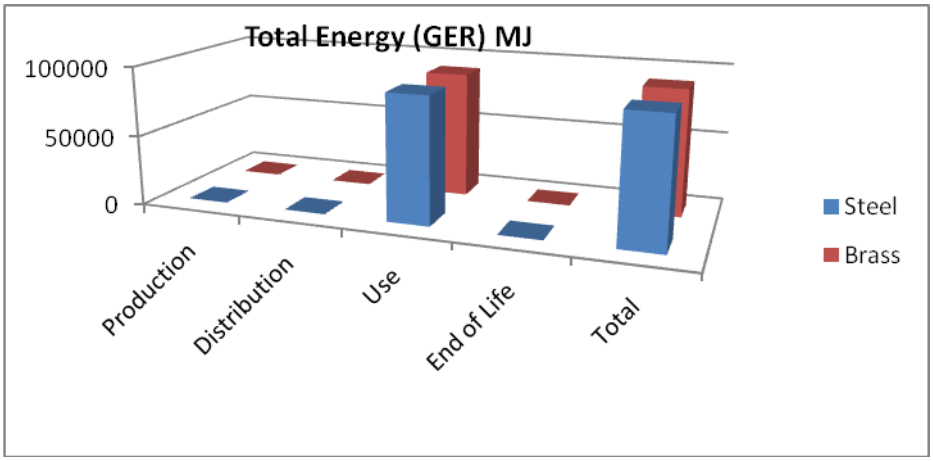


Figure 11: Total energy consumption for domestic taps

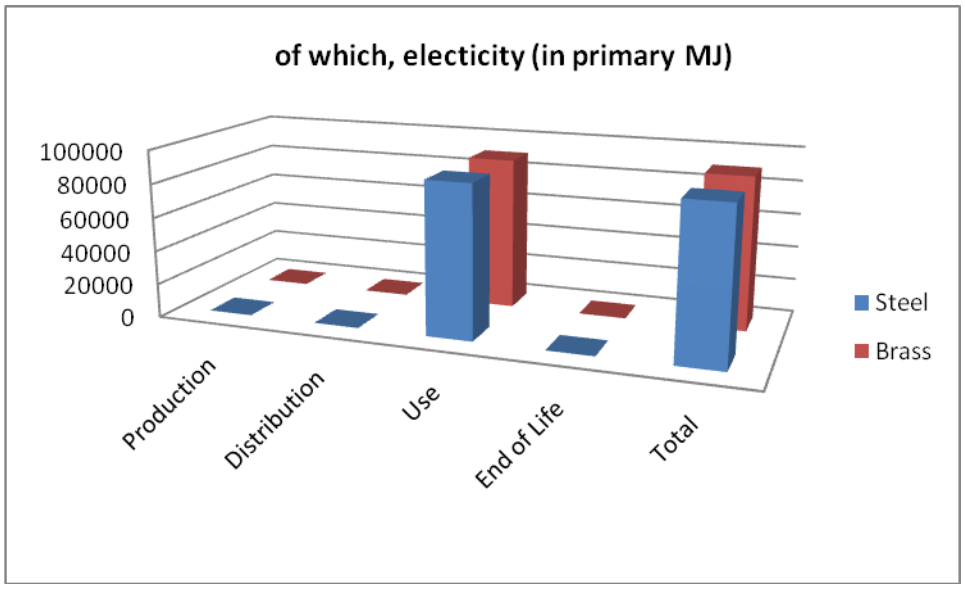


Figure 12: Electricity consumption for domestic taps

The total energy use is dominated by the energy used for the heating of water in the use phase. The in use impact includes not only the direct energy used to heat the water, but also non-product related energy use associated with aspects such as the fuel mix and electricity distribution losses which are predefined by EcoReport. Additional information regarding the assumption behind the environmental impact unit indicators can be found in the EcoReport methodology report[14]. Total energy in the production and manufacturing phase is dominated by the metals i.e. brass or steel used; however this is minor in comparison to the use phase total energy consumption.

The electricity element of the energy use in the production phase relates mainly to the material extraction and production of chrome plating for the brass tap and the material extraction and production of the chrome plating and metal manufacturing of the stainless steel for the steel tap.

[14] http://ec.europa.eu/enterprise/policies/sustainable-business/ecodesign/methodology/index_en.htm

The energy use in the distribution phase is focused on total energy, rather than electricity and will relate to the transportation associated with the distribution of the product.

Figure 11 and Figure 12 present the results for domestic taps. The same observations can be made for non-domestic taps, and even more so due to the higher water consumption and therefore energy consumption for heating water for non-domestic use.

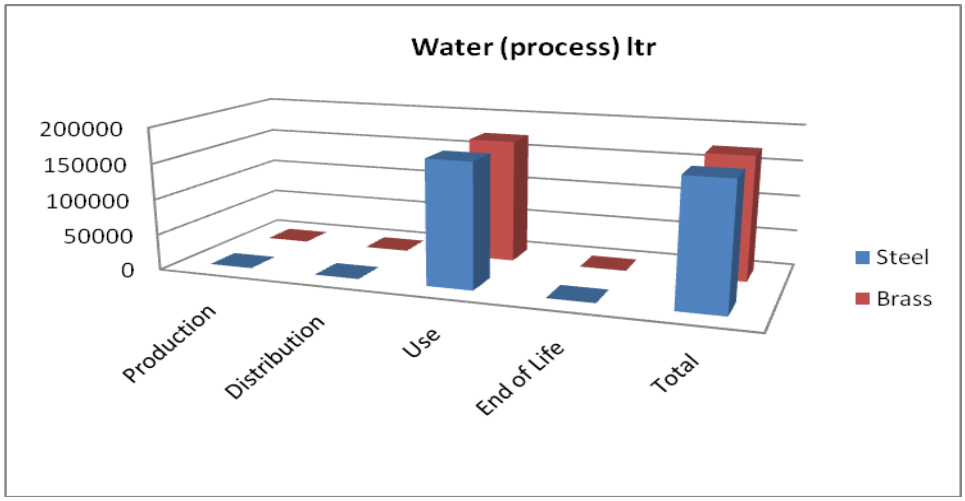


Figure 13: Water (process) consumption for taps

The high amount of process water in the use phase reflects the water consumption by the end user. This will be influenced by flow rate and the behaviour of the end user. Some water is also used in other life cycles phases, for example, during the material extraction and production, however this is insignificant compared to the use phase consumption. Readers should note that the in use water consumption entry in the EcoReport tool takes into account the distribution of the water and also waste water treatment[15]. The use phase water consumption also includes water use associated with energy consumption in the use phase, however this is mainly cooling water rather than process water (see below).

Although process water is dominated by the use phase, there are some key points to highlight regarding process water in the production phase. Table 11 below shows the relative impact for process water of the different materials in the production phase. It is clear within the example of a product, that using stainless steel has more of an impact with regards to process water than brass or chrome plate.

[15]MEEuP Methodology Report – VHK, November 2005, http://www.pre.nl/EUP/Download/default.htm

Table 11: Impact for process water in the production phase from different materials

Material	EcoReport Code	1kg of material	Brass Base-case	Stainless Steel Base-case
Brass	31-CuZn38 cast	0.019 litres	0 litres	N/A
Chrome Plate	40-Cu/Ni/Cr plating	187 litres	0.37 litres	0.37 litres
Stainless Steel	25-Stainless 18/8 coil	75.87 litres	N/A	54.53 litres

These values need to be kept in context so whilst the production water use for the stainless steel base-case tap is 55 litres, the in use water consumption is in excess of 170,000 litres – a factor of three thousand times more.

Figure 13 above shows the situation for domestic use. The differences are even greater when the water use inputs for a non-domestic tap are considered; this is in excess of 530,000 litres.

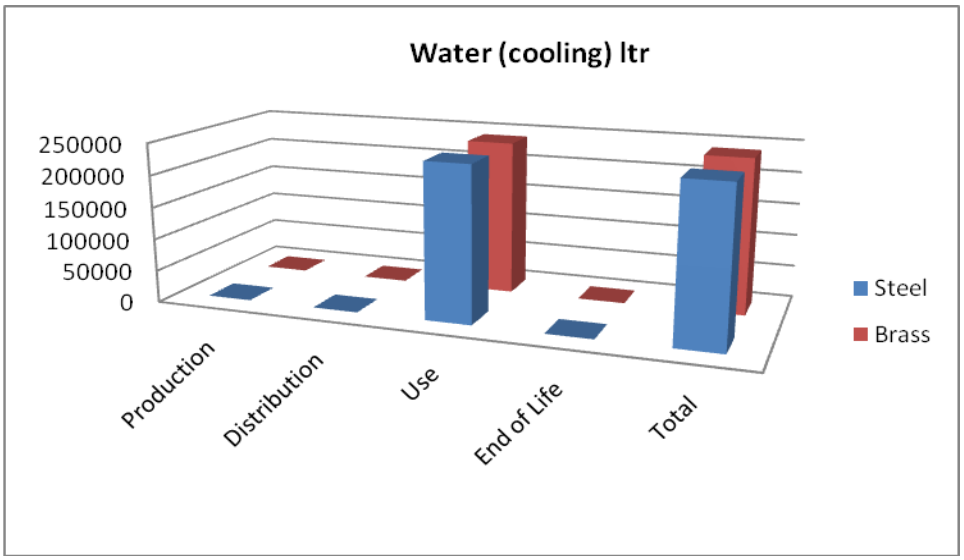


Figure 14: Water (cooling) consumption for taps

The amount of cooling water used throughout the life cycle is focused in the use phase and is again associated with the energy consumption used for the heating of water. Cooling water will be used as part of the energy production process, and will for example be taken and returned to nearby rivers once it has been used for cooling. Based on the EcoReport inputs the amount of cooling water used is greater than the direct water use through the product itself (water (process)), highlighting the importance of the impact from energy use associated with taps.

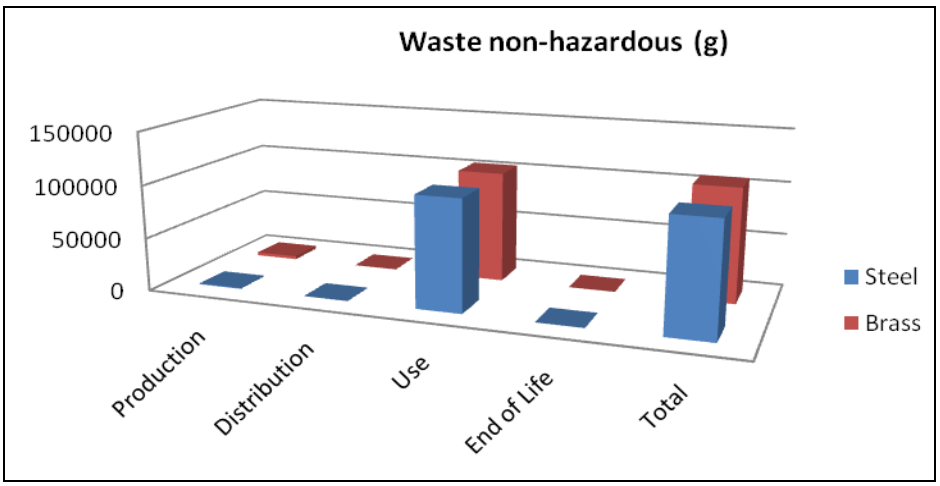


Figure 15: **Non-hazardous waste generation for taps**

Again, the use phase dominates the non-hazardous waste production as a result of the energy use for heating of water, generating in excess of 100 kg of waste in both the brass and stainless steel tap base-cases.

The results from the EcoReport tool, use phase aside, show that non-hazardous waste is generated mainly in the production phase. Scrutiny of the EcoReport outputs shows that the waste generated in the production phase is dominated by the processes for material extraction and production for both base-cases. EcoReport does not identify specific waste types; however this may include waste from ore extraction processes or foundry waste related to the production of metals such as brass and steel. The end of life impacts relate to the disposal of the product.

Table 12 shows the relative impacts for non-hazardous waste for brass and stainless steel in the production phase:

Table 12: **Non-hazardous waste generation in the production phase from brass and stainless steel**

Material	EcoReport Code	1kg of material	Brass Base-case	Stainless Steel Base-case
Brass	31-CuZn38 cast	3049 g	2562 g	N/A
Stainless Steel	25-Stainless 18/8 coil	1047 g	N/A	720 g

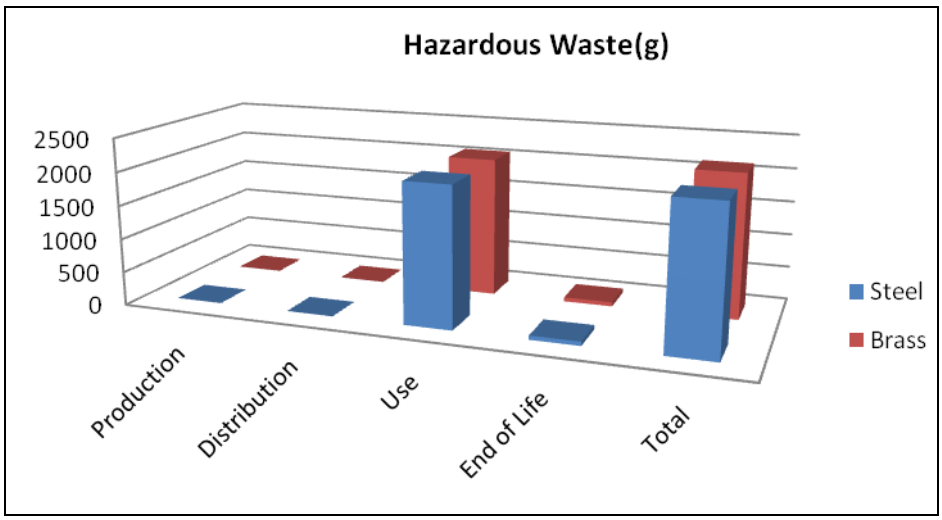


Figure 16: Hazardous waste generation for taps

As with non-hazardous waste, hazardous waste generation is mainly associated with the use phase energy consumption, generating over 2 kg.

After the use phase, the end of life phase generates the most hazardous waste with 62g produced for both the brass and stainless steel base-cases. The hazardous waste generation in the end of life phase calculated by EcoReport is associated with the 'Incineration of plastics not reused/recycled' and reflects the amount of plastic in the two base-cases. This is based on the assumptions in the EcoReport model, and is not wholly true for this product group, as the EcoReport tool was originally designed to be used with energy using products, many of which would contain Printed Wiring Boards (PWBs) in the above category. As the base-case taps do not include PWBs EcoReport may be forming an overestimate based on the assumptions used by the tool.

Emissions to Air

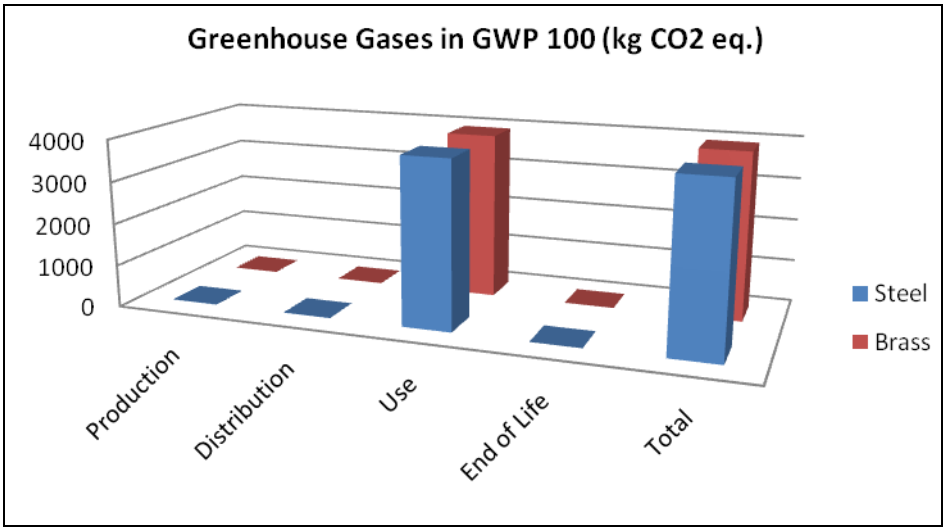


Figure 17: Greenhouse gases emissions for taps

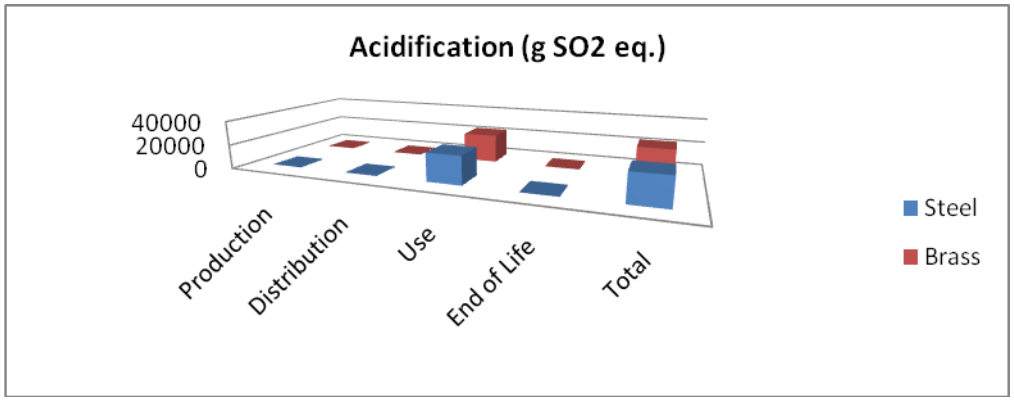


Figure 18: Acidification for taps

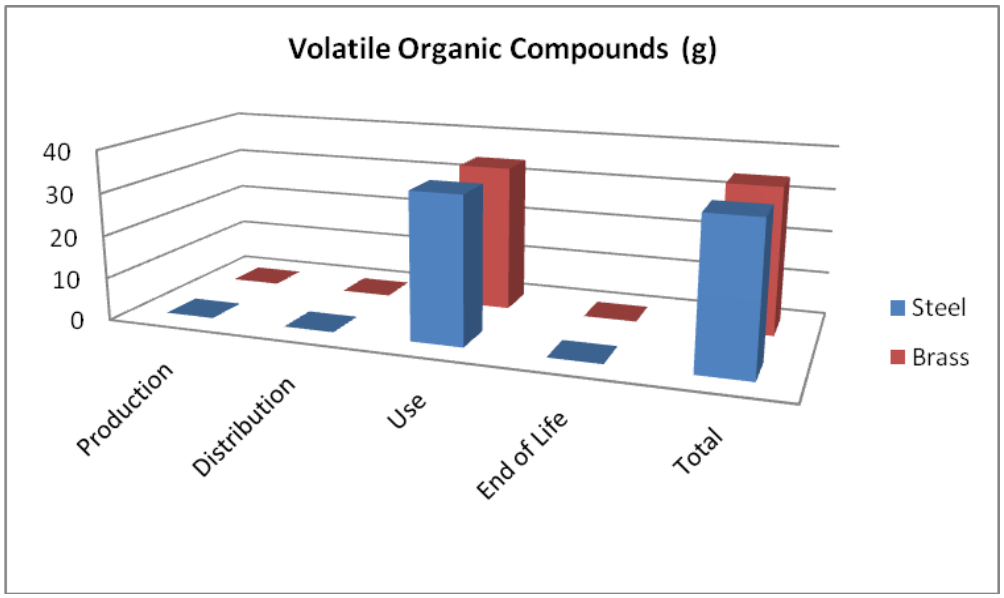


Figure 19: Volatile Organic Compounds emissions for taps

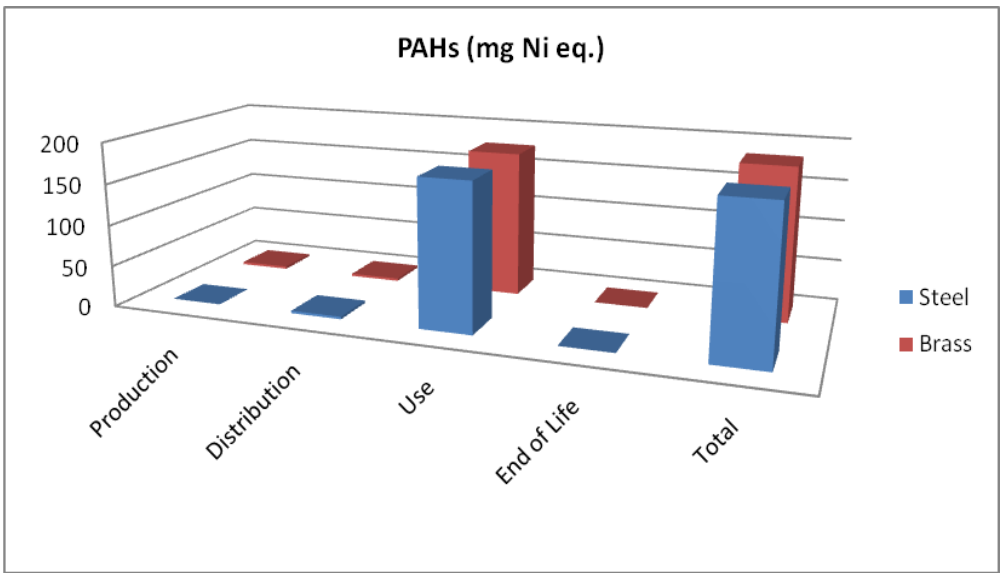


Figure 20: PAHs emissions for taps

The impacts from the global warming potential, acidification, VOCs and PAHs are related to the use of energy and are therefore dominated by use phase energy consumption for the heating of water.

Significantly lower levels of emissions will occur in the extraction and production phases, for example in relation to the processing of metals e.g. melting, casting, smelting activities.

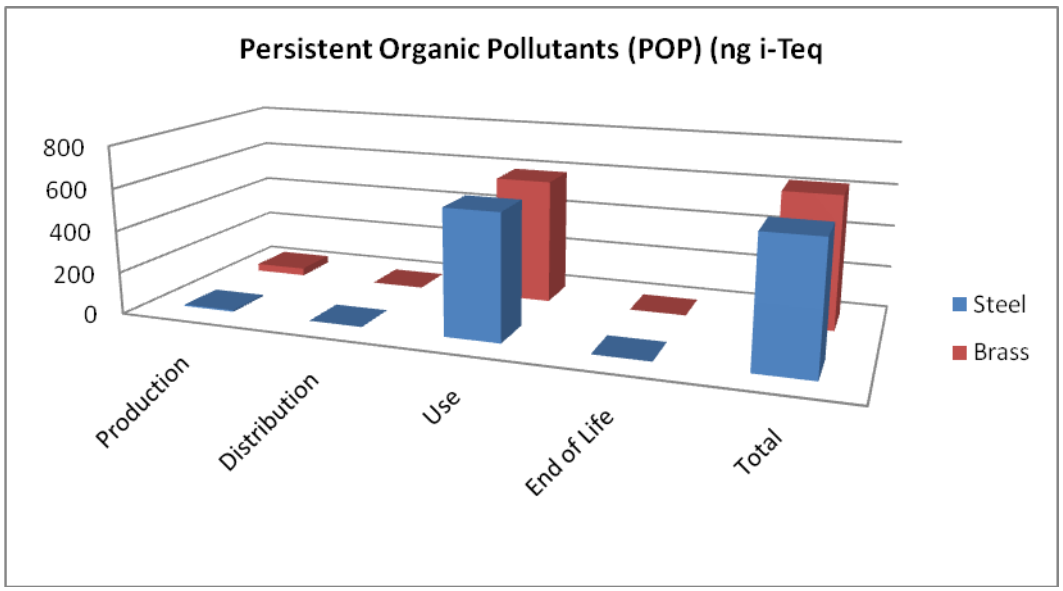


Figure 21: Persistent Organic Pollutants emissions for taps

Again POP emissions are mainly associated with the use phase energy consumption for heating water. However there are some differences in POP emissions at the production phase associated with the use of different materials for the steel and brass taps as shown in Table 13. The increased POP levels in the production phase of brass taps appears to be related mostly to the brass element of the tap, with some input from the chrome plating when analysing the output from the EcoReport tool.

These differences will be the result of the different factors used in EcoReport associated with the various materials, reflecting the differences in emissions from processes such as sinter plants, smelting and casting during their production.

POP emissions as generally expressed as the total concentration equivalent (Teq) of tetrachlorodibenzodioxin (TCCD) EcoReport uses ng I-TEQ (2, 3, 7, 8 TCCD equivalent).

Table 13: POP emissions in the production phase for different materials

Material	EcoReport Code	1kg of material	Brass Base-case	Stainless Steel Base-case
Brass	31-CuZn38 cast	25.49 ng i-Teq	21.47 ng i-Teq	N/A
Chrome Plate	40-Cu/Ni/Cr plating	396.51 ng i-Teq	0.79 ng i-Teq	0.79 ng i-Teq
Stainless Steel	25-Stainless 18/8 coil	7.7 ng i-Teq	N/A	5.54 ng i-Teq
Ceramic	24-Ferrite	39.00 ng i-Teq	0.82 ng i-Teq	0.82 ng i-Teq

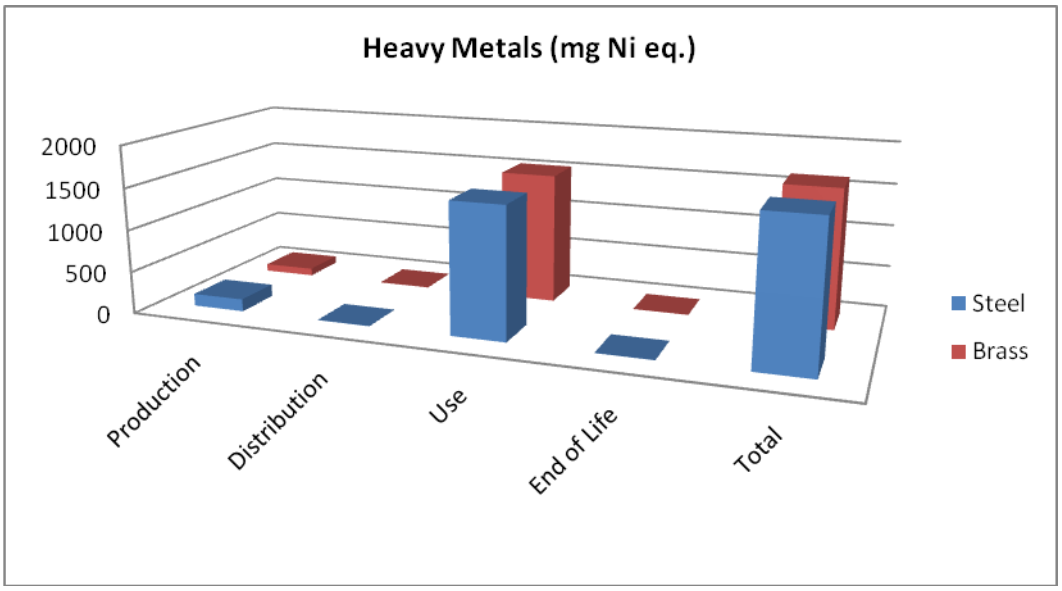


Figure 22: Heavy metals emissions to air for taps

As with previous environmental indicators, energy consumption associated with water heating in the use phase dominates heavy metal emissions to air, approximately 1500 mg Ni eq. The heavy metal emissions in the production phase for stainless steel taps relate mainly to the materials extraction and production of the stainless steel (73 %) and chrome plating (26 %). For the brass tap, the heavy metal emissions are largely a result of the extraction and production of the chrome plating (55 %) and brass (44 %).

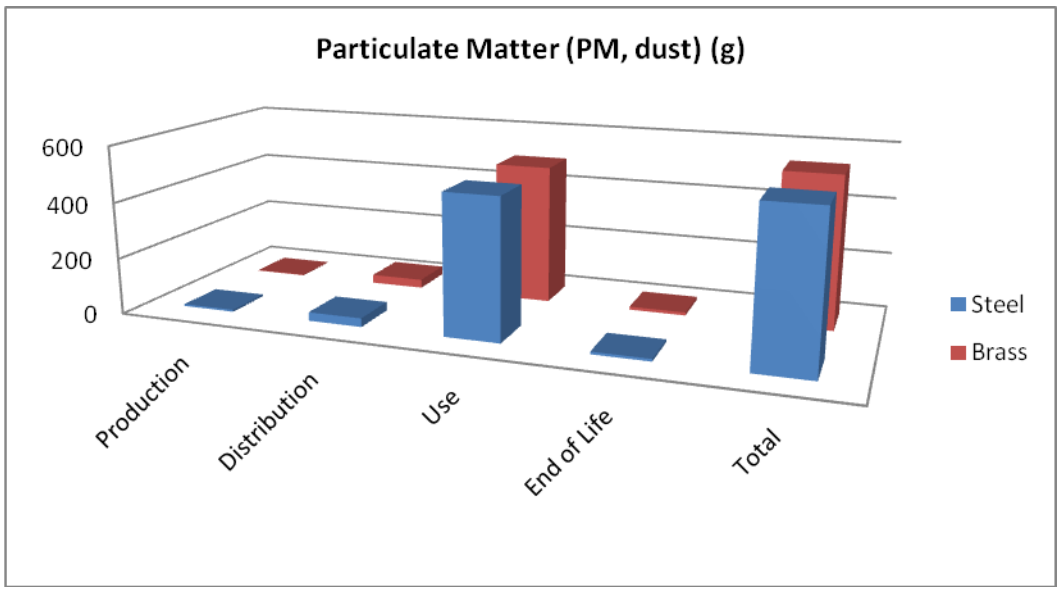


Figure 23: Particulate matter emissions for taps

The particulate matter impacts for both base-cases are mainly due to energy consumption in the use phase associated with water heating. Other particulate matter impacts highlighted by the EcoReport results relate to the distribution phase, and in particular the assumptions made in EcoReport with regards the transportation of the product. The higher production impacts of steel taps compared to brass taps relate to particulate matter associated with the extraction and production of the stainless steel (25-Stainless 18/8 coil).

Emissions to Water

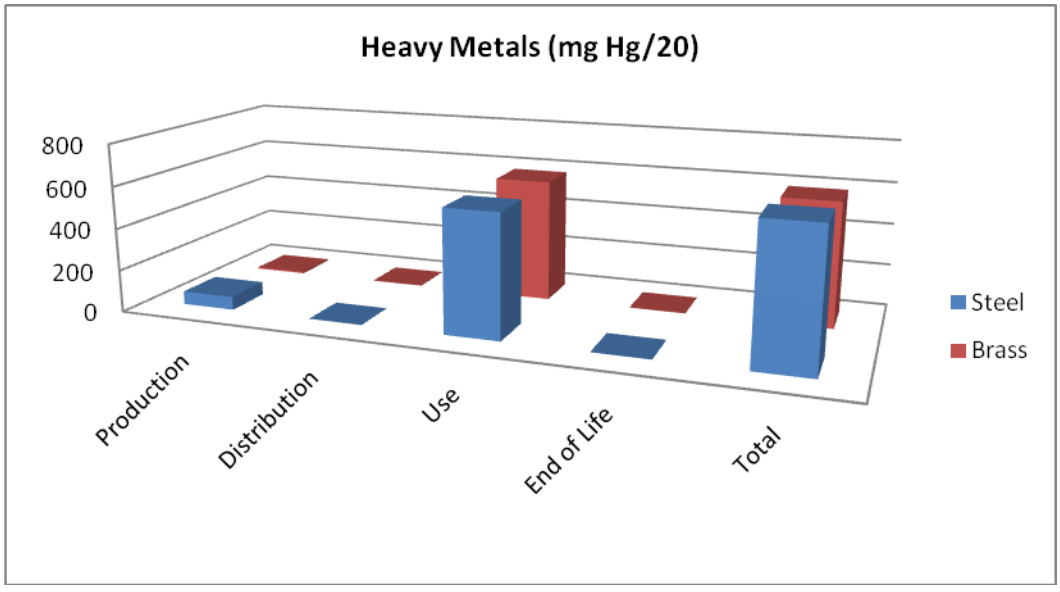


Figure 24: Heavy metals emissions to water for taps

Heavy metal emissions to water are mainly the result of energy consumption in the use phase. However, in the production phase they are mainly associated with the stainless steel included in the products. Heavy Metals are expressed as Hg/20 equivalent (mercury divided by 20) as outlined in the EcoReport Methodology.

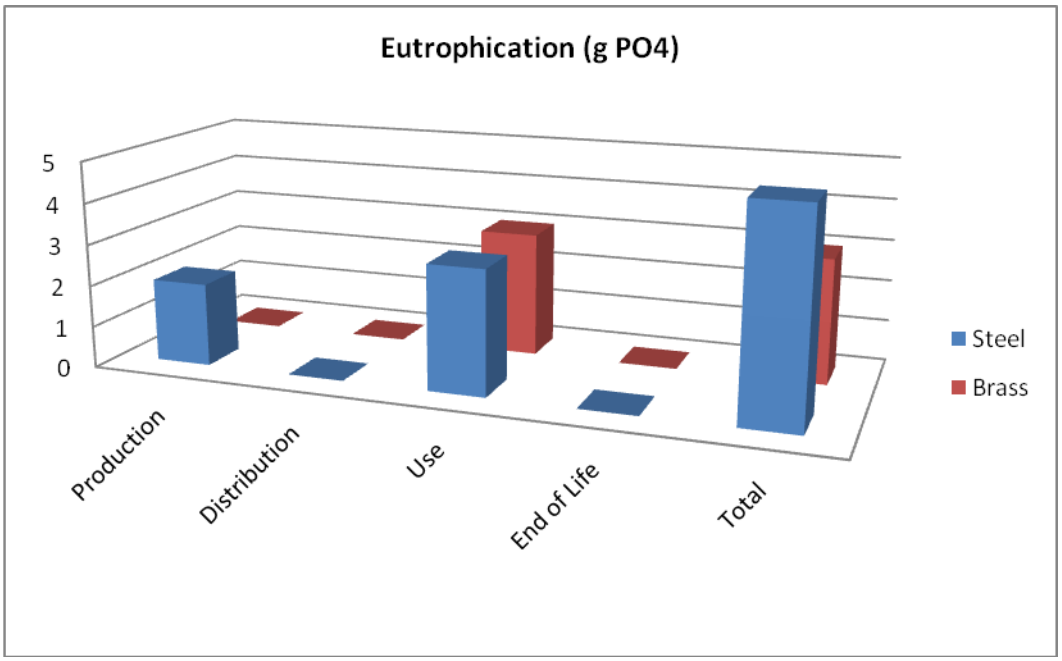


Figure 25: Eutrophication for taps

The use phase related to energy use for heating water contributes most to eutrophication; however the difference between the use phase and the production phase is less significant for eutrophication than for other environmental indicators, although the absolute values are relatively low. The impacts from the production, relating mainly to chrome plating for the brass base-case and the production of stainless steel for the steel base-case impacts, are also noticeable.

Environmental impacts assessment for taps – Summary

It is clear from the above analysis that the use phase is key; as there is no impact category where the use phase does not dominate.

Table 14 clearly demonstrates this for domestic brass taps, with the use phase accounting for a very high percentage across all the impact categories. The same trends are also shown in the data for the domestic stainless steel base-case and non-domestic sector base-cases, which is summarised in Appendix 2.

Table 14: Percentage breakdown of impacts across life cycle phases for the different impact categories for a brass domestic tap[16]

Parameter	Units	Production	Distribution	Use	End of Life	Total
		% of total	% of total	% of total	% of total	% of total
Total Energy (GER)	MJ	0.06 %	0.07 %	**99.86 %**	0.01 %	100.00 %
of which, electricity (in primary MJ)	MJ	0.01 %	0.00 %	**99.99 %**	0.00 %	100.00 %
Water (process)	ltr	0.00 %	0.00 %	**100.00 %**	0.00 %	100.00 %
Water (cooling)	ltr	0.01 %	0.00 %	**99.99 %**	0.00 %	100.00 %
Waste, non-haz./ landfill	g	2.79 %	0.05 %	**97.09 %**	0.07 %	100.00 %
Waste, hazardous/ incinerated	g	0.05 %	0.05 %	**96.96 %**	2.90 %	100.00 %
Emissions (Air)						
Greenhouse Gases in GWP100	kg CO2 eq.	0.08 %	0.13 %	**99.80 %**	0.00 %	100.00 %
Ozone Depletion, emissions	mg R-11 eq.					neg
Acidification, emissions	g SO2 eq.	0.16 %	0.06 %	**99.78 %**	0.00 %	100.00 %
Volatile Organic Compounds (VOC)	g	0.00 %	0.00 %	**100.00 %**	0.00 %	100.00 %
Persistent Organic Pollutants (POP)	ng i-Teq	5.74 %	0.00 %	**94.26 %**	0.00 %	100.00 %
Heavy Metals	mg Ni eq.	5.37 %	0.18 %	**94.33 %**	0.12 %	100.00 %
PAHs	mg Ni eq.	1.63 %	1.63 %	**96.20 %**	0.00 %	100.00 %
Particulate Matter (PM, dust)	g	0.37 %	5.75 %	**91.84 %**	2.04 %	100.00 %
Emissions (Water)						
Heavy Metals	mg Hg/20	1.36 %	0.00 %	**98.64 %**	0.17 %	100.00 %
Eutrophication	g PO4	0.00 %	0.00 %	**100.00 %**	0.00 %	100.00 %
Persistent Organic Pollutants (POP)	ng i-Teq					neg

[16] Values have been rounded to whole numbers, and percentages to two decimal places. Therefore the values in each life cycle phase may not appear to add up to the total value, and small percentages may appear as 0.00 %.

Environmental Impact Assessment for showers – Analysis

Setting up the base-case

As for taps, CEIR has provided the material composition for two example showerheads, one mainly plastic and the other metal. This information has been used to undertake the base-case assessment using the EcoReport tool. These two examples are considered typical products currently available on the market, although it should be noted that some products will use other materials depending on their design or application. Diagrams of the two products are shown in Figure 26 and Figure 27. It should be however remembered that, beside showerheads, also showers, which would cover then tap, are included in the scope of this product group.

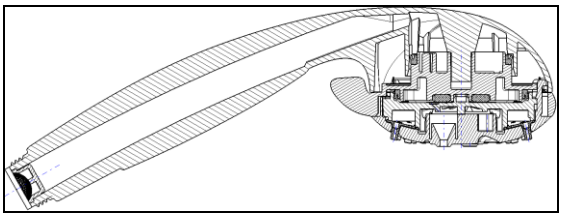


Figure 26: Diagram of the plastic showerhead

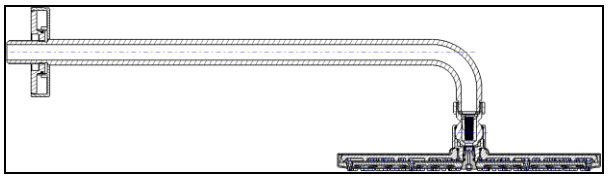


Figure 27: Diagram of the metal showerhead

Product Specific Inputs

The technical analysis outlined the methodology for calculating some of these inputs, in particular the water and energy inputs for the use phase. It also provides a brief overview of the data availability and rationale for other inputs, for example bill of materials for the production phase. This section summarises the product specific inputs for showerheads that are required for the EcoReport tool.

Bill of Materials

The composition of the showerheads shown in Table 15 for the base-case uses information provided by CEIR. These bills of material are used to represent both domestic and non-domestic showerheads.

Table 15: Bill of Materials – Showerheads

Product Type	Material	Weight (g)	Material code in EcoReport
Plastic Showerhead	Nickel chrome plating	2	40 Cu/Ni/Cr Plating
	Plastic	177	10 ABS
Metal Showerhead	Brass	1902	31 CuZn38 Cast
	Nickel chrome plating	2	40 Cu/Ni/Cr Plating
	Plastic	393	10 ABS

Volume of packaged product

Limited information has been provided in relation to the volume of the packaged product. Therefore the packaging dimension/volume for showerheads is based on the same dimension for the tap base-case, as shown in Table 16. The inputs for water and energy are based on the assumptions outlined before.

Table 16: Packaging dimensions and volume for showerheads

Dimensions (cm)	Volume (m3)
38.5(l)x18(w)x13(h)	0.009009

Use Phase

The inputs for the use phase are shown in Table 17. The inputs differ for domestic and non-domestic showerheads.

Table 17: Use phase water and energy inputs for showerheads

Parameter	Domestic Showerhead	Non-domestic Showerhead
Lifetime (years)	10	7
Electricity consumption (kWh/showerhead/year)	846	834
Water consumption (m3/showerhead/year)	13.140	12.953

The product life time based on information gathered during the research for Task 2 and 3 - Economic and Market Analysis and User Behaviour.

Environmental Impact Assessment

A summary of the data generated by the EcoReport Tool is provided in Appendix 3. The graphs below (Figure 28 to Figure 42) illustrate the results for the example showerheads outlined above for the different impact categories, together with commentary as appropriate. The results presented are in relation to the domestic sector base-case for showerheads. The same material composition for the non-domestic base-case has been used; therefore the main difference in the results for domestic and non-domestic showerheads is in relation to water use and energy used for the heating of water. Unlike the base-case for taps, the differences in the domestic and non-domestic water use and energy use for showerheads has been calculated as minimal, with domestic use slightly higher than the non-domestic use.

The analysis for showerheads shows that all impact categories are dominated by the use phase and this is mainly related to the energy use associated with the heating of water, with the exception of process water, which is attributable to the direct consumption of water.

Resources and Waste

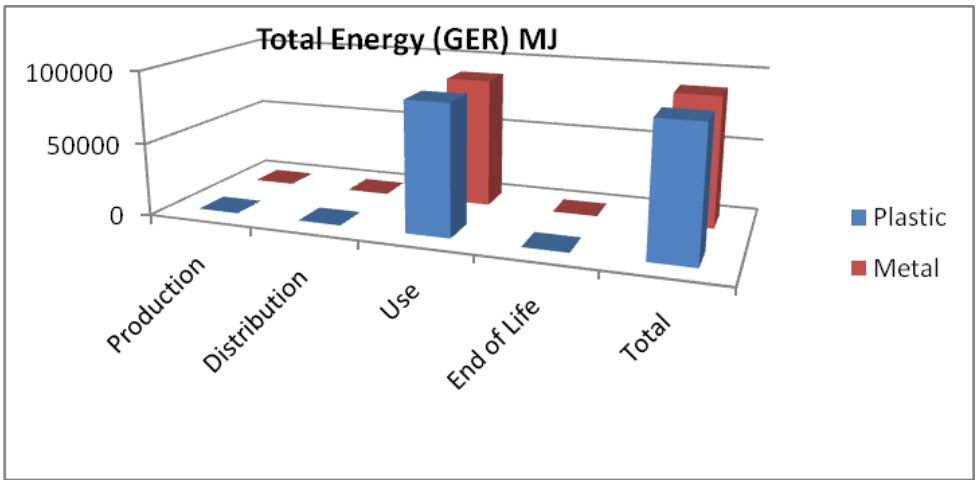


Figure 28: Total energy consumption for showerheads

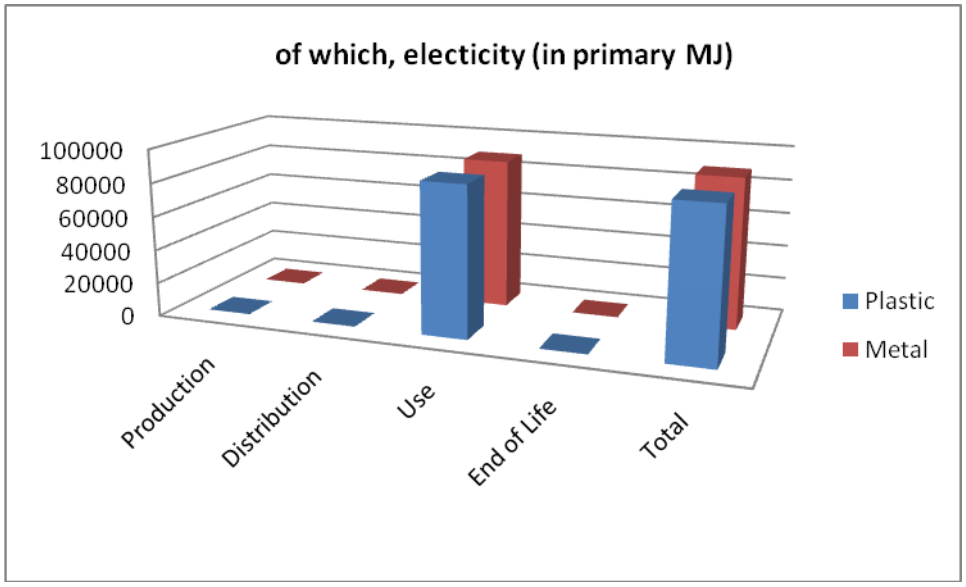


Figure 29: Electricity consumption for showerheads

The total energy use is dominated by the energy used for the heating of hot water in the use phase. As highlighted in the analysis for taps, the use phase impacts include not only the direct energy used to heat the water, but also non-product related energy use associated with aspects such as the fuel mix and electricity distribution losses, which are pre-defined by EcoReport.

The energy use associated with the production and distribution phases is minor in comparison to the use phase. Total energy in distribution phase impacts are defined by the model in relation to packaging size and set parameters. The electricity element of the total energy in the production phase relates mainly to the materials extraction and production of the material used for the plating and the manufacturing of the plastic.

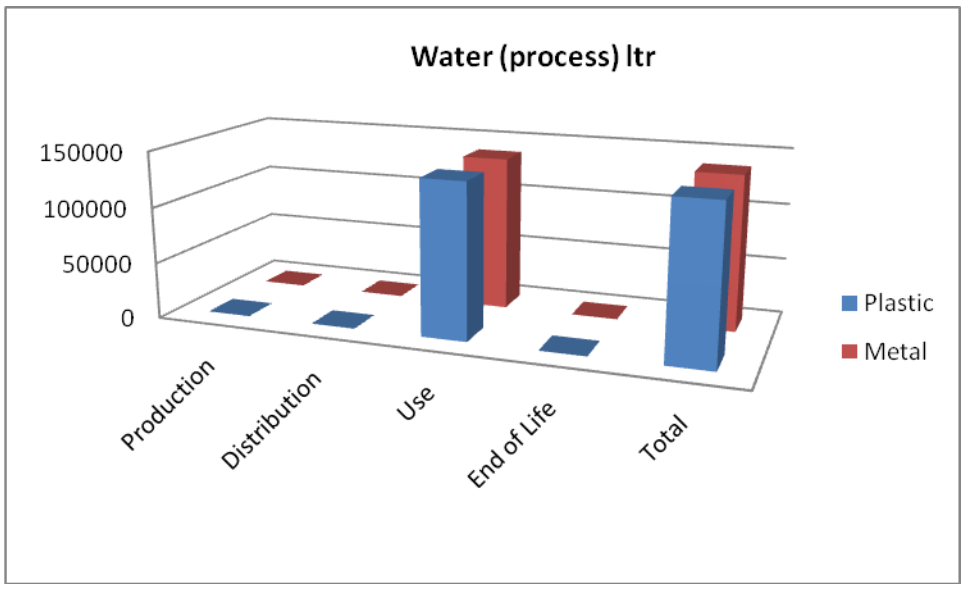


Figure 30: Water (process) consumption for showerheads

The high amount of water in the use phase reflects the water consumption by the end user. As with taps this will be influenced by flow rate and the behaviour of the end user. Behaviour may be influenced by a number of factors for example the region the product is being used, cultural aspects, domestic or non-domestic use. Figure 30 relates to the domestic; however the non-domestic base-case shows the same trend and dominance of water in the use phase when changing the water use and lifetime to reflect non-domestic use. Water consumption in other life cycle phases is insignificant when compared to the use phase consumption.

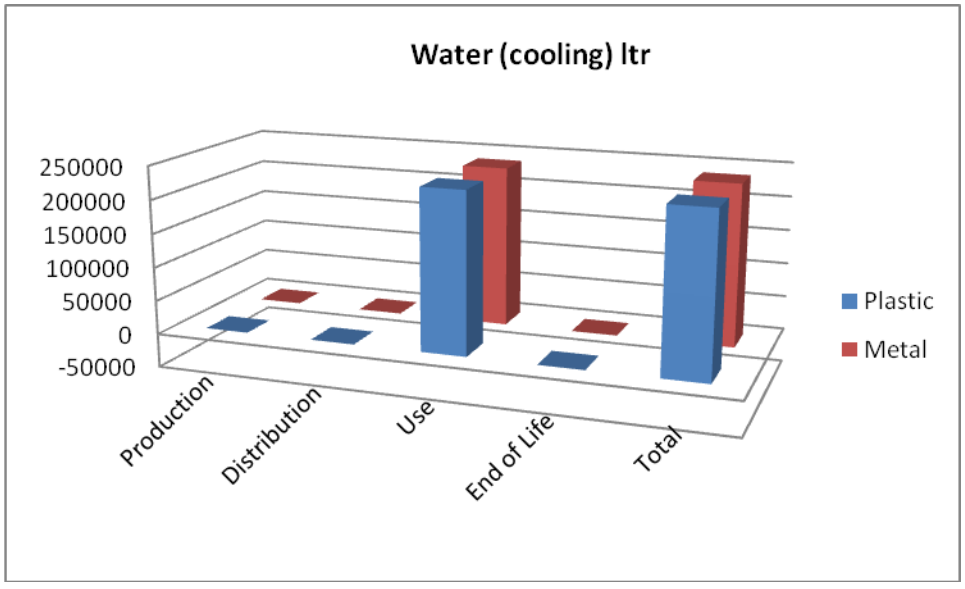


Figure 31: Water (cooling) consumption for showerheads

The amount of cooling water used throughout the life cycle is focused in the use phase and is again associated with the energy consumption used for the heating of water. Based on the EcoReport inputs, the amount of cooling water used is greater than the direct water use, highlighting the importance of

the impact from energy use associated with showers. The y-axis shows a minus due to the recycling and reuse benefits in the end of life phase calculated by EcoReport that are associated with plastics. EcoReport calculates a debit and credit figure associated with the disposal and recycling of plastics to provide a net result. Where the recycling credits are greater than the disposal impact this results in an overall negative value. For the metal showerhead base-case a very small net benefit in relation to cooling water (approximately 1 litre) has been calculated by EcoReport due to the amount of plastic used in the product and subsequently assumed to be recycled. However this is very insignificant.

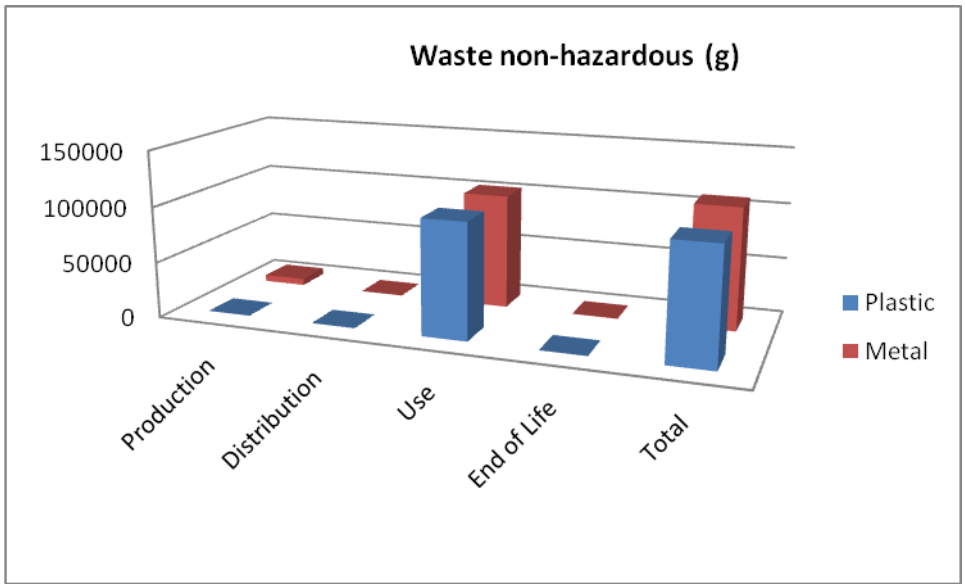


Figure 32: Non-hazardous waste generation for showerheads

Again, the use phase dominates the non-hazardous waste production as a result of the energy use for heating water used through showerhead, generating in excess of 100 kg of waste in both – the metal and plastic showerheads.

The results from the EcoReport tool show that non-hazardous waste is also generated in the production phase, although at much lower levels compared to the use phase. Approximately 5.9 kg of waste is generated in the production phase for the metal showerhead. Scrutiny of the EcoReport outputs shows that this is largely related to the materials extraction and production of brass (31-CuZn38 cast), with much smaller proportions relating to the plastics and plating used. The amount of waste generated in the production phase for the plastic showerhead is much lower, approximately 0.080 kg.

The main end of life impacts for both showerhead base-cases relate to the disposal of the product in landfill.

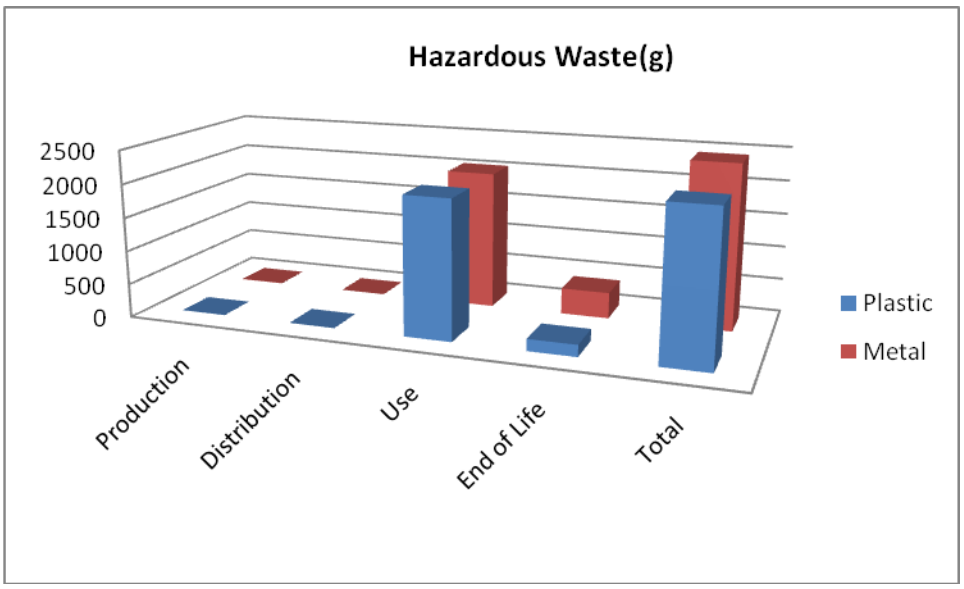


Figure 33: Hazardous waste generation for showerheads

As with non-hazardous waste, hazardous waste generation is mainly associated with the use phase energy consumption, generating over 2kg of waste. The hazardous waste generation in the end of life phase is approximately 175g and 390g for the plastic and metal showerheads, respectively. This is associated with the 'Incineration of plastics not reused/recycled' and reflects the amount of plastic in the respective base-cases. This is based on the assumptions in the EcoReport model, and may not necessarily be the case for this product group, however as outlined already, the extent of end of life recycling is not known for showerheads.

Emissions (Air)

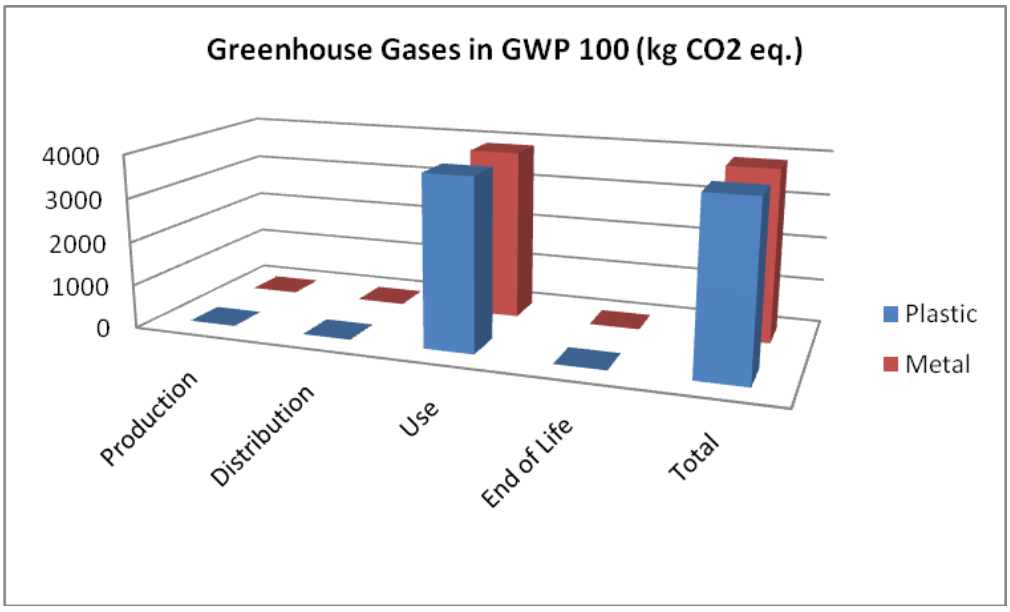


Figure 34: Greenhouse gases emissions for showerheads

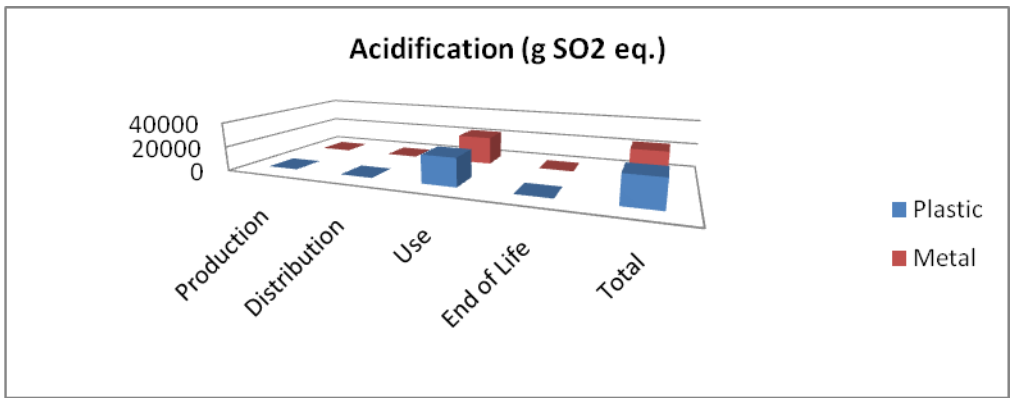


Figure 35: Acidification for showerheads

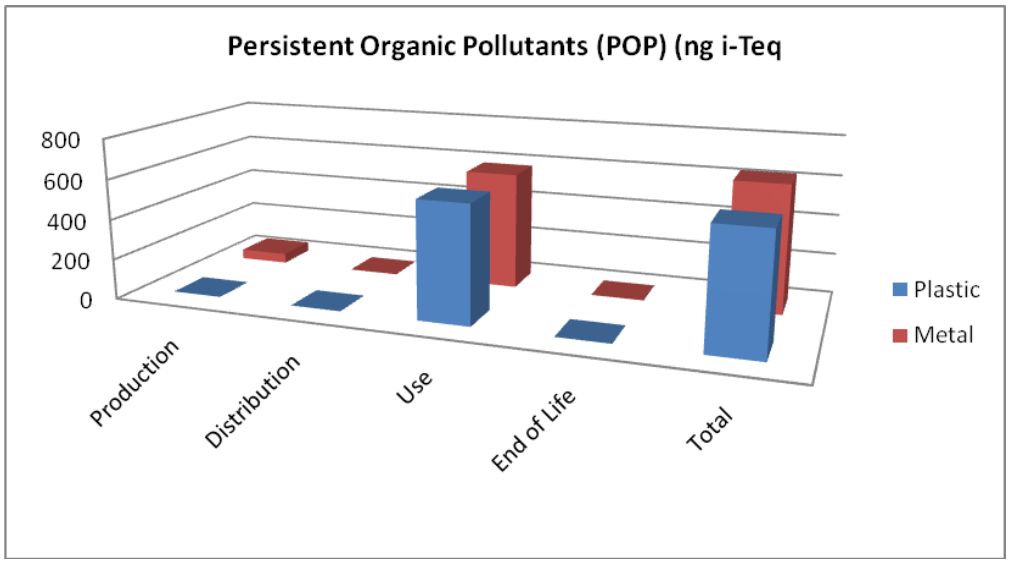


Figure 36: Persistent Organic Pollutants emissions for showerheads

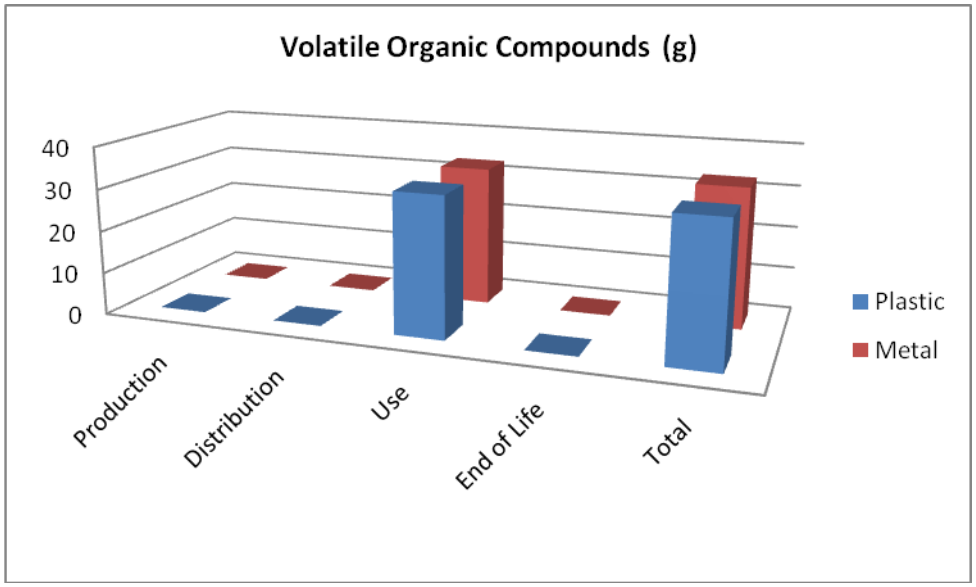


Figure 37: Volatile Organic Compounds emissions for showerheads

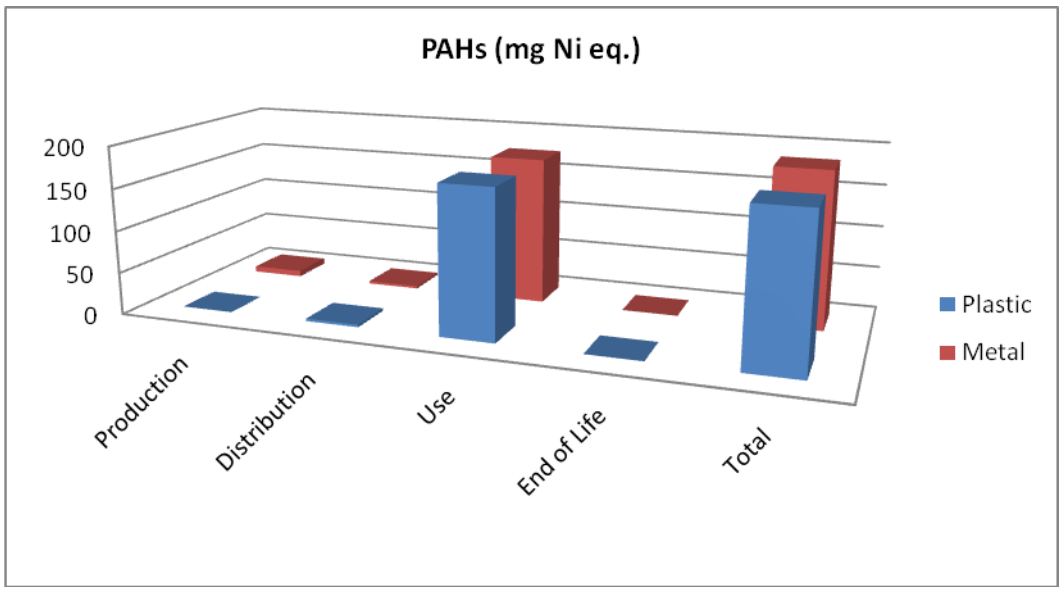


Figure 38: PAHs emissions for showerheads

The global warming potential, acidification, POPs, PAH and VOC impacts dominate the use phase and are related to the energy consumption for the heating of water.

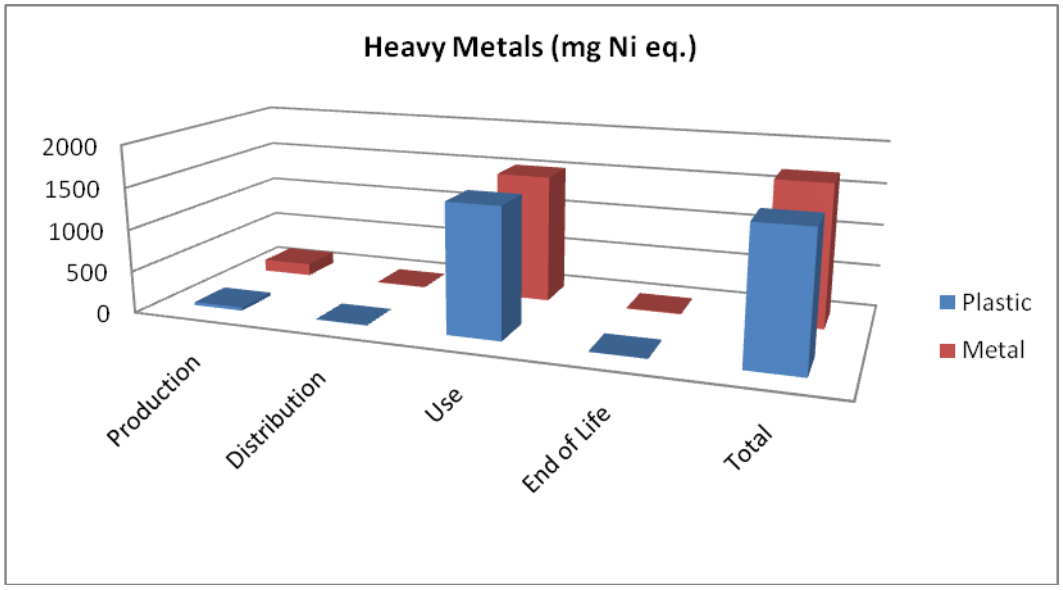


Figure 39: Heavy metals emissions to air for showerheads

As with previous environmental indicators, energy consumption associated with water heating in the use phase dominates heavy metal emissions to air (approximately, 1500 mg Ni eq). The impact of heavy metal emissions to air in the production, distribution and end of life phases is minimal in comparison. The production phase emissions are associated with the extraction and production of brass and are therefore higher in the metal showerhead when compared to the plastic showerhead. Those in the end of life phase are associated with the incineration of plastics not re-used/recycled.

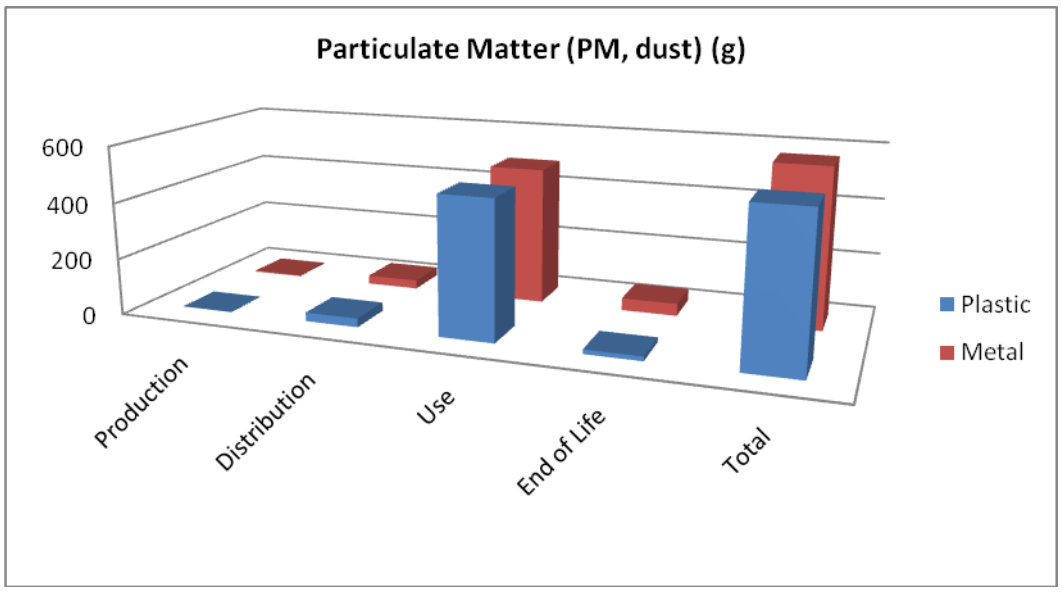


Figure 40: Particulate matter emissions for showerheads

The particulate matter impacts of showerheads are mainly due to energy consumption in the use phase associated with water heating. Other particulate matter impacts highlighted by the EcoReport results relate to the distribution phase, and in particular the assumptions made in EcoReport with regards the transportation of the product. The particulate matter impacts in the end of life phase are associated with the incineration of plastics not re-used/recycled, with the values relating directly to the amount of plastic used in the two base-cases.

Emissions (Water)

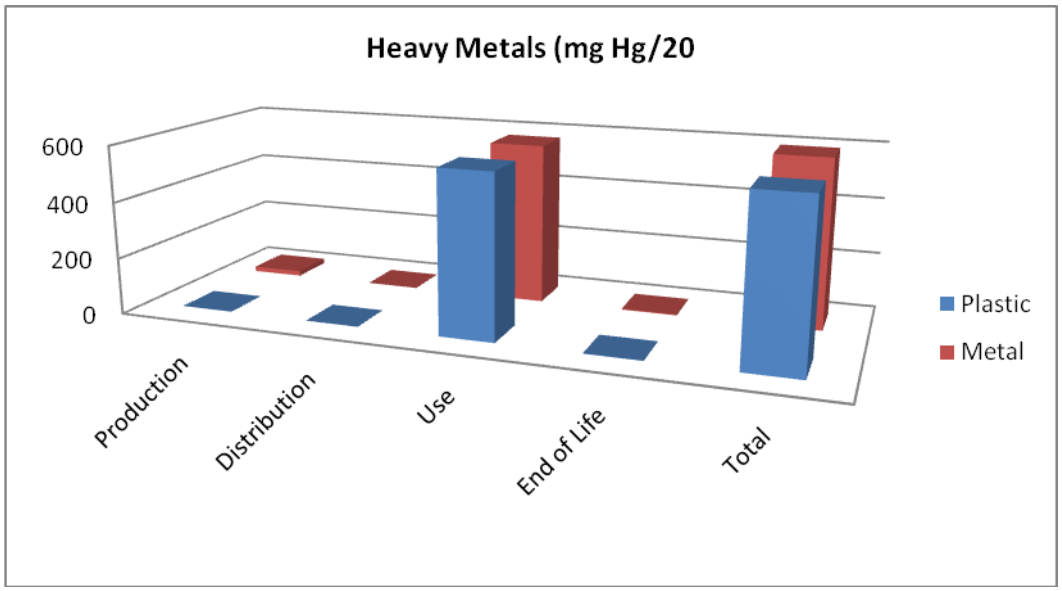


Figure 41: Heavy metals emissions to water for showerheads

Heavy metal emissions to water are mainly the result of energy consumption in the use phase. Minor amounts are generated in the production phase and end of life phases; however this is minimal and becomes insignificant when compared to the use phase.

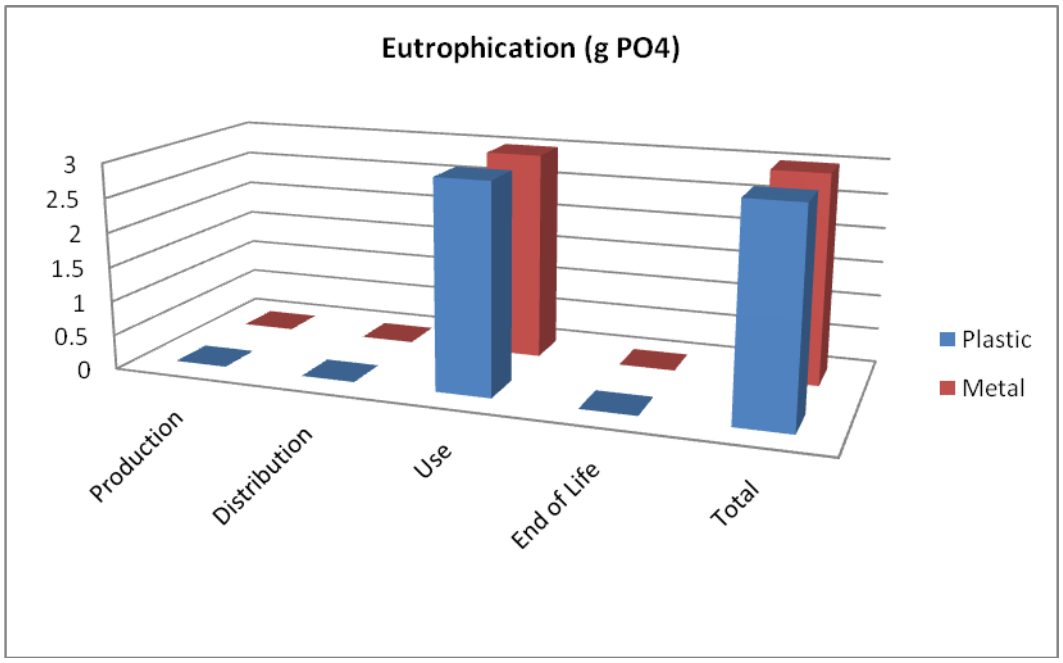


Figure 42: Eutrophication for showerheads

The use phase for showerheads dominates in the results obtained for the eutrophication and is related to the energy use for the heating of water in this life cycle phase.

Environmental Impact Assessment for showerheads – Summary

It is clear from the above analysis that the use phase is key; as there is no impact category where the use phase does not dominate. Table 18 clearly demonstrates this for a domestic showerhead, with the use phase accounting for a very high percentage across all the impact categories. The same trends are also shown for the metal domestic showerheads and the plastic and metal non-domestic sector showerheads, which is summarised in Appendix 3.

Table 18: Percentage breakdown of impacts across life cycle phases for the different impact categories for a plastic domestic showerhead[17]

Parameter	Units	Production	Distribution	Use	End of Life	Total
Total Energy (GER)	MJ	0.03 %	0.07 %	**99.89 %**	0.00 %	100.00 %
of which, electricity (in primary MJ)	MJ	0.01 %	0.00 %	**99.99 %**	0.00 %	100.00 %
Water (process)	ltr	0.00 %	0.00 %	**100.00 %**	0.00 %	100.00 %
Water (cooling)	ltr	0.01 %	0.00 %	**99.99 %**	0.00 %	100.00 %
Waste, non-haz./ landfill	g	0.08 %	0.06 %	**99.86 %**	0.01 %	100.00 %
Waste, hazardous/ incinerated	g	0.09 %	0.04 %	**92.00 %**	7.87 %	100.00 %
Emissions (Air)						
Greenhouse Gases in GWP100	kg CO2 eq.	0.03 %	0.13 %	**99.85 %**	0.00 %	100.00 %
Ozone Depletion, emissions	mg R-11 eq.					neg
Acidification, emissions	g SO2 eq.	0.03 %	0.06 %	**99.90 %**	0.00 %	100.00 %
Volatile Organic Compounds (VOC)	g	0.00 %	0.00 %	**97.06 %**	0.00 %	100.00 %
Persistent Organic Pollutants (POP)	ng i-Teq	0.17 %	0.00 %	**99.83 %**	0.00 %	100.00 %
Heavy Metals	mg Ni eq.	2.49 %	0.19 %	**97.13 %**	0.19 %	100.00 %
PAHs	mg Ni eq.	0.00 %	1.69 %	**98.31 %**	0.00 %	100.00 %
Particulate Matter (PM, dust)	g	0.19 %	5.77 %	**91.06 %**	2.98 %	100.00 %
Emissions (Water)						
Heavy Metals	mg Hg/20	0.17 %	0.00 %	**99.65 %**	0.17 %	100.00 %
Eutrophication	g PO4	0.00 %	0.00 %	**100.00 %**	0.00 %	100.00 %
Persistent Organic Pollutants (POP)	ng i-Teq					neg

In addition, also after conducting scenario variations with regard to numerous parameters (boiler efficiency, water consumption, life-time and product weight) it was confirmed that the use phase, i.e.

[17] NB Values have been rounded to whole numbers, and percentages to two decimal places. Therefore the values in each life cycle phase may not appear to add up to the total value, and small percentages may appear as 0.00 %.

the consumption of water and energy, are the most important aspects from the environmental point of view. Thus reducing the consumption of water (and particularly hot water) via efficient products is the key priority in greener public procurement of sanitary tapware.

Analysis conducted in the framework of EU Ecolabel criteria development

Following the environmental assessment of the base-cases (presented above) conducted with application of EcoReport tool, analysis of environmental aspects, which shall be taken into account for the development of the Green Public Procurement criteria for sanitary tapware was conducted. The main aspects and outcomes from this analysis are presented below.

Criterion – Water consumption and related energy saving

The outcomes of the Ecotapware study, the proposal of the EU Ecolabel criteria and the review of existing research confirm that the issue of increasing water efficiency is the most important in the life cycle of the sanitary tapware product group. Improved water efficiency and reduction of hot water consumption allows for further saving of energy needed to heat the water. Reduction of this (called further) related energy consumption brings also environmental savings related to reduction of impacts associated with energy generation, which are different, depending on the kind of primary energy sources used in a single Member State, but are of importance for the entire EU.

Therefore, the most important criteria for this product group are related to the consumption of water. Four criteria are proposed for the EU Ecolabel for the "sanitary tapware" product group in this respect; and the same criteria are considered most relevant for the Green Public Procurement of such products.

(a) Maximum available water flow rate

Setting a maximum water flow rate shall contribute to reducing water consumption in the use phase of sanitary tapware in domestic and non-domestic premises. Further, this reduction will contribute to lower consumption of energy for water heating and cutting related CO_2 emissions, as well as energy required for water supply and wastewater treatment.
Due to variability of uses of the products and the related needed flow rates, it was decided to divide the product group into three sub-groups:

(a) kitchen taps,

(b) basin taps

(c) showerheads and showers

and to define the maximum water flow rates separately for each of them.

The proposed maximum flow rate values are the outcomes of the technical analysis made, the stakeholders' consultation and the review of existing national and industrial water-efficiency labelling schemes for this product group. The stakeholder pointed also out that the limits to the reduction of

maximum water flow rate value: the end-user comfort and satisfaction, as well as health and safety aspects (i.e. sanitation, protection against scalding etc.), which should also be taken into account.

It was indicated that for the **GPP core criteria** the most appropriate water flow rates for kitchen and basin taps, ensuring end-user comfort and allowing at the same time for rational water consumption, are the values of 8 l/min and 7 l/min, respectively.

For procurers who want to purchase the best products available on the market, comprehensive set of criteria have been developed. The maximum allowed water flow for both kinds of taps was established at 6 l/min level. Nevertheless, it has also been recognised that in both, kitchens and bathrooms, end-users may also need higher water flow rates for specific uses (e.g. for washing hands lower flow rates are sufficient, while e.g. in order fill in quickly a pot or a container a higher water flow rate could be needed). Thus, applying an option of activating a higher flow rate (of maximum 8 l/min) was conceived as a suitable solution and proposed as an option in the **GPP comprehensive criteria**.

Application of a flow limiting device shall allow for setting the default water-saving mode to a maximum value of 6 l/min. If a higher water flow is required (e.g. to fill a vessel quickly) active user intervention is necessary to overcome this limitation and to activate the higher water flow for a chosen period of time within a single use. Such technical solutions include devices as booster button (eco-booster) or mixers with two-step cartridge (so called taps with water brakes) that return to the default position when the user shuts off the water. More details regarding these technologies can be found in Best Available Techniques (BAT) report[18].

Two maximum water flow rates are proposed for basin and kitchen taps in the comprehensive criteria set:
- 6 l/min for products without a possibility of reducing the maximum flow rate to a water-saving mode, i.e. without the flow limiting device,
- 8 l/min for products which allow increasing the flow rate to maximum of 8 l/min, i.e. with the flow limiting device,

The most appropriate water flow rate for showers and showerheads, ensuring on the one hand end-user comfort and allowing on the other hand for rational water consumption, is the value of 9 l/min proposed for **core** and 8 l/min for **comprehensive criteria**.

A summary of the maximum available water flow rates proposed for the Green Public Procurement criteria are given in Table 19 and Table 20:

[18] Available online on the project's website: http://susproc.jrc.ec.europa.eu/ecotapware/stakeholders.html .

Table 19: Maximum available water flow rates for sanitary tapware in GPP core criteria

Product sub-group	Water flow rate [l/min]
Kitchen taps	8.0
Basin taps	7.0
Showerheads and showers[1]	9.0
Note [1]: Showerheads or showers with more than one spray pattern shall fulfil the requirement for the setting with the highest water flow.	

For GPP comprehensive criteria the most water-efficient option, i.e. the recommended EU Ecolabel values, are proposed:

Table 20: Maximum available water flow rates for sanitary tapware in GPP comprehensive criteria

Product sub-group		**Water flow rate [l/min]**
Kitchen taps[1]	without flow limiting device	6.0
	with flow limiting device[2]	8.0
Basin taps[1]	without flow limiting device	6.0
	with flow limiting device[2]	8.0
Showerheads or showers [3]		8.0
Note [1]: Taps can be supplied either with or without a flow limiting device. The maximum water flow rate is dependant on the presence or absence of such a device. Note [2]: The flow limiting device must allow for setting the default water flow rate (water-saving setting) at the value of max of 6/min. The maximum available water flow rate shall not exceed 8 l/min. Note [3]: Showerheads or showers with more than one spray pattern shall fulfil the requirement for the setting with the highest water flow.		

(b) Lowest maximum available water flow rate

Further criterion – the lowest maximum available water flow rate (called also minimum flow rate) – is chosen to guarantee product safety and minimum performance. For the need of these criteria it is defined as follows: "lowest maximum available water flow rate" is the lowest water flow rate from the system or individual fitting available at full opening of the valve.

The minimum flow rate shall ensure that performance of a product is adequate under various household conditions and the flow is consistent across different pressure systems. Setting the minimum values shall ensure that ecolabelled products do not have features which can impede users' satisfaction due to too low water flow and to ensure safety (protection against scalding). The proposed values, for both the EU Ecolabel and GPP (**core** and **comprehensive criteria**), are 2 l/min for both types of taps and 4.5 l/min for showerheads and showers, with the exception of electric showers and low pressure showers for which the threshold of 3.0 l/min was agreed (as given in Table 21):

Table 21: Lowest maximum available water flow rate for sanitary tapware GPP core and comprehensive criteria

Product sub-group	Water flow rate [l/min]
Kitchen taps	2.0
Basin taps	2.0
Showerheads and showers	4.5
Electric showers and low pressure showers[19]	3.0

This separate value of 3 l/min, suitable for such kind of products, was agreed in the process of open consultation with stakeholders and manufacturers of these products. The electric showers, depending among other on seasonal temperature changes, deliver water flow below 4.5 l/min. Setting lower values is also important due to safety reasons (protection against scalding). Such showers are mainly used in the United Kingdom, where they constitute approximately 50 % or the showers sold there. Also for low pressure products this lower value was considered more appropriate.

(c) Temperature management

It is further proposed that products shall be equipped with a device/technical solution which allows temperature/hot water management, e.g. through limiting water temperature/hot water supply. Some possible solutions are for example hot water barrier, cold water supply in middle position, thermostat valves. This criterion aims at decreasing consumption of hot water, i.e. reducing energy consumption to heat the water, and subsequent reducing the related environmental impacts connected with energy generation and consumption. This criterion is not applicable for showerheads and for sanitary tapware that shall be fitted to water supply that is already temperature controlled.

According to information of SwissEnergy[20] around 1.5 l of hot water is lost unused for every hand washing activity (i.e. very short time activity) due to the delay in supply of hot water. Also, for some applications, e.g. basin taps in public bathrooms, given temperature for hot water, sufficient for the purpose of an activity, but still not impeding end-user comfort, could be preset, allowing to consume only as much energy for water heating as necessary. In accordance with studies conducted by the Swedish Energy Agency, up to 40 % of an average household energy consumption for hot water can be saved thanks to installation of energy-efficient sanitary tapware[21].

This criterion aims at driving technological development of the product group of sanitary tapware and supporting wider use of already existing solutions contributing to reducing the amount of energy which is consumed to heat the water, and which, in some cases, is lost unused.

[19] Products marketed to be suitable for low pressure installations, functioning typically at 0.1 to 0.5 bar.
[20] SwissEnergy, 2011, Energy Label Regulation for Sanitary Fittings, available online at: http://www.bfe.admin.ch/.
[21] Swedish Energy Agency, 2011, Save energy with efficient tapware, received per e-mail, dated 14.10.2011.

One of the possibilities to reduce the abovementioned energy loss, pointed by some stakeholders and recommended e.g. in the Austrian Ecolabel[22] and in the Swiss Energy-Label for sanitary tapware (EnergieEtikette)[23], is the application of middle-position for cold water. It was however mentioned by some stakeholders that such a solution might not be suitable for every climatic conditions.

Energy saving can be also achieved through application of thermostatic mixing valves in showers. As in majority cases warm water is derived by users from showers, it is of particular importance that the desired water temperature is achieved quickly. Many stakeholders pointed out that use of double-handle products contributes to loss of water and energy, while thermostatic adjustment allows for their saving. Therefore, based on the feedback received, it is proposed to exclude double lever/handle showers from the scope of the current GPP criteria for sanitary tapware, as they do not fulfil the above criterion and are considered not "energy-efficient" for showering activities.

Another solution to reduce the consumption of energy for water heating can be achieved by equipping the sanitary tapware with device which limits the temperature of hot water, e.g. at 38°C. If higher temperature is needed, active user intervention is necessary to override this barrier (used e.g. in thermostat valves).

(d) Time control for sanitary tapware for multiple users and high frequency use

Further, it is considered of importance that sanitary tapware (basin taps and showers) installed in non-domestic premises for multiple users and high frequency use (e.g. in schools, hospitals, swimming-pools, etc., but not e.g. in bathrooms of hotel rooms) shall allow for limiting time of a single water use (i.e. water volume consumed). This can be done by equipping the products with devices which stop water flow after certain time if they are not used (e.g. sensors stop water flow when a user leaves the sensor range) or after set time of use (e.g. time limiters, which stop water flow when the maximum flow time is exceeded).

This criterion is set only for sanitary tapware intended to be installed for multiple users and high frequency use (in bathrooms, washrooms, toilets). End-users' needs in non-domestic premises are easier to be determined (e.g. time needed to wash hands in a public bathroom or for taking a shower in a swimming-pool), as the typical applications/functions the sanitary tapware have to fulfil are more "homogenous" than in the domestic sector.

Annual non-domestic water consumption in the EU 27 through using sanitary tapware is estimated to be approximately 3 615 Mio. m^3 for taps and 362 Mio. m^3 for showerheads and showers[24]. Regulating water use and eliminating situations where sanitary tapware is left opened though its further use is not intended, as it sometimes happens in public premises, shall contribute to water and related energy

[22] The website of the Austrian Ecolabel is: http://www.umweltzeichen.at/.
[23] Meile O., Swiss Federal Office of Energy, Presentation sent by a stakeholder: Die neue EnergieEtikette: Kennzeichnung für Duschbrausen, Armaturen und Wassersparer.
[24] More details available in Discussion paper: The application of the Ecodesign Directive 2009/125/E to water-using products (WuP) – Identification of a suitable product group; available on the project's website: http://susproc.jrc.ec.europa.eu/ecotapware/stakeholders.html

savings in the non-domestic sector. It is very difficult to estimate the amount of water and related energy lost in this way, even roughly, as it is mainly influenced by user behaviour. Nevertheless, in this way the user behaviour may be influenced. Further, hygienic reasons for applying sensor solutions are of relevance in many non-domestic premises.

The question which appeared in this respect in the process of the open consultation is – whether this criterion shall further specify maximum values for time limiters or whether it shall be left the decision of the user/owner, depending on the intended function/application of the sanitary tapware. For example the recently developed WELL water-efficiency labelling scheme[25] sets the following values for self-closing valves: maximum of 10 seconds for basin taps and maximum of 20 seconds for showerheads. In public procurement criteria document published by WRAP in 2010[26] the proposed values are 20 seconds for taps and 2 minutes for showerhead. Thus, it can be seen that these values vary significantly.

The values proposed for the EU Ecolabel and GPP constitute the results of the discussion conducted during the AHWG meeting, which was held with stakeholders in October 2011 in Brussels and the further feedback received in this regard. It was finally decided to require a maximum pre-set times for the sanitary tapware products (15 seconds for basin taps and 35 seconds for showers). Nevertheless, it should be possible afterwards to adjust the time best to the intended tapware application, depending on the function it will fulfil in given premises.

The sanitary tapware equipped with a sensor shall have additionally an in-built 'security technical feature' with a pre-set shut-off time of maximum 2 minutes to prevent an accident or continuous water flow from taps or showers when not in use. This "Security technical feature" is defined as a device forming part of a sensor controlled sanitary tapware which is used to prevent continuous water flow by stopping the water supply after a pre-set time even if there is a person or an object present within the sensor range. This device is intended to reduce water consumption but could also, depending on the context, reduce accidents and protect against vandalism. The flow of water can be nevertheless restarted when there is a movement within the sensor range.

Criterion – Chemical and hygienic behaviour of materials

Beside the criteria regarding consumption and related energy saving, several other criteria are proposed for this product group. For the **GPP comprehensive criteria** the following requirement regarding the chemical and hygienic characteristics of materials is proposed:

Materials used in products coming into contact with drinking water, or impurities associated with them, shall not release into water intended for human consumption any compounds in the way that, either directly or indirectly, reduce the protection of human health[27]. They shall not cause any deterioration in

[25] WELL - Water Efficiency Labelling Classification scheme for sanitary valves, 2010, available online at: http://www.well-online.eu/config/media/files/171_WELL%20Klassifizierungsscheme.pdf.

[26] In December 2010, WRAP in the UK published 'Procurement requirements for water efficiency' Available from: http://www.wrap.org.uk/downloads/2011_01_19_WRAP_water_eff_model_proc_reqs_v6_FINAL.fad042fd.10378.pdf.

[27] Council Directive 98/83/EC of 3 November 1998 on the quality of water intended for human consumption, Article 10, OJ L 330, 5.12.1998.

the quality of water intended for human consumption with regard to appearance, odour or taste. Within the recommended limits for correct operation (i.e. conditions of use as laid down in the respective EN standards indicated in Table 2), the materials shall not undergo any change which would impair the performance of the product. Materials without adequate resistance to corrosion shall be adequately protected so that they do not present a health risk[28].

Quality of drinking water can be affected by a set of different factors. Among them there are: the source of raw water, water treatment processes, materials, stagnation times of the distribution network, pipe materials used, and microbiological activity in water supply and distribution systems. Quality of drinking water can be affected by dissolving of substances from materials due to interaction of the water and the materials. For example some metals used in the networks can dissolve to certain extent in acidic and soft, aggressive carbon dioxide containing water of low alkalinity (solution of substances depends e.g. on the water aggressively). Substances can also dissolve from organic materials present in networks. It concerns in particular additives from polymeric materials. These organic compounds act then as nutrients for microbes, which can result in faulty taste and odour or induce hygienic problems in the drinking water[29].

The EU Drinking Water Directive (DWD)[30] sets requirements concerning the quality of water intended for human consumption. It sets limits of heavy metal (e.g. lead, copper, nickel) contents in drinking water. Sanitary tapware can constitute a source of low emissions of metal substances to drinking water, though their contribution is considered less relevant than of some other elements of water supply and distribution system, as e.g. of piping system.

DWD obliges Member States to take "all measures necessary to ensure that no substances or materials for new installations used in the preparation or distribution of water intended for human consumption or impurities associated with such substances or materials for new installations remain in water intended for human consumption in concentrations higher than is necessary for the purpose of their use and do not, either directly or indirectly, reduce the protection of human health provided for in this Directive". Further, these materials shall also not contribute to water quality unacceptable to consumers regarding organoleptic parameters, i.e. taste, smell, appearance.

At present there is a lack of harmonised European standards and methods for testing and authorising use of materials in contact with water intended for human consumption. Further, some stakeholders emphasized that there lacks mutual recognition of laboratory test results between most MS and the national differences are sometimes substantial. Works on harmonising these test methods have been conducted for many years in several frameworks. Efforts are made by the so called MS4 group. Germany, France, the Netherlands and the UK work at establishing a scheme for mutual acceptance of certificates between these four countries. The scope of this work shall cover specification of tests to be applied for materials in contact with water intended for human consumption and preparation of lists of approved substances and materials that can be used with limited further testing. This work is intended

[28] Criterion set in accordance with the requirements on materials given in respective EN standards on sanitary tapware and national Ecolabel schemes.

[29] Rikka M. (Ed.): Drinking Water Quality and Network Materials in Finland. Summary Report. Finnish Institute of Drinking Water, Prizztech Ltd. 2008.

[30] Council Directive 98/83/EC of 3 November 1998 on the quality of water intended for human consumption, available online at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:1998:330:0032:0054:EN:PDF.

to constitute a basis for draft regulatory guidance to CEN and for a discussion in the Expert Working group.

Work on several harmonised standards on testing methods for different materials in contact with drinking water is in advanced state of development in the CEN/TC 164. Among them there are e.g.:

- *prEN 16056 – Influence of metallic materials on water intended for human consumption – Method to evaluate the passive behaviour of stainless steel*
- *EN 16057 – Influence of metallic materials on water intended for human consumption - Determination of residual surface lead (Pb) - Extraction method*
- *EN 16058 – Influence of metallic materials on water intended for human consumption - Dynamic rig test for assessment of surface coatings with nickel layers - Long-term test method*

Nevertheless, when finalising the criteria development process they were still under approval and did not have the formal CEN vote or have just been approved.

Works are also under development on hygiene standards in drinking water distribution, including hygienic assessment of plastic materials and other non-metallic materials, which shall be in the future harmonised within the EU. One of the currently drafted standards regards "Prediction of migration from organic materials using mathematical models". Nevertheless, it should be noted that it will not be available before the beginning of 2014.

So far, most Member States have their own requirements and testing procedures and differences between these various systems exist. Some MS require mandatory certification, while in other countries it is voluntary. Several examples illustrating the variability of systems functioning in the EU are given below[31].

For example in the UK[32] testing of non-metallic materials and components (e.g. plastics and elastomeric materials) to ensure conformity with the current requirements for odour, flavour, and growth of aquatic microorganisms tests are conducted in accordance with BS 6920:2000[33]. The tests shall be undertaken in a laboratory accredited under ISO 17025. The UK does currently not have an equivalent test standard for metallic products. Previously, BS 7766[34] was used to determine the release of metals into water; nevertheless, it has now been withdrawn due to lacking reproducibility of the results. At present there are no regulatory test requirements for metallic materials of sanitary tapware and the approval in this respect is not required. The new developed in CEN EN 15664[35] series of standards are awaited, however it is not clear how their results will be used then and the requirements set. On the other hand there are requirements set for all stainless steel products used in

[31] For details please see: Regulations and standards – Water Treatment Equipment, European Water Treatment Association, available online at: http://www.ewta.eu/assets/Uploads/EU-Directory-of-Regulations-and-Standards.pdf.
[32] Drinking Water Inspectorate's website: http://dwi.defra.gov.uk/drinking-water-products/approved-products/index.htm.
[33] British Standard 6920:2000 - Suitability of non-metallic products for use in contact with water intended for human consumption with regard to their effect on the quality of water.
[34] British Standard 7766:1994 – Specification for assessment of the potential for metallic materials to affect adversely the quality of water intended for human consumption.
[35] CEN EN 15664: Influence of metallic materials on water intended for human consumption - Dynamic rig test for assessment of metal release.

contact with drinking water. They must be approved under the relevant regulations, unless considered to be a low-risk product/application. Approval for a range of stainless steel materials with specific grades (tested in accordance with BS 7766[34]) is given.

In France, on the other hand product registration is mandatory and both metallic and non-metallic materials are controlled and must be certified in accordance with ACS standard[36]: organic materials shall be included in a Positive List while metals are assessed depending on their composition.

In Germany, though formally certification is not required, in praxis it is conducted. Products must comply with requirements given in several guidelines. Plastic products/materials have to conform to the KTW guidelines[37], recommendations issued by the Federal Environment Agency (UBA)[38], and all non-metallic materials must be listed in the Positive List. Organoleptic properties, migration, TOC, chlorine demand and microbial growth are tested. Metallic materials appropriate for contact with drinking water shall be listed the in special recommendation. At present a draft list of these materials suitable for contact with drinking water exists in Germany. The Federal Environment Agency does not license or certify products. It develops the basis for setting standards for the hygienic assessment of materials. Certification of products in contact with drinking water in Germany is conducted by the German Technical and Scientific Association for Gas and Water (DVGW).

In Austria the materials must be registered in the Austrian Positive List and comply with the KTW recommendation. The procedure of testing is similar as in Germany with the exception of the microbiological test, which is not required. It is also interesting to add that there is a mutual recognition of test results agreed between Austria, Germany, Switzerland and the Netherlands.

In Netherlands products in contact with drinking water must be certified with Attestation of Toxicological aspects (ATA). Organoleptic, microbiological and migration tests are conducted and there exists also a Positive List.

Voluntary certification is set in Belgium, where plastic materials are checked against a Positive List and tested according to the national standard for general hygiene, migration and microbial growth. Positive lists of materials exist also in other countries like the Czech Republic, Denmark or Spain.

Different approaches are applied in this respect in the national Ecolabel schemes. For example in the Catalan Ecolabel[39] the criterion concerning chemical and hygienic behaviour of materials is defined as given in the above proposed criterion formulation. The verification and assessment of this criterion is done in the form of manufacturer's (and/or suppliers') declaration of conformity and approval of respective documentation attached. The same formulation is contained in the Austrian Ecolabel[40] and

[36] ACS standard – Attestation de Conformité Sanitaire, http://www.sante.gouv.fr/attestation-de-conformite-sanitaire-acs.html.

[37] Testing Guideline for Organic Materials (KTW), available online at: http://www.umweltbundesamt.de/wasser-e/themen/trinkwasser/verteilung.htm.

[38] For details see the Federal Environmental Agency website: http://www.umweltbundesamt.de/wasser-e/themen/trinkwasser/verteilung.htm.

[39] Resolución MAH/2407/2009, de 29 de abril, por la que se establecen los criterios ambientales para el otorgamiento del distintivo de garantía de calidad ambiental a los productos y a los sistemas que favorecen el ahorro de agua. Diari Oficial de la Generalitat de Catalunya 5460 (2009) 66627-66632. Available online at: http://www.mediambient.gencat.cat/cat/empreses/ecoproductes_i_ecoserveis/pdf/criteris_ambientals/cast/040. pdf.

[40] The website of the Austrian Ecolabel is: http://www.umweltzeichen.at/.

in the newly developed Blue Angel[41]. Additionally, as already mentioned before, the German Environmental Agency issues guidelines on hygienic assessment of materials in contact with water intended for human consumption[42]. Compliance verification and assessment in the Blue Angel is conducted by evaluating laboratory tests, indicated in these guidelines, submitted by manufacturer and conducted in laboratories that meet the general requirements of EN ISO 17025 or certificates of a respective certified institution.

With regard to lack of harmonised EU testing methods and unified requirements for sanitary tapware in this area, on the one hand, and concerns raised by many stakeholders regarding the products available at the market and the risk of releasing of e.g. some heavy metals, on the other hand, it is proposed that the tendered attaches to the offer a certificate confirming meeting hygienic requirements of materials/product in contact with drinking water in compliance with the national regulations of the Member State where the product is placed on the market.

Criterion – Product quality and longevity

Further, criteria, defined for sanitary products shall contribute to saving of raw materials needed for manufacturing processes and to reducing emissions and other environmental impacts related to the production phase. In this respect the proposed criteria shall ensure the appropriate quality of the products. The issue of lifetime extension is also of importance.

As most surfaces of sanitary tapware available currently at the market are covered with Ni-Cr coatings, the criterion related to ensuring appropriate quality of exposed Ni-Cr coated surfaces is proposed. Two characteristics are tested in accordance with the EU harmonised standard EN 248:2003 "Sanitary tapware – General specification for electrodeposited coatings of Ni-Cr": resistance to corrosion and adherence. These tests aim to evaluate and ensure the appropriate quality of the coating.

In order to ensure longevity, the products shall be designed in a way which allows end-user/installer to replace the elements which may have a shorter lifetime (e.g. seals) and repair them easily with use of simple tools. This aspect shall be taken into account in the design phase. Moreover, information on which elements can be replaced should be clearly indicated in the accompanying product information sheet and clear instructions to enable basic repairs to be undertaken shall be available. It shall be also required that spare parts are available to purchase for end-users, even several years after production of a given product model is stopped. For the GPP it is proposed to the tenderer shall guarantee that spare parts are available for at least five years from the date of purchase for the **core criteria** and for seven years for the **comprehensive criteria**.

Additionally, it was indicated as important that producers shall ensure warranty conditions valid at least four years, as all products of this product group have relatively long lifetime.

[41] The website of the Blue Angel is: http://www.blauer-engel.de/.

[42] Recommendations of the German Federal Environmental Agency are available online at: http://www.umweltbundesamt.de/wasser-e/themen/trinkwasser/verteilung.htm.

Criterion – User information

Finally, due to the fact that the key factor in the area of sustainable water consumption with regard to use of sanitary tapware is the end-user behaviour; appropriate consumer information is of high importance. Thus, beside installation and maintenance instructions, information concerning rational water use and recommendations concerning potential saving in general and with regard to the given product use shall be attached to the product. This information shall also contain reference to the potential of saving energy for water heating and the explanation about other environmental impacts which can be reduced due to rational water, and, in particular, hot water consumption.

Further, importance of exchanging used parts and preventing dripping water from sanitary tapware shall be emphasized as this contributes to high and unnecessary losses of water, which can however easily be avoided.

Information concerning the suitability of a product for a given pressure system shall also be highlighted (if appropriate) and consequences of installing improper appliances to the existing system shall be pointed out.

It should be ensured that the information is passed from the installer or supplier to the procurer and to the person responsible for the maintenance of the procured sanitary tapware.

Additional aspects relevant for the Green Public Procurement

Apart from the above described criteria, which were considered for both – the EU Ecolabel and GPP criteria, there are additional aspects which are of importance for the public procurement and which require setting some additional (i.e. GPP specific) requirements. These aspects are related to the activity of contracting by the public procurers the service of installation of sanitary tapware products in new or renovated public premises. In this case it is important that the contractor who undertakes the installation or exchange of the sanitary tapware has suitably qualified and experienced personnel.

Further, it might be required that the contractor provides the following:

- Installation (including indication on the suitability to a water pressure system in a building) and disassembly instructions,

- Instructions on how to maintain proper functioning of products (e.g. how to replace sanitary tapware elements, which might require it over time in order to prevent leaks or inappropriate functioning),

- Indications in case special cleaning means shall be used in order not to harm products' surface,

Finally, the contractor shall also ensure sanitary tapware installed is working properly and uses not more water and related energy than required. In this respect (where the tapware includes sensors or time limiters):

- For sensors, sensitivity and time delay shall be set to appropriate levels to meet occupant needs without excessive water and energy consumption,

- Sensors shall be checked to ensure that they are working properly and are sensitive enough to detect typical occupant movements,

- Time limiters shall be set to appropriate times to meet occupant needs without excessive increase in water and related energy consumption.

Improvement potential

In this section the improvement potential related to the use of water-saving sanitary tapware is briefly presented. There are various solutions which can be applied to improve the water efficiency of sanitary tapware. Among them there are: aerators, devices which deliver water at a restricted flow rate in the form of a spray, water-saving brake features used for single lever mixer taps (in case a higher flow is needed, the lever can be pushed past this stop, however the economy option should be a default position), flow restrictors and regulators, products equipped with sensor, timer control operated taps and showerheads, or thermostatic mixing valves[43].

Due to the complexity of the analysis of user behaviour and the variety of water using habits it is not easy to calculate exactly the savings which can be achieved due to application of the water saving solutions and water-efficient products. Various values can be found in literature sources. The study "EU Water saving potential"[44] coordinated by the Institute for International and European Environmental Policy – Ecologic for the European Commission indicates that the application of taps with aerators allows for approximate reduction of 50 %, similarly the taps with thermostats allow for 50 % reduction of water and energy consumption. Even higher reduction of above 70 % is related to the use of taps with infrared sensors; while devices limiting the flow in showers can bring around 10-40 % of water use saving. The US EPA WaterSense estimated that its labelled faucets and faucet accessories can help saving approximately 30 % or more water "without sacrificing performance"[45]. In a study conducted for the DG Environment in 2009, concerning water efficiency standards[46] the values of 20-30 % are given for water saving due to installation of new more water efficient taps or aerators. A project conducted at the Liverpool John Moores University[47] on the example of 18 chosen households showed that installing the aerated showerheads and flow regulators resulted in reducing the flow rate by 28 %; nevertheless the first option (the use of aerators) gained much higher users acceptance.

[43] For more information see Draft Task 2&3 Report: Market and economic analysis & User behavior (section 2.3.2 and 2.3.3), available on the project's website: http://susproc.jrc.ec.europa.eu/ecotapware/stakeholders.html

[44] Dworak T. et al., EU Water saving potential, Ecologic – Institute for International and European Environmental Policy, 2007, available online at: http://ecologic.eu/download/projekte/900-949/917/917_water_saving_1.pdf, accessed February 2011

[45] For details see WaterSense website: http://www.epa.gov/watersense/products/bathroom_sink_faucets.html

[46] Mudgal S., Benito P., Jean-Baptiste V., Dias D., Kong M.A., Inman D., Muro M., Study on water efficiency standards, BIO Intelligence Service & Cranfield university, Report for European Commission (DG Environment) 2009.

[47] Critchley R., Philipps D., Water and Energy Efficient Showers: Project Report, United Utilities, 2007, available online at: http://www.unitedutilities.com/Documents/UULJMUwaterenergyefficientshower Finalreport23rdMay2007.pdf.

Preliminary calculation of the improvement potential based on the results of the study

Based on the calculations conducted in the frame of the project and the necessary assumptions made[48], the potential to save water and related energy for water heating has been estimated. The average combined (i.e. hot and cold) EU 27 domestic water consumption from taps and showers is around 75 l/person/day; the water use from taps accounts for 76 % thereof. On average, the respective water consumption by a statistical EU 27 household amounts to approximately 190 litres. Nevertheless, it should be remembered that very high regional and national differences exist.

In accordance with the conducted calculations the annual domestic and non-domestic water consumption per tap and per showerhead was estimated. It was presented previously in Table 4 (for total water) and Table 5 (for hot water only).

The assumed temperature of hot water used by the customers is 39˚C (which consists of a mix of cold water, i.e. at 5˚C and hot water, i.e. at 60˚C). The amount of hot water needed has been calculated assuming the split of 44 % of cold water and 56 % of hot water use by taps. The cold water to hot water ratio for showers is assumed 30:70. The calculated amount of hot water consumption (of 39˚C) for taps in domestic and non-domestic sectors is as follows:

The calculated amount of energy needed to heat the needed amount of water is approximately 350 kWh per tap per year in the domestic sector and 1 730 kWh per tap per year in the non-domestic sector. For showers the respective values are as follows: 550 kWh per domestic shower per year and 540 kWh for non-domestic[49].

The total EU 27 water and energy consumption related to the product group under study, calculated with use of abovementioned values and the stock values estimated in the frame of Task 2[50] is presented in the following Tables.

Table 22: Domestic and non-domestic water consumption in EU 27

Water use [Mio. m^3]			
Taps		Showerheads	
Domestic	Non-domestic	Domestic	Non-domestic
10 560	3 610	3 270	360

Table 23: Domestic and non-domestic energy consumption for water heating in EU 27

Energy Use [TWh]			
Taps		Showerheads	
Domestic	Non-domestic	Domestic	Non-domestic
350	120	140	15

[48] For details and all references see the Base-case assessment report, available online at: http://susproc.jrc.ec.europa.eu/ecotapware/stakeholders.html.

[49] Energy use per litre is 0.092 kWh. This is based on the following: 4200 (J/deg C/litre) * temperature increase (deg C) / energy efficiency / 3,600,000 (the temperature increase is 55 deg C, i.e. from 5 to 60 ˚C (required to protect from growth of legionella), boiler efficiency is assumed as 70 %. The assumed temperature of hot water used by the customers is 39˚C (constituting a mix of cold, i.e. at 5˚C and hot, i.e. at 60˚C, water).

Based on the review of the literature information concerning the saving potential due to installation of water-efficient products (presented before) in all premises in the EU (neglecting the fact that some of these premises may have already such water and energy efficient products installed), it was consequently assumed that their installation would result in 20 % saving of water and energy needed for water heating. This assumption is rather conservative, as in the literature values of 30 % and even above can be found. It should however only demonstrate the environmental benefits of applying water-efficient products at the European market. The results of the saving potential are shown in the following Table.

Table 24: Water and energy saving potential in EU 27

	Taps		Showerheads	
	Domestic	Non-domestic	Domestic	Non-domestic
Water [Mio. m^3/year]	2 100	720	650	70
Energy [TWh/ year]	70	24	27	3

It should be added that no reliable data exist for the stock of taps and showerheads, thus estimations based on available information had to be made in the course of the study[50].

It should be taken into account that the values obtained are based on the preliminary study where high number of assumptions had to be made (explained in detail in the task reports). Therefore, the results should be treated as approximate and not as accurate values. Furthermore, they refer to water consumption in both – domestic and non-domestic applications. The saving potential for GPP would constitute then a share of the later one. More exact data regarding water consumption in public premises in the EU have not been obtained, though it is clear that this would allow refining this estimation for the needs of GPP.

However, the approximate estimation arrives at values that clearly emphasize the importance of the water and energy saving potentials. This is very well illustrated by the energy saving potential to be achieved by the Ecodesign Implementing Measures[51]. The estimated energy savings due to the first ecodesign measures on 9 product groups (see Table 25) should amount to 12 % of the electricity consumption of the EU 27 in the year 2007 (compared to a 'business as usual' scenario). The joint energy saving potential of taps and showers (subject to the assumptions mentioned before) is with 124 TWh estimated higher than most of other energy using products listed in Table 25.

[50] For de details on stock calculation please see Draft Task 2 Report: Market and economic analysis, available on the project's website: http://susproc.jrc.ec.europa.eu/ecotapware/stakeholders.html

[51] DG Enterprise and Industry, Ecodesign Your Future - How Ecodesign can help the environment by making products smarter, available online at: http://ec.europa.eu/enterprise/policies/sustainable-business/ecodesign/files/brochure_ecodesign_en.pdf, accessed February 2011.

Table 25: Estimated savings from the first nine Ecodesign measures[51]

Ecodesign Measure	Adoption	Estimated savings (annual by 2020)
Standby	December 2008	35 TWh
Simple set top boxes	February 2009	6 TWh
Street & Office Lighting	March 2009	38 TWh
Domestic Lighting	March 2009	37 TWh
External power supplies	April 2009	9 TWh
Electric motors	July 2009	140 TWh
Circulators	July 2009	27 TWh
Domestic refrigeration	July 2009	6 TWh
Televisions	July 2009	43 TWh
Total		**341 TWh**

It should also be added that the calculated energy saving potential covers only the energy consumed for water heating, neither the energy for pumping nor for wastewater treatment were taken into account in the calculations.

Based on the above written (and the assessment results obtained in the frame of Base-case assessment), the first and most important group of criteria refers to water consumption and related energy saving through influencing the water flow rate, improving temperature/hot water management and limiting the time or volume of single water use (for non-domestic multiple users and frequent use products).

4 COST CONSIDERATIONS

Introduction to Life Cycle Costs

In order to allow public procurers to decide which products shall be most cost effective to purchase taking into account product life cycle perspective, life cycle cost (LCC) approach[52] can be applied. It takes into account the following aspects:

- purchase and all associated costs (delivery, installation, etc.)
- operating costs, including energy, spares, and maintenance,
- end of life costs.

In this way all costs associated with a product become visible, particularly operating costs such as water and energy consumption.

In the framework of the Ecotapware project a Life Cycle Costs analysis was conducted for both domestic and non-domestic products. The EcoReport tool has been used to assess the life cycle impacts of taps and showers and for the calculation of associated life cycle costs. The procedure used and the results obtained for the domestic and non-domestic sectors are shown in the following section[53].

In accordance with the results of analysis of environmental impacts and associated costs along life cycle of this product group the **use phase** is the most decisive for the overall impacts and costs.

Green Public Procurement of taps and showers[54]

Taps and showers are procured by a range of public sector bodies and installed in public washrooms, leisure centres, hospitals, social housing, schools, colleges, public offices and other public buildings. There is a large range of taps and showers available on the market for public sector bodies to choose from, which vary in terms of design, price and performance.

It should be noted that public procurement may include taps in both the non-domestic e.g. for public washroom and the domestic e.g. social housing sectors. The base-case assessment highlighted that while the tap and its intended use may be similar in these different sectors, the use patterns of taps and showers do differ between the domestic and non-domestic sectors. Therefore the results of the LCC analysis have been included for both the domestic and non-domestic base-cases.

The sections below outline the inputs used for calculating life cycle costs on a per product basis for taps and showers and summarises the results from EcoReport.

Typical prices identified in the framework of the study for domestic and non-domestic products are given in Table 26 and Table 27.

[52] http://ec.europa.eu/environment/gpp/gpp_and_life_costing_en.htm.
[53] For further details please consult the chapter 5 of Base-case Assessment report, available on the project's website: http://susproc.jrc.ec.europa.eu/ecotapware/stakeholders.html.
[54] The following section constitute a part of the Base-case assessment report, available on the project's website: http://susproc.jrc.ec.europa.eu/ecotapware/stakeholders.html.

Table 26: Typical prices for domestic taps and showerheads (in €)

Type of product		Range (Min – Max)	Average (Median)
Kitchen taps	3 hole mixer	125.0 – 379.0	252.0
	Monobloc mixer	8.0 – 475.0	241.0
	Pillar Taps (pair)	18.3 – 158.3	88.0
Basin taps	2 hole mixer	42.6 – 157.1	100.0
	Monobloc mixer	7.9 – 355.0	181.0
	Pillar Taps (Pair)	18.3 – 59.7	39.0
Showerheads		1.5 – 82.8	42.2

Table 27: Typical prices for non-domestic products (in €)

Type of Tap/ Showerhead	Range (Min – Max)	Average (Median)
Infra Red Mixer Tap	269.48 – 480.75	375.12
Lever Taps (Pair)	43.84 – 74.28	59.06
Single Lever Mixer Tap	89.20 – 624.68	356.94
Self closing single taps	27.73 – 316.60	172.17
Showerheads (Wall mounted/swivel design)	33.49 – 132.33	82.91

Life Cycle Costs for taps

The base-case assessment analysis[55] identified two example base-cases for taps, a brass tap and a stainless steel tap, for which life cycle calculations considered domestic and non-domestic sectors.

Information concerning purchase price, installation, maintenance and water and energy prices has been collated and used as inputs for the assessment of life cycle costs. The differentiation between taps made of brass and those with stainless steel has not been made as initial calculations indicated that rather than purchase price it is the cost of water and energy over the products lifetime that are most important and offer the potential for savings. This is demonstrated in the results below.

The EcoReport inputs for taps are summarised in Table 28. These are based on information gathered as part of Market and Economic Analysis and are detailed in Section 2.4 of the report[56]. The information is based on data collected from product catalogues and stakeholder feedback, in particular from the first questionnaire.

[55] For details see Section 3 of Base-case assessment report, available on the project's website: http://susproc.jrc.ec.europa.eu/ecotapware/stakeholders.html.

[56] For details see Economic and market analysis & User behaviour reports, available on the project's website: http://susproc.jrc.ec.europa.eu/ecotapware/stakeholders.html

Table 28: Life cycle cost inputs for taps

Input parameter	Input value - Domestic	Input value – non-domestic	Notes - Domestic	Notes Non-domestic
Product Life (Years)	16	10	Based on stakeholder feedback	Based on stakeholder feedback
Average product price (Euro)	192 (Bathroom Taps)	240	Mean of prices for a 3 hole mixer, monobloc mixer and pillar taps three taps	Mean of the median prices for the four different types of taps identified
Installation (Euro)	65	150	Mean of range provided by stakeholder feedback	Based on stakeholder feedback
Maintenance and repair (Euro)	60 (Basin Taps)	75	Mean of range provided by stakeholder feedback	Based on stakeholder feedback
Electricity Rate (Euro/kWh)	0.1223	0.0918	Based on 2010 electricity price data. A differentiation is made for electricity prices between household consumers and industrial consumers, which have been used for domestic and non-domestic sectors respectively.	
Water Rate (Euro/m^3)	3.7	3.7	This value is consistent with that used in the EuP Study for Washing machines. The same value has been used for domestic and non-domestic sectors	
Discount Rate % (interest minus inflation)	1.73	1.73	EU27 2010 Inflation Rate (2.1 %) and Interest Rate (3.83) have been used to calculate the discount rate of 1.73 %	

The EcoReport life cycle cost calculation results for taps is presented in Table 29 and indicates higher life cycle costs for a non-domestic tap, which is due to the costs associated with higher water consumption and electricity use for heating water. This point is illustrated further by Table 30, which shows the results of the life cycle cost calculation in terms of percentage cost for the different LCC parameters, highlighting the significant cost contributions from electricity and water.

Table 29: Base-case life cycle costs per product for taps

	Domestic Taps	Non-domestic Taps
LCC Parameter	**Cost (Euro)**	
Product price	192	240
Installation	65	150
Electricity	909	2231
Water	534	1746
Repair & maintenance	52	68
TOTAL	**1752**	**4435**

Table 30: Percentage of total cost for different life cycle cost parameters for taps

	Domestic Tap	Non-domestic Tap
LCC Parameter	**Percentage of Total**	
Product price	11.0	5.4
Installation	3.7	3.4
Electricity	51.9	50.3
Water	30.5	39.4
Repair & maintenance	3.0	1.5
TOTAL	**100.0**	**100.0**

As indicated above the purchase price is a relatively small proportion of the overall life cycle costs. Even if the purchase price of a domestic tap doubles the percentage of total life cycle costs would only be 19.75 % and LCCs would still be dominated by electricity (46.75 %) and water (27.47 %). A similar situation exists for a non-domestic tap, increasing the purchase price to 480 Euros will raise its percentage of total life cycle cost to 9.77 % however electricity (45.39 %) and water (35.52 %) will still dominate.

Using the life cycle costs shown in Table 29 as a baseline, and a scenario of reducing water consumption by 30 %,

Table 31 shows how the life cycle assessment tool can be used to demonstrate potential savings over the lifetime of the tap.

Table 31: Potential LCC savings following a 30 % reduction in water consumption for taps (in €)

	Domestic Taps			Non-Domestic Taps		
LCC Parameter	**Cost in Baseline**	**Cost in 30 % reduction scenario**	**Savings**	**Cost in Baseline**	**Cost in 30 % reduction scenario**	**Savings**
Product price	192	192	0	240	240	0
Installation	65	65	0	150	150	0
Electricity	909	636	273	2231	1562	669
Water	534	374	160	1746	1222	524
Repair & maintenance	52	52	0	68	68	0
TOTAL	**1752**	**1319**	**433**	**4435**	**3243**	**1193**

Life Cycle Costs for showerheads

As for taps, the base-case assessment task identified two example base-cases for showerheads, a metal showerhead and a plastic showerhead for which life cycle calculations considered domestic and non-domestic uses.

Information concerning purchase price, installation, maintenance and water and energy prices has been collected and used as inputs for the assessment of life cycle costs. The differentiation between showerheads made with metal and those with plastic has not been made as our initial calculations indicated that rather than purchase price it is the cost of water and energy over the products lifetime that are most important and offer the potential for savings. This is demonstrated in the results below.

The EcoReport inputs for showerheads are summarised in Table 32. These are based on information gathered as part of Market and Economic Analysis and are detailed in full in Section 2.4 of the respective report[57]. The information is based on data collected from product catalogues and stakeholder feedback, in particular from the first questionnaire.

Table 32: Life cycle cost inputs for showerheads

Input parameter	Input value - Domestic	Input value – Non-domestic	Notes – Domestic	Notes – Non-domestic
Product Life	10 years	7 years	Based on stakeholder feedback	Based on stakeholder feedback
Average product price (Euro)	42	83	Mean of the price range identified	Mean of the price range identified
Installation(Euro)	40	60	Mean of range provided by SH feedback	Based on stakeholder feedback
Maintenance and repair (Euro)	60	60	Mean of range provided by stakeholder feedback	No value provided for showerheads – same figure as domestic used
Electricity Rate (Euro/kWh)	0.1223	0.0918	Based on 2010 electricity price data. A differentiation is made for electricity process between household consumers and industrial consumers, which have been used for domestic and non-domestic sectors respectively.	
Water Rate (Euro/m^3)	3.7	3.7	This value is consistent with that used in the EuP Study for Washing machines. The same value has been used for domestic and non-domestic sectors	
Discount Rate % (interest minus inflation)	1.73	1.73	EU27 2010 Inflation Rate (2.1 %) and Interest Rate (3.83 %) have been used to calculate the discount rate of 1.73 %	

The EcoReport life cycle cost calculation for showerheads is presented in Table 33 and indicates higher life cycle costs for a domestic showerhead, which is again due to the costs associated with higher water consumption and electricity use for heating water. This point is illustrated further by Table 34 which shows the results of the life cycle cost calculation in terms of percentage cost for the different LCC parameters, highlighting the significant cost contributions from electricity and water.

[57] For details see Economic and market analysis & User behaviour reports: available on the project's website: http://susproc.jrc.ec.europa.eu/ecotapware/stakeholders.html

Table 33: Base-case life cycle costs per product for showerheads

	Domestic Showerhead	Non-domestic Showerhead
LCC Parameter	**Cost (Euro)**	**Cost (Euro)**
Product price	42	83
Installation	40	60
Electricity	943	501
Water	443	313
Repair & maintenance	55	56
TOTAL	**1522**	**1013**

Table 34: Percentage of total cost for different LCC parameters for showerheads

	Domestic Showerhead	Non-domestic Showerhead
LCC Parameter	**Percentage of Total**	**Percentage of Total**
Product price	2.8	8.2
Installation	2.6	5.9
Electricity	62.0	49.5
Water	29.1	30.9
Repair & maintenance	3.6	5.5
TOTAL	**100.0***	**100.0**
*Individual values do not total 100 % exactly due to rounding		

As indicated above the purchase price is a relatively small proportion of the overall life cycle costs. Even if the purchase price of a domestic showerhead doubles the percentage of total life cycle costs would only be 5.4 % and LCCs would still be dominated by electricity (60.3 %) and water (28.3 %). A similar situation exists for a non-domestic tap, increasing the purchase price to 166 Euros will raise its percentage of total life cycle cost to 15.2 % however electricity (45.7 %) and water (28.6 %) will still dominate. Using the life cycle costs shown in Table 33 as a baseline, and a scenario of reducing water consumption by 30 %, Table 35 shows how the life cycle assessment tool can be used to demonstrate potential savings over the lifetime of the showerhead.

Table 35: Potential LCC savings following 30 % reduction in water consumption for showerheads (in €)

	Domestic Showerheads			Non-Domestic Showerheads		
LCC Parameter	**Cost in Baseline**	**Cost in 30 % reduction scenario**	**Savings**	**Cost in Baseline**	**Cost in 30 % reduction scenario**	**Savings**
Product price	42	42	0	83	83	0
Installation	40	40	0	60	60	0
Electricity	943	660	283	501	351	150
Water	443	310	133	313	219	94
Repair & maintenance	55	55	0	56	56	0
TOTAL	**1522**	**1106**	**416**	**1013**	**769**	**244**

Life Cycle Cost Assessment – Summary

The life cycle cost assessment using the base-cases as an example has demonstrated that it is important not to consider purchase price in isolation, but the life cycle cost including water and energy use over the product's life.

The calculations above show that the costs of water and electricity dominate the LCCs for taps and showerheads, based on the use profile established for the base-cases. The LCC approach allows public bodies to explore the costs and benefits of different taps and showerheads not just by their purchase price but also their operational cost.

The assessment shows that just by changing water consumption, and keeping all other things equal, savings ranging from 244 to 1193 Euros can be achieved per product for the base-case examples over their lifetime. Even if purchase prices were to double across all examples, the savings in each case would still exceed the increase in purchase price.

By reducing water consumption the greatest financial savings can be made through lower water charges and reduced energy use for the heating of water. This indicates that purchasing strategies should therefore be developed to specify lower flow rate products in order to minimise life cycle costs.

If a tap/showerhead has additional temperature management features, the life cycle cost can be expected to drop even further, as electricity for water heating forms the most cost-intensive factor along the product life cycle (nevertheless, the calculation of this saving is difficult due to variability of technologies which can be applied).

It is clear that given the large variation in designs, functionality, prices and use patterns, the inputs for the LCC assessment will need to be considered by purchasing authorities on a case by case basis.

The use pattern for taps and showerheads within public buildings will vary, for example a shower in an office environment compared to a shower in a leisure centre. The expected use will need to be considered carefully by the purchasing authority in order to calculate LCC accurately.

The installation, repair and maintenance costs used in the above analysis are based on feedback from the first questionnaire for this project. Again, depending on the type of installation, or level of repair and maintenance, e.g. cleaning required, these costs will vary case by case. Nevertheless, repair and maintenance costs are likely to be relatively low in the overall life cycle costs. Likewise installation costs will also vary and may depend on whether it is part of larger refurbishment work or the replacement of individual taps or showerheads. Indeed, an additional source identified during the research suggests lower installation costs for taps of approximately 27 Euros[58].

[58] Based on installation cost of £22 per unit – Appendix D, table 12 in report published by Entec, May 2009 'Office of Government Commerce – CESP Review of Sustainable Operations targets and Sustainable Procurement Measures Final Recommendations'
Available online at: http://www.ogc.gov.uk/documents/Entec_SOGE_final_report.pdf

5 PUBLIC PROCUREMENT NEEDS

Typical procurement

Almost all public buildings are equipped with products from the group of sanitary tapware; nevertheless this group does not belong to the typical Green Public Procurement product groups. This is on the one hand due to the fact that sanitary tapware has long life time (approximately ten years) and it is purchased seldom. On the other hand, the decisions concerning the choice of the sanitary tapware are not exclusively taken by the procurer themselves, if they are not at the same time owners of the building. Further, the choice will also be influenced by the public building application and the function the sanitary tapware shall fulfil (i.e. sanitary tapware in hospitals might have to fulfil different requirements than in office building or a sport centre).

If public procurers can decide about (or at least influence) the choice of sanitary tapware, procurement activities may cover the following areas:

- selection of sanitary tapware products for new/designed buildings,
- selection of sanitary products in existing buildings, which shall be refurbished,
- selection of water saving devices for existing sanitary tapware products.

Typical products cover:

- kitchen taps, e.g. in school and offices cantinas, in hospital kitchens, etc.
- basin taps in bathroom and toilets in all public buildings,
- showers in hospitals, schools and public sport centres, swimming pools.

Due to general lack of data on annuals procurers' needs and the shares of purchase conducted by public procurers in the overall consumption of sanitary tapware, the estimation of the EU 27 public procurement consumption was not possible. Nevertheless, knowing that practically all of the public buildings must be equipped with sanitary tapware and knowing the public sphere is a very important purchaser, the procurement needs are expected to be significant.

Purchasing demands

Among most important issues for the public procurer of sanitary tapware products is their cost and functionality (their various features adjusted to the application, e.g. high hygiene is needed in hospitals, whereas in public toilets and bathrooms also durability will be an important issue). Nevertheless, in this respect not only purchase costs are of importance but also the overall life cycle costs. The key in the life cycle costing of this product group is the actual use of water and related energy for water heating (but also supply and waste water treatment). Though, it must be remembered, that the end-user behaviour has the main influence on water consumption. Nevertheless, water efficient and innovative technologies can also contribute to water and related energy savings.

The criteria considered most important for this product group are the criteria regarding water consumption and related energy saving, i.e. the maximum available water flow rate, the lowest

available maximum water flow rate, the temperature management and the criterion on time limit for a single use. Further, also the criteria ensuring the high product quality and consequently the long life-time of the water-saving products are of high importance.

6 PROPOSAL FOR CORE AND COMPREHENSIVE CRITERIA

It is proposed to set core and comprehensive criteria for sanitary tapware. The proposed GPP criteria are designed to reflect the key environmental impacts. This approach is summarised as follows:

Key Environmental Impacts	GPP Approach
• Water consumption, particularly in the use phase • Energy consumption, in particular for water heating • Emissions to air and water, mainly due to energy generation and production processes	• Equip new and refurbished buildings with water and energy efficient sanitary tapware

The order of impacts does not necessarily reflect their importance.

For each product/service group two sets of criteria are presented:

- The core criteria are those suitable for use by any contracting authority across the Member States and address the key environmental impacts. They are designed to be used with minimum additional verification effort or cost increases.

- The comprehensive criteria are for those who wish to purchase the best products available on the market. These may require additional verification effort or a slight increase in cost compared to other products with the same functionality.

The following sets of EU GPP criteria are proposed:

a) Criteria for purchasing of water efficient sanitary tapware for new or refurbished buildings (3.1),

b) Criteria for installation works in new or renovated premises (3.2), which could be used in addition to the criteria for purchasing of water efficient sanitary tapware.

The criteria are presented in a separate document "EU GPP Criteria for Sanitary Tapware" available at http://ec.europa.eu/environment/gpp.

7 VERIFICATION ISSUES

Verification of the GPP core and comprehensive criteria can be conducted using respective products certification and/or supporting documents from manufacturers and/or supplier, where appropriately.

Recently more and more companies put higher attention to environmental impacts, which their manufacturing processes and products cause and they try to reduce respective negative effects. Growing environmental consciousness among both producers and consumers and increasing importance of sustainability in policy development at various levels contributes to growing importance to establish in companies environmental management systems and/or to certify products with labels indicating preferable environmental performance.

The certification process for awarding a product with Type I Ecolabel consists of fulfilling by the product a set of criteria developed especially for it. In this respect issues of assessment and verification methods used to check the compliance with these criteria are of high importance. Applicants usually have to submit to the awarding authority documents in form of declarations of compliance by the producer or by the supplier, technical and/or product safety sheets; laboratory tests results, etc.

If GPP criteria are based on Type I Ecolabels, the compliance with these criteria may be proved through demonstration of owning the relevant label, provided that this Ecolabel fulfils the given requirements. In this case public procurers shall ask for copies of relevant documents. If this is not the case, contracting authorities shall ask bidders to submit additional documents confirming compliance with the criteria. Verification procedures are indicated in the Verification section of criteria document for a given product for each criterion separately.

8 CONCLUSIONS AND SUMMARY

The product group of sanitary tapware encompasses basin and kitchen taps, showerheads and showers used typically in public utility buildings like schools, offices, hospitals, swimming pools, sport centres, and other.

Both – domestic-like and non-domestic applications are covered by the scope of this product group. In most public premises sanitary tapware is of frequent use and have to fulfil needs of multiple users (e.g. public swimming-pools or sport centres, schools, etc.). Domestic-like functions are on the other hand required e.g. in bathrooms of rooms in apartments, students dormitories, etc.

In some premises also some special features, like ensuring easily hygienic conditions (e.g. in hospitals, public washrooms and toilets) or robustness of the sanitary tapware are of importance.

The main environmental impacts caused by the use of sanitary tapware are associated clearly with the consumption of water and related energy for water heating. All other impacts (emissions, waste generation, etc) are to over 90 % related with energy generation and consumption. Therefore, the key requirements for public procurement of sanitary tapware shall refer to the following aspects influencing water consumption and related energy saving:

- maximum available flow rates,
- temperature management,
- limiting time of single water use for multiple users and frequent use applications.

Further, due to the issues of ensuring comfort for end-users and due to hygienic and safety reasons, minimum flow rate shall be also set.

Finally, in order to ensure proper functioning of the products aspects related to quality of a product, its durability, reparability and warranty are of importance for procurement of sanitary tapware.

There is considerable potential for saving water and energy used for water heating in public buildings by using more efficient sanitary tapware. And, as Life Cycle Cost analysis showed, even if the purchase costs for these products are higher, the return time for this investment is very short.

Summarising, the results of analysis of the life cycle impacts of sanitary products indicate that the environmental and also financial savings due to reduced consumption of water and energy are very high.

9 EXISTING STANDARDS & ECOLABELS AND OTHER INFORMATION SOURCES

There are several ecolabels for the product group of sanitary tapware existing currently in the market. Table 36 presents the main labels being currently in use in the countries of EU and across the world. The most important currently existing Ecolabels are briefly described below. They usually apply separately for basin and kitchen taps and for showerheads. Main ecolabels, considered most relevant for the development of the EU Ecolabel and GPP criteria in the framework of the Ecotapware project, are given in Table 36.

Table 36: Main labels for water-efficient Sanitary Tapware

Ecolabel	**Austrian Ecolabel**	**Blue Angel**	**WEPLS**	**WELL**	**Water Sense**	**WELLS**
Issued by	*Austria*	*Germany*	*UK*	*EUnited*	*US*	*Australia*
Kitchen taps	✓		✓	✓	✓	✓
Basin taps	✓		✓	✓		✓
Showerheads	✓	✓	✓	✓	✓	✓

A comprehensive analysis of various available water efficiency schemes was conducted in the Task 1 of the Ecotapware project, together with the analysis of relevant standards and existing legislation at the EU level, at the MS level and in third countries. For details please refer to the respective report available at the project website[59]. The section of this report concerning the presentation of the existing Ecolabel schemes from the EU 27 and some non-European countries is given below:

Legislation at Member State level[59]

This section gives a brief overview of legislation and labels at Member State level. Both voluntary and mandatory policy instruments are included.

Austria

The Austrian Ecolabel[60] (Figure 43) is available for water efficient sanitary tapware[61]. It is applicable to single-lever mixer taps, thermostatic wall mixers, and water saving equipment (e.g. aerators, water saving valves). The Ecolabel criteria include general specifications on maximum flow rates:

- 6 l/min for bathroom/toilet taps;
- 9 l/min for kitchen taps;
- 12 l/min for bathtub taps and showerheads.

[59] Wolf, O., Uihlein, A., Product definition report, available on the project's website: http://susproc.jrc.ec.europa.eu/ecotapware/stakeholders.html.

[60] The website of the Austrian Ecolabel is: http://www.umweltzeichen.at/.

[61] Umweltzeichen: Österreichisches Umweltzeichen. Richtlinie UZ 33. Wasser- und energiesparende Sanitärarmaturen und Zubehör. Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft, Wien 2007, available online at: http://www.umweltzeichen.at/filemanager/list/15672/

In addition, there are the following criteria for single-lever mixer taps and thermostatic wall (on-wall) mixers: For single-lever mixer taps, there should be a possibility to limit the flow rate to 60 % of the maximum flow rate. It is up to the producer how to meet this requirement. Several possibilities are suggested, e.g. a built-in resistance the user has to overcome when he wants to receive more than 60 % of the maximum flow rate. Thermostatic wall mixers have to be equipped with a flow limiter and a hot water barrier. These have to be overcome actively by the user (e.g. by a push button). The flow limiter has to be preset at 60 % of the maximum flow rate or lower. Both single-lever mixers and thermostatic wall mixers should also be equipped with a device to limit the hot water intake (hot water barrier).

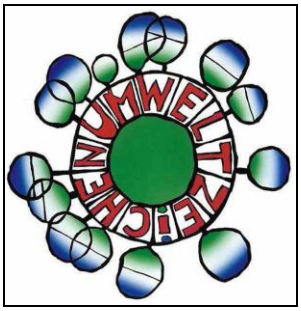


Figure 43: Austrian ecolabel

Considering quality and longevity, the tapware has to conform to the following Austrian standards:

- Single-lever mixers have to comply EN 817,
- Thermo-mixers have to comply with EN 1111,
- Aerators have to comply with EN 246.

In addition, the noise level of water saving equipment should not exceed 15 dBa at a pressure of 0.3 MPa (3 bar). The noise level is determined according to the standards of the ISO 3822 series. So far, no product carries the sanitary tapware ecolabel[62].

As it is the case for the EU ecolabel, there are Austrian ecolabel criteria for tourist accommodation services[63]. With respect to water use, they are mainly concerned with toilet flushing and urinals, however, several requirements for taps and showerheads exist:

- The maximum water flow rate of taps and showerheads is restricted to 12 litres per minute;
- On average, the flow rate of all taps and showerheads should not exceed 8.5 litres per minute;
- At least 80 % of the taps have to be equipped in a way that they allow for a precise and immediate control of water temperature and flow rate;
- Showerheads or taps in kitchens or areas used in common should be equipped with a system (e.g. timer or proximity sensor) that stops water flow after a certain time span when not used.

[62] As of 18 February 2010.

[63] Umweltzeichen: Österreichisches Umweltzeichen. Richtlinie UZ TB. Tourismusbetriebe. „Beherbergungsbetriebe". Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft, Wien 2005. Available online at: http://www.umweltzeichen.at/filemanager/list/15672/

For camp sites, the Austrian requirements are the same than for tourist accommodation services, however, the maximum flow rate allowed is 10 l/min and the average that should not be exceeded is 8 l/min[64]. For gastronomy, there is only the requirement, that there should be a system to stop the water flow from taps or showerheads after a certain time when they are not used[65].

As one can see, the Austrian ecolabel requirements are very similar to the EU ecolabel criteria for tourist accommodation and campsite services. However, EU ecolabel criteria seem to be slightly tighter for accommodation services.

Czech Republic

The Czech ecolabel (Figure 44) includes criteria for hot water boilers, campsite services, and tourist accommodation services[66, 67].

Figure 44: Czech ecolabel

In accordance with the information of the Czech Environmental Information Agency the WuP-related criteria for campsite and tourist accommodation have been recently harmonised with the EU Ecolabel criteria. It is required that all taps and showerheads of an establishment do not deliver more than 9 l/min and 8 l/min of water for campsites and tourist accommodations, respectively. Currently, four accommodation services are awarded the EU Flower and two are awarded the Czech label. In total there are five Ecolabel holders in the Czech Republic. There is none campsite among them[68].

France

The French ecolabel 'was introduced in 1991[69]. So far, no water-using products are covered by the label. Also, tourist accommodations, and campsites are not included into the scheme. Instead, they are left to the European ecolabel[70].

Germany

No national legislation on minimum performance requirements for taps and showerheads exist at the moment in Germany.

The German ecolabel, the Blue Angel, has been very recently developed for showerheads.

[64] Umweltzeichen: Österreichisches Umweltzeichen. Richtlinie UZ TB. Tourismusbetriebe. „Campingplätze". Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft, Wien 2005. Available online at: http://www.umweltzeichen.at/filemanager/list/15672/

[65] Umweltzeichen: Österreichisches Umweltzeichen. Richtlinie UZ TB. Tourismusbetriebe. „Gastronomiebetriebe". Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft, Wien 2005. Available online at: http://www.umweltzeichen.at/filemanager/list/15672/

[66] Cenia: Eco-labelling in the Czech Republic. Eco-label and Environmentally Friendly Products and Services. National programme of labelling environmentally friendly products and services. Czech Environmental Information Agency, Prague 2006. Available online at: http://www.ekoznacka.cz/web/www/web-pub-en.nsf/$pid/MZPMSFJ9H2U6

[67] See http://www.ekoznacka.cz for more information.

[68] Information received directly from the Czech Environmental Information Agency as a feedback to the Report Product definition, October 2010.

[69] See http://www.marque-nf.com/pages.asp?ref=gp_reconnaitre_nf_nfenvironnement&Lang=English for more information.

[70] See http://www.ecologie.gouv.fr/ecolabels/article.php3?id_article=2.

Hungary

The Hungarian ecolabel scheme was set up in 1993[71]. Apparently, only about 60 products have been awarded with the national ecolabel[72]. The ecolabel scheme includes tourist accommodation services. However, we could not find out if there are still criteria or if they were suspended.

Poland

The Polish ecolabel is based on the same criteria for products and services that are covered by the EU ecolabel. This includes water-related criteria for campsites and tourist accommodation.

In addition, national criteria were developed for other product groups (so far, none of them WuP)[73]. Also, criteria from the Nordic Swan for some product groups were adopted, however, again, no WuP are included.

Portugal

The General Regulation for Water and Drainage of Residual Waters in Public and Residential Building Systems from 1995 establishes requirements for the design of water supply systems[74]. However, no water efficiency related criteria are included.

The National Association for Quality in Building Installations (ANQIP) operates a water efficiency labelling scheme (Figure 45). The scheme exists since 2008. The water efficiency of the products is rated from E (lowest) to A++ (highest). Criteria exist for flushing cisterns, showerheads, and shower systems [75] and taps.

Figure 45: ANQIP water efficiency label in Portugal

The criteria for shower and shower heads as well as the proposed criteria for taps are summarised in Table 37.

[71] See http://okocimke.kvvm.hu/public_eng/?ppid=2200000 for more information.
[72] See: http://www.kornyezetbarat-termek.hu/15vh.htm
[73] See http://www.pcbc.gov.pl/index.php?option=com_content&view=article&id=321&Itemid=639 for information.
[74] Anonymous: Regulamento Geral dos Sistemas Públicos e Prediais de Distribuição de Água e de Drenagem de Águas Residuais. Decreto Regulamentar nº 23/95 de 23-08-1995. Diário da República nº 194 Série I Parte B de 23/08/1995, Lisboa. Available online at: http://dre.pt/pdfgratis/1995/08/194B00.pdf .
75 Silva-Afonso A & Pimentel-Rodrigues C: Water efficiency of products. The Portuguese system of certification and labelling. Coimbra 2010

Table 37: ANQIP water efficiency rating scheme

Labelling class	Showers and shower systems*	Bathroom taps**	Kitchen taps**
A++	-	-	-
A+	$Q \leq 5$	-	-
A	$5 < Q \leq 7.2$	$Q \leq 2$	$Q \leq 4$
B	$7.2 < Q \leq 9$	$2 < Q \leq 4$	$4 < Q \leq 6$
C	$9 < Q \leq 15$	$4 < Q \leq 6$	$6 < Q \leq 8$
D	$15 < Q \leq 30$	$6 < Q \leq 8$	$8 < Q \leq 10$
E	$30 < Q$	$8 < Q$	$10 < Q$

* The rating improves by one class if the shower is equipped with a thermostatic tap or an eco-stop function;
** The rating improves by one class if the tap is equipped with am aerator or an eco-stop function;
*** Q: water flow rate in l/min

Ireland

Since 2008, the Irish Building Regulations ask for the installation of water closets showing a maximum flush volume of 6 litres[76]. For manually activated flushing devices, dual flush toilets are mandatory. This applies also to the replacement of old WC suites. Other WuP are not covered by the Building Regulations.

The 2007 water services act only allows local water services authorities to prohibit the use of e.g. hosepipes for garden watering, car washing, or filling of swimming pools[77].

Italy

In Italy, no national legislation exists to reduce water consumption. However, in some municipalities, specific regulations have been introduced. For example, the building regulations of Avigliana (Piedmont region) include specifications on toilet, tap and shower water use for new and renovated buildings. Maximum flow rates are set to 8-12 l/min for all taps of bathrooms and showers except for bathtub taps[78].

Another example is the city of Sassari in Sardinia. Here, a regulation asks for the installation of aerators in all taps in bathrooms and kitchen (except for bathtub taps) to reduce the maximum water flow to 8 l/min[79].

Latvia

The 'Green Certificate' in Latvia (Figure 46) is awarded to environmental friendly accommodation services.[80] Concerning water use, the scheme includes both compulsory and point score criteria.

76 Anonymous: Building Regulations 2008. Technical Guidance Document G: Hygiene. Environment, Heritage and Local Government, Dublin 2008. Available online at: http://www.oireachtas.ie/documents/bills2http://www.environ.ie/en/Publications/DevelopmentandHousing/BuildingStandards/FileDownLoad,18514,en.pdf8/acts/2007/a3007.pdf.

77 Anonymous: Water Services Act 2007. Number 30 of 2007. Ireland. Available online at: http://www.oireachtas.ie/documents/bills28/acts/2007/a3007.pdf.

78 Città di Avigliana: Regolamento Edilizio. Testo Integrato cos'i come emendato in C.C. del 10 Aprile 2007. Allegato energetico – ambientale al Regolamento Edilizio della città di Avigliana. Available online at: http://www.comune.avigliana.to.it/comune/risorse/regolamenti/area_ed_priv/ALLEGATOENERGETICO.pdf.

79 Città di Sassari: Regolamento energetico – ambientale 2008. Available online at: http://www.comune.sassari.it/comune/regolamenti/energetico_ambientale.htm.

80 See http://www.celotajs.lv/cont/prof/quality/certificates_en.html and http://eco.celotajs.lv/ for more information.

Figure 46: Latvian Green Certificate for tourist accommodation services

To be awarded the label, it is obligatory that taps and toilets do not have any leaks and that taps and showerheads are equipped with water flow controlling devices. As point score criteria, taps and showerheads should not have flow rates exceeding 8 l/min and 10 l/min, respectively[81]. So far, the label has been awarded to 76 accommodation services[82].

Lithuania

The ecolabel scheme of Lithuania was set up in 2001. The ecolabel criteria are harmonised with the EU ecolabel criteria. However, according to[83], there is no labelled product available yet. No information on the product groups covered by the scheme could be found. Most probably, they are also the same than in the EU flower scheme.

Luxembourg

In Luxembourg, an ecolabel for tourist accommodation services exist (Figure 47). The ecolabel can be awarded to hotels, camp sites, holiday apartments and accommodations for groups (e.g. youth hostels)[84].

Figure 47: Luxembourgian ecolabel for tourist accommodation services

The obligatory criteria include the following: water flow rate of showers and taps should not exceed 12 l/min and 10 l/min, respectively. Taps have to be single-lever taps. Toilet flush and urinal flush is limited to 6 l/min and 4 l/min, respectively[85].

81 Green Certificate Regulation: "Green Certificate" Regulation. Requirements for tourism establishments in rural areas and small towns in Latvia. Riga 2002. Available online at: http://eco.celotajs.lv/files/ZSN_kriterij_en.DOC

82 As of 17 February 2010. See a full list of all accommodations at: http://www.celotajs.lv/Hotel/.

83 Kaunas Regional Development Agency: Promoting Environmental Procurement in Kaunas Region. The most popular eco-labels. Environmental Projects Management Agency of the Ministry of Environment of the Republic of Lithuania & Kaunas Regional Development Agency, Kaunas 2009. Available online at: http://www.krda.lt/eko/en/ecolabels/popular

84 See http://www.oeko.lu/index.php?idusergroup=12 for more information.

85 OekoZenter: EcoLabel für Tourismusbetriebe des Großherzogtums Luxemburg. Kriterienkatalog gültig ab 1. Januar 2008. OekoZenter/Ministère des Classes moyennes, du Tourisme et du Logement, Luxembourg 2008. Available online at: http://www.oeko.lu/forcedownload.php?iddownload=330&type=_pdf_

The Netherlands

In accordance with the information received from the Dutch Ministry of Housing, Spatial Planning and the Environment[86], the environmental label 'Milieukeur' can not be obtained anymore by tourist accommodations, nor by campsites, as EU Ecolabel can be obtained for these services.

Before, the Dutch ecolabel (Figure 48) included campsites, hotels, and tourist accommodation services.[87]

The campsite criteria included compulsory and optional criteria. For water use, the compulsory requirements were[88]:

- Maximum flow rate of 8.5 l/min for bathroom taps;
- Maximum flow rate of 9 l/min for kitchen taps;
- Maximum flow rate of 8.5 l/min for showerheads.

The optional requirements included maximum flow rates of 6 l/min for taps and showerheads. In addition, criteria were included for toilet flushing, urinals, water consumption of dishwashers and washing machines as well as temperature regulation of taps and automatic shut-off showers.

Figure 48: Dutch ecolabel

For tourist accommodations, the criteria were the same than for campsites. However, the mandatory criterion for kitchen taps was also set at 8.5 l/min[89]. The optional criteria were the same.

Nethertheless, the Milieukeur label can not be obtained anymore by tourist accommodations, nor by campsites.

Nordic countries ecolabel (Denmark, Sweden, Finland, Iceland, and Norway) does not cover taps or showerheads as individual product groups. However, criteria on car-wash facilities and washing machines are included.

The ecolabel criteria for restaurants do not state any obligatory requirements for taps or showerheads but it includes point score requirements for taps: "all rinsing taps for dishwashing are fitted with a "dead man's handle", i.e. they shut off when the lever is released, or are sensor controlled"[90].

[86] Information received directly from the Dutch Ministry of Housing, Spatial Planning and the Environment as a feedback for Report Product definition, October 2010.

[87] See http://www.milieukeur.nl/ for more information.

[88] Certificatieschema Kampeerterreinen. SMK REC.9. MK.51. Stichting Milieukeur 2009. Available online at: http://www.smk.nl/files/categories/6/619/REC-SCHEMA_NL9.pdf

[89] Certificatieschema Toeristische Accommodaties. SMK HOR.3. MK.65. Stichting Milieukeur 2007. Available online at: http://www.smk.nl/files/certificates/HORSCHEMA_NL3.pdf

[90] Nordic Ecolabelling: Nordic Ecolabelling of Restaurants. Version 1.1. 13 December 2006 – 31 December 2011. Nordic Ecolabelling, 2008. Available online at: http://www.svanen.nu/sismabmodules/criteria/getfile.aspx?fileid=102149001

For hotels and youth hostels, the Swan includes more criteria on water use than for restaurants[91]. With respect to taps, a point score criteria asks for 90 % of mixer taps for wash basins with a maximum flow rate below 8 l/min. For guest rooms, 90 % of the showerheads should have a maximum flow rate below 10 l/min and 90 % of the mixer taps should be single-lever taps or sensor equipped[91].

Slovakia

The ecolabel in Slovakia (introduced in 1996) can also be awarded to accommodation services[92].

The obligatory requirements concerning WuP is that water flow from taps and showers shall not exceed 12 litres per minute[93]. The optional criteria (point score) are the following: The average flow from taps and showerheads excluding bath taps shall not exceed 8.5 litres per minute. At least 80 % of WCs shall consume six litres per flush or less.

Figure 49: Slovak ecolabel

At least 80 % of taps allow quick and accurate temperature and water flow. Showers in kitchens or outdoor showers should be equipped with an automatic system to stop the water flow automatically when not in use[93]. So far, only one hotel has been awarded the Slovak ecolabel[94].

Spain

The Spanish national building codes were approved in March 2006[95]. The code includes a section on water saving. Here, the following requirements are mentioned[96]:

- Water meters for both cold and hot water should be available for every single unit of consumption;
- The domestic hot sanitary water piping should include a return tube when the distance between the boiler and the farthest final discharge point is more than 15 m;
- In buildings with access for the public, taps have to be equipped with water saving devices.

Besides the national building codes, regulations on regional and/or local level exist. In Catalonia, a decree from 1998 addresses water saving devices in public buildings. It prescribes that when new buildings are erected or a major renovation is taking place, water using devices (taps, showerheads,

[91] Nordic Ecolabelling: Nordic Ecolabelling of Hotels and Youth Hostels. Version 3.2. 14 June 2007– 30 June 2012. Nordic Ecolabelling, 2008. Available online at: http://www.svanen.nu/sismabmodules/criteria/getfile.aspx?fileid=102149001

[92] See http://www.enviro.gov.sk/ for more information.

[93] SAZP: Ministerstvo životného prostredia Slovenskej republiky. Oznámenie o určení skupiny produktov a osobitných podmienkach na udelenie národnej environmentálnej značky. Skupina produktov: Ubytovacia služba. Slovak Environmental Agency, 2008. Available online at: http://www.sazp.sk/public/index/open_file.php?file=CEM/EVP/RegisterOznameni/Oznamenie_c01-08.doc

[94] SAZP: Produkty, ktoré majú právo používať značku "Environmentálne vhodný produkt". Slovak Environmental Agency, 2010. Available online at: http://www.sazp.sk/public/index/open_file.php?file=CEM/EVP/RegisterEVP/Register_produktov_so_znackou_EVP.doc

[95] Ministerio de Vivienda: Real Decreto 314/2006, de 17 de marzo, por el que se aprueba el Código Técnico de la Edificación. Boletín Oficial del Estado 74 (2006) 11816-11831. Available online at: http://www.boe.es/boe/dias/2006/03/28/pdfs/A11816-11831.pdf

[96] Ministerio de la Vivienda: El Código Técnico de la Edificación. Documento Básico HS. Salubridad. 2009. Available online at: http://www.codigotecnico.org/fileadmin/Ficheros_CTE/Documentos/CTEabr09/DB%20HS%20abril%202009.pdf

bidets, wash basins, sinks, and toilets) have to show a feature that allows for water saving. Toilets have to be equipped with a mechanism that allows interrupting the water flow[97].

A list of other Spanish municipalities or autonomous communities which have legislation in place to save water is presented in[98]. In general, the regulations ask for taps in public buildings being equipped with timers or other devices to stop the water flow automatically when 1 litre of water was discharged (e.g. in Alcobendas, Barberà del Vallès, Camargo, Castro Urdiales, Madrid, Sant Cugat del Vallès, San Cristóbal de Segovia). In some regions, the same also applies to public showers (e.g. in Madrid).

In Madrid, additionally, the maximum water flow rate for taps and showers for new buildings is set to 10 l/min by a municipal ordinance[99]. In San Cristóbal de Segovia, new buildings should be only equipped with single-lever mixers, which are equipped with aerators or other water-saving devices that allow for a maximum flow rate of 8 l/min only. For showers, a maximum water flow of 10 l/min is allowed only[100].

The ecolabel **'Distintiu de Garantia de Qualitat Ambiental'** (emblem of guarantee of environmental quality) of Catalonia (Figure 50) was established in 1994[101]. It covers in total about 30 product groups. Since 2001, the ecolabel is also awarded to products that save water. Eligible products include toilets, showerheads, taps, toilet retrofit devices for water saving, and other systems that offer water savings of at least 20 %[102].

Figure 50: Catalonian ecolabel

[97] Anonymous: Decreto 202/1998, de 30 de julio, por el que se establecen medidas de fomento para el ahorro de agua en determinados edificios y viviendas. Diari Oficial de la Generalitat de Catalunya 2697 (1998) 10052. Available online at: http://mediambient.gencat.net/binLegis/983829e.pdf

[98] Ecología y Desarrollo: Lo público debe ser ejemplar. Ecología y Desarrollo, Zaragoza 2009. Available online at: http://www.agua-dulce.org/htm/legislacion/legislacion_efic_espana_1.asp

[99] Anonymous: Ordenanza de Gestión y Uso Eficiente del Agua en la Ciudad de Madrid. Boletín oficial del Ayuntamiento de Madrid 5709 (2006) 2410-2443. Available online at: http://www.munimadrid.es/UnidadesDescentralizadas/UDCBOAM/Contenidos/Boletin/2006/Ficheros/22062006.pdf

[100] Anonymous: Ordenanza municipal para el ahorro en el consumo de agua en San Cristóbal de Segovia. Boletín oficial de la provincia de Segovia 20 (2005). Available online at: http://www.dipsegovia.es/uploads/bops/N20_160205.pdf

[101] Anonymous: Decreto 316/1994, de 4 de novembre, sobre atorgament del distintiu de garantia de qualitat ambiental per la Generalitat de Catalunya. Diari Oficial de la Generalitat de Catalunya 2697 (1988) 10052. Available online at: http://mediambient.gencat.cat/Images/43_72176.pdf

[102] Anonymous: Resolució de 15 de gener de 2001, per la qual s'estableixen els criteris mediambientals per a l'atorgament del distintiu de garantia de qualitat ambiental als productes i als sistemes que afavoreixen l'estalvi d'aigua. Diari Oficial de la Generalitat de Catalunya 3321 (2001). Available online at: http://mediambient.gencat.net/cat/el_departament/actuacions_i_serveis/legislacio/ecoprod/resoluci__15_01_2001.jsp?ComponentID=2307&SourcePageID=3872

The requirements are a maximum flow rate of 10 l/min for fixed and mobile showerheads, and 8 l/min for lavatory, bidet and sink faucets. Flow limiters should allow for a maximum flow rate of 10 l/min. For taps, the maximum allowed flow rate is 8 l/min[103].

Altogether, about 17 manufacturers have joined the label in the area of water saving products. The label was awarded to between 750 and 800 water using products.

Like in Austria or in the Nordic countries, the Catalonian ecolabel is also awarded to accommodation services. Eligible are campsites, hotels, youth hostels, and rural tourist accommodation services. Taps, showerheads, and toilet flushes have to be water efficient or have to be equipped with water saving devices according to ecolabel for water saving products, in general. The criteria are optional point score criteria. Showerhead should show flow rates less than 10 l/min or they should be ecolabelled. For taps, a maximum flow rate of 8 l/min is allowed, or they should be ecolabelled taps. Toilet flushes should operate with less than 6 litres per flush or should be ecolabelled[104, 105, 106, 107]. For office buildings, the same criteria apply[108].

The Catalonian ecolabel can also be awarded to establishments that own a network of branch offices with access of the public (e.g. post offices, banks, travel agencies. Here, the following obligatory criteria apply: 50 % of the basin taps have to show a flow rate of less than 12 l/min or should be ecolabelled, 50 % of toilets should use not more than 6 litres per flush or should be ecolabelled. As an additional point score, taps should use less than 8 l/min or should be ecolabelled, and toilet flush should use less than 6 litres per flush or should be ecolabelled[109].

Sweden

The Swedish building regulations include criteria on tap water flow in the section on hygiene, health and the environment[110]. The regulations are mainly concerned with hygienic and health issues (e.g. microbial growth, scalding, back flow). The general recommendations ask for a design of water pipes

[103] Anonymous: Resolución MAH/2407/2009, de 29 de abril, por la que se establecen los criterios ambientales para el otorgamiento del distintivo de garantía de calidad ambiental a los productos y a los sistemas que favorecen el ahorro de agua. Diari Oficial de la Generalitat de Catalunya 5460 (2009) 66627-66632. Available online at: http://www.mediambient.gencat.cat/cat/empreses/ecoproductes_i_ecoserveis/pdf/criteris_ambientals/cast/040.pdf

[104] Anonymous: Resolución MAH/1239/2007, de 11 abril, por la que se establecen los criterios ambientales para el otorgamiento del distintivo de garantía de calidad ambiental en los campings. Diari Oficial de la Generalitat de Catalunya 4876 (2007) 15654-15657. Available online at: http://www.mediambient.gencat.cat/cat/empreses/ecoproductes_i_ecoserveis/pdf/criteris_ambientals/cast/090.pdf

[105] Anonymous: Resolución MAH/4041/2007, de 30 de noviembre, por la que se establecen los criterios ambientales para el otorgamiento del distintivo de garantía de calidad ambiental a los establecimientos hoteleros. Diari Oficial de la Generalitat de Catalunya 5053 (2008) 5558-5570. Available online at: http://www.mediambient.gencat.cat/cat/empreses/ecoproductes_i_ecoserveis/pdf/criteris_ambientals/cast/140.pdf

[106] Anonymous: Resolución MAH/2107/2009, de 29 de abril, por la que se establecen los criterios ambientales para el otorgamiento del distintivo de garantía de calidad ambiental a las instalaciones juveniles. Diari Oficial de la Generalitat de Catalunya 5429 (2009) 59273-59285. Available online at: http://www.mediambient.gencat.cat/cat/empreses/ecoproductes_i_ecoserveis/pdf/criteris_ambientals/cast/130.pdf

[107] Anonymous: Resolución MAH/2151/2009, de 15 de julio, por la que se establecen los criterios ambientales para el otorgamiento del distintivo de garantía de calidad ambiental en los establecimientos de turismo rural. Diari Oficial de la Generalitat de Catalunya 5431 (2009) 60093-60103. Available online at: http://www.mediambient.gencat.cat/cat/empreses/ecoproductes_i_ecoserveis/pdf/criteris_ambientals/cast/160.pdf

[108] Anonymous: Resolución MAH/1390/2006, de 24 de abril, por la que se establecen los criterios ambientales para el otorgamiento del distintivo de garantía de calidad ambiental a los edificios de uso de oficinas. Diari Oficial de la Generalitat de Catalunya 4632 (2006) 21411-21415. Available online at: http://www.mediambient.gencat.cat/cat/empreses/ecoproductes_i_ecoserveis/pdf/criteris_ambientals/cast/250.pdf

[109] Anonymous: Resolución MAH/1389/2006, de 27 de abril, por la que se establecen los criterios ambientales para el otorgamiento del distintivo de garantía de calidad ambiental a las redes de oficinas con atención al público. Diari Oficial de la Generalitat de Catalunya 4632 (2006) 21408-21411. Available online at: http://www.mediambient.gencat.cat/cat/empreses/ecoproductes_i_ecoserveis/pdf/criteris_ambientals/cast/240.pdf

[110] Anonymous: Building Regulations. Mandatory provisions and general recommendations. Section 6 Hygiene, health and the environment. Swedish Board of Housing, Building and Planning, 2006. Available online at: http://www.boverket.se/Global/Webbokhandel/Dokument/2008/BBR_English/6_Hygiene_health_and_the_environment.pdf

and placement of water heaters in such a way that "hot tap water can be obtained within approximately 10 seconds with a flow of 0.2 l/s"[110] which corresponds to 12 l/min.

The Swedish standard SS 820000:2010 includes a testing scheme for a proposed energy labelling of taps[111]. An energy certification scheme based on the standard was currently proposed[112].

United Kingdom

The Water Supply (Water Fittings) Regulations 1999 set minimum standards for the water use of WCs, washing machines, dishwashers, and washer driers[113]. No requirements for taps or showerheads are provided. The Water Supply (Water Fittings) Regulations 1999 will undergo a revision in 2009. Most probably, the new regulations will also include maximum permitted water use for showers or taps.

The Code for Sustainable Homes, introduced in 2007, rates the sustainability of a house. Criteria include minimum standards for energy and water use. From May 2008, the code is mandatory for all newly erected buildings. Concerning water use, the current guidance document includes only overall potable water use criteria, i.e. the water consumption per person and day is rated[114]. The latest version of the guidelines entered in force in June 2009[115] does not change the criteria for water use. Total water use will be limited to 80 to 120 l per person and day depending on efficiency level. However, water use of the building has to be assessed using the water efficiency calculator. The methodology used here calculates water use according to micro-components, e.g. toilets, taps, bathtubs, dishwashers[116]. However, no minimum performance standards for taps and showerheads have been introduced so far.

As a voluntary measure, the Waterwise Marque (Figure 51) is "awarded annually to products which reduce water wastage or raise the awareness of water efficiency"[117]. So far, 27 labels have been awarded to a large variety of product groups. These include e.g. dishwashers, showerheads, recycling products, tap flow restrictors, or shower timers.

[111] SS 820000:2010 Sanitary tapware – Method for determination of energy efficiency of mechanical basin and sink mixing valves

[112] Wahlström Å: Test methods and scheme rules for energy labelling of tap water devices. ECEEE 2009 Summer Study, 1-6 June 2009, La Colle sur Loup, France. Available online at: http://www.energy-management.se/attachments/documents/40/4033_wahlstrom.pdf

[113] Anonymous: The Water Supply (Water Fittings) Regulations 1999. Statutory Instrument 1999 No. 1148. Available online at: http://www.opsi.gov.uk/si/si1999/19991148.htm

[114] Department for Communities and Local Government: The Code for Sustainable Homes. Setting the standard in sustainability for new homes. February 2008. Department for Communities and Local Government, London 2008. Available online at: http://www.communities.gov.uk/documents/planningandbuilding/pdf/codesustainhomesstandard.pdf

[115] Department for Communities and Local Government: Code for Sustainable Homes. Technical Guide. May 2009. Version 2. Department for Communities and Local Government, London 2009. Available online at: http://www.planningportal.gov.uk/uploads/code_for_sustainable_homes_techguide.pdf

[116] Department for Communities and Local Government: The Water Efficiency Calculator for new dwellings. The Government's national calculation methodology for assessing water efficiency in new dwellings in support of: The Code for Sustainable Homes, May 2009 and subsequent versions; The Building Regulations 2000 (as amended); The Building (Approved Inspector etc) Regulations 2000 (as amended). Department for Communities and Local Government, London 2009. Available online at: http://www.planningportal.gov.uk/uploads/br/water_efficiency_calculator.pdf

[117] More information is provided at: http://www.waterwise.org.uk/reducing_water_wastage_in_the_uk/house_and_garden/waterwise_marque.html

Figure 51: Waterwise Marque in the United Kingdom

Overview over mandatory and voluntary legislation in EU Member States

An overview over both mandatory and voluntary legislation in place in the EU Member States is given in Table 38.

Table 38: Mandatory and voluntary legislation covering taps and showerheads in EU Member States

Country	Type	Criteria	Comment
Austria	Voluntary	Maximum flow rate of 6 l/min for bathroom/toilet taps Maximum flow rate of 9 l/min for kitchen taps Maximum flow rate of 12 l/min for bathtub taps and showerheads	Ecolabel for water efficient sanitary tapware
	Voluntary	Maximum flow rate of 12 l/min for taps and showerheads Maximum average flow rate of 8.5 l/min for all taps and showerheads	Ecolabel for tourist accommodation services
	Voluntary	Maximum flow rate of 10 l/min for taps and showerheads Maximum average flow rate of 8 l/min for all taps and showerheads	Ecolabel for campsites
Czech Republic	Voluntary	Maximum flow rate of 9 l/min for taps and showerheads for campsites Maximum flow rate of 8 l/min for taps and showerheads for tourist accommodation services	Ecolabel for tourist accommodation services and campsites
Portugal	Voluntary	Classification system (A++ to E), different criteria for kitchen taps, bathroom taps, and showerheads	ANQIP water efficiency labelling scheme
Italy	Mandatory	Maximum flow rates of 8-12 l/min for taps except for bathtub taps	In some municipalities
Latvia	Voluntary	Maximum flow rate of 8 l/min for taps and 10 l/min for showerheads	Ecolabel for tourist accommodation services
Luxembourg	Voluntary	Maximum flow rate of 10 l/min for taps and 12 l/min for showerheads Taps have to be single-lever taps	Ecolabel for tourist accommodation services
Denmark, Sweden,	Voluntary	Rinsing taps equipped with dead man's handle to switch off when lever is	Nordic Swan for restaurants

Country	Type	Criteria	Comment
Finland, Iceland, Norway		released or sensor control	
	Voluntary	90 % of mixer taps less then 8 l/min 90 % of showerheads less than 10 l/min 90 % of mixer taps should be single-lever taps or sensor-equipped	Nordic Swan for hotels and youth hostels
Slovakia	Voluntary	Maximum flow rate of 12 l/min for taps and showerheads	Ecolabel for accommodation services Optional (point score criteria), the average maximum flow rate from all taps and showerheads (excl. bathtub) is 8.5 l/min
Spain	Mandatory	Water meters should be available for every single unit of consumption Taps in buildings with access for the public have to be equipped with water saving devices	National building codes
	Mandatory	Water using devices in public buildings have to be equipped with water saving devices	Regional regulations (e.g. Catalonia)
	Mandatory	Taps in public buildings equipped with switch off mechanisms	In some municipalities. In some regions, this also applies to showers
	Mandatory	Maximum flow rates of 10 l/min for taps and showers in new buildings	Madrid
	Mandatory	Maximum flow rates of 8 l/min for taps and 10 l/min for showers in new buildings	San Cristóbal de Segovia
	Voluntary	Maximum flow rate of 8 l/min for taps and 10 l/min for showers	Ecolabel in Catalonia for water using equipment
	Voluntary	Maximum flow rate of 8 l/min for taps and 10 l/min for showers	Ecolabel in Catalonia for tourist accommodation services and campsites
Sweden	Mandatory	Hot tap water should be obtained after 10 seconds with 12 l/min	Swedish building regulations (hygiene sections)
United Kingdom	Voluntary	Total water use limited to 80-120 l/min and person	Code for sustainable homes. Overall water consumption is rated. No criteria for individual WuP exist
	Voluntary	No fixed criteria	Waterwise marque
	Voluntary	Maximum flow rate of 6 l/min for taps and 13 l/min for showerheads	BMA water label

From the overview of the legislation in place, the following conclusions can be drawn:

- In general, no mandatory legislation is in place except for some Member States;
- Mandatory legislation is usually due to national building codes;

- Often, mandatory legislation exists only on regional or municipal level.
- Mandatory legislation usually covers toilets. In some cases, also taps and showerheads are included;
- Voluntary legislation exist most often in the form of an ecolabel scheme;
- Ecolabel schemes that include criteria for taps and showerheads are mainly criteria for accommodation services, only sometimes, there are ecolabel criteria for WuP;
- The voluntary labelling schemes usually are pass-fail (endorsement) types of label; in one Member State, also a rating scheme according to efficiency class (comparative label) is in place;
- Other voluntary measures on Member State level include codes or guidelines for sustainable buildings.

Other Ecolabels

Apart from the above described legal acts and labelling schemes existing in various Member States a more detailed presentation of two industrial labels and two non-European water-efficiency ecolabel schemes, considered of relevance, is given below. Outside the EU there are among other the Japanese 'Eco-Mark', the WELS schemes in Singapore or the Swiss energy label.

Further information on non-European countries legislation on sanitary tapware and their schemes can be found in Product Definition report of the ECOTAPWARE project (see chapter 1.4)[118].

The four below described labels are:

- WELL – Water Efficiency Label, recently developed by the EUnited,
- WEPLS - Water Efficient Product Labelling Scheme operated by the Bathroom Manufacturers Association in the United Kingdom,
- United States Environmental Protection Agency WaterSense label
- and the Australian WELS - Water Efficiency Labelling Scheme.

WELL – Water Efficiency Label[119]

A new system of classification (rating) of sanitary products – Water Efficiency Label (WELL) – has just recently been developed by the EUnited Valves. The label is intended to be awarded EU-wide. Among others the criteria for wash basin and kitchen valves, shower valves and showerheads are included; while bath filling valves are excluded from its scope. Pressure-dependant and pressure-independent restrictive solutions are considered in this scheme. Three evaluation criteria constitute the basis of this classification: volume (flow limit), time (only for non-domestic products) and temperature. For each criterion a product can be awarded with a maximum of 2 stars. In total a maximum of 6 stars can be

[118] Product definition report, available on the project website: http://susproc.jrc.ec.europa.eu/ecotapware/stakeholders.html
[119] For details see the website of WELL http://www.well-online.eu/ and the document: WELL - Water Efficiency Labelling - Classification scheme for sanitary valves, accessed February 2011

achieved for non-domestic products and 4 stars for domestic appliances. Depending on the total number of stars a product is assigned to one of six, respectively four – in the domestic products sector, classes.

The single criteria are briefly described below.

Volume (flow limit)

The maximum and minimum flow rate for all product groups, i.e. basin taps, kitchen taps and showerheads are shown in Table 39. Among water devices which can be used in the products awarded with WELL label are spray regulators, regulating angle valves, valves with an economy button and cartridges with a water economy position. In the last two the economy setting must be the default setting; if a higher flow is required it can be achieved, but must require conscious user intervention.

Table 39: WELL classification scheme regarding the flow rate

	Wash basin valves		Kitchen valves		Shower valves/shower heads/shower hoses	
	Pressure-dependant solutions	Pressure-independent solutions	Pressure-dependant solutions	Pressure-independent solutions	Pressure-dependant restrictive solutions	Pressure-independent volume-regulating solutions
Max flow rate [l/min]	9	6	12	9	12*	6
Min flow rate [l/min]	6	4	9	6	9	4.5
Pressure [bar]	3	3	3	3	3	3
Number of stars	1	2	1	2	1	2

*at 2 bar flow pressure

Time (for non-domestic premises)

This criterion refers to the use of time-controlled self-closing valves with or without sensor activation with the flow time below 10 seconds for kitchen and bath valves and below 20 seconds for showerheads if the product should be given 1 star. In order to receive 2 stars the valve has to be equipped with a sensor with use-dependant on/off function (see Table 40).

Table 40: WELL classification scheme regarding time (for non-domestic premises)

	Wash basin valves and kitchen valves		Showerheads	
	Time-controlled self-closing valves with or without sensor activation	Sensor valves with use-dependent on/off function	Time-controlled self-closing valves with or without sensor activation	Sensor valves with use-dependent on/off function
Time control [s]	≤ 10		≤ 20	
Number of stars	1	2	1	2

Temperature

This criterion covers the solutions with the flow-independent temperature setting for 1 star product rating (achieved e.g. through the use of thermostat valves or single lever valves). 2 star rating can be given for solutions based on devices which limit draw-off temperatures (thermostat valves with by-passable or permanently set hot water stop, single lever valves and other mixers equipped with devices limiting the admixture of hot water (e.g. manual devices limiting the opening angle of the operating element); as well as to cold water valves.

WEPLS - The Water Efficient Product Labelling Scheme[120]

Another European ecolabelling scheme is the WEPLS - the Water Efficient Product Labelling Scheme, supported by United Kingdom Bathroom Manufacturing Association's (BMA). This is a voluntary scheme open to companies manufacturing and selling their products in the UK. It was established in September 2007. It covers among others taps and combination tap assemblies for use with wash basins and bidets, shower controls and shower handsets.

This is a rating scheme, which distinguishes it from the planned EU Ecolabel scheme (which is a pass/fail system). A water efficiency rating system across all covered product categories is set with water flow ranges. The flow rate is the only criteria set in this scheme, assuming that the products have to fulfil all respective UK regulatory requirements.

In reference to taps (including self closing and electronic taps) and combination tap assemblies five classes for flow rates are defined (however, four qualify the product for being eligible to be awarded the label). The recorded flow should not exceed the value of 10 l/min to receive the WEPLS label. For shower controls, including bath shower mixers, and shower handsets a nominal flow rate of not more than 13 l/min per minute is set. An exact flow value can be also shown on the label.

The ranges of water flow rate for both product groups, i.e. taps and showerheads, are shown in Table 41. The flow rate is the only parameter assessed in the scheme.

Table 41: Water flow ranges in WEPLS scheme

Taps [l/min]	Mixer showers [l/min]
4 or less	6 or less
6 or less	8 or less
8 or less	10 or less
10 or less	13 or less
greater than 10	greater than13

WaterSense[121]

The WaterSense labelling scheme for high efficiency lavatory faucets and showerheads was released in 2007 and is supported by the United States Environmental Protection Agency. In reference to taps it

[120] The Water Efficient Product Labelling Scheme, for more information please see http://www.water-efficiencylabel.org.uk/

[121] US EPA WaterSense – High-Efficiency Lavatory Faucet Specification, available online at: http://www.epa.gov/WaterSense/docs/faucet_spec508.pdf, accessed February 2011

covers products installed in private use (residences, but also restrooms in hotels and hospitals); however, it does not apply to the products in public use and in residential kitchens.

The system is based on water-efficiency criteria and performance criteria. The following criteria are included in the scheme: **a maximum flow rate, a minimum flow, non-adjustability criteria** and **criteria concerning the flow marking**. For showerheads two additional criteria, called the performance criteria are established as a result of customer testing conducted by WaterSense. The first is defined as **spray force**, the second as **spray coverage**. The procedures for testing of these criteria are described in detail in Appendices A and B, respectively, contained in the WaterSense Specification for Showerheads[122].

The maximum flow rate set for lavatory faucets is 5.7 l/min at pressure of around 4.1 bars at the inlet (60 psi); while the minimum flow rate is set at 3 l/min at the pressure of 1.4 bars. A tap equipped with a device allowing fulfilling these requirements (e.g. flow restrictor, flow regulator, aerator) also meets this ecolabel criterion.

In reference to the showerheads, the maximum flow rate must be equal to or less than 7.6 l/min, while the minimum flow rate shall not be less than 60 % of the maximum flow rate (measured at the pressure of 1.4 bars). For multimode showerheads all modes must meet this maximum flow rate value and at least one of the modes must meet all requirements set in the criteria specification (maximum and minimum flow rates, spray force and coverage).

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 exceed the maximum flow rate. Also the maintenance instruction shall explain how to return the product to its intended maximum flow rate after cleaning or exchanging the faucet accessories.

WELS – the Water Efficiency Labelling and Standards scheme[123]

The Water Efficiency Labelling and Standards scheme is an example of a mandatory scheme (valid from 1 July 2006), which sets the criteria "for rating the water efficiency and/or performance" of certain products covered by the Australian and New Zealand Standard AS/NZS 6400:2005 Water-efficient products – Rating and labelling. It replaced the voluntary water saving rating label, established by the Water Services Association of Australia.

WELS is also a ranking scheme, in which the classes are displayed in the form of stars and additionally the flow is displayed on the label. The more stars are displayed on the label (max of six) and the lower the number (which indicates the **water flow**), the better the water efficiency of a given product.

WELS covers among others tap equipment, showers and (optionally) flow controllers. The flow rate requirements for the Australian WELS for the product group under study are presented in Table 3 below.

[122] For detailed procedure see US EPA WaterSense – Specification for Showerheads http://www.epa.gov/WaterSense/docs/showerheads_finalspec508.pdf

[123] For more information please see the website of the Water Efficiency Labelling and Standards (WELS) Scheme http://www.waterrating.gov.au/about/index.html, accessed February 2011

Table 42: Rating specification of the WELS scheme[124] - flow rates [l/min]

Labelling class	Tap equipment, flow controllers	Showers
0 Stars	> 16 or failing the performance requirements	> 16 or failing the performance requirements
1 stars	> 12 but not > 16	> 12 but not > 16
2 stars	> 9 but not > 12	> 9 but not > 12
3 stars	> 7.5 but not > 9	> 7.5 but not > 9
4 stars	> 6 but not > 7.5	not currently available
5 stars	> 4.5 but not > 6	not currently available
6 stars	< 4.5	not currently available

The testing of the products is conducted by a National Association of Testing Authorities accredited laboratory in accordance with the respective national standards (AS/NZS 3718:2005[125] for tap equipment and AS/NZS 3662:2005[126] for showers).

In general it can be said that the key issue covered in all analysed schemes is the water flow rate. In most ecolabels a maximum water flow rate values in litters pro minute are set, sometimes different for various applications (types of products). In some schemes, e.g., WELL and WaterSense, also minimum water flow rate value is set. Apart from the criteria of the flow rate, in some ecolabels the use of certain limiting devices is recommended.

EU Ecolabel for sanitary tapware

The European Ecolabel is a voluntary scheme, established in 1992 to encourage businesses to market products and services that are kinder to the environment, identified through the Ecolabel flower logo. Currently the EU Ecolabel criteria are being developed for the product group of sanitary tapware in the framework of the "Ecotapware" project in parallel with the development of Green Public Procurement criteria for this product group.

[124] Australian/New Zealand Standard – Water efficient products – Rating and labelling AS/NZS 6400:2005
[125] AS/NZS 3718:2005 Water Supply – Tap Ware. Standards Australia & Standards New Zealand, Sydney/Wellington 2005
[126] AS/NZS 3662:2005 Performance of showers for bathing, Standards Australia & Standards New Zealand, Sydney/Wellington 2005

Studies and Other Sources of Information

The basis for this report constitute studies conducted in the frame of the Ecotapware project – a pilot study on sanitary tapware (taps and showerheads), carried out by the Joint Research Centre's Institute for Prospective Technological Studies (JRC-IPTS) in cooperation with the AEA consultancy for the European Commission's Directorate General for the Environment. This study aims to develop a joint evidence base from which EU policy making in the area of water using products can be developed, i.e. EU Ecolabel and Green Public Procurement criteria. In addition, the evidence base information and data to assist the potential future development of other environmental policy instruments shall be gathered. The study results are published at the project's website[127] in the following reports:

- Report Product definition
- Report Economic and market analysis
- Report User behaviour
- Report Base-case assessment
- Report BAT

Further, for the 1st Ad-hoc Working Group meeting for the development of Ecolabel criteria a technical background report was prepared. Information from the abovementioned reports have been used for the development of draft Green Public Procurement criteria for this ad-hoc Working Group meeting[128].

Other main sources of information used in the Ecotapware study are given below:

- CEIR – European Committee for the Valve Industry
- www.ceir-online.org/
- Clarke A., Grant, N. and Thornton, J., Quantifying the energy and carbon effects of water saving – final report, 2009, available online:
- http://www.environment-agency.gov.uk/static/documents/Business/EA_EST_Water_Report_Full.pdf
- Critchley, R. and Phipps, D., Water and Energy Efficient Showers: Project Report, 2007, available online:
- http://www.unitedutilities.com/Documents/UULJMUwaterenergyefficientshowerFinalreport23rdMay2007.pdf
- http://ec.europa.eu/enterprise/policies/sustainable-business/ecodesign/methodology/index_en.htm

[127] Ecotapware project's website: http://susproc.jrc.ec.europa.eu/ecotapware/stakeholders.html.
[128] For further reference studies and information sources used in the Ecotapware project, please consult the abovementioned reports.

- Entec, Review of Sustainable Operations targets and Sustainable Procurement Measures Final Recommendations, 2009, available online:
- http://www.ogc.gov.uk/documents/Entec_SOGE_final_report.pdf
- EUROSTAT, http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/themes
- UK Market Transformation Programme

  http://efficient-products.defra.gov.uk/
- WaterWise, Water Efficiency Retrofitting in Schools - Evidence Base for Large-scale - Water Efficiency - Phase II, Second Report, 2010, available online: http://www.waterwise.org.uk/images/site/Documents/WES/evidence%20base%20for%20large%20scale%20water%20efficiency%20-%20water%20efficiency%20in%20schools%20report%20-%20december%202010.pdf
- WaterWise, A Review – The Water and Energy Implications of Bathing and Showering Behaviours and Technologies, 2009, available online: http://www.waterwise.org.uk/images/site/Research/final%20water%20and%20energy%20implications%20of%20personal%20bathing%20-%20for%20est%20apr%2009.pdf
- WRAP: Procurement requirements for water efficiency, 2010, available online: http://www.wrap.org.uk/downloads/2011_01_19_WRAP_water_eff_model_proc_reqs_v6_FINAL.fad042fd.10378.pdf

Relevant European Legislation and Policies

Further information about current legislation for sanitary tapware at Member State level and in Third Countries can be found in relevant sections (Section 1.4.2 and 1.4.3) of the ECOTAPWARE Product definition report[129] published at the projects website. The respective information from section 1.4.1 of this report on the legislation and agreements at European Community level are given below:

Legislation and agreements at European Community level[129]

Currently, no mandatory legislation or agreements exist at European Community level currently for both water taps and showerheads. However, for other WuP, energy labelling and ecodesign measures exist which will be shortly described below. As a voluntary approach, the EU ecolabel provides some water performance criteria for accommodation and campsite services concerning showerheads and taps.

[129] From Oliver Wolf, Andreas Uihlein, Report Product definition, available online at: http://susproc.jrc.ec.europa.eu/ecotapware/stakeholders.html.

Energy labelling Directive 92/75/EEC[130]

The energy labelling Directive was introduced to allow costumers to choose energy-efficient household appliances. In addition, the consumption of other resources or additional information is included into the label (e.g. water consumption, noise). So far, energy labels are mandatory for e.g. refrigerators, freezers and their combinations, washing machines, tumble driers, dishwashers, electric ovens, water heaters.

Water consumption as a criterion was introduced for dishwashers and washing machines. For washing machines, the Commission Directive 96/89/EC asks for the water consumption in litres per cycle to be displayed on the label[131]. The same is the case for dishwashers[132].

Directive 2005/32/EC[133]

Within the framework of the Ecodesign Directive 2005/32/EC, minimum energy performance requirements will be set for dishwashers and washing machines.

For washing machines, the Regulatory Committee adopted ecodesign requirements for washing machines in March 2009. The draft regulation foresees minimum energy and washing performance criteria from July 2010 on[134]. In addition, the water consumption will be limited.

The ecodesign implementing measures for dishwashers still have to be discussed by the Regulatory Committee. The current proposals that have passed the consultation forum foresee minimum energy and cleaning performance requirements only[135]. The water consumption benchmarks (BAT) included in the proposal are e.g. 9 l water per cycle for a 12 place settings dishwasher and 7 l water per cycle for a 6 place settings dishwasher.

EU Ecolabel Regulation EC 66/2010[136]

The EU Ecolabel (Figure 52) scheme was introduced in 1992 by Council Regulation 880/92 to enable consumers to easily identify more environmental friendly products[137]. The scheme was amended in

[130] Anonymous: Council Directive 92/75/EEC of 22 September 1992 on the indication by labelling and standard product information of the consumption of energy and other resources by household appliances. Official Journal of the European Union L 297 (1992) 16-19. Available online at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31992L0075:en:NOT.

[131] Anonymous: Commission Directive 96/89/EC of 17 December 1996 amending Directive 95/12/EC implementing Council Directive 92/75/EEC with regard to energy labelling of household washing machines (Text with EEA relevance). Official Journal of the European Union L 338 (1996) 85-85. Available online at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31996L0089:en:NOT.

[132] Anonymous: Commission Directive 1999/9/EC of 26 February 1999 amending Directive 97/17/EC implementing Council Directive 92/75/EEC with regard to energy labelling of household dishwashers (Text with EEA relevance). Official Journal of the European Union L 56 (1999) 46-46. Available online at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31999L0009:en:NOT.

[133] Anonymous: Directive 2005/32/EC of the European Parliament and of the Council of 6 July 2005 establishing a framework for the setting of ecodesign requirements for energy-using products and amending Council Directive 92/42/EEC and Directives 96/57/EC and 2000/55/EC of the European Parliament and of the Council. Official Journal of the European Union L 191 (2005) 29-58. Available online at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32005L0032:EN:HTML.

[134] Available online at: http://www.eceee.org/Eco_design/products/domestic_washing_machines/FinalReg_WM.

[135] Available online at: http://www.eceee.org/Eco_design/products/domestic_dishwashers/updated_wd_dishwashers.

[136] Anonymous: Regulation (EC) No 66/2010 of the European Parliament and of the Council of 25 November 2009 on the EU Ecolabel. Official Journal of the European Union L 27 (2010) 1-19. Available online at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32010R0066:en:NOT

[137] Anonymous: Council Regulation (EEC) No 880/92 of 23 March 1992 on a Community eco-label award scheme. Official Journal of the European Union L 99 (1992) 1-7. Available online at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31992R0880:en:NOT.

2010 by the new Ecolabel regulation EC 66/2010. Water consumption criteria have been established for household appliances e.g. dishwashers and washing machines. However, the ecolabel criteria for dishwashers and washing machines have been expired since November 2008 and February 2009, respectively. Currently, it is discussed if these products will remain within the ecolabel scheme and if the Ecolabel criteria will be reviewed.

Figure 52: EU Ecolabel

Compared to the water consumption benchmarks defined as the BAT in the proposed implementing measures for dishwashers and washing machines, the thresholds for the Ecolabel are higher. Thus, in case the Ecolabel criteria will be reviewed, these benchmarks have to be taken into account.

The EU Ecolabel can also be awarded to tourist accommodation and campsite services. The following criteria related to taps and showerheads have to be met: "the average water flow of the taps and showerheads, excluding kitchen and bath tub taps, shall not exceed 9 litres/ minute". Optional there are the following criteria[138, 139]:

- The average flow from all taps and showerheads excluding bath taps shall not exceed 8 litres/minute;
- At least 95 % of taps shall allow a precise and prompt regulation of the water temperature and of the water flow;
- All showers in staff facilities, outdoor and common areas shall have a timing/proximity device, which interrupts water flow after a defined time or if not in use.

Further, there are two other legal documents which refer indirectly to sanitary tapware, i.e. refer to certain aspect of relevance for this product group – materials in contact with drinking water. The following section presents them briefly and indicates the issues of importance for the product group of sanitary tapware.

[138] Anonymous: Commission Decision of 9 July 2009 establishing the ecological criteria for the award of the Community eco-label for tourist accommodation service (notified under document number C(2009) 5619) (Text with EEA relevance) (2009/578/EC). Official Journal of the European Union L 198 (2009) 57-79. Available online at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32009D0578:EN:NOT.

[139] Anonymous: Commission Decision of 9 July 2009 establishing the ecological criteria for the award of the Community eco-label for campsite service (notified under document number C(2009) 5618) (Text with EEA relevance) (2009/564/EC). Official Journal of the European Union L 196 (2009) 36-58. Available online at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32009D0564:EN:NOT.

Directive 98/83/EC on the quality of water intended for human consumption[140]

The Drinking Water Directive (DWD) sets requirement concerning the quality of water intended for human consumption. It sets limits of heavy metal (e.g. lead, copper, nickel) contents in drinking water. Sanitary tapware can constitute a source of low emissions of metal substances to drinking water, though their contribution is considered less relevant than of some other elements of water supply and distribution system, as e.g. of piping system.

Substances and materials used in products in contact with drinking water shall comply with the requirements of the Art. 10 of the DWD. DWD obliges Member States to take "all measures necessary to ensure that no substances or materials for new installations used in the preparation or distribution of water intended for human consumption or impurities associated with such substances or materials for new installations remain in water intended for human consumption in concentrations higher than is necessary for the purpose of their use and do not, either directly or indirectly, reduce the protection of human health provided for in this Directive".

Directive 89/106/EE – Construction Products Directive, with later amendments[141, 142]**:**

The Construction Products Directive aims at ensuring "the free movement of all construction products within the European Union by harmonising national laws with respect to the essential requirements applicable to these products in terms of health and safety to create a single market for construction products, through the use of CE Marking. It defines the Essential Requirements of construction works (buildings, civil engineering works) which indirectly determines the requirements for construction products"[143].

It obligates manufacturers of such products to declare their various features, as mechanical strength and stability, fire safety, health and environment effects, safety of use, etc., if relevant EU or national regulatory requirements are available. A mandate is also given to standardisation organisations to develop standards (e.g. CEN) in consultation process with industry. A list of the adopted standards can be found on the European Commission's website[144].

At present three standards relevant for the product group under study are in the advanced stage of development:

- prEN 16056 Influence of metallic materials on water intended for human consumption – Method to evaluate the passive behaviour of stainless steel.
- prEN 16057 Influence of metallic materials on water intended for human consumption – Determination of residual surface lead (Pb) - Extraction method

[140] Council Directive 98/83/EC of 3 November 1998 on the quality of water intended for human consumption, available online: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:1998:330:0032:0054:EN:PDF

[141] Directive 89/106/EEC of 21 December 1988 **on** the approximation of laws, regulations and administrative provisions of the Member States relating to construction products**:** http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31989L0106:EN:HTML

[142] Directive 93/68/EEC amending among others the Directive 89/106/EEC: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31993L0068:EN:HTML

[143] http://ec.europa.eu/enterprise/sectors/construction/documents/legislation/cpd/index_en.htm

[144] http://ec.europa.eu/enterprise/newapproach/standardization/harmstds/reflist/construc.html

- prEN 16058 Influence of metallic materials on water intended for human consumption – Dynamic rig test for assessment of surface coatings with nickel layers – Long-term test method.

Directive 93/68/EEC [145] amended the Construction Products Directive 89/106/EEC. Later, the Regulation[146] laying down harmonised conditions for the marketing of construction products has been adopted by the EC in 2011[147] repealing the Construction Products Directive. The Regulation "provides more clarification of the concepts and the use of CE marking; introduces simplified procedures, which will reduce the costs incurred by enterprises, in particular SMEs. By imposing new and stricter designation criteria to bodies involved in the assessment and the verification of construction products, the CPR is also increasing the credibility and reliability of the whole system".

Beside the abovementioned legal acts, the Contracting Authorities should also be aware of and take into account any additional local, regional or national legislation pertinent to their situation with respect to a particular product or service.

[145] OJ L 220, 30.8.1993, p. 1–22 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31993L0068:EN:HTML

[146]

[147] http://ec.europa.eu/enterprise/construction/index_en.htm

Appendix 1 – European Standards and Guidance

- EN 200: Sanitary tapware. Single taps and combination of taps for water supply systems of type 1 and type 2 – General technical specification
- EN 246 General specifications for flow rate regulators
- EN 248 Sanitary tapware. General specification for electrodeposited coatings of Ni-Cr
- EN 816 Sanitary tapware. Automatic shut-off valves (PN10)
- EN 817 Sanitary tapware. Mechanical mixing valves (PN10) – General technical specifications
- EN 1111 Sanitary tapware. Thermostatic mixing valves (PN10) – General technical specification
- EN 1112 Sanitary tapware. Shower outlets for sanitary tapware for water supply systems type 1 and type 2 – General technical specification
- EN 1113 Showers hoses for (PN10) sanitary tapware
- EN 1286 Sanitary tapware. Low pressure mechanical mixing valves. General technical specification
- EN 1287 Sanitary tapware. Low pressure thermostatic mixing valves. General technical specifications
- EN 13904 Low resistance shower outlets for sanitary tapware
- EN 13905 Low resistance shower hoses for sanitary tapware
- EN 15091 Sanitary tapware. Electronic opening and closing sanitary tapware

Currently under development:

- prEN 16056 Influence of metallic materials on water intended for human consumption – Method to evaluate the passive behaviour of stainless steel.
- prEN 16057 Influence of metallic materials on water intended for human consumption – Determination of residual surface lead (Pb) - Extraction method
- prEN 16058 Influence of metallic materials on water intended for human consumption – Dynamic rig test for assessment of surface coatings with nickel layers – Long-term test method.

Standards related to electric showers:

1) Safety

- EN 60335-1 Safety of household and similar electrical appliances - Part 1: General requirements
- EN 60335-2-35 Household and similar electrical appliances - Safety - Part 2-35: Particular requirements for instantaneous water heaters
- EN 60335-2-41 (if including a pump) Household and similar electrical appliances - Safety - Part 2-41 Particular requirements for pumps
- EN 62233 Measurement methods for electromagnetic fields of household appliances and similar apparatus with regard to human exposure

2) Electro Magnetic Compatibility Directive (EMC)

- EN 55014-1 Electromagnetic compatibility - Requirements for household appliances, electric tools and similar apparatus - Part 1: Emission
- EN 55014-2 Electromagnetic compatibility - Requirements for household appliances, electric tools and similar apparatus - Part 2: Immunity - Product family standard
- EN 61000-3-11 Electromagnetic compatibility (EMC) - Part 3-11: Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems - Equipment with rated current <= 75 A and subject to conditional connection
- EN 61000-3-12 Electromagnetic compatibility (EMC) - Part 3-12: Limits - Limits for harmonic currents produced by equipment connected to public low-voltage systems with input current > 16 A and <= 75 A per phase

Appendix 2 – EcoReport Results for Taps

Table 43: Domestic Brass Taps

Parameter	Units	Production		Distribution		Use		End of Life		TOTAL	
		Value	% of total	Value	% of total	Value	**% of total**	Value	% of total	Value	% of total
Total Energy (GER)	MJ	56	0.06 %	64	0.07 %	90,050	**99.86 %**	5	0.01 %	90,175	100.00 %
of which, electricity (in primary MJ)	MJ	8	0.01 %	0	0.00 %	90,048	**99.99 %**	0	0.00 %	90,057	100.00 %
Water (process)	ltr	2	0.00 %	0	0.00 %	172,435	**100.00 %**	0	0.00 %	172,438	100.00 %
Water (cooling)	ltr	15	0.01 %	0	0.00 %	240,128	**99.99 %**	0	0.00 %	240,143	100.00 %
Waste, non-haz./ landfill	g	2,999	2.79 %	57	0.05 %	104,437	**97.09 %**	70	0.07 %	107,563	100.00 %
Waste, hazardous/ incinerated	g	1	0.05 %	1	0.05 %	2,075	**96.96 %**	62	2.90 %	2,140	100.00 %
Emissions (Air)											
Greenhouse Gases in GWP100	kg CO2 eq.	3	0.08 %	5	0.13 %	3,930	**99.80 %**	0	0.00 %	3,938	100.00 %
Ozone Depletion, emissions	mg R-11 eq.	neg		neg		**neg**		neg		neg	
Acidification, emissions	g SO2 eq.	37	0.16 %	14	0.06 %	23,188	**99.78 %**	1	0.00 %	23,240	100.00 %
Volatile Organic Compounds (VOC)	g	0	0.00 %	0	0.00 %	34	**100.00 %**	0	0.00 %	34	100.00 %
Persistent Organic Pollutants (POP)	ng i-Teq	36	5.74 %	0	0.00 %	591	**94.26 %**	0	0.00 %	627	100.00 %
Heavy Metals	mg Ni eq.	88	5.37 %	3	0.18 %	1,546	**94.33 %**	2	0.12 %	1,639	100.00 %
PAHs	mg Ni eq.	3	1.63 %	3	1.63 %	177	**96.20 %**	0	0.00 %	184	100.00 %
Particulate Matter (PM, dust)	g	2	0.37 %	31	5.75 %	495	**91.84 %**	11	2.04 %	539	100.00 %
Emissions (Water)											
Heavy Metals	mg Hg/20	8	1.36 %	0	0.00 %	581	**98.64 %**	1	0.17 %	589	100.00 %
Eutrophication	g PO4	0	0.00 %	0	0.00 %	3	**100.00 %**	0	0.00 %	3	100.00 %
Persistent Organic Pollutants (POP)	ng i-Teq	neg		neg		**neg**		neg		neg	

NB Values have been rounded to whole numbers, and percentages to two decimal places. Therefore the values in each life cycle phase may not appear to add up to the total value, and small percentages may appear as 0.00 %.

Table 44: Domestic Steel Taps

Parameter	Units	Production		Distribution		Use		End of Life		TOTAL	
		Value	% of total	Value	% of total	Value	% of total	Value	% of total	Value	% of total
Total Energy (GER)	MJ	71	0.08 %	64	0.07 %	90,050	**99.85 %**	1	0.00 %	90,186	100.00 %
of which, electricity (in primary MJ)	MJ	21	0.02 %	0	0.00 %	90,048	**99.98 %**	0	0.00 %	90,069	100.00 %
Water (process)	ltr	56	0.03 %	0	0.00 %	172,436	**99.97 %**	0	0.00 %	172,492	100.00 %
Water (cooling)	ltr	24	0.01 %	0	0.00 %	240,128	**99.99 %**	0	0.00 %	240,152	100.00 %
Waste, non-haz./ landfill	g	863	0.82 %	57	0.05 %	104,416	**99.08 %**	49	0.05 %	105,386	100.00 %
Waste, hazardous/ incinerated	g	1	0.05 %	1	0.05 %	2,075	**97.01 %**	62	2.90 %	2,139	100.00 %
Emissions (Air)											
Greenhouse Gases in GWP100	kg CO2 eq.	6	0.15 %	5	0.13 %	3,930	**99.72 %**	0	0.00 %	3,941	100.00 %
Ozone Depletion, emissions	mg R-11 eq.	neg		neg		**neg**		neg		neg	
Acidification, emissions	g SO2 eq.	48	0.21 %	14	0.06 %	23,188	**99.73 %**	0	0.00 %	23,251	100.00 %
Volatile Organic Compounds (VOC)	g	0	0.00 %	0	0.00 %	34	**100.00 %**	0	0.00 %	34	100.00 %
Persistent Organic Pollutants (POP)	ng i-Teq	7	1.17 %	0	0.00 %	590	**98.66 %**	0	0.00 %	598	100.00 %
Heavy Metals	mg Ni eq.	146	8.60 %	3	0.18 %	1,546	**91.10 %**	2	0.12 %	1,697	100.00 %
PAHs	mg Ni eq.	0	0.00 %	3	1.66 %	177	**97.79 %**	0	0.00 %	181	100.00 %
Particulate Matter (PM, dust)	g	7	1.29 %	31	5.72 %	495	**91.33 %**	9	1.66 %	542	100.00 %
Emissions (Water)											
Heavy Metals	mg Hg/20	63	9.77 %	0	0.00 %	581	**90.08 %**	1	0.16 %	645	100.00 %
Eutrophication	g PO4	2	40.00 %	0	0.00 %	3	**60.00 %**	0	0.00 %	5	100.00 %
Persistent Organic Pollutants (POP)	ng i-Teq	neg		neg		**neg**		neg		neg	

NB Values have been rounded to whole numbers, and percentages to two decimal places. Therefore the values in each life cycle phase may not appear to add up to the total value, and small percentages may appear as 0.00 %.

Table 45: Non-Domestic Brass Taps

Parameter	Units	Production		Distribution		Use		End of Life		TOTAL	
		Value	% of total	Value	% of total	Value	% of total	Value	% of total	Value	% of total
Total Energy (GER)	MJ	56	0.02 %	64	0.02 %	280,145	**99.96 %**	5	0.00 %	280,270	100.00 %
of which, electricity (in primary MJ)	MJ	9	0.00 %	0	0.00 %	280,140	**100.00 %**	0	0.00 %	280,149	100.00 %
Water (process)	ltr	2	0.00 %	0	0.00 %	536,506	**100.00 %**	0	0.00 %	536,508	100.00 %
Water (cooling)	ltr	15	0.00 %	0	0.00 %	747,040	**100.00 %**	0	0.00 %	747,055	100.00 %
Waste, non-haz./ landfill	g	2,999	0.91 %	57	0.02 %	324,841	**99.05 %**	70	0.02 %	327,967	100.00 %
Waste, hazardous/ incinerated	g	1	0.02 %	1	0.02 %	6,455	**99.00 %**	62	0.95 %	6,520	100.00 %
Emissions (Air)											
Greenhouse Gases in GWP100	kg CO2 eq.	3	0.02 %	5	0.04 %	12,225	**99.93 %**	0	0.00 %	12,234	100.00 %
Ozone Depletion, emissions	mg R-11 eq.	neg		neg		**neg**		neg		neg	
Acidification, emissions	g SO2 eq.	37	0.05 %	14	0.02 %	72,138	**99.93 %**	1	0.00 %	72,189	100.00 %
Volatile Organic Compounds (VOC)	g	0	0.00 %	0	0.00 %	106	**100.00 %**	0	0.00 %	106	100.00 %
Persistent Organic Pollutants (POP)	ng i-Teq	36	1.92 %	0	0.00 %	1,837	**98.08 %**	0	0.00 %	1,873	100.00 %
Heavy Metals	mg Ni eq.	88	1.80 %	3	0.06 %	4,807	**98.10 %**	2	0.04 %	4,900	100.00 %
PAHs	mg Ni eq.	3	0.54 %	3	0.54 %	552	**98.92 %**	0	0.00 %	558	100.00 %
Particulate Matter (PM, dust)	g	2	0.13 %	31	1.96 %	1,541	**97.29 %**	11	0.69 %	1,584	100.00 %
Emissions (Water)											
Heavy Metals	mg Hg/20	8	0.44 %	0	0.00 %	1806	**99.50 %**	1	0.06 %	1815	100.00 %
Eutrophication	g PO4	1	11.11 %	0	0.00 %	9	**100.00 %**	0	0.00 %	9	100.00 %
Persistent Organic Pollutants (POP)	ng i-Teq	neg		neg		**neg**		neg		neg	

NB Values have been rounded to whole numbers, and percentages to two decimal places. Therefore the values in each life cycle phase may not appear to add up to the total value, and small percentages may appear as 0.00 %

Table 46: Non-Domestic Steel Taps

Parameter	Units	Production		Distribution		Use		End of Life		TOTAL	
		Value	% of total	Value	% of total	Value	% of total	Value	% of total	Value	% of total
Total Energy (GER)	MJ	71	0.03 %	64	0.02 %	280,145	**99.95 %**	1	0.00 %	280,281	100.00 %
of which, electricity (in primary MJ)	MJ	21	0.01 %	0	0.00 %	280,140	**99.99 %**	0	0.00 %	280,161	100.00 %
Water (process)	ltr	56	0.01 %	0	0.00 %	536,507	**99.99 %**	0	0.00 %	536,563	100.00 %
Water (cooling)	ltr	24	0.00 %	0	0.00 %	747,040	**100.00 %**	0	0.00 %	747,064	100.00 %
Waste, non-haz./ landfill	g	863	0.26 %	57	0.02 %	324,480	**99.60 %**	49	0.02 %	325,790	100.00 %
Waste, hazardous/ incinerated	g	1	0.02 %	1	0.02 %	6,455	**99.00 %**	62	0.95 %	6,520	100.00 %
Emissions (Air)											
Greenhouse Gases in GWP100	kg CO2 eq.	6	0.05 %	5	0.04 %	12,225	**99.90 %**	0	0.00 %	12,237	100.00 %
Ozone Depletion, emissions	mg R-11 eq.	neg		neg		**neg**		neg		neg	
Acidification, emissions	g SO2 eq.	48	0.07 %	14	0.02 %	72,138	**99.91 %**	0	0.00 %	72,201	100.00 %
Volatile Organic Compounds (VOC)	g	0	0.00 %	0	0.00 %	106	**100.00 %**	0	0.00 %	106	100.00 %
Persistent Organic Pollutants (POP)	ng i-Teq	7	0.38 %	0	0.00 %	1,836	**99.57 %**	0	0.00 %	1,844	100.00 %
Heavy Metals	mg Ni eq.	146	2.94 %	3	0.06 %	4,808	**96.96 %**	2	0.04 %	4,959	100.00 %
PAHs	mg Ni eq.	0	0.00 %	3	0.54 %	552	**99.46 %**	0	0.00 %	555	100.00 %
Particulate Matter (PM, dust)	g	7	0.44 %	31	1.95 %	1,541	**97.04 %**	9	0.57 %	1,588	100.00 %
Emissions (Water)											
Heavy Metals	mg Hg/20	63	3.37 %	0	0.00 %	1807	**96.63 %**	1	0.05 %	1870	100.00 %
Eutrophication	g PO4	2	18.18 %	0	0.00 %	9	**81.82 %**	0	0.00 %	11	100.00 %
Persistent Organic Pollutants (POP)	ng i-Teq	neg		neg		**neg**		neg		neg	

NB Values have been rounded to whole numbers, and percentages to two decimal places. Therefore the values in each life cycle phase may not appear to add up to the total value, and small percentages may appear as 0.00 %.

Appendix 3 – EcoReport Results for Showerheads

Table 47: Domestic Showerheads – Plastic

Parameter	Units	Production		Distribution		Use		End of Life		TOTAL	
		Value	% of total	Value	% of total	Value	**% of total**	Value	% of total	Value	% of total
Total Energy (GER)	MJ	30	0.03 %	64	0.07 %	88,831	**99.89 %**	4	0.00 %	88,928	100.00 %
of which, electricity (in primary MJ)	MJ	11	0.01 %	0	0.00 %	88,830	**99.99 %**	0	0.00 %	88,841	100.00 %
Water (process)	ltr	2	0.00 %	0	0.00 %	137,322	**100.00 %**	0	0.00 %	137,324	100.00 %
Water (cooling)	ltr	35	0.01 %	0	0.00 %	236,880	**99.99 %**	0	0.00 %	236,915	100.00 %
Waste, non-haz./ landfill	g	79	0.08 %	57	0.06 %	102,995	**99.86 %**	11	0.01 %	103,142	100.00 %
Waste, hazardous/ incinerated	g	2	0.09 %	1	0.04 %	2,047	**92.00 %**	175	7.87 %	2225	100.00 %
Emissions (Air)											
Greenhouse Gases in GWP100	kg CO2 eq.	1	0.03 %	5	0.13 %	3,877	**99.85 %**	0	0.00 %	3,883	100.00 %
Ozone Depletion, emissions	mg R-11 eq.	neg		neg		**neg**		neg		neg	
Acidification, emissions	g SO2 eq.	8	0.03 %	14	0.06 %	22,874	**99.90 %**	1	0.00 %	22,898	100.00 %
Volatile Organic Compounds (VOC)	g	0	0.00 %	0	0.00 %	33	**97.06 %**	0	0.00 %	34	100.00 %
Persistent Organic Pollutants (POP)	ng i-Teq	1	0.17 %	0	0.00 %	582	**99.83 %**	0	0.00 %	583	100.00 %
Heavy Metals	mg Ni eq.	39	2.49 %	3	0.19 %	1,524	**97.13 %**	3	0.19 %	1,569	100.00 %
PAHs	mg Ni eq.	0	0.00 %	3	1.69 %	175	**98.31 %**	0	0.00 %	178	100.00 %
Particulate Matter (PM, dust)	g	1	0.19 %	31	5.77 %	489	**91.06 %**	16	2.98 %	537	100.00 %
Emissions (Water)											
Heavy Metals	mg Hg/20	1	0.17 %	0	0.00 %	573	**99.65 %**	1	0.17 %	575	100.00 %
Eutrophication	g PO4	0	0.00 %	0	0.00 %	3	**100.00 %**	0	0.00 %	3	100.00 %
Persistent Organic Pollutants (POP)	ng i-Teq	neg		neg		**neg**		neg		neg	

NB Values have been rounded to whole numbers, and percentages to two decimal places. Therefore the values in each life cycle phase may not appear to add up to the total value, and small percentages may appear as 0.00 %.

Table 48: Domestic Showerheads – Metal

Parameter	Units	Production		Distribution		Use		End of Life		TOTAL	
		Value	% of total	Value	% of total	Value	% of total	Value	% of total	Value	% of total
Total Energy (GER)	MJ	136	0.15 %	64	0.07 %	88,832	**99.76 %**	15	0.02 %	89,047	100.00 %
of which, electricity (in primary MJ)	MJ	20	0.02 %	0	0.00 %	88,830	**99.98 %**	0	0.00 %	88,850	100.00 %
Water (process)	ltr	4	0.00 %	0	0.00 %	137,322	**100.00 %**	0	0.00 %	137,326	100.00 %
Water (cooling)	ltr	74	0.03 %	0	0.00 %	236,881	**99.97 %**	-1	0.00 %	236,954	100.00 %
Waste, non-haz./ landfill	g	5927	5.43 %	57	0.05 %	103,054	**94.39 %**	140	0.13 %	109,179	100.00 %
Waste, hazardous/ incinerated	g	5	0.20 %	1	0.04 %	2,047	**83.82 %**	389	15.93 %	2442	100.00 %
Emissions (Air)											
Greenhouse Gases in GWP100	kg CO2 eq.	6	0.15 %	5	0.13 %	3,877	**99.69 %**	1	0.03 %	3,889	100.00 %
Ozone Depletion, emissions	mg R-11 eq.	neg		neg		**neg**		neg		neg	
Acidification, emissions	g SO2 eq.	82	0.36 %	14	0.06 %	22,875	**99.57 %**	3	0.01 %	22,974	100.00 %
Volatile Organic Compounds (VOC)	g	0	0.00 %	0	0.00 %	33	**97.06 %**	0	0.00 %	34	100.00 %
Persistent Organic Pollutants (POP)	ng i-Teq	49	7.74 %	0	0.00 %	583	**92.10 %**	1	0.16 %	633	100.00 %
Heavy Metals	mg Ni eq.	147	8.72 %	3	0.18 %	1,525	**90.50 %**	9	0.53 %	1,685	100.00 %
PAHs	mg Ni eq.	7	3.78 %	3	1.62 %	175	**94.59 %**	0	0.00 %	185	100.00 %
Particulate Matter (PM, dust)	g	4	0.70 %	31	5.46 %	489	**86.09 %**	44	7.75 %	568	100.00 %
Emissions (Water)											
Heavy Metals	mg Hg/20	18	3.03 %	0	0.00 %	573	**96.46 %**	3	0.51 %	594	100.00 %
Eutrophication	g PO4	0	0.00 %	0	0.00 %	3	**100.00 %**	0	0.00 %	3	100.00 %
Persistent Organic Pollutants (POP)	ng i-Teq	neg		neg		**neg**		neg		neg	

NB Values have been rounded to whole numbers, and percentages to two decimal places. Therefore the values in each life cycle phase may not appear to add up to the total value, and small percentages may appear as 0.00 %.

Table 49: Non-Domestic Showerheads – Plastic

Parameter	Units	Production		Distribution		Use		End of Life		TOTAL	
		Value	% of total	Value	% of total	Value	% of total	Value	% of total	Value	% of total
Total Energy (GER)	MJ	30	0.05 %	64	0.10 %	61,300	**99.84 %**	4	0.01 %	61,397	100.00 %
of which, electricity (in primary MJ)	MJ	11	0.02 %	0	0.00 %	61,299	**99.98 %**	0	0.00 %	61,310	100.00 %
Water (process)	ltr	2	0.00 %	0	0.00 %	94,758	**100.00 %**	0	0.00 %	94,760	100.00 %
Water (cooling)	ltr	35	0.02 %	0	0.00 %	163,464	**99.98 %**	0	0.00 %	163,499	100.00 %
Waste, non-haz./ landfill	g	79	0.11 %	57	0.08 %	71,074	**99.79 %**	11	0.02 %	71,221	100.00 %
Waste, hazardous/ incinerated	g	2	0.13 %	1	0.06 %	1,413	**88.81 %**	179	11.25 %	1,591	100.00 %
Emissions (Air)											
Greenhouse Gases in GWP100	kg CO2 eq.	1	0.04 %	5	0.19 %	2,675	**99.74 %**	0	0.00 %	2,682	100.00 %
Ozone Depletion, emissions	mg R-11 eq.	neg		neg		**neg**		neg		neg	
Acidification, emissions	g SO2 eq.	8	0.05 %	14	0.09 %	15,785	**99.85 %**	1	0.01 %	15,808	100.00 %
Volatile Organic Compounds (VOC)	g	0	0.00 %	0	0.00 %	23	**100.00 %**	0	0.00 %	23	100.00 %
Persistent Organic Pollutants (POP)	ng i-Teq	1	0.25 %	0	0.00 %	402	**99.75 %**	0	0.00 %	403	100.00 %
Heavy Metals	mg Ni eq.	39	3.56 %	3	0.27 %	1,052	**95.90 %**	3	0.27 %	1,097	100.00 %
PAHs	mg Ni eq.	0	0.00 %	3	2.42 %	121	**97.58 %**	0	0.00 %	124	100.00 %
Particulate Matter (PM, dust)	g	1	0.26 %	31	8.05 %	337	**87.53 %**	16	4.16 %	385	100.00 %
Emissions (Water)											
Heavy Metals	mg Hg/20	1	0.25 %	0	0.00 %	395	**99.50 %**	1	0.25 %	397	100.00 %
Eutrophication	g PO4	0	0.00 %	0	0.00 %	2	**100.00 %**	0	0.00 %	2	100.00 %
Persistent Organic Pollutants (POP)	ng i-Teq	neg		neg		**neg**		neg		neg	

NB Values have been rounded to whole numbers, and percentages to two decimal places. Therefore the values in each life cycle phase may not appear to add up to the total value, and small percentages may appear as 0.00 %.

Table 50: Non-Domestic Showerheads - Metal

Parameter	Units	Production		Distribution		Use		End of Life		TOTAL	
		Value	% of total	Value	% of total	Value	% of total	Value	% of total	Value	% of total
Total Energy (GER)	MJ	136	0.22 %	64	0.10 %	61,301	**99.65 %**	15	0.02 %	61,516	100.00 %
of which, electricity (in primary MJ)	MJ	20	0.03 %	0	0.00 %	61,299	**99.97 %**	0	0.00 %	61,319	100.00 %
Water (process)	ltr	4	0.00 %	0	0.00 %	94,758	**100.00 %**	0	0.00 %	94,762	100.00 %
Water (cooling)	ltr	74	0.05 %	0	0.00 %	163,465	**99.96 %**	-1	0.00 %	163,538	100.00 %
Waste, non-haz./ landfill	g	5927	7.67 %	57	0.07 %	71,133	**92.07 %**	140	0.18 %	77,258	100.00 %
Waste, hazardous/ incinerated	g	5	0.28 %	1	0.06 %	1,413	**78.15 %**	389	21.52 %	1,808	100.00 %
Emissions (Air)											
Greenhouse Gases in GWP100	kg CO2 eq.	6	0.22 %	5	0.19 %	2,675	**99.52 %**	1	0.04 %	2,688	100.00 %
Ozone Depletion, emissions	mg R-11 eq.	neg		neg		**neg**		neg		neg	
Acidification, emissions	g SO2 eq.	82	0.52 %	14	0.09 %	15,786	**99.38 %**	3	0.02 %	15,885	100.00 %
Volatile Organic Compounds (VOC)	g	0	0.00 %	0	0.00 %	23	**100.00 %**	0	0.00 %	23	100.00 %
Persistent Organic Pollutants (POP)	ng i-Teq	49	10.82 %	0	0.00 %	402	**88.74 %**	1	0.22 %	453	100.00 %
Heavy Metals	mg Ni eq.	147	12.12 %	3	0.25 %	1,053	**86.81 %**	9	0.74 %	1,213	100.00 %
PAHs	mg Ni eq.	7	5.34 %	3	2.29 %	121	**92.37 %**	0	0.00 %	131	100.00 %
Particulate Matter (PM, dust)	g	4	0.96 %	31	7.43 %	337	**80.82 %**	44	10.55 %	417	100.00 %
Emissions (Water)											
Heavy Metals	mg Hg/20	18	4.33 %	0	0.00 %	395	**94.95 %**	3	0.72 %	416	100.00 %
Eutrophication	g PO4	0	0.00 %	0	0.00 %	2	**100.00 %**	0	0.00 %	2	100.00 %
Persistent Organic Pollutants (POP)	ng i-Teq	neg		neg		**neg**		neg		neg	

NB Values have been rounded to whole numbers, and percentages to two decimal places. Therefore the values in each life cycle phase may not appear to add up to the total value, and small percentages may appear as 0.00 %.

European Commission
EUR 26043 – Joint Research Centre – Institute for Prospective Technological Studies

Title: Green Public Procurement for Sanitary Tapware - Technical Background Report

Authors: Renata Kaps, Oliver Wolf

Luxembourg: Publications Office of the European Union

2013- 114 pp. – 21.0 x 29.7 cm

EUR – Scientific and Technical Research series – ISSN 1831-9424 (online)

ISBN 978-92-79-31485-8 (pdf)

doi:10.2788/57886

Abstract
The report proposes and substantiates Green Public Procurement criteria for the product group of 'Sanitary Tapware', which includes taps and showers. Green Public Procurement criteria allow public authorities to integrate environmental aspects in their purchasing decisions. The report contains the criteria proposal itself, the underlying scientific evidence regarding the environmental impacts of sanitary tapware, and it describes the most important European legislation and labelling schemes relevant for this product group. Discussions with stakeholders from industry, NGOs and Member States have supported the development of the criteria. These contributions are also reflected in the analysis presented in this report.

LB-NA-26043-EN-N

As the Commission's in-house science service, the Joint Research Centre's mission is to provide EU policies with independent, evidence-based scientific and technical support throughout the whole policy cycle.

Working in close cooperation with policy Directorates-General, the JRC addresses key societal challenges while stimulating innovation through developing new standards, methods and tools, and sharing and transferring its know-how to the Member States and international community.

Key policy areas include: environment and climate change; energy and transport; agriculture and food security; health and consumer protection; information society and digital agenda; safety and security including nuclear; all supported through a cross-cutting and multi-disciplinary approach.

Publications Office

ISBN 978-92-79-31485-8

9 789279 314858