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Lot 23

Domestic and commercial hobs and grills included when incorporated in cookers

Task 5: Definition of Base-Case

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In association with

ERA Technology Ltd

Bio Intelligence Service - Scaling sustainable development
Industrial Ecology - Nutritional Health

Bio Intelligence Service S.A.S - bio@biois.com
20-22 Villa Deshayes - 75014 Paris - France
Tél. +33 (0)1 53 90 11 80 - Fax. +33 (0)1 56 53 99 90

Contact BIO Intelligence Service
Shailendra Mudgal – Benoît Tinetti
☎ + 33 (0) 1 53 90 11 80
shailendra.mudgal@biois.com
benoit.tinetti@biois.com

Project Team

BIO Intelligence Service

Mr. Shailendra Mudgal

Mr. Benoît Tinetti

Mr. Eric Hoa

Mr. Guillaume Audard

ERA Technology

Dr. Chris Robertson

Dr. Paul Goodman

Dr. Stephen Pitman

Contents

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5. TASK 5 – DEFINITION OF BASE-CASE

The purpose of this task is:

- To select the average EU representative model or to construct an average EU model based on key characteristics from several important product subcategories.
- To define a standard Base-Case, i.e. the environmental impact, functionality and Life Cycle Costs for a reference year, measured according to harmonised test standards (that would also be used for compliance testing).
- To define a real-life Base-Case, i.e. the (estimated) environmental impact, functionality and Life Cycle Costs in real-life for a reference year with actual consumer behaviour and ambient conditions.

The Base-Case is a conscious abstraction of reality, which is a necessary instrument for practical reasons (budget, time). Given this abstraction, the question whether it leads to unsuitable conclusions for certain market segments will be addressed in the impact- and sensitivity analysis (Task 8).

The description of the Base-Cases is the synthesis of the results of Tasks 1 to 4. Most of the environmental and life cycle cost analysis are built on these Base-Cases throughout the rest of the study and it serves as the point-of-reference for Task 6 (technical analysis of BAT), Task 7 (improvement potential) and Task 8 (policy analysis).

5.1. PRODUCT-SPECIFIC INPUTS

This section describes the technical analysis of typical domestic and commercial hobs and grills which exist in the EU market. This data will cover the production phase, the distribution phase, the use phase and the end-of-life phase. Bill of materials (BOM) and resource consumption during product life are the most important parameters to be looked at[1]. This will be used as the general input for the Base-Case environmental impact assessment, in section 5.2.

5.1.1. DEFINITION OF BASE-CASES

The objective of this section is to define and describe the Base-Cases, based on the previous tasks and the information recovered from the stakeholders and the literature review. The Base-Cases are "a conscious abstraction of reality" and have to cover the wide variety of existing products in order to be as representative of the European market as possible. Therefore, the number of Base-Cases is dimensioned to be small

[1] Necessary input into EcoReport

enough to enable a simplified analysis of the market but large enough to deal with the technological panel of products.

The appliances covered by Lot 23 are very diverse in the way they are designed and used. The definition of base-cases has to take into account this diversity, but the MEEuP methodology requires the number of base-cases to be low. As a result, some appliances that are under the scope of this study will not be covered by the Base-Cases, as their energy consumption at the EU level was considered too low to be included as Base-case. The following paragraphs detail the choice of the base-cases presented in Table 5-1.

- **Domestic Sector**

The electric hob using radiant technology is chosen as a representative of electric hobs based on its greater market share (see Table 2-14 in Task 2). Therefore, the Base-Case for domestic electric hobs are built on related data. Induction and solid plate hobs are not further characterised in this Task but their market shares are considered in Task 8 when running the scenario analysis (including the potential impact on the EU total energy consumption). Regarding the hob configuration, built-in independent hobs (for both gas and electric) are the most representative of the market while 74% of the hobs have 4 cooking zones (See Tables 2-13 and 2-15, in Task 2). These parameters are then chosen to characterise the domestic base-cases for electric and gas hobs.

Grills in the domestic sector are not further investigated either. This is due to their low frequency of use which leads to a low annual energy consumption at EU level. Therefore, any improvement potential in energy efficiency is currently not foreseen to have significant saving impacts at the EU level. Moreover, as the offer for domestic grills is quite diversified with many different designs, the identification of potential Base-Cases is problematic.

- **Commercial sector**

Hobs and grills used in the commercial sector are different from those found in the domestic sector, in terms of technology as well as user behaviour. Different designs and functionalities are available to meet specific needs of the commercial sector.

A market survey at manufacturer level was performed in order to identify the most relevant commercial appliances within lot 23 scope, and therefore converge towards defined base-cases. Based on the feedback of four main EU manufacturers on their sale shares according to their product catalogues, a preliminary overview of the market distribution was compiled (see Figure 5-1). As presented in Task 2, this overview is only indicative as there is some uncertainty on the aggregated shares of the different manufacturers but some common trends have however been observed: gas boiling tops, electric boiling tables and gas and electric fry tops are the most sold products (in total 67.6% of the lot 23 cooking appliances) and will then be further considered as base-cases in the study.

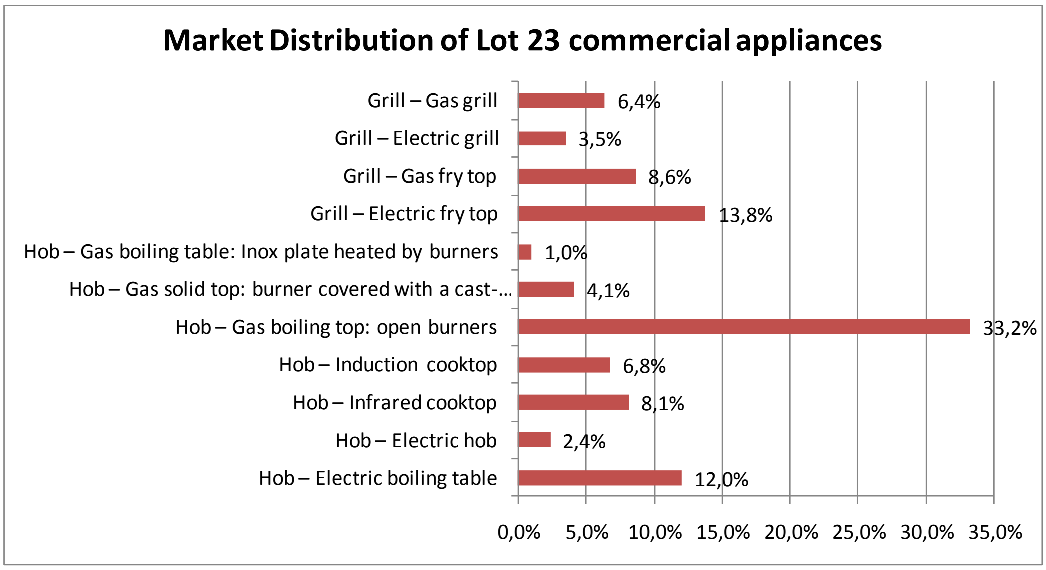


Figure 5-1 : Proposed Market distribution of Lot 23 commercial appliances at EU level

- **Separation between appliances using different energy sources**

Appliances of the same category using different energy sources will be treated in separate Base-cases.

At the present time, there are no common standard test procedures to measure the energy consumption of electric and gas hobs or grills. Therefore, even by converting final energy consumptions into primary energy consumptions, it is currently not possible to make a rigorous comparison between appliances using different energy sources.

A Base-case for each energy source will result in assessing the improvement potential and pinpointing the Best Available Technology separately for each Base-case. However, a separation between energy sources at this stage of the study will have not influence in any way the recommendations that will be made in Task 8, or on the implementing measures that will be adopted by the European Commission. The aim of this preparatory study is to provide the European Commission the necessary knowledge to set up implementing measures. Having implementing measures covering all appliances whatever their energy source or specific implementing measures for each type of appliance is a political decision that will be made by the European Commission later in the legislative process.

- **Synthesis**

Although the MEEuP methodology foresees one or two BCs to cover the entire EU market for the products considered in each preparatory study, in this study six BCs emerged for hobs and grills. Such a high number of BCs is necessary to appropriately cover the broad range of technical specifications and functionalities of hobs. Table 5-1 gives an overview of the four base-cases, which are products that have already been presented in the previous tasks.

Table 5-1: Description of the base-cases

Base-Case	Configuration	Number of cooking zones (Surface Area in cm^2 for commercial appliances)	Technology Type	Total maximum power (kW)
BC1 - Domestic electric hob	Built-in independent	4	Radiant (Vitroceramic surface)	7.4
BC2 - Domestic gas hob	Built-in independent	4	Stainless Steel on open-burners	9
BC3 - Commercial electric hob	Free-standing	4 (3,600 cm^2)	Electric Resistance	16
BC4 - Commercial gas hob	Free-standing	4 (5,900 cm^2)	Stainless Steel plate on open-burners	28
BC5 - Commercial electric fry-top	Free-standing	1 (2,000 cm^2)	Electric Resistance	6.6
BC6 - Commercial gas fry-top	Free-standing	1 (2,000 cm^2)	Stainless Steel plate on open-burners	10

5.1.2. DOMESTIC APPLIANCES

5.1.2.1. INPUTS IN THE PRODUCTION PHASE

Production phase data related to typical hobs consists of the Bill of Materials (BOM) and the sheet metal scrap generated during the manufacturing phase. The BOMs have already been presented in Task 4.

- **Material equivalents**

Because the EcoReport was initially designed as a simple and generic tool for all Ecodesign preparatory studies, its database does not include some materials found in domestic hobs. The list of those materials is presented in Table 5-2. The equivalences were mainly based from the assumptions made in previous Ecodesign preparatory studies.

Table 5-2: Material found in domestic appliances covered by Lot 23 not included in EcoReport

Material	BC	Weight	Percentage of the total weight	Most similar material available
Ceramic glass	BC1	3230 g	33%	54-Glass for lamps
Silicone seal	BC1	90	1%	16-Flex PUR
Silicone Glue	BC1	16	0.2%	14-Epoxy
PTFE	BC2	118.5	1.5%	11-PA6

The equivalence for the ceramic glass in BC1 is here pointed as a critical point as it represents around 33% of the total weight. A more detailed characterisation could be recommended in future work.

- **Weight distribution**

In Table 5-3, the weight distribution according to material categories is presented.

Table 5-3: Composition of the Base-Cases, by category of materials

Base-Case	Weight	1 Bulk Plastics	2 Tech. Plastics	3 Ferro	4 Non-ferro	5 Coating	6 Electronics	7 Misc.	Total
Base-Case 1: Domestic electric hob	in g	121	106	5,147	616	0	489	3,230	9,709
	in %	1%	1%	53%	7%	0%	5%	33%	100%
Base-Case 2: Domestic gas hob	in g	107	150.5	5,467	2,030.5	0	0	39	7,794
	in %	1.5%	2%	70%	26%	0%	0%	0.5%	100%

As all domestic base-cases have a high proportion of ferrous materials in their BOM, environmental impacts of the production and manufacturing phases are expected to be mainly due to this category of materials. BC1 has also a significant proportion of materials under the category 7-Misc, mainly glassy materials. However, EcoReport provides only a few glassy materials (18-E-glass fiber and 54-Glass for lamps). Thus, the approximations which had to be made to fill the BOMs could bias the environmental analysis (as previously announced in the section on material equivalents).

Regarding the sheet metal scrap percentage generated during the manufacturing phase, a rate of 5% has been assumed for all Base-Cases.

5.1.2.2. INPUTS IN THE DISTRIBUTION PHASE

Input data related to the distribution phase of the product to be used in the MEEuP EcoReport calculations are based on the volume of the packaged product. These volumes are exposed in Table 5-4 below.

Table 5-4: Volume of packaged product for base-cases

Base-Case	Volume of packaged product (in m^3)
BC1: Domestic electric hob	0.061
BC2: Domestic gas hob	0.057

Both BCs have similar package volumes.

Two other pieces of information are required in this section. These parameters will be common for all base-cases:

- Is it an ICT or Consumer Electronics product <15 kg: **No**
- Is it an installed appliance: **No**

5.1.2.3. INPUTS IN THE USE PHASE

Energy consumption

The energy consumption during the use phase is expected to be a major contributor to the environmental impacts of a hob. The annual energy consumption is required as an input in EcoReport, as well as the product lifetime which was evaluated in the market analysis (see Task 2). These inputs will also be used to calculate the Life Cycle Costs (LCC) of the base-cases.

Table 5-5: Energy consumption for each base-case

Base-Cases	Consumption per cycle (kWh)	Number of cycle per year
BC1: Domestic electric hob	0.55	438
BC2: Domestic gas hob	0.75	438

The energy consumption per cycle and the number of cycle per year were assessed in Task 3. In the case of domestic electric hobs, radiant technology has been chosen as a representative scenario.

The calculation of the impacts of gas consumption in EcoReport was intended to be applied to building heating systems. Consequently, an “Avg. Heat Power Output” is required. To input the gas consumption in the tool, “69-Gas, atmospheric” was selected as fuel, with an efficiency of 86.0%. The “heat output” parameter was calculated to have an energy input of 0.75kWh with an efficiency of 86.0%, which is 0.645kWh.

Number of kilometres over the product life

For all domestic Base-Cases, the number of kilometres travelled for maintenance and repair for one hob was estimated is given in Table 5-6.

Table 5-6: Number of kilometre over the product life

Base-Case	Number of kilometres over the product life
BC1: Domestic electric hob	15
BC2: Domestic gas hob	15

As no stakeholder was able to provide this information, the number of kilometres estimated in previous preparatory studies concerning household appliances[2] was reused.

5.1.2.4. INPUTS IN THE END-OF-LIFE PHASE

For the Base-Case 1, end-of-life inputs have been provided by a manufacturer of electric hob who stated that 54**%** of the product weight is not recovered (go to landfill). This significant share would correspond to the glassy materials that are currently not-well standardised for recycling.

For the Base-Case 2, the approach is different. Similar to ovens, it is assumed that most of all materials in the gas hob (98%) are recovered and follow one of the following options:

- metals are 100% recycled;
- paper, cardboard, and plastics are 100% incinerated or thermally recycled (benefits of energy recovery);
- Hazardous waste consists only of electronic components, which are considered easy to disassemble and are in limited quantity.

Regarding the plastic fraction (see Table 5-7), the following end-of-life management options were also differently estimated for the domestic base-cases, based on stakeholders' feedback:

Table 5-7: End-of-Life management for plastic fraction

Base-Case	Re-use, closed loop recycling	Material recycling	Thermal recycling
BC1: Domestic electric hob	30 %	54 %	17 %
BC2: Domestic gas hob	15 %	83 %	2 %

[2] See Preparatory Study for Eco-design Requirements of EuPs – Lot 13: Domestic refrigerators & Freezers: www.ecocold-domestic.org/index.php?option=com_docman&task=doc_download&gid=122&Itemid=40

5.1.2.5. ECONOMIC INPUTS

Economic data used for the calculations of the Life Cycle Costs (LCC) were elaborated in Task 2 (product lifetime and product prices, energy rates, etc).

Table 5-8 presents the lifetimes, sales and stock figures (which are used to assess environmental and economic impacts at EU level) and product prices for both Base-Cases. It is considered that consumers are not charged with any disposal costs.

Table 5-8: EcoReport economic inputs of the base-cases

Base-Case	Product Lifetime (in years)	Sales in 2007 (units)	Stock in 2007 (units)	Product price (in €)	Maintenance costs (in €)
BC1: Domestic electric hob	19	5,200,000	71,500,000	380*	0
BC2: Domestic gas hob	19	3,300,000	62,150,000	268	0

*average price related to radiant technology, which is representative for the base-case.

In addition, Table 5-9 presents the energy rates used for each base-case.

Table 5-9: Energy, water and consumables rates, by base-case

Base-Case	Electricity rate (€/kWh)	Natural gas rate (€/MJ)
BC1: Domestic electric hob	0.1658	
BC2: Domestic gas hob		0.01621

Furthermore, the discount rate (4%) was provided by the EC and is the same for all Base-Cases.

For each base-case, the improvement ratio indicates the difference of global efficiency during the use phase between the new sales and the current stock. For Lot 23, the overall improvement ratios (market over stock) were assumed to be 1.

5.1.3. COMMERCIAL APPLIANCES

5.1.3.1. INPUTS IN THE PRODUCTION PHASE

Production phase data related to commercial cooking appliances consists of the Bill of Materials (BOM) and the sheet metal scrap generated during the manufacturing phase, which were collected and manufacturer level. The BOMs have already been presented in Task 4.

In Table 5-10, the weight distribution according to material categories is presented.

Table 5-10: Composition of the base-cases, by category of materials

Base-Case	Weight	1 Bulk Plastics	2 Tech. Plastics	3 Ferro	4 Non-ferro	5 Coating	6 Electronics	7 Misc.	Total
Base-Case 3: Commercial electric hob	in g	5,400	1,160	72,200	1,200	0	0	120	80,080
	in %	6.7	1.4	90.2	1.5	0	0	0.1	100
Base-Case 4 : Commercial gas hob	in g	5,100	6,60	50,500	2,000	0	0	0	58,260
	in %	8.8	1.1	86.7	3.4	0	0	0	100
Base-Case 5 : Commercial electric fry top	in g	7,070	860	53,820	3,430	0	0	170	65,350
	in %	10.8	1.3	82.4	5.2	0	0	0.3	100
Base-Case 6 : Commercial gas fry top	in g	5,530	860	54,090	3,660	0	0	170	64,310
	in %	8.6	1.3	84.1	5.7	0	0	0.3	100

As all commercial base-cases have a high proportion of ferrous materials in their BOM, environmental impacts of the production and manufacturing phases are expected to be mainly due to this category of materials.

Regarding the sheet metal scrap percentage generated during the production phase, a rate of 7% has been assumed for hobs and 7.5% for grills, based on manufacturers' feedbacks.

5.1.3.2. INPUTS IN THE DISTRIBUTION PHASE

Input data related to the distribution phase of the product to be used in the MEEuP EcoReport calculations are based on the volume of the packaged product. These volumes are exposed in Table 5-11 below.

Table 5-11: Volume of packaged product for base-cases

Base-Case	Volume of packaged product (in m^3)
Base-Case 3: Commercial electric hob	1.1
Base-Case 4 : Commercial gas hob	0.8
Base-Case 5 : Commercial electric fry top	0.8
Base-Case 6 : Commercial gas fry top	0.8

Two other pieces of information are required in this section. These parameters will be common for all base-cases:

- Is it an ICT or Consumer Electronics product <15 kg: **No**
- Is it an installed appliance: **No**

5.1.3.3. INPUTS IN THE USE PHASE

Energy consumption

The energy consumption during the use phase is expected to be a major contributor to the environmental impacts of a hob. The annual energy consumption is required as an input in EcoReport, as well as the product lifetime which was evaluated in the market analysis (see Task 2). These inputs will also be used to calculate the Life Cycle Costs (LCC) of the base-cases.

Table 5-12: Energy consumption for each base-case

Base-Cases	Consumption per hour (kWh)	Number of hours per year (equivalent at full-power)
Base-Case 3: Commercial electric hob	16	1248
Base-Case 4 : Commercial gas hob	28	1248
Base-Case 5 : Commercial electric fry top	6.6	1248
Base-Case 6 : Commercial gas fry top	10	1248

The energy consumption per cycle and the number of cycle per year were assessed in Task 3.

The calculation of the impacts of gas consumption in EcoReport was intended to be applied to building heating systems. Consequently, an "Avg. Heat Power Output" is required. To input the gas consumption in the tool, "69-Gas, atmospheric" was selected as fuel, with an efficiency of 86.0%. In Base-cases 4 and 6, the "heat output" parameters were calculated to have energy inputs of 28 and 10 kWh with an efficiency of 86.0%, which respectively correspond to 24.08 and 8.6 kWh.

Number of kilometres over the product life

For all base-cases, the number of kilometres travelled for maintenance and repair for one hob was estimated is given in Table 5-13, based on manufacturers' feedbacks.

Table 5-13: Number of kilometre over the product life

Base-Case	Number of kilometres over the product life
Base-Case 3: Commercial electric hob	600
Base-Case 4 : Commercial gas hob	400
Base-Case 5 : Commercial electric fry top	600
Base-Case 6 : Commercial gas fry top	690

5.1.3.4. INPUTS IN THE END-OF-LIFE PHASE

For commercial hobs and grills, respectively 15% and 10% of their weights were assumed to be not-recovered (go to landfill) during the end-of-life phase, based on manufacturers' feedbacks.

Indeed, in principle, almost all materials in the electric and gas hobs and grills' composition are recovered and follow one of the following options:

- Metals are 100% recycled;
- Paper, cardboard, and plastics are 100% incinerated or thermally recycled (benefits of energy recovery);
- Hazardous waste consists only of electronic components, which are considered easy to disassemble and are in limited quantity (around 1% of the total weight).

Regarding the plastic fraction, the following end-of-life management options were estimated for all Base-cases, based on stakeholders' feedbacks:

- Re-use, closed loop recycling: 0 %
- Material (or mechanical) recycling: 5 %
- Thermal recycling: 95 %.

5.1.3.5. ECONOMIC INPUTS

Economic data used for the calculations of the Life Cycle Costs (LCC) were elaborated in Task 2 (product lifetime and product prices, energy rates, etc).

Table 5-14 reminds the lifetimes, sales and stock figures (which are used to assess environmental and economic impacts at EU level) and product prices for the commercial Base-Cases. It is considered that consumers are not charged with any disposal costs.

Table 5-14: EcoReport economic inputs of the base-cases

Base-Case	Product Lifetime (in years)	2007 Sales (units)	2007 Stock (units)	Product price (€)	Installation costs (€)	Maintenance costs (€)
Base-Case 3: Commercial electric hob	12	10,833	130,000	2,900	60	980
Base-Case 4 : Commercial gas hob	12	16,667	200,000	2,950	60	400
Base-Case 5 : Commercial electric fry top	10	7,500	75,000	2,300	60	920
Base-Case 6 : Commercial gas fry top	10	7,500	75,000	2,400	60	1,130

In addition, Table 5-15 presents the energy rates used for each base-case.

Table 5-15: Energy, water and consumables rates, by base-case

Base-Case	Electricity rate (€/kWh)	Natural gas rate (€/MJ)
Base-Case 3: Commercial electric hob	0.1554	
Base-Case 4 : Commercial gas hob		0.01481
Base-Case 5 : Commercial electric fry top	0.1554	
Base-Case 6 : Commercial gas fry top		0.01481

Furthermore, the discount rate (4%) was provided by the EC and is the same for all base-cases. The overall improvement ratios (market over stock) were assumed to be 1. For each base-case, this improvement ratio indicates the difference of global efficiency during the use phase between the new sales and the current stock.

5.2. BASE-CASE ENVIRONMENTAL IMPACT ASSESSMENT

The aim of this subtask is to assess the environmental impacts of each Base-Case following the MEEuP (EcoReport Unit Indicators) for each life cycle stage:

- Raw Materials Use and Manufacturing (Production phase);
- Distribution;
- Use;
- End-of-Life.

The base-case environmental impact assessment will lead to an identification of basic technological design parameters being of outstanding environmental relevancy[3]. These parameters will be listed as they will serve as an important input to the identification of eco-design options.

The assessment results are tracked back to the main contributing components, materials and features of the hobs.

5.2.1. DOMESTIC APPLIANCES

5.2.1.1. BASE-CASE 1: DOMESTIC ELECTRIC HOB

Table 5-16 shows the environmental impacts of a domestic electric hob over its whole life cycle. The total energy consumption for the whole life cycle of the Base-

[3] As far as the MEEuP EcoReport allows the identification of such indicators.

Case 1 is 49.4 GJ, of which 48.5 GJ (i.e. 13.5 MWh) comes from the electricity consumption.

Table 5-16: Life Cycle Impact (per unit) of Base-Case 1

	Life Cycle phases -->		PRODUCTION			DISTRI-	USE	END-OF-LIFE*			TOTAL
	Resources Use and Emissions		Material	Manuf.	**Total**	**BUTION**		Disposal	Recycl.	**Total**	
	Other Resources & Waste							debet	credit		
8	Total Energy (GER)	MJ	761	85	847	134	48,104	362	12	350	49,435
9	of which, electricity (in primary MJ)	MJ	356	51	407	0	48,064	0	1	-1	48,470
10	Water (process)	ltr	436	1	437	0	3,208	0	1	-1	3,645
11	Water (cooling)	ltr	108	23	132	0	128,160	0	4	-4	128,287
12	Waste, non-haz./ landfill	g	16,712	302	17,014	91	55,892	6,428	3	6,425	79,422
13	Waste, hazardous/ incinerated	g	324	0	324	2	1,111	39	0	38	1,475
	Emissions (Air)										
14	Greenhouse Gases in GWP100	kg CO2 eq.	54	5	58	9	2,101	27	0	27	2,195
15	Ozone Depletion, emissions	mg R-11 eq.	negligible								
16	Acidification, emissions	g SO2 eq.	489	21	509	27	12,383	53	1	52	12,972
17	Volatile Organic Compounds (VOC)	g	4	0	4	1	19	2	0	2	25
18	Persistent Organic Pollutants (POP)	ng i-Teq	97	3	100	1	316	44	0	44	461
19	Heavy Metals	mg Ni eq.	353	6	359	5	836	106	0	106	1,306
	PAHs	mg Ni eq.	55	0	55	5	103	0	0	0	163
20	Particulate Matter (PM, dust)	g	40	3	43	209	397	475	0	475	1,125
	Emissions (Water)										
21	Heavy Metals	mg Hg/20	384	0	384	0	314	30	0	30	728
22	Eutrophication	g PO4	8	0	8	0	2	2	0	2	11
23	Persistent Organic Pollutants (POP)	ng i-Teq	negligible								

Figure 5-2 exposes the contribution of each life cycle phase to each environmental impact. Several observations can be made from this analysis:

- **Material acquisition** is predominant in the total environmental impact for the following categories :
    - Heavy metals emissions to water: 53% (mainly due to the stainless steel used for the heating elements and the electronic controls)
    - Eutrophication: 70% (mainly due to the stainless steel used for the heating elements and the electronic controls)

  and contributes for the categories:
    - Heavy metals emissions to the air: 27% (mainly due to the stainless steel used for the heating elements)
    - PAHs : 34% (mainly due to the aluminium used in the casing and the electronic controls)

- **Manufacturing** is not significantly impacting any of the categories
- **Distribution** is significantly contributing to the emissions of Particulate matter to the air, with 19%
- **The use phase** impacts are dominating the total environmental in the case of :
    - Total Energy (GER): 97%
    - Electricity: 99%
    - Water (process): 88%
    - Waste, non-hazardous / landfill : 70%
    - Waste, hazardous / incinerated: 75%
    - Greenhouse gases: 96%
    - Acidification (emissions to air): 95%
    - Volatile Organic Compounds (VOC): 73%
    - Persistent Organic Pollutants (POP): 69%
    - Heavy metals emissions to the air: 64%
    - PAHs (emissions to the air): 63%

  and contributes in the case of:
    - Particulate Matter: 35%
    - Heavy metals emissions to water: 43%
- **End-of-life** is having a significant impact on Particulate Matter : 42% (due to the high share of the product going to landfill)

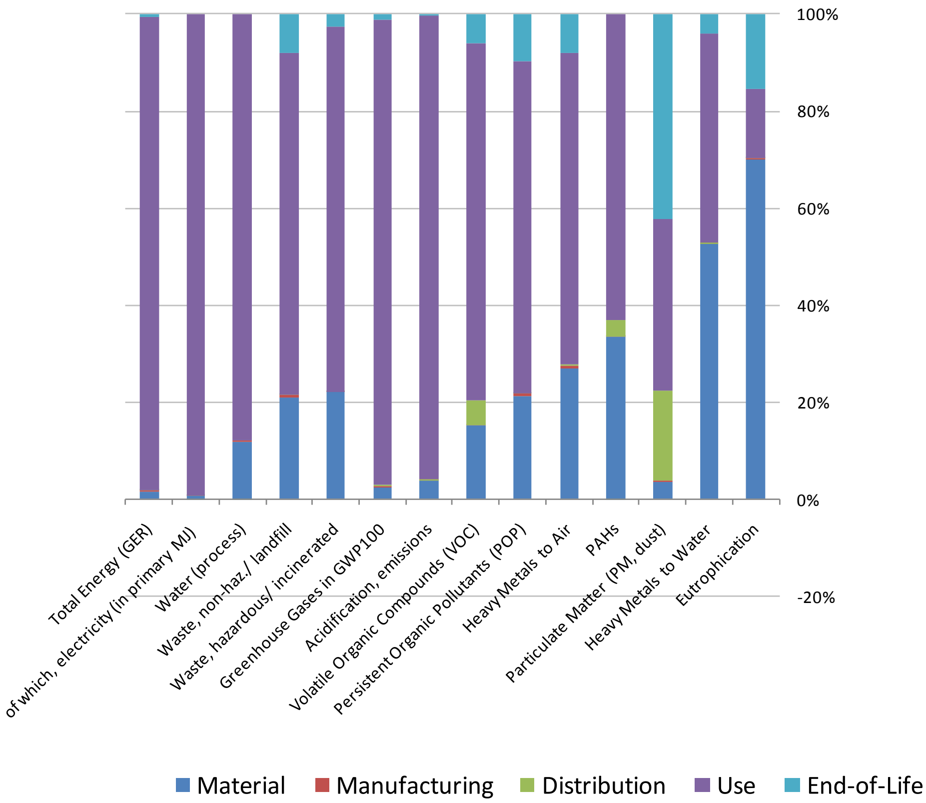


Figure 5-2: Distribution of environmental impacts of BC 1 per life cycle phase

5.2.1.2. BASE-CASE 2: DOMESTIC GAS HOB

Table 5-17 shows the environmental impacts of a domestic gas hob over its whole life cycle. The total energy consumption for the whole life cycle of the Base-Case 2 is 24.4 GJ, of which 58 MJ (i.e. 16.1 kWh) comes from the electricity consumption.

Table 5-17: Life Cycle Impact (per unit) of Base-Case 2

	Life Cycle phases -->		PRODUCTION			DISTRI-	USE	END-OF-LIFE*			TOTAL
	Resources Use and Emissions		Material	Manuf.	Total	BUTION		Disposal	Recycl.	Total	
	Other Resources & Waste							debet	credit		
8	Total Energy (GER)	MJ	286	58	343	129	23,968	13	13	0	24,440
9	of which, electricity (in primary MJ)	MJ	24	34	58	0	1	0	1	-1	58
10	Water (process)	ltr	6	1	6	0	0	0	1	-1	6
11	Water (cooling)	ltr	36	16	52	0	1	0	5	-5	47
12	Waste, non-haz./ landfill	g	16707	198	16,905	89	169	192	4	188	17,351
13	Waste, hazardous/ incinerated	g	4	0	4	2	0	5	1	5	10
	Emissions (Air)										
14	Greenhouse Gases in GWP100	kg CO2 eq.	20	3	23	9	1,326	1	0	1	1,359
15	Ozone Depletion, emissions	mg R-11 eq.	negligible								
16	Acidification, emissions	g SO2 eq.	176	14	190	26	390	2	1	1	608
17	Volatile Organic Compounds (VOC)	g	1	0	1	1	18	0	0	0	20
18	Persistent Organic Pollutants (POP)	ng i-Teq	146	1	148	1	1	1	0	1	151
19	Heavy Metals	mg Ni eq.	74	3	77	5	9	4	0	4	94
	PAHs	mg Ni eq.	23	0	23	5	9	0	0	0	36
20	Particulate Matter (PM, dust)	g	17	2	19	195	139	22	0	22	375
	Emissions (Water)										
21	Heavy Metals	mg Hg/20	44	0	44	0	0	1	0	1	45
22	Eutrophication	g PO4	1	0	1	0	0	0	0	0	1
23	Persistent Organic Pollutants (POP)	ng i-Teq	negligible								

Figure 5-3 exposes the contribution of each life cycle phase to each impact. Several observations can be made from this analysis:

- **Material acquisition** is predominant in the total environmental impact for the following categories :
  - Water (process) : 92% (mainly due to the ferrite used in the burners and the pan support)
  - Waste, non-hazardous /landfill: 96% (mainly due to the steel used for the casing to the ferrite used in the burners)
  - Persistent Organic Pollutants (POP): 97% (mainly due to the steel used for the casing and to the ferrite used in the burners and pan support)

- Heavy metals emissions to the air: 79% (mainly due to the ferrite used in the burners and pan support)
- PAHs (emissions to the air): 62% (mainly due to the aluminium used for the burners)
- Heavy metals emissions to water: 96.7% (mainly due to the steel used for the casing and to the cupper used in the thermocouple)
- Eutrophication: 91% (due to most metals and tec. plastics)

and contributes for the categories:

- Electricity consumption: 41% (mainly due to the steel used for the casing)
- Waste, hazardous / incinerated: 36% (mainly due to PA-6)
- Acidification, emissions: 29% (due to most metals)

- **Manufacturing** is the phase where 59% of the electricity is consumed, but the overall energy consumption of the manufacturing phase can be neglected compared to the total energy consumption.

- **Distribution** is significantly contributing to the categories:
  - Particulate Matter (PM, dust): 52%
  - Waste, hazardous / incinerated: 18%

  and to lower extend to :
  - PAHs: 14%

- **The use phase** impacts are dominating the total environmental impacts in the case of :
  - Total Energy (GER): 98%
  - Greenhouse gases: 98%
  - Acidification, emissions: 64%
  - Volatile Organic Compounds (VOC): 90%

- **End-of-life is contributing to the category:**
  - Waste, hazardous / incinerated: 46% (this was not the case for BC1 as the majority of this impact came from the electricity consumption during the use phase. For gas hobs, the use phase is less significant. Therefore, in relative terms, the share of the end-of-life phase is greater even if in quantitative terms the impact from this stage is weaker than in BC1)

The use of Ecoreport for the impacts of gas consumption does not give more information of the potential formation of organic pollutants, NOx and CO in gas burners.

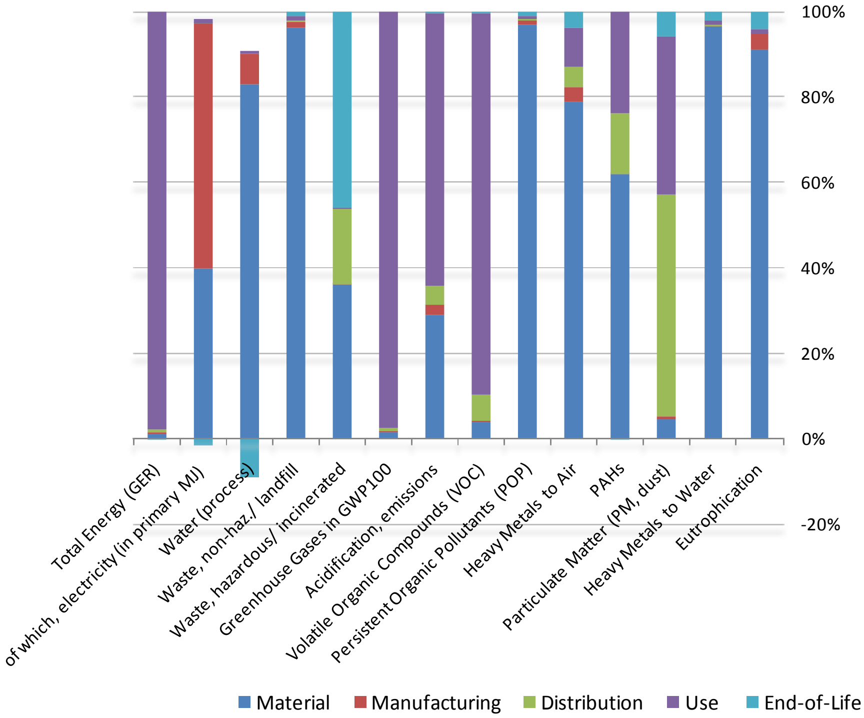


Figure 5-3: Distribution of environmental impacts of BC 2 per life cycle phase

5.2.1.3. CONCLUSIONS FOR DOMESTIC APPLIANCES

The contribution of each life cycle phase to the indicators is widely varying depending on the Base-Case. However, some trends common to both domestic base-cases can be highlighted. The use phase is by far, and as expected, the main contributor to the energy consumption and greenhouse gases emissions. Non-hazardous waste is significantly produced during the material acquisition phase, which is also impacting on heavy metals emissions to water and eutrophication. Particulate matter is significantly emitted during the distribution phase, and the end-of-life is not dominating any category.

It is interesting to highlight that the energy consumption per unit in BC2 is significantly lower (-50%) than in BC1. More generally, life cycle quantitative impacts on emissions to air or water in BC1 can be up to a factor 20 higher than in BC2. It has direct consequences on the overall distribution of the life cycle phases' contribution to the different indicators, as the use phase in BC2 is not as dominant as it is in BC1.

5.2.2. COMMERCIAL APPLIANCES

5.2.2.1. BASE-CASE 3: COMMERCIAL ELECTRIC HOB

Table 5-18 shows the environmental impacts of a commercial electric hob over its whole life cycle. The total energy consumption for the whole life cycle of the Base-Case 3 is 2.53 TJ, of which 2.52 TJ (i.e. 0.7 GWh) comes from the electricity consumption.

Table 5-18: Life Cycle Impact (per unit) of Base-Case 3

	Life Cycle phases -->		PRODUCTION			DISTRI-	USE	END-OF-LIFE*			TOTAL
	Resources Use and Emissions		Material	Manuf.	**Total**	**BUTION**		Disposal	Recycl.	**Total**	
	Other Resources & Waste							debet	credit		
8	Total Energy (GER)	MJ	5,226	1,440	6,667	1,544	2,517,479	1,242	607	635	2,526,325
9	of which, electricity (in primary MJ)	MJ	759	855	1,614	3	2,515,984	0	1	-1	2,517,600
10	Water (process)	ltr	5,557	12	5,569	0	167,787	0	1	-1	173,355
11	Water (cooling)	ltr	1,161	391	1,552	0	6,709,264	0	7	-7	6,710,809
12	Waste, non-haz./ landfill	g	77,511	5,245	82,756	771	2,917,950	14,727	5	14,722	3,016,200
13	Waste, hazardous/ incinerated	g	47	0	47	15	57,976	6,232	1	6,231	64,269
	Emissions (Air)										
14	Greenhouse Gases in GWP100	kg CO2 eq.	477	81	557	93	109,913	93	44	48	110,611
15	Ozone Depletion, emissions	mg R-11 eq.	negligible								
16	Acidification, emissions	g SO2 eq.	4,193	348	4,541	284	648,019	183	56	127	652,971
17	Volatile Organic Compounds (VOC)	g	10	1	11	23	971	4	1	4	1,008
18	Persistent Organic Pollutants (POP)	ng i-Teq	562	55	617	4	16,497	102	0	102	17,220
19	Heavy Metals	mg Ni eq.	10,712	130	10,842	39	43,585	353	0	353	54,819
	PAHs	mg Ni eq.	140	0	140	51	5,270	0	0	0	5,462
20	Particulate Matter (PM, dust)	g	604	54	657	3,761	19,136	1,606	1	1,605	25,160
	Emissions (Water)										
21	Heavy Metals	mg Hg/20	6,329	0	6,329	1	16,286	104	0	104	22,719
22	Eutrophication	g PO4	172	1	173	0	79	6	0	6	258
23	Persistent Organic Pollutants (POP)	ng i-Teq	negligible								

Figure 5-4 exposes the contribution of each life cycle phase to each impact. Several observations can be made from this analysis:

- **Material acquisition** is predominant in the total environmental impact for eutrophication with 66.8% and significantly contributes to emissions of heavy metals to air and water (respectively 19.5 and 27.9%). This is due to most metals.
- **Manufacturing** does not significantly impact on any environmental indicators.
- **The use phase** impacts are dominating the total environmental impacts in the case of :
  - Total Energy (GER): 99.6%
  - Electricity: 99.9%
  - Water (process): 96.8%
  - Waste, non-hazardous / landfill : 96.7%
  - Waste, hazardous / incinerated: 90.2%
  - Greenhouse gases: 99.4%

- Acidification (emissions to air): 99.2%
    - Volatile Organic Compounds (VOC): 96.3%
    - Persistent Organic Pollutants (POP): 95.8%
    - Heavy metals emissions to air: 79.5%
    - PAHs (emissions to the air): 96.5%
    - Particulate Matter: 76.1%
    - Heavy metals emissions to water: 71.7%

- **Distribution** is significantly contributing to particulate matter (PM, dust): 15%
- **End-of-life** is slightly contributing to the category:
    - Waste, hazardous / incinerated: 9.7%
    - Particulate matter (PM, dust): 6.4%

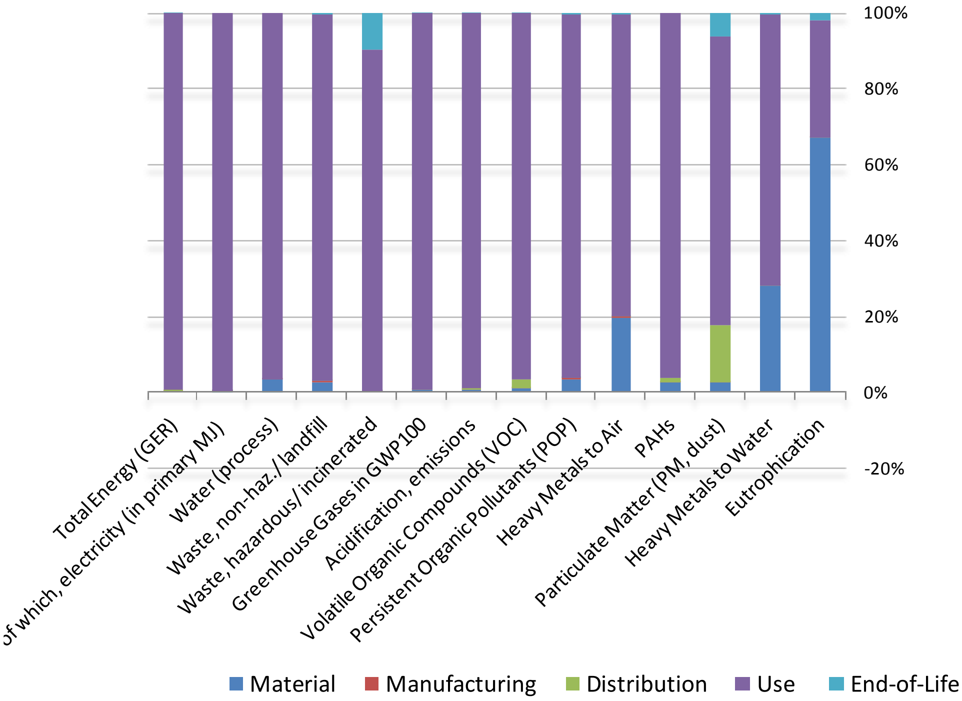


Figure 5-4: Distribution of environmental impacts of BC 3 per life cycle phase

5.2.2.2. BASE-CASE 4: COMMERCIAL GAS HOB

Table 5-19 shows the environmental impacts of a commercial gas hob over its whole life cycle. The total energy consumption for the whole life cycle of the Base-Case 4 is 1.61 TJ, of which 594 MJ (i.e. 165 kWh) comes from the electricity consumption.

Table 5-19: Life Cycle Impact (per unit) of Base-Case 4

	Life Cycle phases -->		PRODUCTION			DISTRI-	USE	END-OF-LIFE*			TOTAL
	Resources Use and Emissions		Material	Manuf.	**Total**	**BUTION**		Disposal	Recycl.	**Total**	
	Other Resources & Waste							debet	credit		
8	Total Energy (GER)	MJ	2,221	599	2,820	1,137	1,608,609	967	356	612	1,613,177
9	of which, electricity (in primary MJ)	MJ	229	358	587	2	6	0	1	-1	594
10	Water (process)	ltr	1,354	5	1,359	0	14	0	1	-1	1,372
11	Water (cooling)	ltr	641	166	807	0	8	0	6	-6	809
12	Waste, non-haz./ landfill	g	37,215	2,063	39,277	575	393	10,714	4	10710	50,955
13	Waste, hazardous/ incinerated	g	35	0	35	11	0	5,472	1	5,471	5,519
	Emissions (Air)										
14	Greenhouse Gases in GWP100	kg CO2 eq.	174	33	208	69	88,958	72	26	46	89,281
15	Ozone Depletion, emissions	mg R-11 eq.	negligible								
16	Acidification, emissions	g SO2 eq.	1226	144	1,370	210	25,973	143	33	110	27,662
17	Volatile Organic Compounds (VOC)	g	6	0	7	17	1,186	3	0	3	1,212
18	Persistent Organic Pollutants (POP)	ng i-Teq	362	14	376	3	4	74	0	74	457
19	Heavy Metals	mg Ni eq.	2,538	33	2,571	29	234	274	0	274	3,108
	PAHs	mg Ni eq.	206	0	206	38	255	0	0	0	499
20	Particulate Matter (PM, dust)	g	603	22	625	2,736	3,984	1,250	1	1,249	8,594
	Emissions (Water)										
21	Heavy Metals	mg Hg/20	1,566	0	1,566	1	16	81	0	81	1,664
22	Eutrophication	g PO4	42	0	43	0	0	5	0	5	48
23	Persistent Organic Pollutants (POP)	ng i-Teq	negligible								

Figure 5-5 exposes the contribution of each life cycle phase to each impact. Several observations can be made from this analysis:

- **Material acquisition** is predominant in the total environmental impact for the following categories, (mainly due to the ferrous materials) :
    - Water (process) : 98.7%
    - Waste, non-hazardous /landfill: 73%
    - Persistent Organic Pollutants (POP): 79.2%
    - Heavy metals emissions to the air: 81.7%
    - PAHs (emissions to the air): 41.3%
    - Heavy metals emissions to water: 94.2%
    - Eutrophication: 88.8%
- **Manufacturing** is the phase where 60.2% of the electricity is consumed, but the overall energy consumption of the manufacturing phase can be neglected compared to the total energy consumption.

- **Distribution** is significantly contributing to particulate matter (31.8%) and to a lower extent PAHs (7.6%).
- **The use phase** impacts are dominating the total environmental impacts in the case of :
    - Total Energy (GER): 99.7%
    - Greenhouse gases: 99.6%
    - Acidification, emissions: 93.9%
    - Volatile Organic Compounds (VOC): 97.8%
    - PAHs: 51.1%
    - Particulate Matter: 46.4%
- **End-of-life is contributing to the category:**
    - Waste, hazardous / incinerated: 99.1% (this was not the case for BC3 as the majority of this impact came from the electricity consumption during the use phase. For gas hobs, the use phase is less significant. Therefore, in relative terms, the share of the end-of-life phase is greater even if in quantitative terms the impact from this stage is weaker than in BC3)

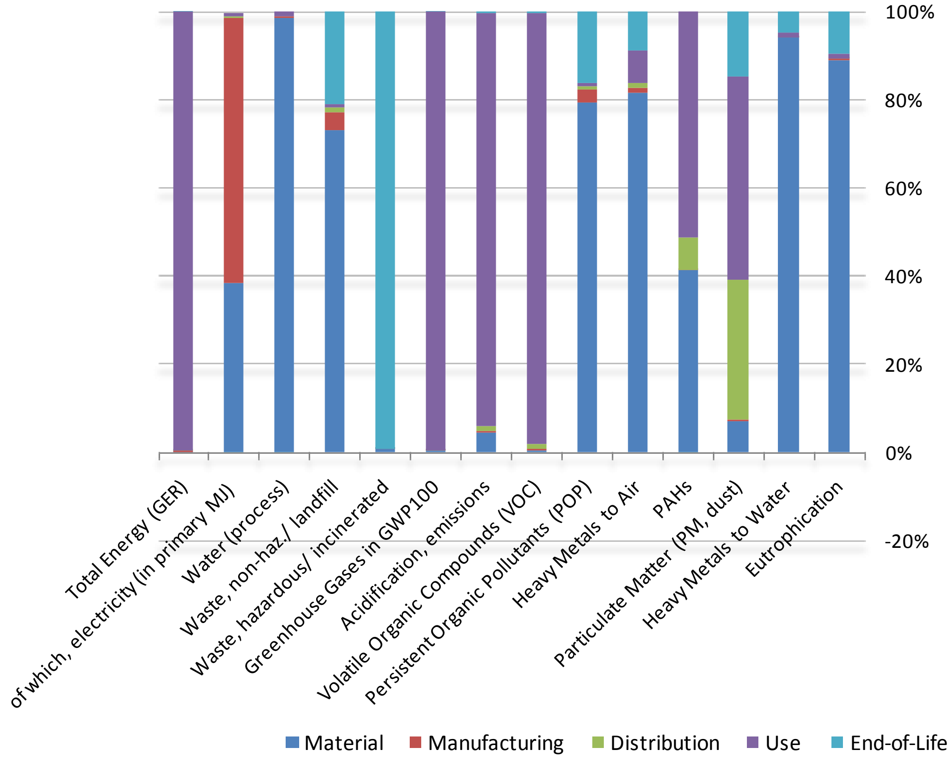


Figure 5-5: Distribution of environmental impacts of BC 4 per life cycle phase

5.2.2.3. BASE-CASE 5: COMMERCIAL ELECTRIC FRY-TOP

Table 5-20 shows the environmental impacts of a commercial electric fry-top over its whole life cycle. The total energy consumption for the whole life cycle of the Base-Case 5 is 873 GJ, of which 866 GJ (i.e. 241 MWh) comes from the electricity consumption.

Table 5-20: Life Cycle Impact (per unit) of Base-Case 5

	Life Cycle phases -->		PRODUCTION			DISTRI-	USE	END-OF-LIFE*			TOTAL
	Resources Use and Emissions		Material	Manuf.	**Total**	**BUTION**		Disposal	Recycl.	**Total**	
	Other Resources & Waste							debet	credit		
8	Total Energy (GER)	MJ	3,780	984	4,764	1,137	866,356	956	545	411	872,669
9	of which, electricity (in primary MJ)	MJ	466	586	1,052	2	864,875	0	1	-1	865,927
10	Water (process)	ltr	2,868	9	2,877	0	57,686	0	1	-1	60,562
11	Water (cooling)	ltr	867	269	1,137	0	2,306,315	0	8	-8	2,307,444
12	Waste, non-haz./ landfill	g	60,475	3,514	63,989	575	1,003,401	8,013	6	8,007	1,075,972
13	Waste, hazardous/ incinerated	g	48	0	48	11	19,929	7,534	1	7,533	27,522
	Emissions (Air)										
14	Greenhouse Gases in GWP100	kg CO2 eq.	302	55	358	69	37,857	71	40	32	38,315
15	Ozone Depletion, emissions	mg R-11 eq.	negligible								
16	Acidification, emissions	g SO2 eq.	2,412	238	2,650	210	222,841	141	50	91	225,792
17	Volatile Organic Compounds (VOC)	g	7	0	8	17	349	3	1	2	376
18	Persistent Organic Pollutants (POP)	ng i-Teq	457	32	489	3	5,674	55	0	55	6,222
19	Heavy Metals	mg Ni eq.	5,492	76	5,568	29	15,205	267	0	267	21,069
	PAHs	mg Ni eq.	349	0	350	38	2,019	0	0	0	2,407
20	Particulate Matter (PM, dust)	g	481	37	518	2,736	10,054	1,232	1	1,231	14,538
	Emissions (Water)										
21	Heavy Metals	mg Hg/20	3,348	0	3,348	1	5,610	80	0	80	9,038
22	Eutrophication	g PO4	90	0	90	0	27	5	0	5	122
23	Persistent Organic Pollutants (POP)	ng i-Teq	negligible								

Figure 5-6 exposes the contribution of each life cycle phase to each impact. Several observations can be made from this analysis:

- **Material acquisition** is predominant in the total environmental impact for eutrophication with 73.4% and significantly contributes to emissions of heavy metals to air and water (respectively 26.1 and 37%). This is mostly due to metals.
- **Manufacturing** does not significantly impact on any environmental indicators.
- **The use phase** impacts are dominating the total environmental impacts in the case of :
    - Total Energy (GER): 99.3%
    - Electricity: 99.9%
    - Water (process): 95.3%
    - Waste, non-hazardous / landfill : 93.3%
    - Waste, hazardous / incinerated: 72.4%
    - Greenhouse gases: 98.8%

- Acidification (emissions to air): 98.7%
- Volatile Organic Compounds (VOC): 92.9%
- Persistent Organic Pollutants (POP): 91.2%
- Heavy metals emissions to air: 72.2%
- PAHs (emissions to the air): 83.9%
- Particulate Matter: 69.2%
- Heavy metals emissions to water: 62.1%

- **Distribution** is significantly contributing to particulate matter (PM, dust): 18.8%
- **End-of-life** is slightly contributing to the category:
    - Waste, hazardous / incinerated: 27.4%
    - Particulate matter (PM, dust): 8.5%

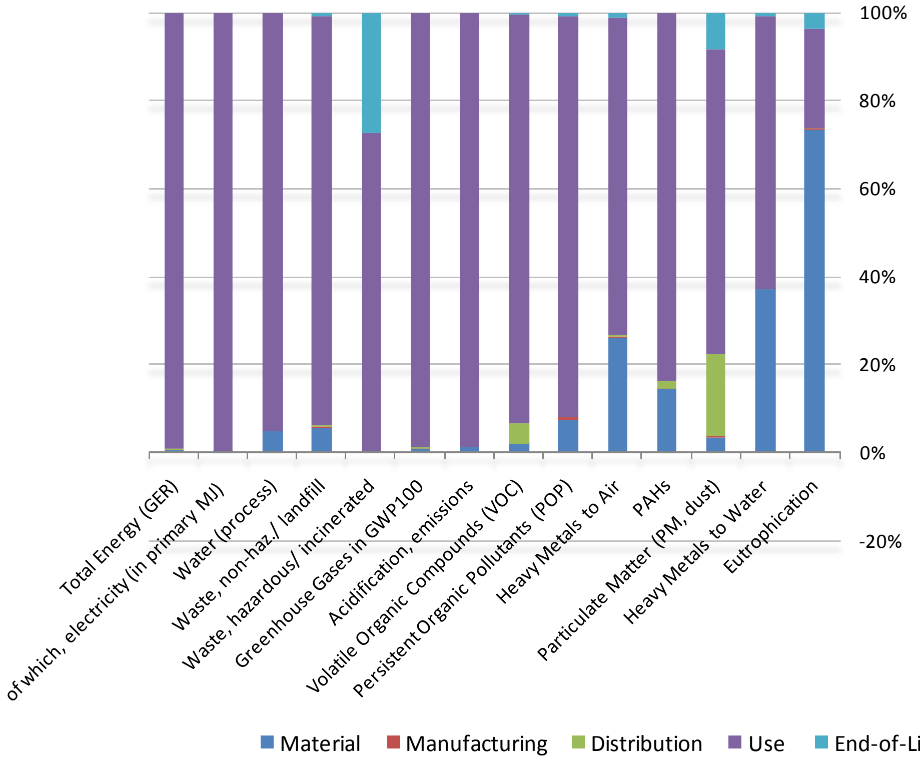


Figure 5-6: Distribution of environmental impacts of BC 5 per life cycle phase

5.2.2.4. BASE-CASE 6: COMMERCIAL GAS FRY-TOP

Table 5-21 shows the environmental impacts of a commercial gas fry-top over its whole life cycle. The total energy consumption for the whole life cycle of the Base-Case 6 is 486 GJ, of which 1 GJ (i.e. 278 kWh) comes from the electricity consumption.

Table 5-21: Life Cycle Impact (per unit) of Base-Case 6

	Life Cycle phases -->		PRODUCTION			DISTRI-	USE	END-OF-LIFE*			TOTAL
	Resources Use and Emissions		Material	Manuf.	Total	BUTION		Disposal	Recycl.	Total	
	Other Resources & Waste							debet	credit		
8	Total Energy (GER)	MJ	3,807	945	4,753	1,137	480,166	850	470	380	486,436
9	of which, electricity (in primary MJ)	MJ	476	562	1,038	2	10	0	1	-1	1,049
10	Water (process)	ltr	2,979	8	2,987	0	30	0	1	-1	3,017
11	Water (cooling)	ltr	810	258	1,068	0	11	0	6	-6	1,072
12	Waste, non-haz./ landfill	g	63,133	3,411	66,543	575	665	7,885	4	7,881	75,664
13	Waste, hazardous/ incinerated	g	41	0	41	11	0	6,071	1	6,070	6,123
	Emissions (Air)										
14	Greenhouse Gases in GWP100	kg CO2 eq.	311	53	364	69	26,585	63	34	29	27,046
15	Ozone Depletion, emissions	mg R-11 eq.	Negligible								
16	Acidification, emissions	g SO2 eq.	2,506	228	2,734	210	7,859	126	43	82	10,885
17	Volatile Organic Compounds (VOC)	g	7	0	8	17	375	3	1	2	402
18	Persistent Organic Pollutants (POP)	ng i-Teq	470	34	504	3	5	54	0	54	567
19	Heavy Metals	mg Ni eq.	5,730	79	5,809	29	417	238	0	238	6,493
	PAHs	mg Ni eq.	371	0	371	38	376	0	0	0	785
20	Particulate Matter (PM, dust)	g	462	35	497	2,736	6,225	1,096	1	1,095	10,552
	Emissions (Water)										
21	Heavy Metals	mg Hg/20	3,494	0	3,495	1	35	71	0	71	3,601
22	Eutrophication	g PO4	93	0	94	0	1	4	0	4	99
23	Persistent Organic Pollutants (POP)	ng i-Teq	negligible								

Figure 5-7 exposes the contribution of each life cycle phase to each impact. Several observations can be made from this analysis:

- **Material acquisition** is predominant in the total environmental impact for the following categories (mainly due to the ferro materials):
  - Water (process) : 98.8%
  - Waste, non-hazardous /landfill: 83.4%
  - Persistent Organic Pollutants (POP): 83%
  - Heavy metals emissions to the air: 88.2%
  - PAHs (emissions to the air): 47.3%
  - Heavy metals emissions to water: 97%
  - Eutrophication: 94.5%
- **Manufacturing** is the phase where 53.6% of the electricity is consumed, but the overall energy consumption of the manufacturing phase can be neglected compared to the total energy consumption.

- **Distribution** is significantly contributing to particulate matter (25.9%) and to a lower extent PAHs (4.9%).
- **The use phase** impacts are dominating the total environmental impacts in the case of :
    - Total Energy (GER): 98.7%
    - Greenhouse gases: 98.3%
    - Acidification, emissions: 72.2%
    - Volatile Organic Compounds (VOC): 93.4%
    - PAHs: 47.8%
    - Particulate Matter: 59%
- **End-of-life is contributing to the category:**
    - Waste, hazardous / incinerated: 99.1% (this was not the case for BC5 as the majority of this impact came from the electricity consumption during the use phase. For gas fry-tops, the use phase is less significant. Therefore, in relative terms, the share of the end-of-life phase is greater even if in quantitative terms the impact from this stage is lower than in BC5)

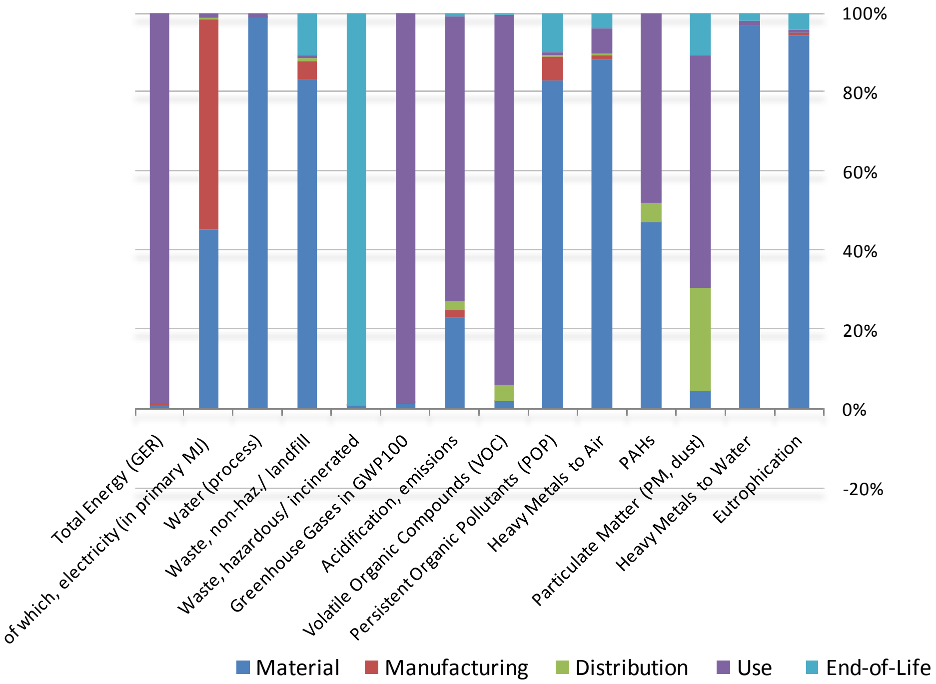


Figure 5-7: Distribution of environmental impacts of BC 6 per life cycle phase

5.2.2.5. CONCLUSIONS ON COMMERCIAL APPLIANCES

Some common trends with domestic base-cases can be observed according to the energy source. The use phase is by far, and even more than in domestic base-cases, the main contributor to the energy consumption and greenhouse gases emissions. The material acquisition phase is also largely impacting heavy metal emissions to water and eutrophication and particulate matter is significantly emitted during the distribution phase.

It is interesting to highlight that the energy consumption per unit in BC4/6 is significantly lower (around -40%) than in BC3/5. More generally, life cycle quantitative impacts on emissions to air or water in BC3/5 can be up to a factor 38 higher than in BC4/6. It has direct consequences on the overall distribution of the life cycle phases' contribution to the different indicators, as the use phase in BC 4/6 is not as dominant as it is in BC3/5.

5.3. BASE-CASE LIFE CYCLE COSTS

The result of the procurement process should be the cheapest hobs, having the lowest total cost of ownership, i.e. taking into account the whole life cycle of the product.

5.3.1. DOMESTIC APPLIANCES

The Life Cycle Costs (LCC) of the domestic base-cases are presented in Table 5-22 and Figure 5-8. This was automatically calculated by EcoReport using the product price, the energy consumption, the price of energy and the discount rate.

Table 5-22: EcoReport outcomes of the LCC calculations of the domestic base-cases

Environmental Impact	Base-Case 1	Base-Case 2
Product price (€)	380	268
Energy cost (€)	525	251
Life Cycle Cost (€)	905	519

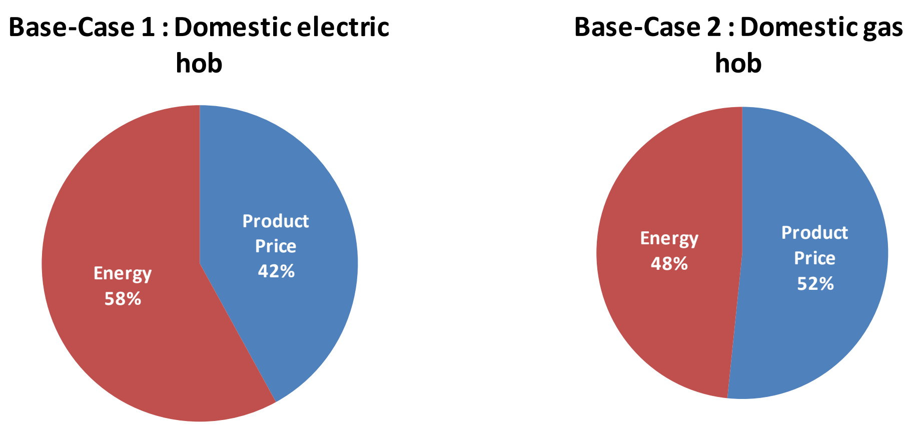


Figure 5-8: Distribution of the domestic BC life-cycle costs

5.3.2. Commercial appliances

The Life Cycle Costs (LCC) of the commercial base-cases are presented in Table 5-23 and Figure 5-9. This was automatically calculated with EcoReport using the product price, the installation cost, the maintenance costs, the energy consumption, the price of energy and the discount rate.

Table 5-23: EcoReport outcomes of the LCC calculations of the commercial base-cases

Environmental Impact	Base-Case 3	Base-Case 4	Base-Case 5	Base-Case 6
Product price (€)	2,900	2,950	2,300	2,400
Installation cost (€)	60	60	60	60
Energy cost (€)	29,122	17,451	10,382	5,386
Repair and Maintenance (€)	766	313	746	917
Life Cycle Cost (€)	32,849	20,771	13,488	8,763

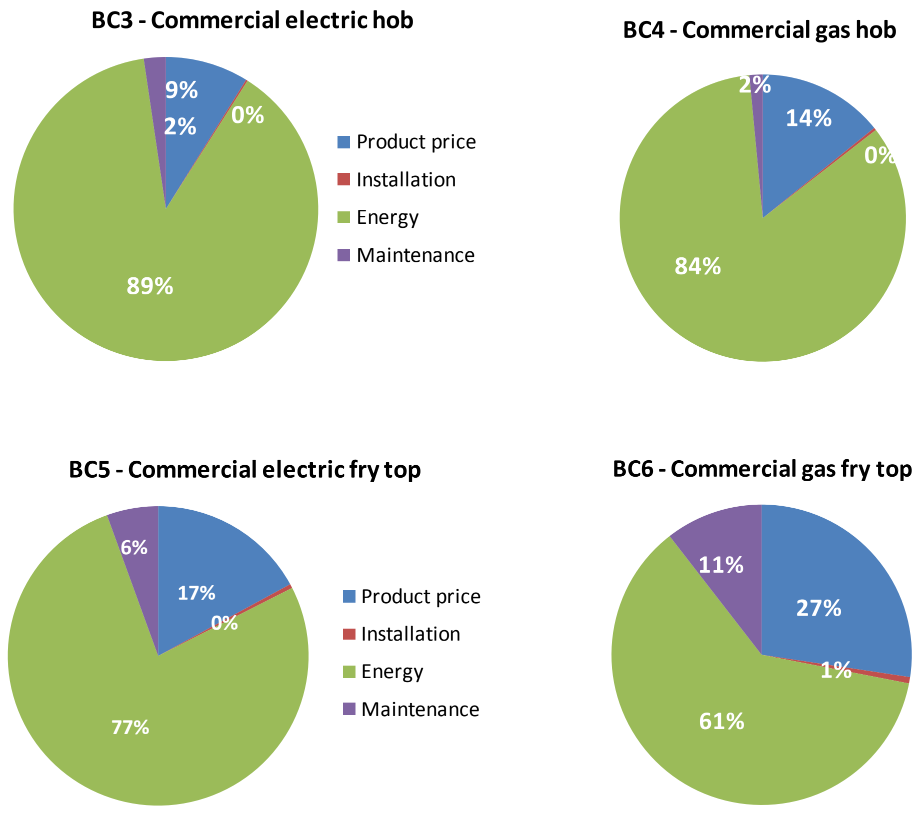


Figure 5-9: Distribution of the commercial BC life-cycle costs

5.4. EU TOTALS

This section provides the environmental assessment of the base-cases at the EU-27 level using stock and market data from Task 2.

5.4.1. Domestic appliances

5.4.1.1. Market data

Table 5-24 displays the market data of the two domestic base-cases in EU-27 in 2007.

Table 5-24: Market and technical data for all base-cases in 2007

Base-Case	Lifetime (years)	EU stock (units)	Annual sales (units/year)
BC1: Domestic electric hob	19	71,500,000	5,200,000
BC2: Domestic gas hob	19	62,150,000	3,300,000

5.4.1.2. Life Cycle Environmental Impacts

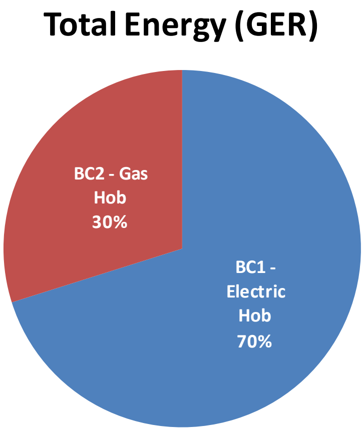
Table 5-25 shows the total environmental impacts of all products in operation in EU-27 in 2007, based on the extrapolation of the base-cases impacts (all hobs have the same impacts as the base-case of their category). These figures come from the EcoReport tool by multiplying the individual environmental impacts of a base-case with the stock of this base-case in 2007.

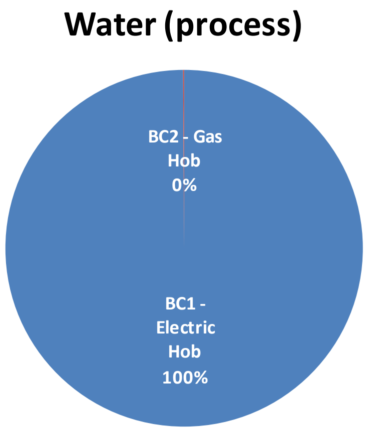
Table 5-25: Environmental impacts of the EU-27 stock in 2007 for all domestic base-cases

Environmental Impact	Base-Case 1	Base-Case 2	Total Domestic
Total Energy (GER) (in PJ)	**188**	**80**	**268**
of which electricity (in PJ)	**183.0**	**0.2**	**183.2**
Water process (in million m^3)	**14.3**	**0.0**	**14.3**
Waste, non-hazardous/landfill (in kt)	**333**	**57**	**390**
Waste, hazardous/ incinerated *(in kt)*	**6.1**	**0.0**	**6.1**
Emissions to air			
Greenhouse Gases in GWP100 (in Mt CO_2 eq.)	**8.4**	**4.4**	**12.8**
Acidification, emissions (in kt SO_2 eq.)	**49.7**	**2.0**	**51.7**

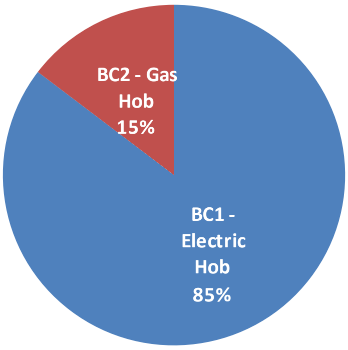
Environmental Impact	Base-Case 1	Base-Case 2	Total Domestic
Volatile Organic Compounds (VOC) (in kt)	0.1	0.1	0.2
Persistent Organic Pollutants (POP) (in g i-Teq.)	1.9	0.5	2.4
Heavy Metals emissions to the air (in ton Ni eq.)	5.6	0.3	5.9
PAHs (in ton Ni eq.)	0.7	0.1	0.8
Particulate Matter (PM, dust) (in kt)	5.3	1.2	6.5
Emissions to water			
Heavy Metals emissions to water (in ton Hg/20)	3.3	0.1	3.5
Eutrophication (in kt PO_4)	0.1	0.0	0.1

Summary of environmental impacts of base-cases as a percentage of total impact are presented in Figure 5-10

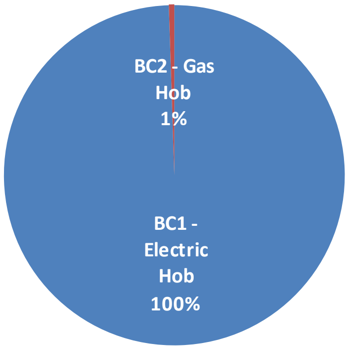




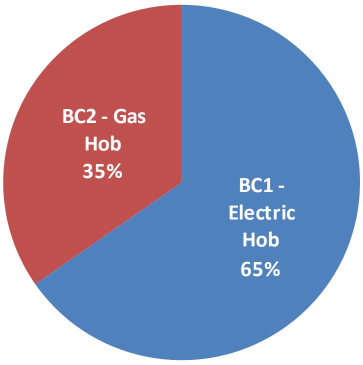
Waste, non-haz./ landfill



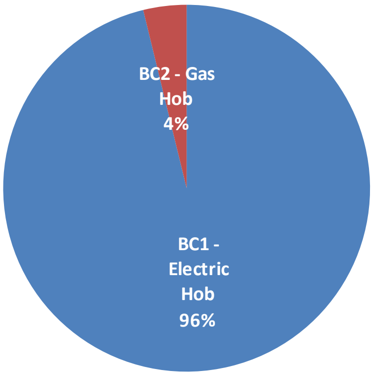
Waste, hazardous/ incinerated



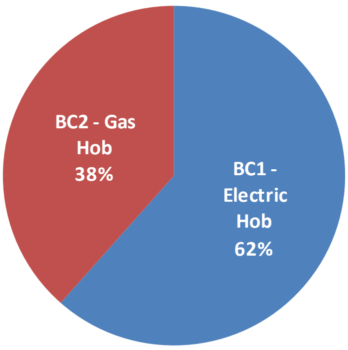
Greenhouse Gases in GWP100



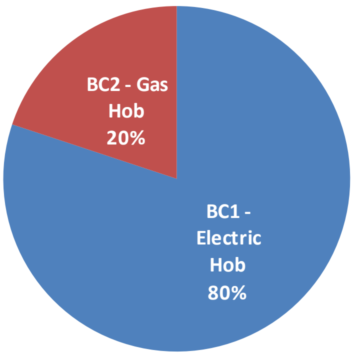
Acidification, emissions



Volatile Organic Compounds (VOC)



Persistent Organic Pollutants (POP)



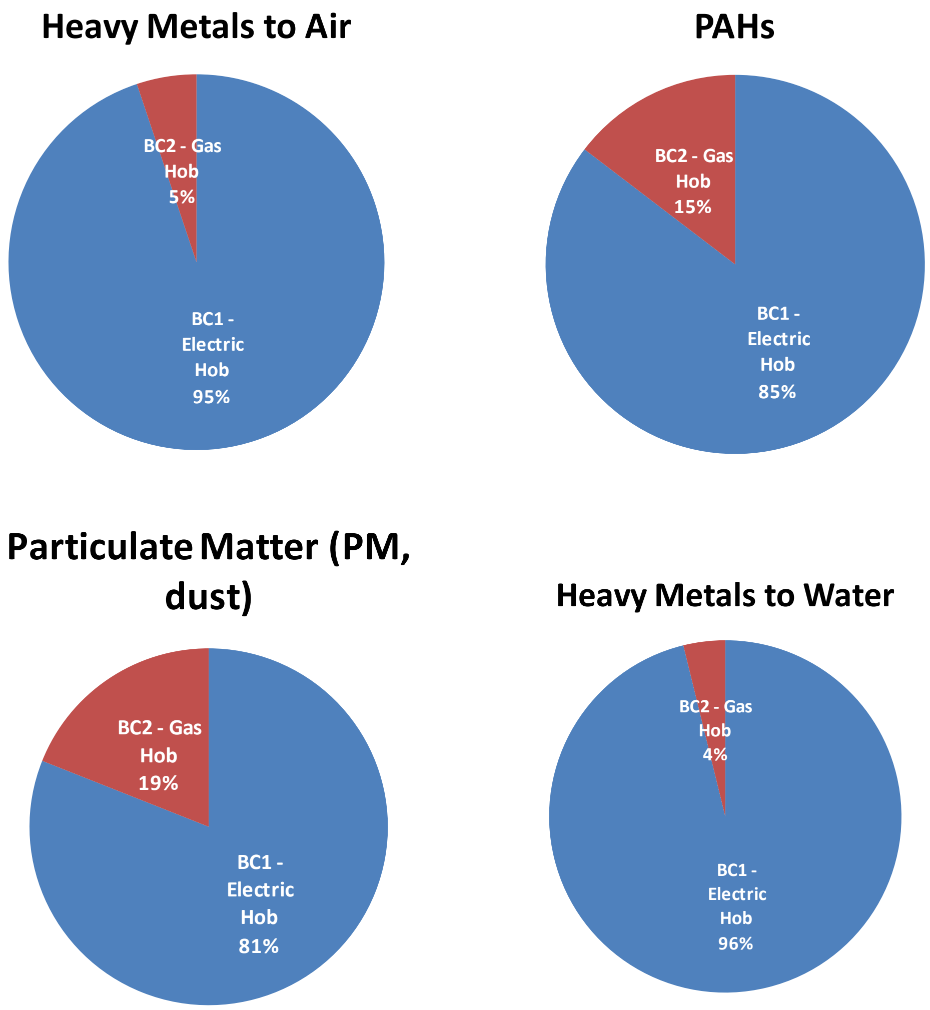


Figure 5-10: Base-cases' shares of the environmental impacts of the 2007 domestic stock

Domestic electric hobs clearly contribute to the biggest share in all indicators calculated by EcoReport. This cannot be only explained by a more important stock. Differences in the energy requirements and the landfill waste production are 2 other significant reasons.

5.4.1.3. Life Cycle Costs

Regarding the total consumer expenditure in 2007 related to domestic hobs, around 50-60% of the total costs is due to energy consumption. Details on consumer expenditure are presented in Table 5-26.

Table 5-26: Total Annual Consumer expenditure in EU-27 in 2007

	Base-Case 1	Base-Case 2	Total domestic
EU-27 sales (in mln units)	5.2	3.3	**8.5**
Share of the EU-27 sales	*61%*	*39%*	***100%***
Product Price (in mln €)	1976	884	**2860**
Energy (in mln €)	2856	1189	**4045**
Total (in mln €)	**4832**	**2073**	**6905**
Share of the total expenditure	*70 %*	*30%*	***100%***

5.4.2. Commercial appliances

5.4.2.1. Market data

Table 5-27 displays the market data of the commercial base-cases in EU-27 in 2007.

Table 5-27: Market and technical data for all base-cases in 2007

Base-Case	Lifetime (years)	EU stock (units)	Annual sales (units/year)
Base-Case 3: Commercial electric hob	12	130,000	10,833
Base-Case 4: Commercial gas hob	12	200,000	16,667
Base-Case 5: Commercial electric fry top	10	75,000	7,500
Base-Case 6: Commercial gas fry top	10	75,000	7,500

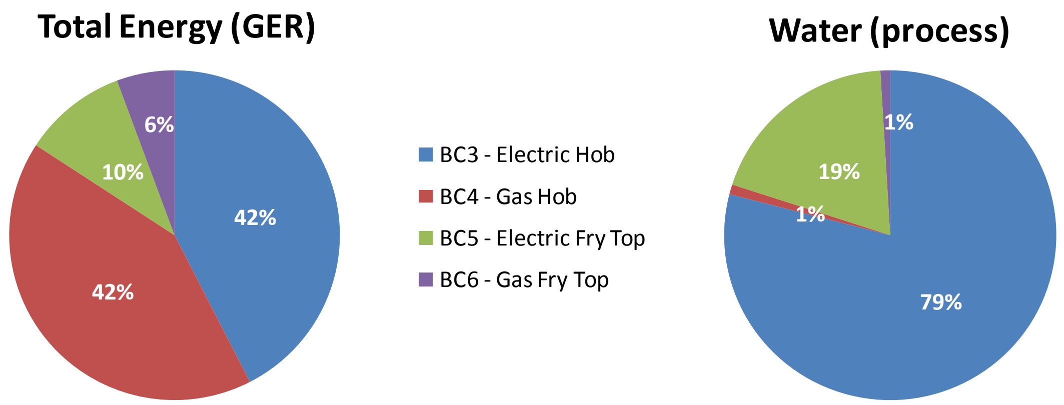
5.4.2.2. Life Cycle Environmental Impacts

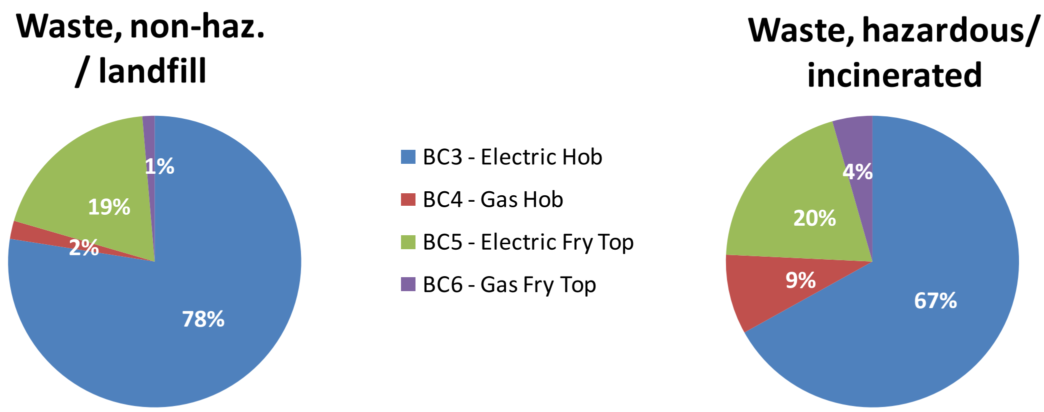
Table 5-28 shows the total environmental impacts of all products in operation in EU-27 in 2008, based on the extrapolation of the base-cases impacts (all hobs have the same impacts as the base-case of their category). These figures come from the EcoReport tool by multiplying the individual environmental impacts of a base-case with the stock of this base-case in 2007.

Table 5-28: Environmental impacts of the EU-27 stock in 2007 for all base-cases

Environmental Impact	Base-Case 3	Base-Case 4	Base-Case 5	Base-Case 6	Total Commercial
Total Energy (GER) (in PJ)	27.4	26.9	6.5	3.6	64.4
of which electricity (in PJ)	27.3	0.0	6.5	0.0	33.8
Water process (in million m^3)	1.9	0.0	0.5	0.0	2.4
Waste, non-hazardous/landfill (in kt)	32.7	0.8	8.1	0.6	42.2
Waste, hazardous/ incinerated *(in kt)*	0.70	0.09	0.21	0.05	1.04
Emissions to air					
Greenhouse Gases in GWP100 (in Mt CO_2 eq.)	1.20	1.49	0.29	0.20	3.18
Acidification, emissions (in kt SO_2 eq.)	7.07	0.46	1.69	0.08	9.31
Volatile Organic Compounds (VOC) (in kt)	0.011	0.020	0.003	0.003	0.04
Persistent Organic Pollutants (POP) (in g i-Teq.)	0.19	0.01	0.05	0.00	0.25
Heavy Metals emissions to the air (in ton Ni eq.)	0.59	0.05	0.16	0.05	0.85
PAHs (in ton Ni eq.)	0. 059	0. 008	0. 018	0. 006	0.091
Particulate Matter (PM, dust) (in kt)	0. 273	0. 143	0. 109	0.079	0.604
Emissions to water					
Heavy Metals emissions to water (in ton Hg/20)	0.246	0.028	0.068	0.027	0.369
Eutrophication (in kt PO_4)	0.003	0.001	0.001	0.001	0.005

Summary of environmental impacts of base-cases as a percentage of total impact are presented in Figure 5-11.


Total Energy (GER)
6%
10%
42%
42%
BC3 - Electric Hob
BC4 - Gas Hob
BC5 - Electric Fry Top
BC6 - Gas Fry Top
Water (process)
1%
19%
1%
79%


Waste, non-haz. / landfill
1%
19%
2%
78%
BC3 - Electric Hob
BC4 - Gas Hob
BC5 - Electric Fry Top
BC6 - Gas Fry Top
Waste, hazardous/ incinerated
4%
20%
9%
67%


Greenhouse Gases in GWP100
6%
9%
38%
47%
BC3 - Electric Hob
BC4 - Gas Hob
BC5 - Electric Fry Top
BC6 - Gas Fry Top
Acidification, emissions
1%
18%
5%
76%

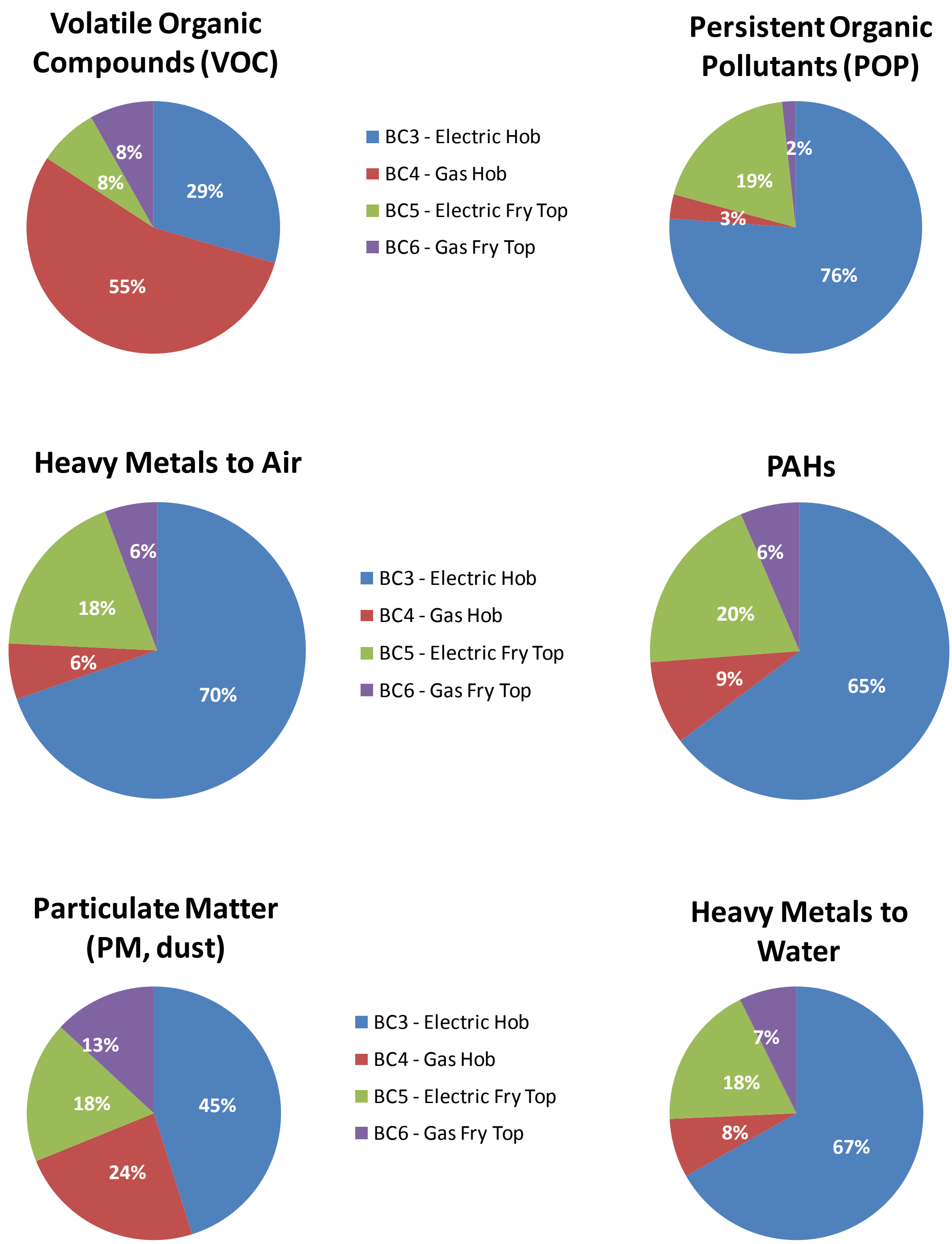


Figure 5-11: Base-cases' shares of the environmental impacts of the 2007 commercial stock

5.4.2.3. LIFE CYCLE COSTS

Regarding the total consumer expenditure in 2007 related to the base-cases, about 86% of the total costs is due to energy consumption. Details on consumer expenditure are presented in Table 5-29.

Table 5-29: Total Annual Consumer expenditure in EU-27 in 2007

	Base-Case 3	Base-Case 4	Base-Case 5	Base-Case 6	Total commercial
EU-27 sales (in units)	10,833	16,667	7,500	7,500	**42,500**
Share of the EU-27 sales	*25.6%*	*39.2%*	*17.6%*	*17.6%*	***100%***
Product Price (in mln €)	31.4	49.2	17.3	18.0	**115.8**
Installation (in mln €)	0.6	1.0	0.5	0.5	**2.6**
Energy (in mln €)	403.4	371.9	96.0	49.8	**921.1**
Repair and Maintenance (in mln €)	10.6	6.7	6.9	8.5	**32.7**
Total (in mln €)	446.1	428.7	120.6	76.7	**1072.1**
Share of the total expenditure	*41.6%*	*40.0%*	*11.2%*	*7.2%*	***100%***

5.4.3. Impacts of domestic and commercial appliances at the EU level

As domestic and commercial hobs and grills target different markets, and do not compete with each other, they were separately assessed. However, it is interesting to compare the energy consumed at the EU level by all types of hobs and grills.

Figure 5-12 presents the share of each Base-case in the total primary energy consumed. More than half of this consumption is due to the domestic electric hob (57%). The commercial sector represents only 19% of the total consumption. Cooking appliances powered with gas (Base-cases 2, 4 and 6) have a smaller share (33%) in the energy consumption. This can be explained by a lower stock of appliances, but also by the fact that gas appliances consume less primary energy.

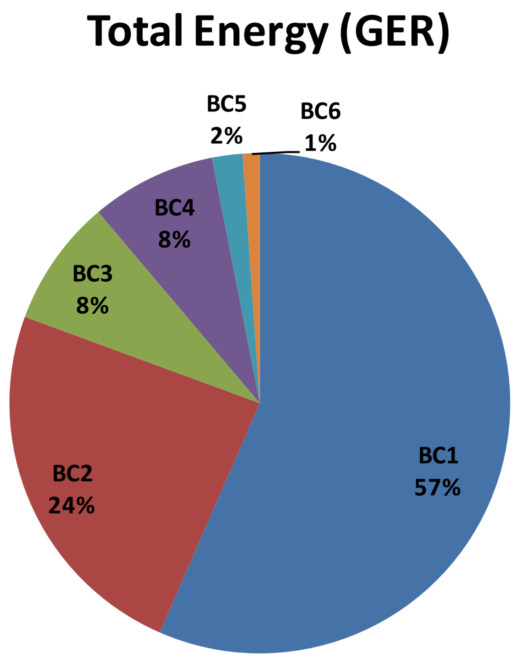


Figure 5-12: Share of the overall EU energy consumption for Lot 23 Base-cases

5.5. CONCLUSIONS

The environmental impact assessments carried out with the EcoReport tool shows that there are some common observations to both domestic and commercial Base-Cases: the use phase is by far the most impacting stage of the life cycle in terms of energy consumption and greenhouse gases emissions. The production phase has a significant contribution to the following impacts: heavy metals emissions to air and water and eutrophication.

However, electricity generation is contributing to an important part of the global environmental impacts of the electric appliances, and so the impacts of the gas appliances are different: the use phase is not as a dominant contributor as it is with electric appliances and the quantitative impacts are also significantly lower.

The analysis of the improvement potential in Task 7 will focus on technologies that reduce the energy consumption, and also on alternative material reducing environmental impacts.

Task 6 will examine the improvement options of hobs considered as best available technologies, in an attempt to improve upon the base-cases.