Environmental Product Declaration

as per ISO 14025

Hand showers
Croma 100 and Crometta 85

Hansgrohe AG

Declaration number
EPD-HGR-2011111-E

Institute Construction and Environment e.V. (IBU)
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Institut Bauen
und Umwelt e.V.

Brief version

Environmental Product Declaration

Environmental Product Declaration

Institute Construction and Environment e.V. (IBU) **www.bau-umwelt.com**	**Programme holder**
Hansgrohe AG **Auestr. 5-9** **D-77761 Schiltach**	**Declaration holder**
EPD-HGR-2011111-E	**Declaration number**
Hand showers: Croma 100 and Crometta 85 product range This Declaration is an Environmental Product Declaration in accordance with ISO 14025 and describes the environmental features of the construction products outlined here. It intends to promote the development of construction which is compatible with the environment and health. This validated Declaration discloses all of the relevant environmental data. This Declaration is based on the "Sanitary fittings and showers" PCR document dated February 2011. /PCR 2011/	**Declared construction products**
This validated Declaration entitles the holder to bear the symbol of the Institut Bauen und Umwelt e.V. It exclusively applies for the products referred to for a period of three years from the date of issue. The Declaration holder is liable for the details and documentation upon which the evaluation is based.	**Validity**
The **Declaration** is complete and comprises in detail: - Product definition and physical construction data - Details on base materials and material origin - Description of the product manufacturing process - Information on product processing - Data on the utilisation status, extraordinary effects and re-use phase - Results of the Life Cycle Assessment - Documentation and tests	**Content of the Declaration**

20 May 2011		**Issue date**
Prof. Dr.-Ing. Horst J. Bossenmayer (President of Institut Bauen und Umwelt)		**Signatures**

This Declaration and the regulations upon which it is based have been tested by the independent Committee of Experts (SVA) in line with ISO 14025.		**Testing the Declaration**
Prof. Dr.-Ing. Hans-Wolf Reinhardt (Chairman of the SVA)	Dr. Birgit Grahl (Verifier appointed by the SVA)	**Signatures**

Brief version

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Chromium-plated hand showers essentially comprise a plastic housing made of ABS (acrylonitrile butadiene styrene), a spray disc with silicon cleaning bobbles and the shower cartridge for distributing the water in the interior. They comply with the DIN EN 1112 "Bathroom fittings - Type 1 and Type 2 showers for bathroom fittings for water supply systems".

Product description

Hand showers are usually connected to a fitting via a shower hose. They are secured to either a shower rod or a wall holder. They are primarily used in bathrooms in the shower or bath, in residential applications, hotels and public facilities such as swimming pools, saunas or showers.

Area of application

The **Life Cycle Assessment (LCA)** was performed in accordance with ISO 14040 and ISO 14044, the requirements of the IBU Guidelines on Type III Declarations and the specific rules of the PCR for "Bathroom fittings and showers". Specific plant data on the products tested as well as data from the "GaBi 4" data base was applied. The Life Cycle Assessment comprises all of the stages associated with the life cycle: extraction of raw materials and energy and manufacturing with transport, transport to use and usage as well as transport associated with disposal. Transport to use and usage are only depicted as scenarios in the long form.

Life Cycle Assessment Framework

LCA results

per hand shower		Crometta 85 Vario/Multi			Croma 100 Vario/Multi		
		Manufacture	EoL	Total	Manufacture	EoL	Total
Abiotic consumption of resources (ADP elementary)	[kg Sb equiv.]	5.27E-05	-9.11E-09	5.27E-05	5.85E-05	-2.54E-06	5.60E-05
Abiotic consumption of resources (ADP fossil)	[MJ]	28.99	-3.96	25.03	38.32	-3.63	34.69
Global Warming Potential (GWP 100 years)	[kg CO_2 equiv.]	1.96	2.25E-01	2.18	2.52	0.40	2.92
Ozone Depletion Potential (ODP, catalytic)	[kg R11 equiv.]	1.63E-07	-2.42E-08	1.39E-07	1.98E-07	-8.06E-09	1.90E-07
Acidification Potential (AP)	[kg SO_2 equiv.]	6.17E-03	-4.15E-05	6.13E-03	7.45E-03	-4.06E-05	7.41E-03
Eutrification Potential (EP)	[kg PO_4^{3-}	6.15E-04	4.10E-05	6.56E-04	7.77E-04	2.23E-05	7.99E-04
Photochemical Ozone Creation Potential (POCP)	[kg C_2H_4 equiv.]	6.45E-04	-7.94E-06	6.37E-04	7.66E-04	-6.36E-06	7.60E-04
Primary energy requirements from regenerative resources	[MJ]	2.52	-0.31	2.20	3.23	-0.10	3.13
Primary energy requirements from resources	[MJ]	34.70	-4.82	29.88	45.24	-3.92	41.32

per hand shower		Crometta 85 1 jet/green			Croma 100 1 jet		
		Manufacture	EoL	Total	Manufacture	EoL	Total
Abiotic consumption of resources (ADP elementary)	[kg Sb equiv.]	5.27E-05	-8.03E-09	5.27E-05	5.84E-05	-1.00E-08	5.84E-05
Abiotic consumption of resources (ADP fossil)	[MJ]	27.52	-3.13	24.39	34.68	-3.34	31.34
Global Warming Potential (GWP 100 years)	[kg CO_2 equiv.]	1.89	2.67E-01	2.15	2.32	0.35	2.67
Ozone Depletion Potential (ODP, catalytic)	[kg R11 equiv.]	1.58E-07	-1.22E-08	1.45E-07	1.89E-07	-7.51E-09	1.81E-07
Acidification Potential (AP)	[kg SO_2 equiv.]	6.02E-03	3.59E-05	6.06E-03	7.06E-03	-3.03E-05	7.03E-03
Eutrification Potential (EP)	[kg PO_4^{3-} equiv.]	5.95E-04	4.37E-05	6.39E-04	6.92E-04	2.27E-05	7.15E-04
Photochemical Ozone Creation Potential (POCP)	[kg C_2H_4 equiv.]	6.03E-04	-1.79E-06	6.02E-04	6.83E-04	-5.48E-06	6.78E-04
Primary energy requirements from regenerative resources	[MJ]	2.46	-0.16	2.30	3.14	-0.10	3.05
Primary energy requirements from resources	[MJ]	33.04	-3.56	29.48	41.25	-3.61	37.65

Created by: Hansgrohe AG, Schiltach in co-operation with
PE INTERNATIONAL AG, Leinfelden-Echterdingen

No documentation or tests are required.

Documentation and tests

Area of applicability

This Environmental Product Declaration refers to hand showers for technical sanitary applications. The data on which it is based was collated in the Hansgrohe AG shower production plant in Offenburg in which the Crometta 85 and Croma 100 product ranges are manufactured.

1 Product definition

Product definition

The hand showers in the Croma 100 and Crometta 85 product range essentially comprise a plastic housing made of ABS, a channel flow (partial), a spray disc with a diameter of 100 mm, the so-called shower motor as well as several assembly components made of various materials. The individual product variants are distinguished in terms of spray type, i.e. they have slightly modified spray discs and shower cartridges – 1jet, 2jet (Vario), 3jet (Multi). The surface of hand showers declared here is chrome-plated by means of various galvanic process stages. An additional flow limiter can be used to reduce water consumption (EcoSmart variants: approx. 9 l/min).

- Article number: 28580000, Croma 100 1jet (28583000 EcoSmart)
- Article number: 28535000, Croma 100 Vario (28537000 EcoSmart)
- Article number: 28536000, Croma 100 Multi (28538000 EcoSmart)

- Article number: 28561000 Crometta 85 green
- Article number: 28585000, Crometta 85 1jet (28606000 EcoSmart)
- Article number: 28562000, Crometta 85 Vario (28607000 EcoSmart)
- Article number: 28563000, Crometta 85 Multi (28608000 EcoSmart)

Application

Hand showers are largely used in baths and showers for personal hygiene. The mixed water in an upstream sanitary fitting is applied to body and hair using the shower featuring various spray types.

Placing on the market / Application rules

Hand showers are developed in accordance with the applicable DIN EN 1112 standard and manufactured accordingly. Products are approved for use in Germany and in many other countries. All of the products outlined here are distributed at international level – these are not national variants specific for individual countries but are tested and approved in accordance with European standards. The corresponding test symbols are lasered onto the hand shower and/or printed on the packaging label or in the assembly instructions. Plastics with drinking water contact correspond with the /KTW 2008/ KTW recommendations of the Federal Health Office.

Quality assurance

A quality management system in accordance with DIN EN ISO 9001 is available for quality assurance.

Delivery status, Features

The hand showers declared here are dispatched in a so-called "Fotopack". This involves printed and designed sales packaging including additional information. The scope of packaging also includes instructions on care and installation. The packaging is made of corrugated board.

Croma 100 1jet hand shower,
Article number: 28580000
Unit weight: 207g

Product group:	Bathroom fittings and showers, 02/2011	Issued on
Declaration holder:	Hansgrohe AG	20.05.2011
Declaration number:	EPD-HGR-2011111-E	

Croma 100 Vario hand shower
Article number: 28535000
Unit weight: 241g
P-IX 18335/ID

Croma 100 Multi hand shower
Article number: 28536000
Unit weight: 234 g
P-IX 18336/ID

Crometta 85 green hand shower
Article number: 28561000
Unit weight: 191g
P-IX 18737/IZ
DVGW NW-6517BT0633

Crometta 85 Vario hand shower
Article number: 28562000
Unit weight: 207g
P-IX 18738/IC
DVGW NW-6517BT0633

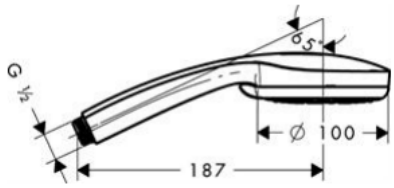
Crometta 85 Multi hand shower
Article number: 28563000
Unit weight: 202g
P-IX 18739/IB
DVGW NW-6517BT0633

Crometta 85 1jet hand shower
Article number: 28585 000
Unit weight: 189g

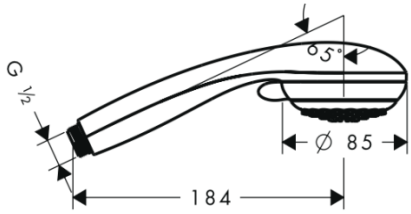
Dimensions:

The dimensions are identical for all Croma 100 and Crometta 85 hand showers as they are only distinguished in terms of spray type.

Croma 100 dimensional drawing:



Crometta 85 dimensional drawing:



Features:

- Suitable for instantaneous water heaters.
- Option: with water-saving function approx. 9 l/min (EcoSmart)

Certification/Approval:

-Drinking water recommendations KTW /KTW 2008/ (evidence provided by the TZW Karlsruhe (DVGW Technologiezentrum Wasser) or the HYG Hygieneinstitut Gelsenkirchen)
- DVGW – German Association of the Gas and Water Trade
- P-IX – Sound insulation conformity symbol tested by LGA Nuremberg
- SVGW – Swiss Association of the Gas and Water Trade
- KIWA – International certification organisation

Structural data

o Maximum load temperature of 60 °C (short-term/permanent operation)

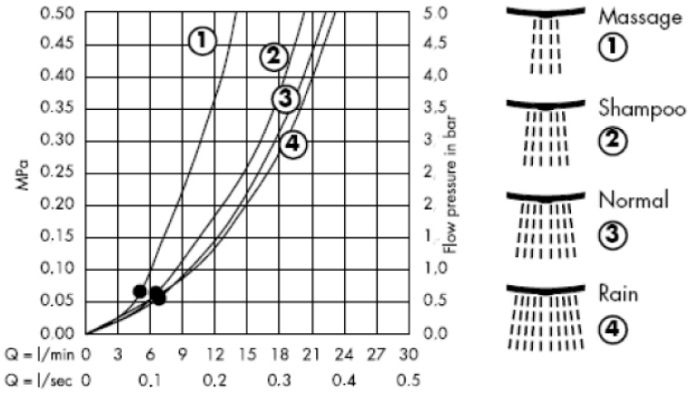
o Please refer to the flow diagram for the flow volume.

The flow data is indicated in the diagram for each individual spray type, min. 1-3 bar. The same applies for the MPa unit. For each spray, a function point is indicated from which perfect function of the spray type is available. Hand shower models in Vario and Multi variants are comparable in flow rates of the normal spray most frequently used. All hand showers in EcoSmart design are limited to max. 9 l/min.

The "Multi" version has 3 spray types, including the "Rain" spray type which has the highest flow rate. The same spray type is also offered by the "Vario" version at practically the same flow rate with the result that a separate graphic has been dispensed with. The EcoSmart graphic depicts the flow-limiting effect to approx. 9 l/min. which is practically identical for all EcoSmart showers ("practically" because the flow limiter displays tolerances).

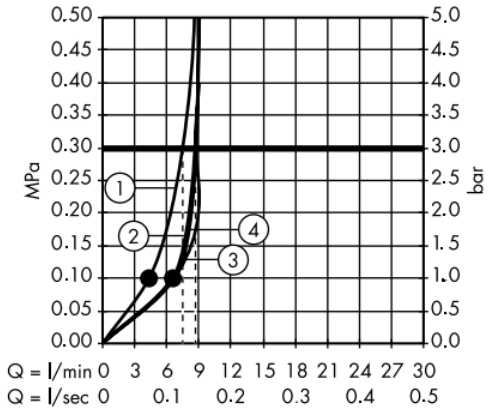
The black dots indicate the function point from which expert opinion maintains that the spray works in a satisfactory manner.

28536000 Croma 100 Vario

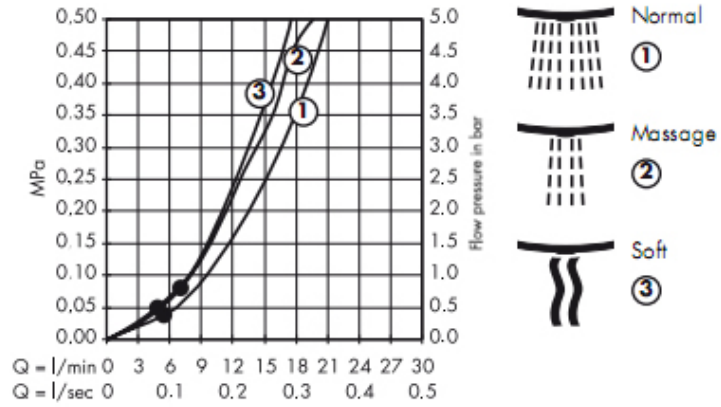


As of • the function is guaranteed.

28537000 Croma 100 Vario EcoSmart



28563000 Crometta 85 Multi



o Acoustic emission

All products are noise-control tested. The corresponding P-IX test symbols are indicated above. Specifications can be found in the superior DIN 4109 "Noise insulation in buildings" standard.

2 Base materials

Base materials
Primary products

The following base materials and/or primary products are used in the Croma 100 Vario and Multi hand shower models:

Acrylonitrile-butadiene-styrene	approx. 33 mass %
Polyphenylene ether	approx. 30 mass %
Polybutylene terephthalate	approx. 32 mass %
Silicon	approx. 3 mass %
Polyoxymethylene	≤ 1%
Ethylene propylene diene monomer	≤ 1%
Polyethylene low density	≤ 1%
Stainless steel	≤ 1%

The following base materials and/or primary products are used in the Croma 100 1jet hand shower model:

Acrylonitrile-butadiene-styrene	approx. 37 mass %
Polyphenylene ether	approx. 38 mass %
Polybutylene terephthalate	approx. 18 mass %
Silicon	approx. 4 mass %
Polyoxymethylene	≤ 1%
Ethylene propylene diene monomer	≤ 1%
Polyethylene low density	≤ 1%

The following base materials and/or primary products are used in the Crometta 85 Vario and Multi hand shower models:

Acrylonitrile-butadiene-styrene	approx. 72 mass %
Polyoxymethylene	approx. 23 mass %
Silicon	approx. 2 mass %
Ethylene propylene diene monomer	approx. 2 mass %
Polyethylene low density	< 1%

The following base materials and/or primary products are used in the Crometta 85 1jet and green hand shower models:

Acrylonitrile-butadiene-styrene	approx. 68 mass %
Polyoxymethylene	approx. 28 mass %
Silicon	approx. 2 mass %
Ethylene propylene diene monomer	≤ 1%
Polyethylene low density	≤ 1%

As a general rule, recycled materials are not used for parts with drinking water contact. Exclusively single-variety plastics are used in such applications. Supplier parts are subject to a declaration by the respective supplier that the products used are harmless and in particular do not display any substances in accordance with the so-called Reach Chemicals Regulation (EG No.1907/2006).

Consumables / Additives

Surface coatings:

- Chromosulphuric acid
- Precious metal (palladium)
- Nickel (chemically separated)
- Copper (electrolytically separated)
- Nickel (electrolytically separated)
- Chromic acid

Material definitions

The majority of base materials used involve plastics.

- Acrylonitrile-butadiene-styrene – ABS

  Acrylonitrile-butadiene-styrene is a plastic which can be galvanised. All plastics to be galvanised at Hansgrohe are made of ABS.
- Polyoxymethylene – POM

  POM is used for plastic parts coming into contact with water in the hand shower.
- Polyphenylene ether – PPE

  PPE (formerly polyphenylene oxide PPO) replaces POM. It displays better resistance to cleaning agents and sprayability.
- Polybutylene terephthalate – PBT

  PBT is used for internal parts of the hand shower which are subject to high mechanical stress.
- Silicon

  Silicon is used for gaskets and spray discs.
- Ethylene propylene diene monomer – EPDM

  EPDM is used for gaskets.
- Polyethylene

  Polyethylene is only contained in small quantities and serves as a connection thread cover cap protecting the shower hose.
- Stainless steel

  Stainless steel is also only contained in small quantities and is used in the shower cartridge.

Surface coatings:

- **Chromosulphuric acid:**
  Chromosulphuric acid is used for pickling the plastic to be galvanised. The chromosulphuric acid roughens the surface of the plastic to enable the subsequent activation involving chemical and electrolytical treatment to be effective.
- **Precious metal (palladium):**
  Palladium is used for activating the pickled plastic. The palladium collects in the pickled pittings of the plastic and serves as a catalyst for the subsequent "chemical nickel layer".
- **Chemical separation of nickel:**
  This process involves chemically (currentless) applying a conductive metal coating to the non-conductive plastic. The plastic can then be galvanised normally. The watery solution of the chemical nickel bath contains nickel ions, a reducing agent and a stabiliser.
- **Electrolytical separation of copper:**
  The copper electrolyte used contains elementary copper and copper salt. The copper is isolated electrolytically (with current) on the surface of the part to be galvanised. This process step smooths the surface.
- **Electrolytical separation of nickel:**
  The nickel electrolyte contains nickel salt and elementary nickel. This process involves the nickel being isolated electrolytically (with current) on the surface of the part to be galvanised. The nickel layer serves as corrosion protection.
- **Chromic acid:**
  Using chromic acid, the last layer of the galvanisation process is also applied electrolytically. The glossy chrome-plated surface is for decorative purposes while simultaneously increasing the hardness of the part and is resistant to scratches and chemical influences.

Origin of components and manufacturing depth

All of the substances/chemicals are manufactured and can be procured world-wide. No raw materials are procured outside the EU for the Offenburg plant.
The chemicals and supplier parts for assembly are purchased ready for use. The ABS granulate is purchased for the hand shower handle and for other small assembly parts, and processed in the Offenburg plant using the injection moulding process.

Availability of raw materials

ABS and other plastics

The basic materials for ABS and the other plastics are fossil energy carriers (e.g. crude oil).

The reserves of fossil energy carriers in the earth's crust are finite. Just how long the production of crude oil can cover demand is a controversial topic of discussion among experts. The World Energy Outlook 2009 by the IEA presents a scenario in which only around 75% of the (anticipated) crude oil requirements can be covered from oil fields already tapped after 2030.

Palladium

Palladium is a platinum metal. Platinum mines can only be found in South Africa (Transvaal). Platinum sources also include the generation of non-ferrous metals (copper and nickel) in Greater Sudbury (Ontario) and Norilsk (Russia) where platinum group metals (PGM) are incurred as an ancillary product of nickel refinement. Six metals are referred to as minor platinum metals whose chemical properties are so similar to platinum that separation and isolation in a pure state originally posed major difficulties: platinum, palladium, iridium, osmium, rhodium and ruthenium. Platinum metals are precious metals and display similar resistance to corrosion as gold.
According to /Fraunhofer 2009/, the statistical scope of platinum metal resources is 190 years.

Nickel

Nickel is a common element; with a share of 0,015%, it is number 21 in the elementary table making it more common than copper or zinc. The most significant ore reserves are in Cuba, Canada, New Caledonia, Indonesia and the Philippines.
As a metal, nickel is only required in small quantities; the majority of production is directed towards the production of stainless steel and nickel alloys. Today's estimates put reserves of minable nickel at between 70 and 170 million tonnes. More than one million tonnes is currently mined each year world-wide. According to /INSG 2011/, the scope of nickel resources is estimated as more than 100 years.

Chrome

Chrome is a silvery metal which, in its pure state, is tough, flexible and malleable, becoming hard and brittle on contamination with hydrogen or oxygen. In nature, it usually only prevails in the form of compounds. The ore is largely mined in opencast mining or at low depth. The most significant reserves can be found in South Africa, Kazakhstan, India, Zimbabwe and Finland. According to /Fraunhofer 2009/, the statistical scope of chrome resources is around 600 years.

Copper

Copper is found in nature in the form of a native metal (i.e. as "copper particles") and can also be found in minerals. This raw material can be found on almost all continents and is the 23rd most common element. The most significant copper reserves are in Chile and the USA accounting for 20 per cent of known international reserves. Other key mining areas include Africa, Australia, China, Canada, Indonesia, South America, Russia and Poland.
More than 80 per cent of copper ever mined is still in circulation today. This is attributable to its easy remelting properties with the result that copper can be recycled any number of times without any quality losses incurred. According to /Fraunhofer 2009/, the statistical scope of copper resources is 190 years.

3 Product manufacture

Product manufacture

The hand shower carcass is manufactured from ABS. This involves heating ABS granulate and using injection moulding machinery to form it into a housing carcass. This is followed by chemical and galvanic coatings in various baths.

The non-conductive plastic surface must by activated first in order to obtain electrical conductivity. This is achieved by pickling with chromosulphuric acid and coating with the precious metal palladium. An initial nickel coating is then isolated chemically (currentless) on the surface. This is followed by electrolytical isolation of copper, nickel and chrome. During the coating process, the ABS parts pass through several galvanic and rinsing baths. During the downstream assembly stage, the basic carcass is then joined with the spray disc and supplemented with the smallest assembly parts such as gaskets and sieves.

Health protection in manufacturing

The following measures exceeding the national guidelines have been implemented in order to improve health protection during the manufacturing process. Industrial Protection Management in accordance with OHSAS 18001 has been introduced in particular:

- Ergonomic workplace design
- Back exercises for personnel in the Galvanic and Assembly areas
- Nutritional advice
- Sporting activities for employees
- Health checks
- Ventilation procedures in the Assembly area

Environmental protection in manufacturing

The following measures have been implemented in order to improve environmental protection during the manufacturing process. An Environment Management system in accordance with DIN ISO 14001 has been introduced in particular:

- Extending the service life of process baths in galvanisation using
  - Oxamate (electrolysis): 3-fold chrome can be oxidised to 6-fold chrome and reused for galvanising. This saves chromic acid and prevents waste.
  - UV lamp: this prevents the development of organic interfering substances thereby enabling rinsing baths to be operated longer.
- Heat recovery
- Photovoltaic on the production hall roofs

4 Product processing

Installation recommendations

Hand showers are easy to install. As a general rule, they are screwed to a shower hose using a standardised DN15 thread connection and tightened by hand. A gasket inserted between the hand shower and the hose securely seals against flowing water. A removable and rinsable filter at the end of the handle prevents dirt from being rinsed inwards. Professional rinsing of the pipelines should also be performed in order to avoid dirt from being washed in. The shower is therefore easy to operate. Each product includes detailed and graphic assembly instructions.

Industrial safety / Environmental protection

Thanks to the easy assembly steps associated with hand showers, only the typical industrial safety measures on sites need to be observed (e.g. safety shoes or gloves), nor are any particular environmental protection measures required.

Residual materials

No residual materials are incurred.

Packaging

The hand shower is packed in a printed folding box made of corrugated board. Packaging is usually disposed of by the wholesaler or fitter. To this aim, Hansgrohe AG is connected to a dual system which organises the collection, sorting and recycling of sales packaging. The corresponding Interseroh contract number 31880 and logo are printed on the base of the packaging.

5 Condition of use

Contents

All materials used which come into contact with drinking water have a drinking water recommendation in accordance with the KTW (drinking water approval for plastic). Verification is provided by the TZW Karlsruhe (DVGW Technologiezentrum Wasser) or the HYG Hygieneinstitut Gelsenkirchen (Institut für Umwelthygiene und Umweltmedizin). The harmlessness of materials is confirmed in these recommendations.

Showers manufactured and distributed by Hansgrohe AG only contain chemical substances which are regarded as being particularly low-risk by the ECHA (European Chemicals Agency) and the REACH Chemicals Regulation and therefore do not require any special approval.

Cleaning and care

Each product includes the corresponding care instructions. As a general rule, the following must be observed:

Cleaning agents containing hydrochloric acid, formic acid, bleach or acetic acid may not be used as they can cause considerable damage. Cleaning agents containing phosphoric acid can only be used conditionally.

Abrasive cleaning agents and equipment such as unsuitable abrasives, sponge pads and microfibre cloths may not be used.

Limescale deposits should be prevented by regular cleaning.

When spray-cleaning, never spray the cleaning solution on the products but rather on a cloth for cleaning as the fine spray can penetrate the openings and gaps in the showers and cause damage.

After cleaning, rinse with clear water to remove all traces of product residue (cleaning agents).

Relationships between environment and health

When hand showers are used as designated, the products can not cause any environmental damage or health impairments. In the case of the models in the Croma 100 product range, an internal flow channel is also used which prevents the water from coming into contact with the chrome-plated contact points inside the product. The Crometta 85 product range is also being converted to this technology.

In order to avoid or reduce the propagation of bacteria (e.g. Legionnaires) introduced by water, we recommend regular brief thermal disinfection with water at a temperature of 60 °C. For longer periods of non-use, the hose can be disconnected and drained of water.

Useful life

All showers are developed and manufactured in line with the corresponding EU standard. Furthermore, in-house design specifications are in place with much higher demands on the product in order to further extend service life. This is ensured by comprehensive tests and simulations. High-quality plastics are used throughout for shower designs. Many years of experience mean that the combination of various materials is optimised here. Product service lives are primarily influenced by the quality of materials and water, line pressure and care. Consistent care of the spray types by cleaning the elastic silicon bobbles is particularly beneficial. Hand showers are part of a bath and shower system which has been designed for a long useful life (15-20 years) and are themselves replacement parts. Accordingly, they are designed such that they achieve long service lives before being replaced in full for economic reasons.

Usage scenario

A usage scenario is considered as regards the energy costs associated with the provision of hot water and water consumption for the shower declared here. More information is provided in section 8.1 "Information on the usage phase".

6 Extraordinary effects

Fire Irrelevant

Water Irrelevant

7 Re-use phase

Re-use

Hand showers involve products for personal body hygiene with a decorative chrome surface. Usage gives rise to normal signs of use, e.g. limescale deposits or discolouration. For this reason, hand showers can not be recommended for re-use.

Further use

Hand showers are often used when spray types are no longer fully functional or the decorative chrome surface is damaged. It is conceivable that hand showers are used in the garden for watering flowers or as garden showers on account of their standardised connection threads.

Recycling

Owing to the chrome-plated surface, single-variety sorting of the plastic is rather difficult. The recycled material would not be suitable for complying with the high requirements on the surface quality (chrome gloss). Nor would the requirements outlined by the drinking water approvals be complied with.

Further use

Where showers are no longer functional, they should be directed towards thermal disposal. Synthetic materials are marked.

Disposal

Hand showers may be disposed of as household waste and directed to thermal disposal.

8 Life Cycle Assessment

8.1 Information on system definition and modelling the life cycle

Declared unit

The Declaration refers to the manufacture, usage and disposal of 1 hand shower.

On account of the similarity of the product variants within the Croma 100 and Crometta 85 product ranges, a cluster has been developed to enable a summary of the product variants for the Life Cycle Assessment.

Table 8-1: Clustering hand showers

Clustering	Hand shower	Weight (average) [g]
Croma 100 1jet	Croma 100 1jet	**206.4**
	Croma 100 1jet EcoSmart	
Croma 100 Vario/Multi	Croma 100 Vario	**236.5**
	Croma 100 Vario EcoSmart	
	Croma 100 Multi	
	Croma 100 Multi EcoSmart	
Crometta 85 1jet/green	Crometta 85 1jet	**190.45**
	Crometta 85 1jet EcoSmart	
	Crometta 85 green	
Crometta 85 Vario/Multi	Crometta 85 Vario	**204.5**
	Crometta 85 Vario EcoSmart	
	Crometta 85 Multi	
	Crometta 85 Multi EcoSmart	

System limits

The system limits have been drawn from manufacture through usage to disposal.

The following individual processes have been included for manufacturing:

- Manufacture of an ABS basic carcass (handle) via injection moulding
- Plastic galvanisation (chrome-plating the ABS components)
- Provision and manufacture of the supplier parts (including ABS parts – not the handle – manufactured in the Offenburg plant; these are not galvanised)
- Assembly and packaging of the hand showers

Packaging and disposal following installation of the product is analysed as part of the manufacturing process.

The use of hand showers should be considered as regards the energy consumption

associated with the provision of hot water and the drinking water used. The analysis period accounts for one year. The usage scenario was drawn up analogue to the PCR. The following processes are included in the model:

- Transporting the hand shower to the wholesaler
- Use of the hand shower

In terms of disposal, it was assumed that the hand showers reach a garbage incineration plant via residual waste. A specific garbage incineration process was applied for each plastic contained in the hand shower. A recycling potential was assumed for the low stainless steel content. The following processes are included in the model:

- Transport of the hand shower to the End of Life
- Disposal of the hand shower

Assumptions and estimates

The manufacture and provision of supplier parts (especially plastic) was estimated in terms of their base materials and a plastic processing step.

Cut-off criteria

All operating data, i.e. all of the starting materials used, thermal energy, electricity consumption as well as all direct production waste were taken into consideration in the analysis. The expenses associated with transport were also included. Accordingly, material and energy flows with a share of less than 1 per cent were also considered.

It can be assumed that the processes not taken into consideration would have accounted for less than 5% of the impact categories to be considered. Machinery, plants and infrastructure required in the manufacturing process are ignored.

Transport

The transport distances for supplier parts, packaging materials and ABS were made available. They are within a range of 1 to 445 kilometres. Utilisation is between 85 and 94%. An average transport distance of 377.4 kilometres was indicated for transport to the wholesaler. 50 kilometres were assumed as the distance for transport to disposal as it can be assumed that a garbage incineration plant can be found within a 50-kilometre radius in Germany. Utilisation of 85% is applied for both types of transport.

Period under review

The Life Cycle Assessments available are based on data recorded by Hansgrohe AG for hand showers in 2009. The volumes of raw materials, energy, auxiliaries and consumables used must be considered as average annual values in the Offenburg plant under review.

Background data

"GaBi 4", the software system for comprehensive analysis developed by PE INTERNATIONAL AG, was used for modelling the life cycle for the manufacture of hand showers. The consistent data items contained in the GaBi data base are documented in the online GaBi documentation. The basic data in the GaBi data base was applied for the raw materials, energy, transport and consumables used.

The Life Cycle Assessments were drawn up for Germany as a reference area. This means that apart from the production processes under these marginal conditions, the pre-stages also of relevance for Germany such as provision of electricity or energy carriers were also used.

The power mix for Germany 2008 is applied.

Data quality

The data collated on the manufacture of showers is based on measurements as well as purchasing and sales figures acquired by Hansgrohe AG. Background data from the GaBi 4 data base is also used in the Life Cycle Assessment model. The data used was last revised less than 5 years ago.

Allocation

The production data recorded related to the entire hand shower plant in Offenburg. The expenses were applied to the mass (e.g. in ABS injection moulding and assembly) and/or surface (e.g. galvanising) of the respective hand shower.

Credits were allocated for the energy generated in the incineration of packaging materials and/or hand shower End of Life.

Thermal recycling of waste and packaging

Credits for electricity (Strom-Mix Deutschland 2008) and heat (thermal energy from Erdgas Deutschland) arising from thermal recycling of waste and packaging in a waste incineration plant have been taken into consideration.

Information on the usage phase

Usage is calculated analogue to the /PCR 2011/ PCR in this Life Cycle Assessment. The following formula in accordance with the "Drinking water requirements and waste water volumes" profile no. 14 NWO of the DGNB Certification of New Residential Buildings /DGNB-SB14/ forms the basis for calculating the usage scenario for the product described and use thereof

$wb_I = (n_{NU} * f_I * as_I * 345\ d/a)/1000$

with

- wb_I Specific drinking water requirements by the installation in m³/a
- n_{NU} Number of users (standard value of 2.05 users per household according to the German Statistics Agency[1])
- f_I Installation-specific (application-specific) factor for water consumption as per Table 8-2 in sec/d
- as_I Installation-specific connection value in l/sec or l/rinse

The installation-specific factor for the shower is adopted from the 14 profile and outlined in the following table:

Table 8-2: Installation-specific factor f_I

Installation	Installation-specific factor f_I for water consumption (sec. or rinse per person and day)
Shower	120

The installation-specific connection value corresponds with the flow rate of the declared products. Four usage scenarios are taken into consideration:

Table 8-3: Overview of usage scenarios

Scenario	Hand showers	Flow rate (at 2 bar)
1	Croma 100 Vario/Multi and 1jet	15.1 l/min
2	Crometta 85 Vario/Multi and 1jet	14.4 l/min
3	Croma 100/Crometta 85 Vario/Multi and 1jet – Eco Smart	9 l/min
4	Crometta 85 green	6 l/min

Based on Part 8 of DIN 18599 /DIN 18599-8/, the useful energy requirements for hot water are calculated in kWh/a for the application outlined in the Declaration:

[1] www.destatis.de among the population – advance calculation of households

$Q = \rho * c * V * 345d/a * n_{NU} * (\theta_m - \theta_k)$

with

- Q — Useful energy requirements for hot water in kWh/a
- ρ — Density of water in kg/l
- c — Specific thermal capacity ($1.163*10^{-3}$ kWh/kg*K)
- V — Volume of water in l/person and day (the water volume is calculated from the flow rate of the fitting and the installation-specific factors for the respective fitting, please refer to Table 8-2).
- n_{NU} — Number of users (standard value of 2.05 users per household according to the German Statistics Agency[1])
- θ_m — Average tap temperature in °C (50 °C) (average temperature of the drinking water network (with circulation line and/or electric heating) and the boiler as per DIN 18599-8)
- θ_k — Cold water supply temperature in °C (10 °C) (standard as per DIN 18599-8)

Gas heating is applied (data record from Ökobau.dat: 8.6.1_Nutzung_-_Gas_Niedertemperatur_20-120_kW).

Selecting the End-of-Life scenario

For the disposal scenario, it is assumed that the hand showers are disposed of as residual waste in a garbage incineration plant. A specific garbage incineration plant data record was adapted for each plastic material used in the hand shower.

Credits

The substitution approach is applied for generating energy from thermal utilisation. The volumes of electricity and heat generated are offset agsint the "DE: Strom Mix PE" and "DE: Thermal energy from natural gas PE" (both GaBi 2010) processes. This depicts the savings of fossil fuels and their emissions which would otherwise be incurred during the process of conventional energy generation.

8.2 Depicting the analyses and evaluations

The following sections depict the life cycle inventory analysis in terms of material and energy resources as well as waste and water consumption incurred.

Primary energy

The following tables depict the ise of primary energy for Croma 100 Vario/Multi and Crometta 85 Vario/Multi hand showers.

Table 8-4: Use of primary energy in the manufacture and disposal of Croma 100 Vario/Multi

Croma 100 Vario/Multi	Manufacture	End of Life	Total
Non-regenerative primary energy [MJ]	45.24	-3.92	41.32
Regenerative primary energy [MJ]	3.23	-1.03E-01	3.13

Table 8-5: Use of primary energy in the manufacture and disposal of Crometta 85 Vario/Multi

Crometta 85 Vario/Multi	Manufacture	End of Life	Total
Non-regenerative primary energy [MJ]	34.70	-4.82	29.88
Regenerative primary energy [MJ]	2.52	-3.13E-01	2.20

The following graphics depict in more detail the process stages incurring the use of primary energy.

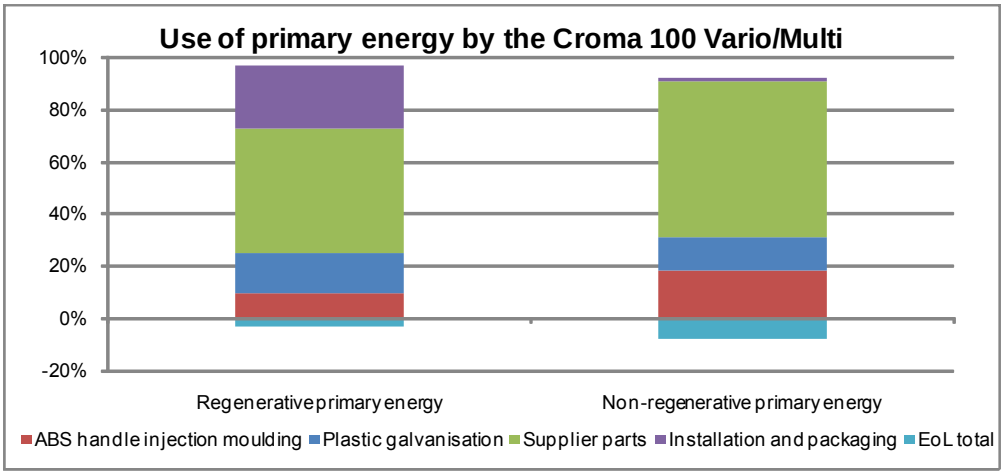


Fig. 8-1: Use of primary energy in the manufacture and disposal of Croma 100 Vario/Multi hand showers

In the case of the Croma 100 Vario/Multi, the use of non-regenerative primary energy is especially incurred in the manufacture of supplier parts (ABS handle not included). The greatest influence is exerted by PBT and PPE, which together account for approx. 90% of the supplier parts mass. The remaining influence by supplier parts is attributable to silicon, POM, EPDM and PE-HD. At 20%, the manufacture of the ABS handle in injection moulding accounts for the next largest share. The non-regenerative primary energy results in particular from the electricity used for manufacturing the supplier parts. What's more, the paper used for packaging also displays a significant influence.

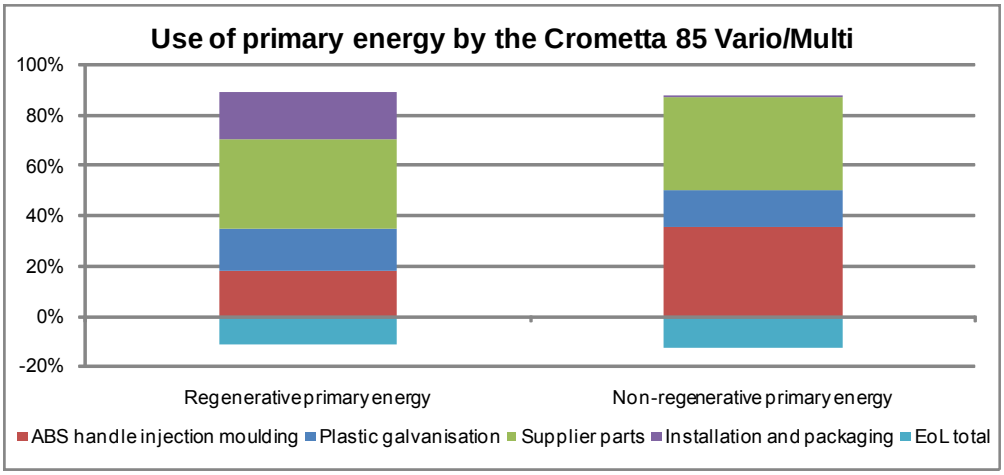


Fig. 8-2: Use of primary energy in the manufacture and disposal of Crometta 85 Vario/Multi hand showers

In the case of the Crometta 85 Vario/Multi, the use of non-regenerative primary energy is incurred at similar volumes by the manufacture of the ABS handle in injection moulding and the manufacture and provision of supplier parts. As a basic material, ABS for the handle in particular accounts for a large share of the use of primary energy via its upstream chain. In terms of supplier parts, the greatest influence is also incurred by the ABS upstream materials (additional assembly parts, not the ABS handle) and POM, which account for the largest mass percentage of supplier parts at approx. 90%. The remaining share is accounted for by silicon, EPDM and PE-HD. The regenerative primary energy here is also largely attributable to electricity and paper.

The following tables depict the use of primary energy for Croma 100 1jet and Crometta 85 1jet/green hand showers.

Table 8-6: Use of primary energy in the manufacture and disposal of Croma 100 1jet

Croma 100 1jet	Manufacture	End of Life	Total
Non-regenerative primary energy [MJ]	41.25	-3.61	37.65
Regenerative primary energy [MJ]	3.14	-9.59E-02	3.05

Table 8-7: Use of primary energy in the manufacture and disposal of Crometta 85 1jet/green

Crometta 85 1jet/green	Manufacture	End of Life	Total
Non-regenerative primary energy [MJ]	33.04	-3.56	29.48
Regenerative primary energy [MJ]	2.46	-1.57E-01	2.30

The following graphics depict in more detail the process stages incurring the use of primary energy. Distribution of the use of primary energy for the Croma 100 1jet is very similar to that of the Croma 100 Vario/Multi. Distribution of the use of primary energy for the Crometta 85 1jet/green is also very similar to that of the Crometta 85 Vario/Multi.

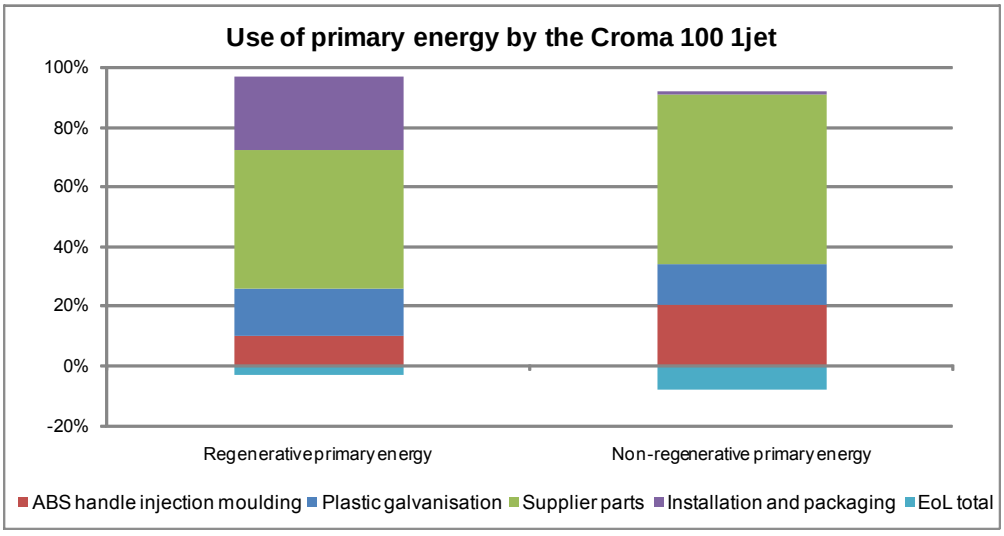


Fig. 8-3: Use of primary energy in the manufacture and disposal of Croma 100 1jet hand showers

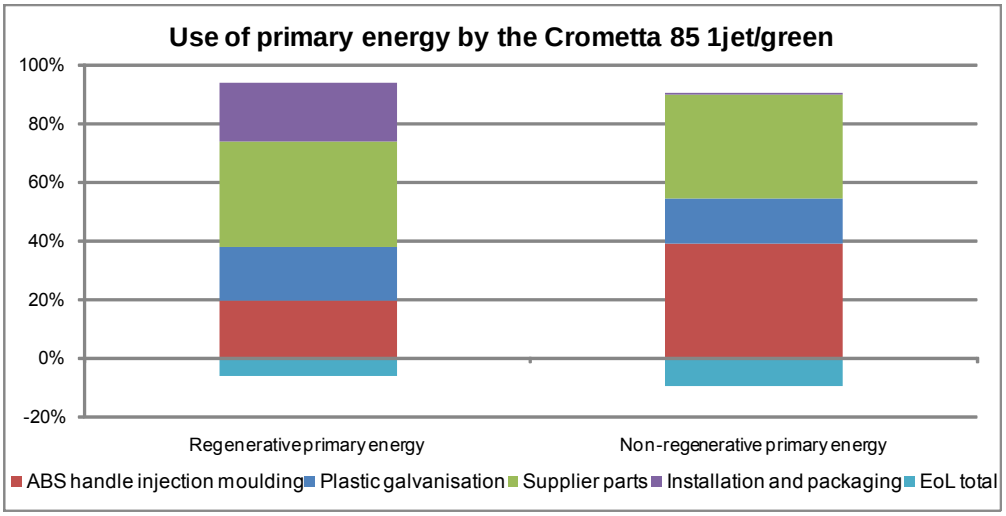


Fig. 8-4: Use of primary energy in the manufacture and disposal of Crometta 85 1jet/green hand showers

It goes without saying that one-year usage (not depicted in the graphics) far exceeds the use of primary energy in the manufacture and disposal. Nevertheless, usage falls as the hand shower flow rate decreases. Usage is depicted for the four scenarios in the following tables.

Table 8-8: Use of primary energy for usage scenarios 1-4

Usage scenario 1 - 15.1 l/min	Transport to the wholesaler	Usage	Total usage
Non-regenerative primary energy [MJ]	8.86E-02	4399.89	4399.98
Regenerative primary energy [MJ]	9.63E-05	6.72	6.72
Usage scenario 2 - 14.4 l/min	Transport to the customer	Usage	Total usage
Non-regenerative primary energy [MJ]	7.00E-02	4195.92	4195.99
Regenerative primary energy [MJ]	7.61E-05	6.41	6.41
Usage scenario 3 - 9 l/min	Transport to the customer	Usage	Total usage
Non-regenerative primary energy [MJ]	7.00E-02	2622.45	2622.52
Regenerative primary energy [MJ]	7.61E-05	4.01	4.01
Usage scenario 4 - 6 l/min	Transport to the customer	Usage	Total usage
Non-regenerative primary energy [MJ]	6.64E-02	1748.30	1748.37
Regenerative primary energy [MJ]	7.21E-05	2.67	2.67

Distribution of the energy carriers for the Croma 100 Vario/Multi hand shower is depicted in Fig. 8-5.

If only manufacture and disposal are considered, a relatively well-balanced image arises for the most important non-regenerative energy carriers. This is attributable to the materials used and the power mix in particular.

In the case of regenerative energetic resources, the largest share is accounted for by wind power which is in turn depicted in the power mix. The share of solar energy is particularly accounted for by paper used in packaging.

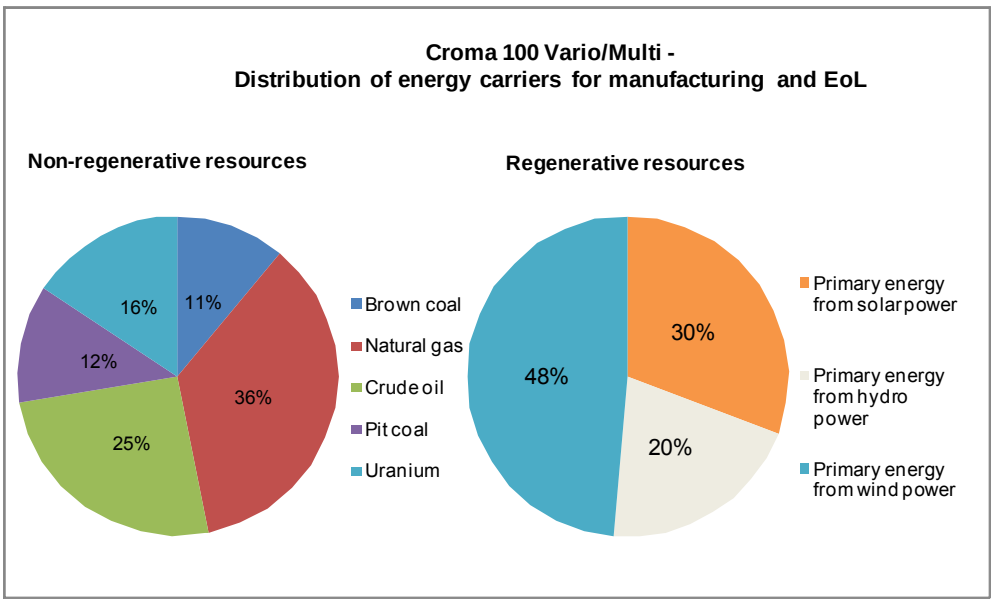


Fig. 8-5: Distribution of energy carriers for the Croma 100 Vario/Multi hand shower

A similar percentage distribution evolves for the Croma 100 1jet (please refer to Table 8-9).

Table 8-9: Distribution of energy carriers for the Croma 100 1jet hand shower

Croma 100 1jet	Manufacturing and EoL
Non-regenerative energetic resources	
Brown coal	11%
Natural gas	36%
Crude oil	25%
Pit coal	12%
Uranium	16%
Regenerative energetic resources	
Primary energy from solar power	32%
Primary energy from hydro power	18%
Primary energy from wind power	49%

Distribution of the energy carriers for the Croma 85 Vario/Multi hand shower is depicted in Fig. 8-6.

If only manufacture and disposal are considered, a relatively well-balanced image arises for the most important non-regenerative energy carriers. This is attributable to the materials used and the power mix in particular.

In the case of regenerative energetic resources, the largest share is accounted for by wind power which is in turn depicted in the power mix. The share of solar energy is particularly accounted for by paper used in packaging.

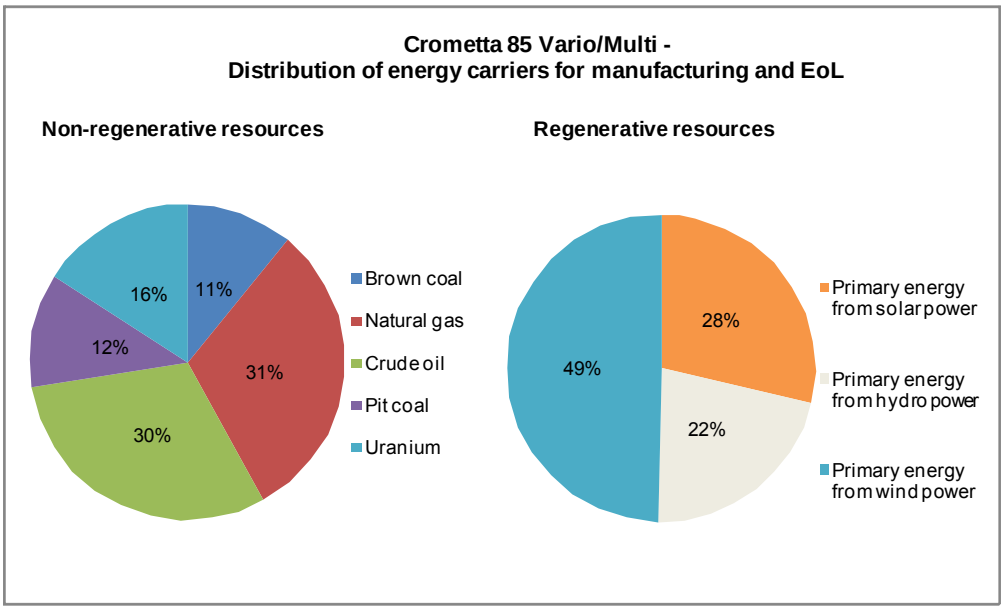


Fig. 8-6: Distribution of energy carriers for the Crometta 85 Vario/Multi hand shower

A similar percentage distribution evolves for the Croma 85 1jet/green (please refer to Table 8-10).

Table 8-10: Distribution of energy carriers for the Crometta 85 1jet/green hand shower

Crometta 85 1jet/green	Manufacturing and EoL
Non-regenerative energetic resources	
Brown coal	12%
Natural gas	34%
Crude oil	24%
Pit coal	12%
Uranium	17%
Regenerative energetic resources	
Primary energy from solar power	25%
Primary energy from hydro power	18%
Primary energy from wind power	56%

When usage is considered, natural gas dominates over all other energy carriers. This is due to the fact that the gas burner was used in the usage scenarios calculated here.

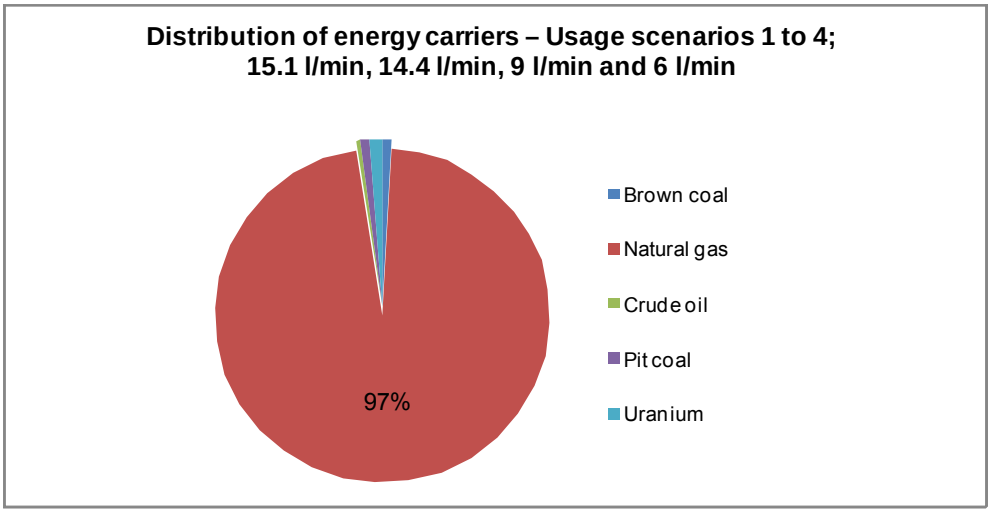


Fig. 8-7: Distribution of energy carriers for the usage scenarios

Water requirements

The following tables depict the water requirements for each hand shower during manufacture and disposal.

Table 8-11: Water requirements in the manufacture and disposal of Croma 100 Vario/Multi

Croma 100 Vario/Multi	Manufacture	End of Life	Total
Water [l]	28.97	1.49E-01	29.12

Table 8-12: Water requirements in the manufacture and disposal of Crometta 85 Vario/Multi

Crometta 85 Vario/Multi	Manufacture	End of Life	Total
Water [l]	25.19	-0.96	24.22

Table 8-13: Water consumption in the manufacture and disposal of Croma 100 1jet

Croma 100 1jet	Manufacture	End of Life	Total
Water [l]	27.89	1.22E-01	28.01

Table 8-14: Water consumption in the manufacture and disposal of Crometta 85 1jet/green

Crometta 85 1jet/green	Manufacture	End of Life	Total
Water [l]	24.76	-0.25	24.51

Water consumption by the hand showers for the manufacture and disposal is dominated by the manufacturing process. Approx. 50% of consumption in manufacturing is attributable to plastic galvanisation.

The water consumption in usage for all scenarios is depicted in the following tables. Consumption falls as flow rates decrease.

Table 8-15: Water requirements for the usage scenarios

Usage scenario 1 - 15.1 l/min	Transport to the customer	Usage	Total usage
Water [l]	1.62E-03	21929.75	21929.75
Usage scenario 2 - 14.4 l/min	Transport to the customer	Usage	Total usage
Water [l]	1.28E-03	20913.14	20913.14
Usage scenario 3 - 9 l/min	Transport to the customer	Usage	Total usage
Water [l]	1.28E-03	13070.71	13070.71
Usage scenario 4 - 6 l/min	Transport to the customer	Usage	Total usage
Water [l]	1.21E-03	8713.81	8713.81

Waste

The following tables depict the waste incurred for each hand shower during manufacture and disposal.

Table 8-16: Waste incurred in the manufacture and disposal of Croma 100 Vario/Multi

Croma 100 Vario/Multi	Manufacture	End of Life	Total
Pithead stocks [kg]	7.79	-0.29	7.50
Municipal solid waste [kg]	1.50E-01	-1.76E-05	0.15
Hazardous waste [kg]	8.87E-02	1.28E-03	9.00E-02
Special waste [kg]	8.63E-02	1.38E-03	8.77E-02
Radioactive waste [kg]	2.37E-03	-1.01E-04	2.27E-03

Table 8-17: Waste incurred in the manufacture and disposal of Crometta 85 Vario/Multi

Crometta 85 Vario/Multi	Manufacture	End of Life	Total
Pithead stocks [kg]	6.52	-0.84	5.67
Municipal solid waste [kg]	1.04E-01	-3.36E-06	0.10
Hazardous waste [kg]	7.89E-02	2.67E-03	8.16E-02
Special waste [kg]	7.70E-02	2.98E-03	7.99E-02
Radioactive waste [kg]	1.97E-03	-3.04E-04	1.66E-03

Table 8-18: Waste incurred in the manufacture and disposal of Croma 100 1jet

Croma 100 1jet	Manufacture	End of Life	Total
Pithead stocks [kg]	7.45	-0.27	7.18
Municipal solid waste [kg]	1.48E-01	-9.99E-07	0.15
Hazardous waste [kg]	8.84E-02	1.23E-03	8.97E-02
Special waste [kg]	8.62E-02	1.32E-03	8.75E-02
Radioactive waste [kg]	2.25E-03	-9.41E-05	2.16E-03

Table 8-19: Waste incurred in the manufacture and disposal of Crometta 85 1jet/green

Crometta 85 1jet/green	Manufacture	End of Life	Total
Pithead stocks [kg]	6.34	-0.43	5.91
Municipal solid waste [kg]	1.03E-01	-1.65E-06	0.10
Hazardous waste [kg]	7.88E-02	1.78E-03	8.06E-02
Special waste [kg]	7.69E-02	1.93E-03	7.88E-02
Radioactive waste [kg]	1.89E-03	-1.52E-04	1.74E-03

Pithead stocks represent the largest percentage of waste. This is primarily attributable to the production of electricity. The negative contribution at the End of Life phase arises on the basis of the credits for electricity and steam when incinerating the hand shower.

Special and radioactive waste are regarded as "Hazardous waste". Special waste essentially comprises waste from upstream stages while radioactive waste is exclusively incurred during electricity production in nuclear power plants.

The following table depicts the waste incurred in the usage scenarios.

Table 8-20: Waste incurred in the usage scenarios

Usage scenario 1 - 15.1 l/min	Transport to the customer	Usage	Total usage
Pithead stocks [kg]	4.36E-04	55.56	55.56
Municipal solid waste [kg]	0.00	1.82E-03	1.82E-03
Hazardous waste [kg]	1.39E-07	2.24E-02	2.24E-02
Special waste [kg]	0.00	4.44E-03	4.44E-03
Radioactive waste [kg]	1.39E-07	1.79E-02	1.79E-02
Usage scenario 2 - 14.4 l/min	Transport to the customer	Usage	Total usage
Pithead stocks [kg]	3.44E-04	52.98	52.99
Municipal solid waste [kg]	0.00	1.73E-03	1.73E-03
Hazardous waste [kg]	1.10E-07	2.13E-02	2.13E-02
Special waste [kg]	0.00	4.24E-03	4.24E-03
Radioactive waste [kg]	1.10E-07	1.71E-02	1.71E-02
Usage scenario 3 - 9 l/min	Transport to the customer	Usage	Total usage
Pithead stocks [kg]	3.44E-04	33.12	33.12
Municipal solid waste [kg]	0.00	1.08E-03	1.08E-03
Hazardous waste [kg]	1.10E-07	1.33E-02	1.33E-02
Special waste [kg]	0.00	2.65E-03	2.65E-03
Radioactive waste [kg]	1.10E-07	1.07E-02	1.07E-02
Usage scenario 4 - 6 l/min	Transport to the customer	Usage	Total usage
Pithead stocks [kg]	3.26E-04	22.08	22.08
Municipal solid waste [kg]	0.00	7.22E-04	7.22E-04
Hazardous waste [kg]	1.04E-07	8.88E-03	8.88E-03
Special waste [kg]	0.00	1.77E-03	1.77E-03
Radioactive waste [kg]	1.04E-07	7.12E-03	7.12E-03

Estimated impact

The following tables depict the impact categories pertaining to fossil abiotic consumption of resources (ADP fossil), elementary abiotic consumption of resources (ADP elementar), Global Warming Potential (GWP), Ozone Depletion Potential (ODP), Acidification Potential (AP), Eutrification Potential (EP) and Photochemical Ozone Creation Potential (POCP) per hand shower for the manufacturing and disposal stages.

Table 8-21: Impact categories per Croma 100 Vario/Multi hand shower – Manufacture and disposal

Croma 100 Vario/Multi		Manufacture	End of Life	Total
ADP elem.	[kg Sb equiv.]	5.85E-05	-2.54E-06	5.60E-05
ADP fossil	[MJ]	38.32	-3.63	34.69
GWP	[kg CO_2 equiv.]	2.52	3.99E-01	2.92
ODP	[kg R11 equiv.]	1.98E-07	-8.06E-09	1.90E-07
AP	[kg SO_2 equiv.]	7.45E-03	-4.06E-05	7.41E-03
EP	[kg PO_4^{3-} equiv.]	7.77E-04	2.23E-05	7.99E-04
POCP	[kg C_2H_4 equiv.]	7.66E-04	-6.36E-06	7.60E-04

Table 8-22: Impact categories per Crometta 85 Vario/Multi hand shower – Manufacture and disposal

Crometta 85 Vario/Multi		Manufacture	End of Life	Total
ADP elem.	[kg Sb equiv.]	5.27E-05	-9.11E-09	5.27E-05
ADP fossil	[MJ]	28.99	-3.96	25.03
GWP	[kg CO_2 equiv.]	1.96	2.25E-01	2.18
ODP	[kg R11 equiv.]	1.63E-07	-2.42E-08	1.39E-07
AP	[kg SO_2 equiv.]	6.17E-03	-4.15E-05	6.13E-03
EP	[kg PO_4^{3-} equiv.]	6.15E-04	4.10E-05	6.56E-04
POCP	[kg C_2H_4 equiv.]	6.45E-04	-7.94E-06	6.37E-04

Table 8-23: Impact categories per Croma 100 1jet hand shower – Manufacture and disposal

Croma 100 1jet		Manufacture	End of Life	Total
ADP elem.	[kg Sb equiv.]	5.84E-05	-1.00E-08	5.84E-05
ADP fossil	[MJ]	34.68	-3.34	31.34
GWP	[kg CO_2 equiv.]	2.32	3.50E-01	2.67
ODP	[kg R11 equiv.]	1.89E-07	-7.51E-09	1.81E-07
AP	[kg SO_2 equiv.]	7.06E-03	-3.03E-05	7.03E-03
EP	[kg PO_4^{3-} equiv.]	6.92E-04	2.27E-05	7.15E-04
POCP	[kg C_2H_4 equiv.]	6.83E-04	-5.48E-06	6.78E-04

Table 8-24: Impact categories per Crometta 85 1jet/green hand shower – Manufacture and disposal

Crometta 85 1jet/green		Manufacture	End of Life	Total
ADP elem.	[kg Sb equiv.]	5.27E-05	-8.03E-09	5.27E-05
ADP fossil	[MJ]	27.52	-3.13	24.39
GWP	[kg CO_2 equiv.]	1.89	2.67E-01	2.15
ODP	[kg R11 equiv.]	1.58E-07	-1.22E-08	1.45E-07
AP	[kg SO_2 equiv.]	6.02E-03	3.59E-05	6.06E-03
EP	[kg PO_4^{3-} equiv.]	5.95E-04	4.37E-05	6.39E-04
POCP	[kg C_2H_4 equiv.]	6.03E-04	-1.79E-06	6.02E-04

Fig. 8-8 depicts the impact categories for the Croma 100 Vario/Multi hand shower in terms of manufacturing and End of Life.

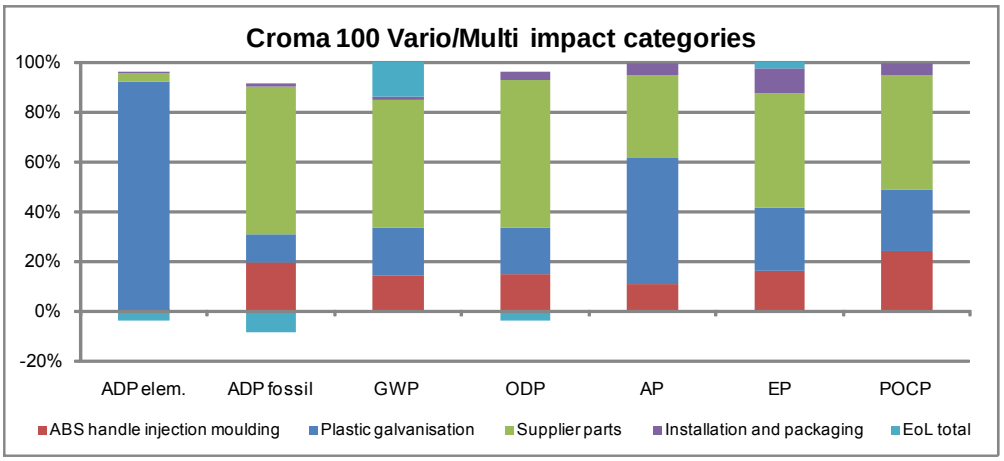


Fig. 8-8: Impact categories per Croma 100 Vario/Multi hand shower – Manufacture and disposal

Some impact categories are dominated by the "Supplier parts" manufacturing phase. As for primary energy, the influence of supplier parts is particularly attributable to PBT and PPE, followed by silicon, POM, EPDM and PE-HD. ADP elementary is dominated by galvanising thanks to the major application of various organic and anorganic chemicals. ADP fossil is similar to primary energy distribution.
The GWP is significantly influenced by the energy- and raw materials-intensive manufacturing stages. The ODP also displays the greatest influence during these manufacturing phases, especially as a result of the electricity used.
Acidification is dominated by the galvanising process. This is particularly attributable to the large number of chemicals used as well as waste water incurred during the galvanising process. Eutrification is dominated by the supplier parts manufacturing phases.
The POCP is largely influenced by supplier parts and injection moulding. This is attributable to the upstream chains of basic materials in the supplier parts.
Assembly, packaging and disposal of the hand showers remain negligible across all of the impact categories.

Distribution of the Croma 100 1jet is similar to that of the Croma 100 Vario/Multi.

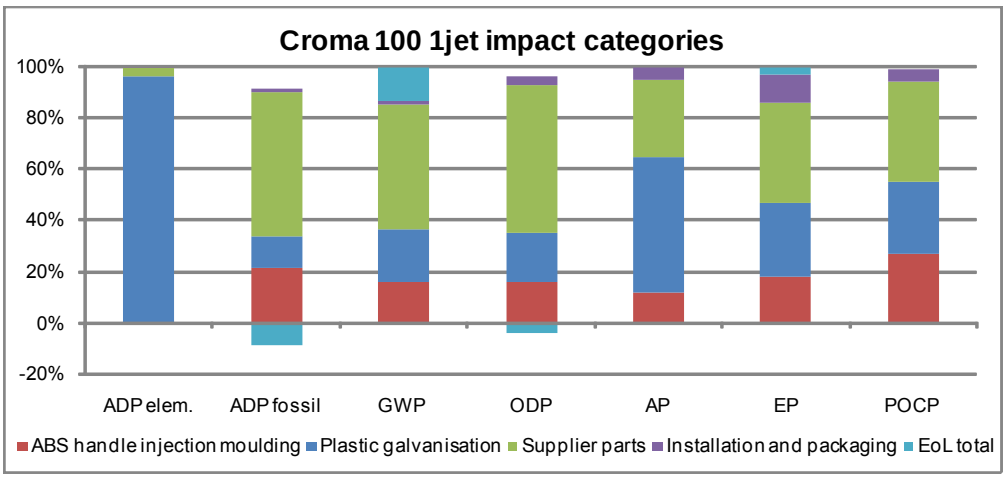


Fig. 8-9: Impact categories per Croma 100 1 jet hand shower – Manufacture and disposal

Fig. 8-10 depicts the impact categories for the Crometta 85 Vario/Multi hand shower in terms of manufacturing and End of Life.

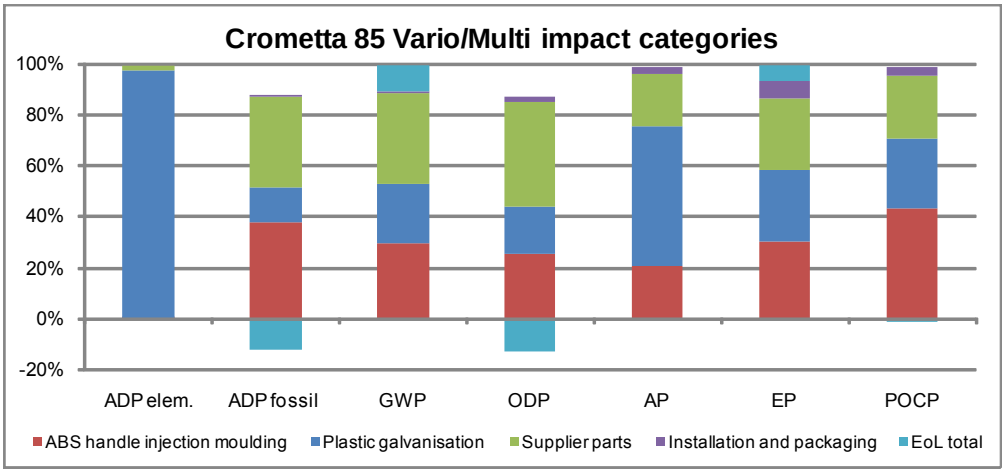


Fig. 8-10: Impact categories per Crometta 85 Vario/Multi hand shower – Manufacture and disposal

What is distinctive here is that nearly every impact category is dominated by a different phase. ADP elementary is dominated by galvanising thanks to the major application of various organic and anorganic chemicals. ADP fossil is similar to primary energy distribution.
The GWP is significantly influenced by the energy- and raw materials-intensive manufacturing stages. The ODP also displays the greatest influence during the manufacturing phases, especially as a result of the electricity used. Acidification is dominated by the galvanising process. This is particularly attributable to the large number of chemicals used as well as waste water incurred during the galvanising process. Eutrification is however dominated to equal extents by the injection moulding, galvanising and supplier parts manufacturing phases.
The POCP is largely influenced by injection moulding. This is particularly attributable to the upstream chain associated with the ABS base material. Assembly, packaging and disposal of the hand showers remain negligible across all of the impact categories.
As for primary energy, the influence of supplier parts is largely attributable to the ABS and POM shares. This is followed by silicon, EPDM and PE-HD.

Distribution of the Crometta 85 1jet/green is similar to that of the Crometta 85 Vario/Multi.

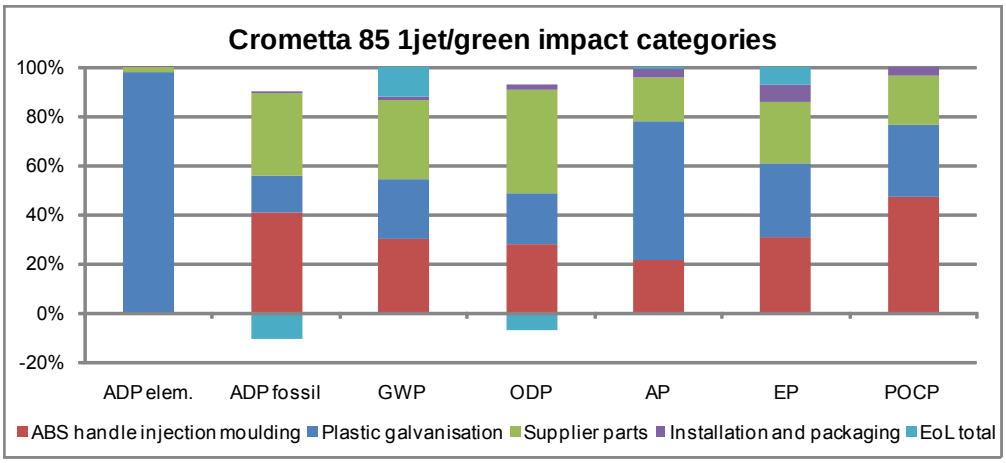


Fig. 8-11: Impact categories per Crometta 85 1 jet/green hand shower – Manufacture and disposal

The following table depicts the impact categories for the usage scenarios.

Table 8-25: Impact categories for the usage scenarios

Usage scenario 1 - 15.1 l/min		Transport to the customer	Usage	Total usage
ADP elem.	[kg Sb equiv.]	2.13E-10	1.66E-05	1.66E-05
ADP fossil	[MJ]	8.82E-02	4347.02	4347.11
GWP	[kg CO_2 equiv.]	6.33E-03	261.72	261.72
ODP	[kg R11 equiv.]	1.12E-11	1.49E-06	1.49E-06
AP	[kg SO_2 equiv.]	2.79E-05	1.95E-01	1.96E-01
EP	[kg PO_4^{3-} equiv.]	6.38E-06	2.54E-02	2.55E-02
POCP	[kg C_2H_4 equiv.]	2.75E-06	2.38E-02	2.38E-02
Usage scenario 2 - 14.4 l/min		Transport to the customer	Usage	Total usage
ADP elem.	[kg Sb equiv.]	1.68E-10	1.58E-05	1.58E-05
ADP fossil	[MJ]	6.97E-02	4145.50	4145.57
GWP	[kg CO_2 equiv.]	5.00E-03	249.58	249.59
ODP	[kg R11 equiv.]	8.83E-12	1.42E-06	1.42E-06
AP	[kg SO_2 equiv.]	2.20E-05	1.86E-01	1.86E-01
EP	[kg PO_4^{3-} equiv.]	5.04E-06	2.43E-02	2.43E-02
POCP	[kg C_2H_4 equiv.]	2.17E-06	2.27E-02	2.27E-02
Usage scenario 3 - 9 l/min		Transport to the customer	Usage	Total usage
ADP elem.	[kg Sb equiv.]	1.68E-10	9.87E-06	9.87E-06
ADP fossil	[MJ]	6.97E-02	2590.94	2591.01
GWP	[kg CO_2 equiv.]	5.00E-03	155.99	156.00
ODP	[kg R11 equiv.]	8.83E-12	8.85E-07	8.86E-07
AP	[kg SO_2 equiv.]	2.20E-05	1.17E-01	1.17E-01
EP	[kg PO_4^{3-} equiv.]	5.04E-06	1.52E-02	1.52E-02
POCP	[kg C_2H_4 equiv.]	2.17E-06	1.42E-02	1.42E-02
Usage scenario 4 - 6 l/min		Transport to the customer	Usage	Total usage
ADP elem.	[kg Sb equiv.]	1.60E-10	6.58E-06	6.58E-06
ADP fossil	[MJ]	6.60E-02	1727.29	1727.36
GWP	[kg CO_2 equiv.]	4.74E-03	103.99	104.00
ODP	[kg R11 equiv.]	8.36E-12	5.90E-07	5.90E-07
AP	[kg SO_2 equiv.]	2.09E-05	7.77E-02	7.77E-02
EP	[kg PO_4^{3-} equiv.]	4.78E-06	1.01E-02	1.01E-02
POCP	[kg C_2H_4 equiv.]	2.06E-06	9.46E-03	9.47E-03

The following graphics (Figs. 8-12) depict the impact categories for the entire manufacturing, usage and End of Life phases taking the Crometta 85 Vario/Multi as an example. In this case, usage is calculated on the basis of the flow rate of 14.4 l/min.

In almost all of the impact categories, it goes without saying that one-year usage dominates on account of the high energy consumption levels. In the case of ADP elementary however, manufacturing still displays the largest share. This is attributable to the chemicals used in galvanising.
At lower flow rates, the percentage accounted for by manufacturing increases while usage falls, whereby usage still continues to dominate in practically all of the impact categories (please refer to Fig. 8-13).

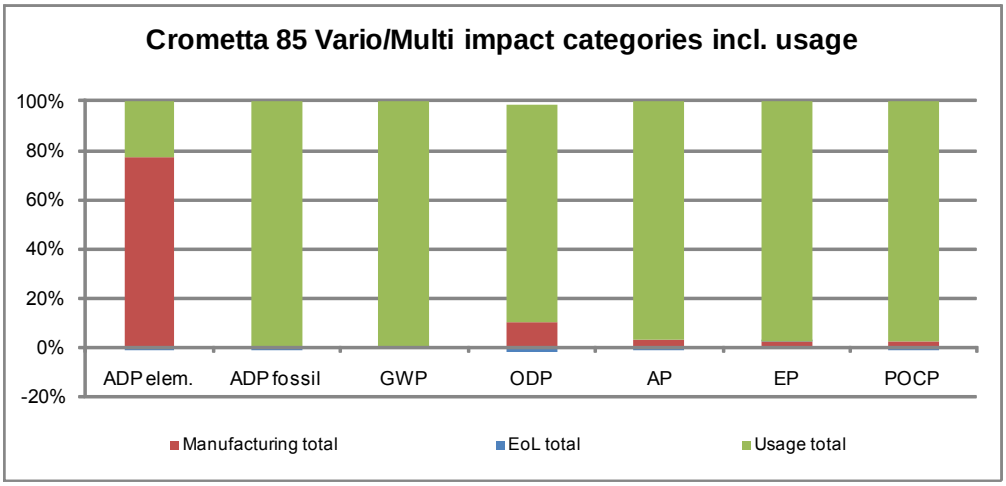


Fig. 8-12: Impact categories for the Crometta 85 Vario/Multi incl. usage scenario 2

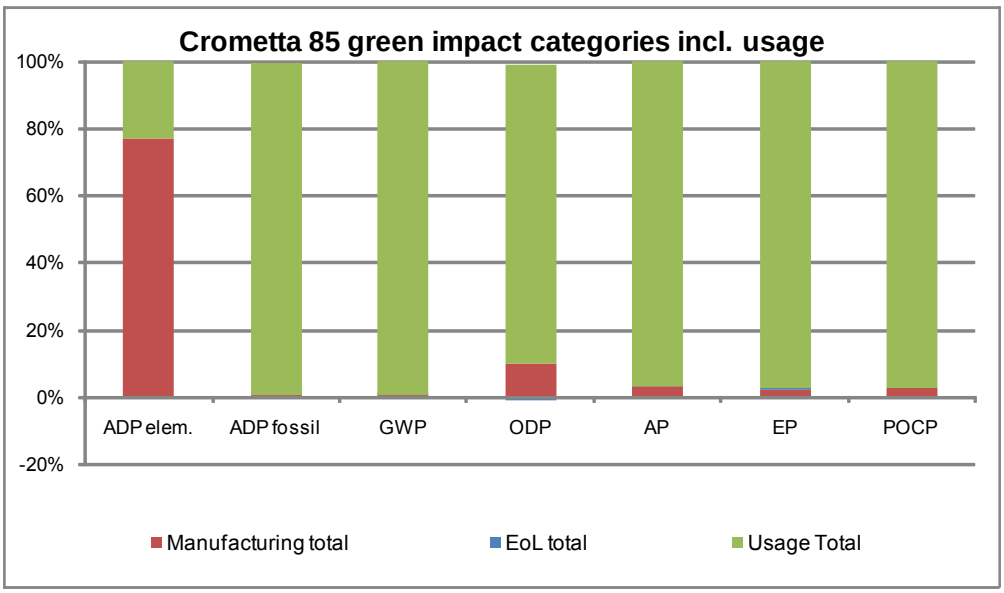


Fig. 8-13: Impact categories for the Crometta 85 Vario/Multi incl. usage scenario 4

9 Requisite evidence

No documentation is required.

10 PCR document and examination

This Declaration is based on the "Bathroom fittings and showers" PCR document, December 2010, / PCR 2011/.

Review of the PCR document by the Expert Committee. Chairman of the Expert Committee: Prof. Dr.-Ing. Hans-Wolf Reinhardt (University of Stuttgart, IWB)
Independent examination of the Declaration in accordance with ISO 14025: ☐ internal ☒ external
Validation of the Declaration: Dr. Birgit Grahl

11 Literature

DGNB-SB14 — DGNB building certification: New residential buildings; profile no.: NWO10-14 Drinking water requirements and waste water volumes

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DIN EN 1112	Sanitary fittings - Showers for Type I and Type 2 Sanitary Fittings for Water Supply Systems - General technical specification;
DIN EN ISO 9001	DIN EN ISO 9001 – Quality Management Systems – Requirements; Version in 3 languages DIN EN ISO 9001:2008
DIN ISO 14001	DIN ISO 14001 - Environment Management system – Requirements with instructions on application; German and English versions EN ISO 14001:2004 + AC:2009
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OHSAS 18001	OHSAS 18001 Health and industrial protection management in the workplace

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