Energy

Preparatory Studies for Eco-design Requirements of EuPs

(Tender TREN/D1/40-2005)

LOT 14: Domestic Washing Machines and & Dishwashers

Part I – PRESENT SITUATION

Task 5
Definition of base case
Rev. 2.0

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NOTE: according to international standards dealing with quantities and units, the numbers in this study are written according to the following rules:

- the comma "," is the separator between the integer and the decimal part of a number
- numbers with more than three digits are divided by a blank in groups of three digits
- in case of monetary values the numbers are divided by a dot in groups of three digits.

Brief summary of the Study Tasks

Washing machines and dishwashers, also known as "wash appliances", have been the second and most studied EuP in the European Union with the goal to reduce their energy consumption. In 1995, the study of the Group for Efficient Appliances (GEA, 1995) provided the technical basis for the energy labelling Directive, and later also partially for the Eco-label awarding criteria. Its results and methodology were the starting point for the second study on washing machines (NOVEM, 2000, known as the WASH-2 study) promoted by DG TREN in 1998, which took into consideration the methodological, technical, economical and market developments and proposed a new structure for a revised label and the possible setting of efficiency targets, which then for various reasons were not fully accepted by Member States.
Contemporarily, the European Eco-label Board started to address these two product groups more from the environmental impact point of view with other studies, which resulted in the definition of eco-labelling awarding criteria, the latest being:

- for washing machines: on December 1999[1] the Commission adopted the criteria valid until December 1st 2002. These criteria were then prolonged to November 30th 2005 (Decision 2003/240/EC);
- for dishwashers: on August 1998[2] the Commission adopted the criteria valid until January 20th 2003 through the extension given by Decision 2001/397/EC. Criteria were revised in August 2001 (AEAT, 2001) and are valid until August 26th 2006.

In the meantime, a series of monitoring studies were promoted by the SAVE Programme to evaluate the impact of the EU legislation on the market transformation of washing machines and their energy consumption (ADEME, 2000; ADEME, 2001). Dishwashers were monitored through the annual reports presented by the European Association of Household Appliance Manufacturers (CECED) to the EC and the Regulatory Committee responsible for the management of the EU energy labelling scheme, describing the effectiveness of the industry "Voluntary Commitment on Reducing the Energy Consumption of Household Dishwashers" issued in 1999 and ended in 2004. Also washing machine market was monitored through CECED annual reports under the two Voluntary Commitments issued in 1997 and in 2002 for this product group.

Since markets and technologies change continually, including in response to past policy settings, the present study proposal takes the results and methodology defined in the last decade of studies as the starting point to be updated and upgraded where necessary to evaluate the technical, economic and market developments of cold appliances and the new aspects of these products to be covered following the indications of the eco-design directive 2005/32/EC[3]. This is necessary in order to define the need of implementing measures and possible targets for voluntary or mandatory policies.

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[1] Commission Decision of 17 December 1999 establishing the ecological criteria for the award of the Community eco-label to washing machines (2000/45/EC).
[2] Commission Decision of 20 July 1998 establishing the ecological criteria for the award of the Community eco-label to dishwashers (98/483/EC).
[3] Directive 2005/32/EC of the European Parliament and of the Council of 6 July 2005 establishing a framework for the setting of ecodesign requirements for Energy-Using Products and amending Council Directive 92/42/EEC and Directives 96/57/EC and 2000/55/EC of the European Parliament and of the Council.

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The study is divided in two working phases and seven Tasks or Chapters:

Part I: Present Situation that envisages the following five Tasks:

- Task 1 - Definitions
- Task 2 - Economic and Market Analysis
- Task 3 - Consumer Behaviour
- Task 4 - Product System Analysis
- Task 5 - Definition of base case

Part II: Improvement Potential, with the following two Tasks:

- Task 6 - Technical Analysis
- Task 7 - Scenario, Policy, and Impact and Sensitivity analysis.

Within the first part (Present Situation) the project team will set the study boundaries (Task 1), collect and organise the data for the economic, market (Task 2) and consumers behaviour analysis (Task 3), analyse the interaction of the studied appliances on the energy system to which the product belongs (Task 4) and set up the reference parameters, material, energy and costs inputs to define the starting base case (Task 5). All the data and information analysed within the first part of the study will serve as an input for the second part (Improvement Potential) during which the project team will carry out the technical and economic analysis to set up the optimal eco-design options of the analysed appliance (Task 6) and finally suggest the most suitable policies to achieve the recommended energy and ecological improvements (Task 7). A Glossary and References will be also included in the study.

This report present the results of the base case definition carried out in task 5.

DESCRIPTION OF TASK 5

Subtask 5.1: Definition of Base Case for Washing Machines and Dishwashers

[4] Directive 2005/32/EC of the European Parliament and of the Council of 6 July 2005 establishing a framework for the setting of ecodesign requirements for Energy-Using Products and amending Council Directive 92/42/EEC and Directives 96/57/EC and 2000/55/EC of the European Parliament and of the Council.

One or two average EU product(s) for the representative product category will be defined as the "Base case" for the whole of the EU25 for the two appliance types.

A "Standard Base Case" and "Real Life Base Case" will be defined. The base case is the average washing machine/dishwasher on the European market, where:

- the "Standard Base Case" (STBC) is defined according to the standard consumer behaviour (in terms of washing temperature, amount of load/place settings, number of cycles/year, etc.) as defined in measurement standards or in EU legislation;
- the "Real Life Base Case" (RLBC) is defined according to the actual average consumer behaviour, which can significantly differ from the standardised definition.

The selection of base case models will be done on the basis of the analysis of the latest technical database developed by CECED. CECED database have been developed since 1997 for washing machines and 1999 for dishwashers, and are regularly presented to the EC and the Regulatory Committee responsible for the management of the EU energy-labelling scheme. Technical databases include the parameters declared for the energy labelling directives for the two product types.

The selection of the reference model(s) will be mainly based on the analysis of the energy and water consumption and of functional performance classification. The energy consumption characteristics of the models will be expressed through their actual consumption values in kWh/kg_cycle or kWh/place setting (first choice) or with their energy efficiency class.

The database analysis will result in the identification of a *virtual average* reference model (or more than one) for each appliance group. This model will be then compared with the real models in the database: the models close to the "virtual average" could be considered as participating in the composition of the average itself, both in terms of technical characteristics and relevant brands & manufacturers. The technical characteristics of the selected real models will be averaged to evaluate how close the *real average* reference model is from the "virtual" one. This analysis will allow the validation of the chosen real average reference washing machine and dishwasher, or will suggest the need of selecting a new set of models from the database or to accept more than one set. In addition, outcome of Tasks 2 and 3 will be taken into consideration.

Once the real average reference model(s) is validated, its brand composition will be analysed, in term of number of models per each brand included in the selected real models. The results will be the percentage of each brand (and therefore of each manufacturer) concurring to the real average reference model in each appliance group.
At this point, the identified manufacturers/brands will be asked to select a real appliance model (or more than one model) - possibly[5] among the identified set in the technical database - and to provide the information included in the so called "Environmental Performance Questionnaire" for this reference model. Once the information is collected, all data will be weighted according to the previously mentioned brand/manufacturer composition, to create the ecological profile of the base case average reference washing machine and dishwasher models. As alternative, a more simple average of the data collected by the manufacturers could be used.

The same procedure will be applied for the identification of the "best case" model(s) or "top of the range model(s)" in each appliance category. Top of the range models will be used to evaluate the gap already existing between the average and the best available appliances in the reference year.

[5] Since the analysed technical database includes models produced in 2005 or before, manufacturers could select a reference model, which is not among the identified set.

Subtask 5.2: Product-specific inputs

Product-specific inputs will be, first of all collected and organised according to the "EuP Eco Report" requirements and taking into account the LCA ISO 14040 norms. Similarly, the methodology used for the LCA analysis will be, at first glance, based on the EuP-Ecoreport settings, but it will be, as close as possible, also compared and aligned with the LCA standard methodology by using others LCA software and data (like, i.e. the SimaPro tool) and databases).

Primary input data will come from direct communication with producers and/or, if not available, collected on sector specific or commercial data base (secondary data). These data will be considered both for the standard and the real base case for the two appliance types.

The product's specific inputs are thus classified according to the following data sets:

- General information on product type (washing machines and dishwashers reference models, efficiency class, capacity, …);
- Production phase (raw materials, components and assembling):
  - Used materials, related working processes (moulding, extrusion, wiring, ..), average distances from production sites, percentage of scrap, …)
  - Energy consumption (electric - kWh, thermal – MJ as Natural Gas, Oil,….or different sources) for assembling
  - Water (and others) consumption for assembling
  - Waste production
  - Waste water quality (BOD, COD, other indicators, …);
- Distribution of products (average distances and types of transport modes);
- Use phase (average life, specific consumption, maintenance and repairs);
- Packaging (type and weight);
- End of Life (disposal, thermal valorisation, incineration, dismantling…).

Production phase: a portion of a possible data-input inventory table for the production phase is:

Material	***from recycling***	***net weight***	***scrap***	***gross weight***	***processing*** *(on gross weight)*	***average distance***	***Mode of transport***
	(%)	(kg)	%	(kg)		(km)	
Ferro metals							
Iron							
Stainless steel							
…..							
Non Ferro Metals							
Aluminium							
Copper							
…..							
Electronic equipments							
Plastics							
ABS							
PP							
PVC							
….							
Glass							
White							
….							
Rubber							
Others							
Total weight							

Any other specification on material type, specific processes, would be useful to complete the picture. All data as is to be product specific (allocation procedure).

Distribution: the following data are required:

- transport to final user: average distance and transport medium (at least more than one transport medium and specific distances covered);
- packaging management: indication on packaging recovery and disposal (as an alternative medium EU situation will be considered).

Use: the following data are required:

- average life
- energy consumption (kWh/cycle) and load in kg for washing machines (to calculate the specific energy consumption (in kWh/kg_cycle) and in place settings for dishwashers (to calculate the specific energy consumption (in kWh/ps_cycle);
- water consumption (in litre/cycle);
- detergent consumption (detergent, rinsing aid, softener, depending on the appliance type as g/cycle);
- waste water quality (BOD, COD, Eutrophication)
- washing performance and spin drying performance for washing machines and washing performance and drying performance for dishwashers
- stand-by power consumption (literature data and measured data if available) in Watt, defined according to the product measurement standard (if existing)
- Ordinary Maintenance (ex: substitution of pumps, ….) as requested by producer for a specified working time;
- Extra-ordinary maintenance (if possible, as suggested by producer or market analysis)
- Noise (dB(A)).

Disposal: the following data are required:

- indication on typical (or average) disposal system (if existing or known) and % and types of recycled materials.

If specific data from producers are not available, average EU data will be used.

Subtask 5.3: Base Case Environmental Impact Assessment

The environmental impact assessment will be performed for both the Standard Base Case and the Real-life Base Case. The methodology used will be based on the "EuP EcoReport", specifying emissions and raw material consumption during the whole life cycle of the appliance.

A life cycle assessment will be in parallel also carried out using a different specialised LCA module (as the "SimaPro " one) in order to verify and validate the results obtained by the "EuP EcoReport". The methodology used will comply with the ISO 14040 standards and will take into account the whole life cycle of products and their related impacts.
According to the LCA standards, output will be firstly presented in physical terms (e.g. kg of CO_2), disaggregated by each Life Cycle Phase (assembling, use, distribution, end of life, ..). Then the physical parameters will be aggregated by damage category (e.g.: global warming, as weighted

addition of greenhouse gases), as follow:

- global warming,
- acid rain,
- ozone depletion,
- resource consumption
- energy consumption

It is worth noting that EuP-Ecoreport stops at Characterization phase. In order to evaluate the magnitude of damage among the different life cycle phase and compare the eco-profile outputs between different products and/or scenarios, it will be also analysed and discussed the subsequent LCA phases (normalisation, weighting, damage evaluation) by using tools like SimaPro6.

Using SimaPro6 is useful in order to compare and validate the EuP-Ecoreport. The extensive data bases of SimaPro6 improves the possibility that chosen data corresponds as close as possible with the information provided by producers (for geography, technology, period and other relevant characteristics including data quality).

Output, both from EuP-Ecoreport and from SimaPro6 software, will be presented by domestic appliance (e.g. CO_2/machine) and by unit service (CO_2/place setting or CO_2/kg_load). The second type of indicator, per unit service, is more effective for the comparison of different appliances.

Subtask 5.4: Base Case Life Cycle Cost

The life cycle costs, or net present value of the costs, to the consumer are calculated for each technological option beginning with the standard and real-life base case. The formula using the real cost of capital, interest – inflation, as suggested in the invitation to tender[6], will be utilized. This implies that the average real (as opposed to nominal) future price of electricity over the next 15 years should be used in this calculation.

To standardize and make the results of the different lots comparable, it was suggested that the DG-TREN set a reference price for electricity to be used in these studies. The DG may also wish to standardize the real cost of capital to around 5% which also would make all the LCC analysis of the different lots readily comparable. Nevertheless, a value between 0,14-0,15 Euro/kWh will be used for this study, along with a real cost of capital of 5%.

Sensitivity analysis will be applied to the main parameters here including purchase price and electricity price and the level of consumption per year of the representative washing machines and dishwashers.

Subtask 5.5: EU Totals

With regard to the total LCC data, the starting point is the individual LCC data for the real life base case of the representative wash appliances estimated in Subtask 5.3. In general, the sales for the year 2005 and the cumulative sales from 2005 to 2020 will be estimated for EU-25 for the representative models. The product of individual LCC and the 2005 sales gives the total life cycle

[6] We define, for the Standard and Real-Life Base-Case, the Life Cycle Costs. LCC = PP + PWF * OE, where LCC is Life Cycle Costs, PP is the purchase price, OE is the operating expense and PWF (Present Worth Factor) is PWF= $\{1 - 1/(1+ r)^{N}\}/r$, in which N is the product life and r is the discount (interest-inflation) rate.

costs for the base case models in 2005. Instead, the total cumulative sales, 2005 through 2020, cannot be simply multiplied times the LCC for 2005 to give the cumulative total, since LCC refers to the present year (2005) and the LCCs in question occur at each year over the product life. They must be discounted. So the average growth rate in sales for the EU25 is estimated and the total LCC is calculated for each year and discounted accordingly.
An effort will be made to estimate the LCC of representative new models coming to the market after the base case model, depending upon the availability of data. The total calculations will be performed as above.

In addition to the total models sold in 2005, it is necessary to estimate the energy consumption of the existing stock for year 2005. This will allow the environmental impact to be estimated for the existing stock. Adding the impacts for the models of the base case, of the other new models for 2005 and the existing stock(less the new sales) we have the impact environmental impact for 2005 which can be compared to the results of the CEDA EU-25 Input Output method, which will require some scaling, as described in Task 4. This comparison can be performed for washing machines, which is an explicit product and product service (household laundry washing) in the CEDA model, but not for dishwashers that are not included as a distinct product.

Essentially repeating for each of the future years the calculation of the base case unit sales, other non-base case unit sales and the number of units in stock (minus new sales) along with their respective environmental impacts, the cumulative environmental impact and LCC for the next fifteen years can be estimated. The impact of production, use and disposal of the product group assumes post-RoHs[7] and post-WEEE[8] conditions. This cumulative result will constitute the "Business as Usual" scenario for the lifetime of the product. Actually it makes sense to discount the annual results. Discounting environmental impacts for the cumulative impact may be new to some environmentalists, however certainly most would agree that there is a value in deferring these negative impacts. Total environmental impact without discounting will also be shown

Subtask 5.6: EU25 Total System Impact

For the year 2005 the results of Task 4, the environmental impact of the I/O model for 'washing with household laundry equipment,' CEDA code 540300, will be compared to the total environmental impacts given in Subtask 5.4 for year 2005, including those for sales of the base case models and for the other new models for year 2005 and for the existing stock in 2005, as previously described.

The steps necessary to make these two results as comparable as possible has been discussed in the description of Task 4. The guiding idea is to have the basic inputs of specific energy consumption and number of unit sales and units in the stock be the same for both methods. With this approach it will be possible to analyze and understand the differences in results, which will be due primarily to the addition of indirect inputs in the input output method and in the possible difference in environmental coefficients. Because we have controlled for inputs this is a good opportunity to better understand the two methods.

The other very important result will be the analysis of the environmental differences in the CEDA

[7] RoHs directive: Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment, O.J. L37, 13.02.2003.
[8] WEEE directive: Directive 2002/96/EC of the European Parliament and of the Council of 27 January 2003 on waste electrical and electronic equipment (WEEE), O.J. L37, 13.02.2003.

outputs between no use of off peak electricity (the normal use) and the use of off-peak electricity through the utilization of more silent machines during the night. While the economic advantages have been studied, the environmental impacts are less well established and constitute an important part of this research. Besides modelling a change in the input energy mix for the production of electricity, an attempt will be made to introduce the changes due to better utilization of the capacity for production and distribution of electricity.

5 Task 5: Definition of base case

5.1 SUBTASK 5.1: DEFINITION OF BASE CASE

A “Standard Base Case” and “Real Life Base Case” will be defined for washing machines and dishwashers.

5.1.1 The Standard Base Case for Dishwashers

During the first stakeholder meeting of the study it was proposed to define two standard base cases for the dishwashers, a 9 place settings machine (representing the so called “compact dishwashers”) and a 12 place settings machine (representing the so called “standard dishwashers”). The subdivision of the dishwashers in the two mentioned families derives from the knowledge of the market of this appliance type in the past decade and has been followed in the policy measures already in place: it is in fact at the basis of the ecolabel criteria for energy and water consumption, the energy efficiency classes of the energy labelling scheme and the industry voluntary commitment described in Task 1.

5.1.1.1 The analysis of the 2005 technical database

The 2005 technical database collected by CECED includes 4 342 models, from 4 to 15 place settings. The analysis started with the validation of the collected data, mainly in terms of the coherence between the declared Energy Efficiency Class of each model and the relevant energy consumption and the energy and water consumption of the models within the same place settings category. In other words, the data declared for the best and the worst models were particularly examined for errors. For 12 (0,28%) of the 4 342 models, a lack of coherence was found: for 9 models the declared place settings was wrong, and was therefore corrected, while for 3 model a lack of coherence existed between the declared energy efficiency class and the calculated one: for 2 models the declared class was better than what should be but for 1 other model the declared class was found worse than the recalculated one. For sake of coherence of the statistical analysis all the “wrong” models were corrected and the statistical analysis of the energy efficiency class was based on the validated results.

About 82% of the models in the database belong to the 12ps category, followed by the 9ps with 12,2% of the models (Table 5.1), these to categories account for 94% of the entire database. The third category in order of importance - the 15 place settings - accounts for only the 2,4% of the models. The energy and water consumption of the models in the database, in kWh and litres per cycle, are presented in Figures 5.1-5.2, while in Figures 5.3-5.4 the specific energy and water consumption, in kWh and litre per place setting and per cycle, are given.

Average, minimum and maximum consumption values are also presented in Table 5.2 for the different place settings. The 9ps and the 12ps machines are highlighted. In the same Table also the break down of the models in the energy efficiency, washing performance and drying performance classes is given. As clearly shown also in Figure 5.5, in 2005 the large majority of the models belonged to A class for the three characteristics: 90% for energy efficiency and washing

Figure 5.1: Energy consumption as function of the place settings for the dishwasher models in the 2005 CECED technical database

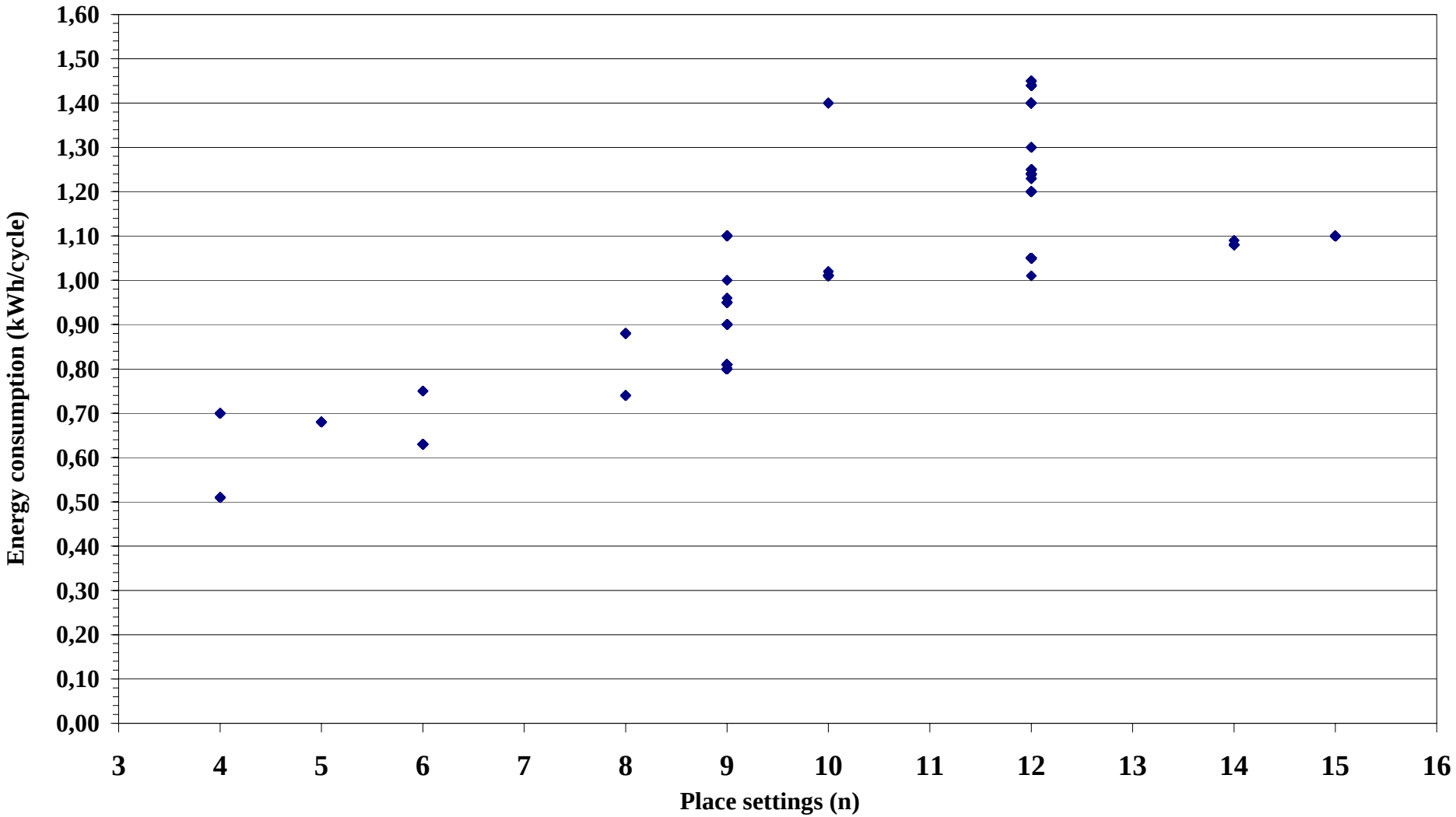


Figure 5.2: Water consumption as function of the place settings for the dishwasher models in the 2005 CECED technical database

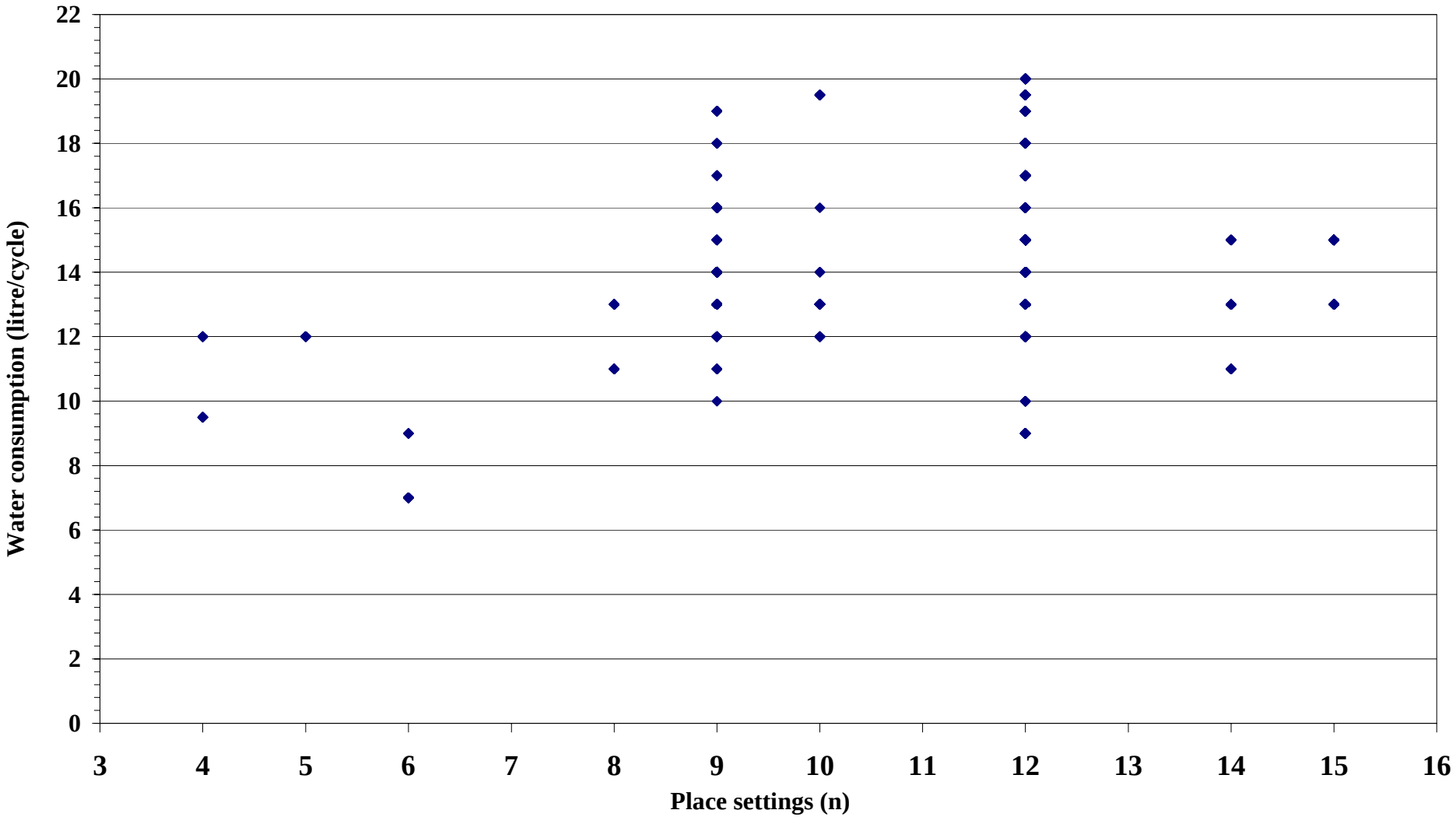


Figure 5.3: Specific energy consumption as function of the place settings for the dishwasher models in the 2005 CECED technical database

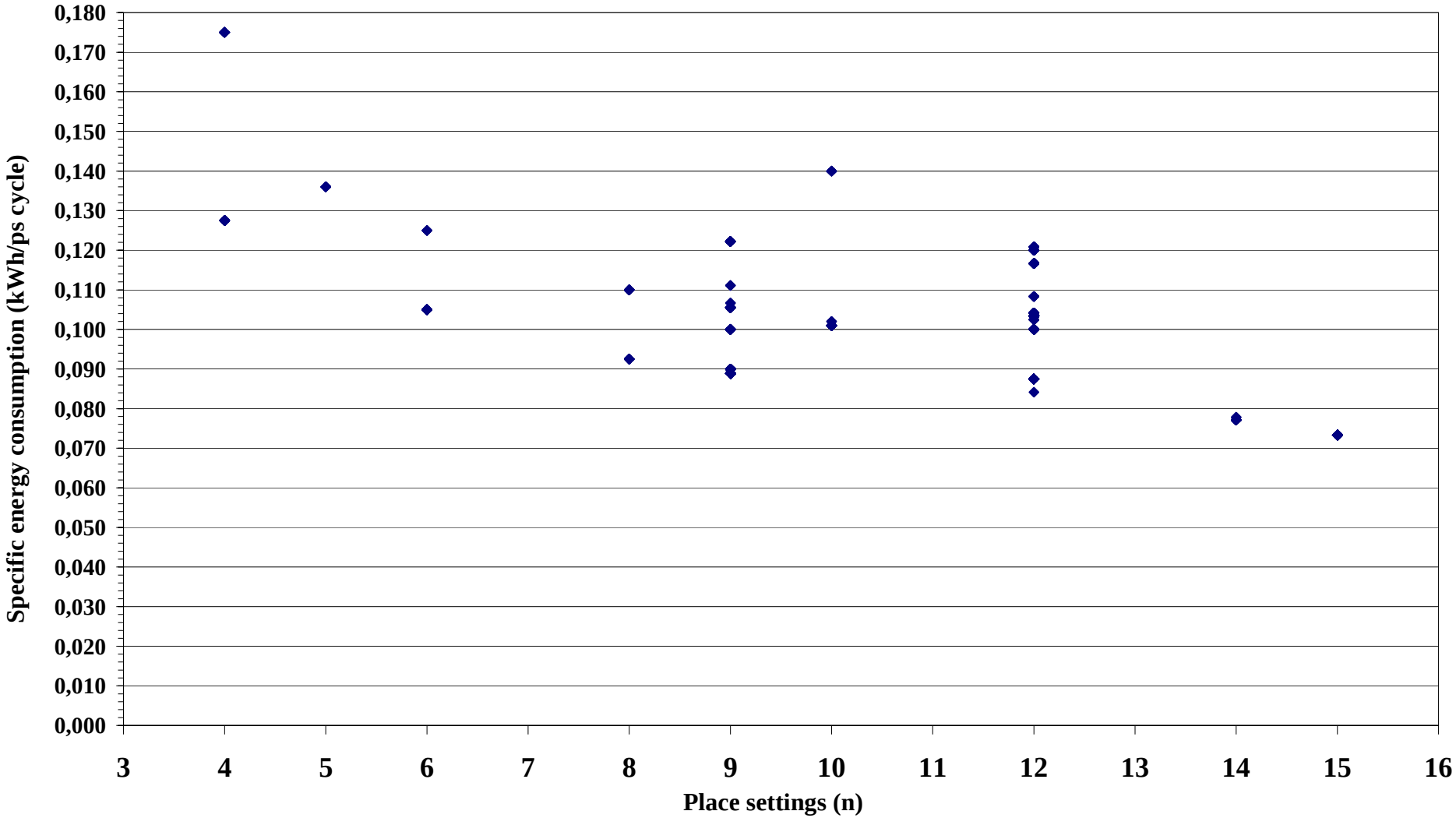


Figure 5.4: Specific water consumption as function of the place settings for the dishwasher models in the 2005 CECED technical database

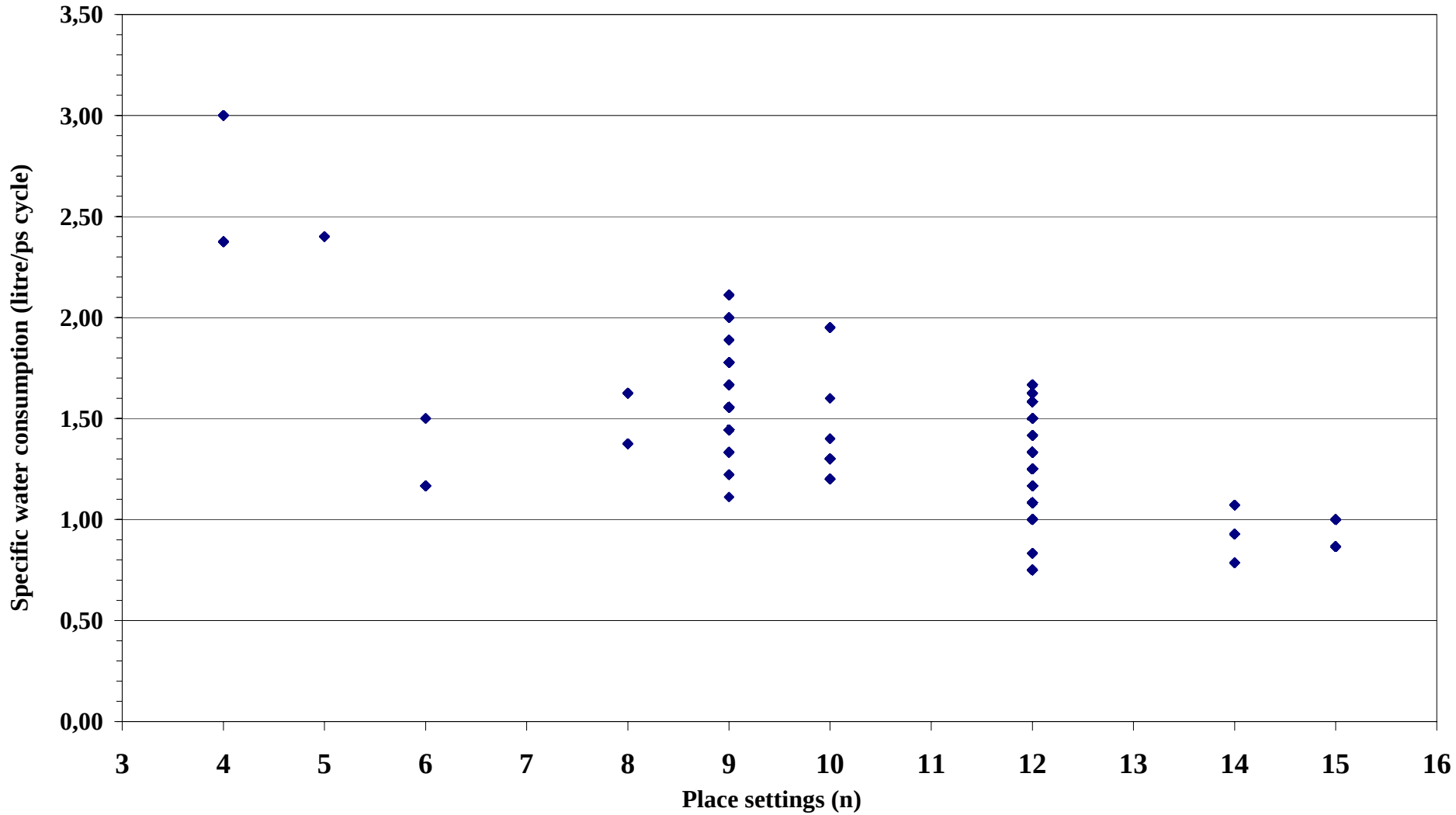


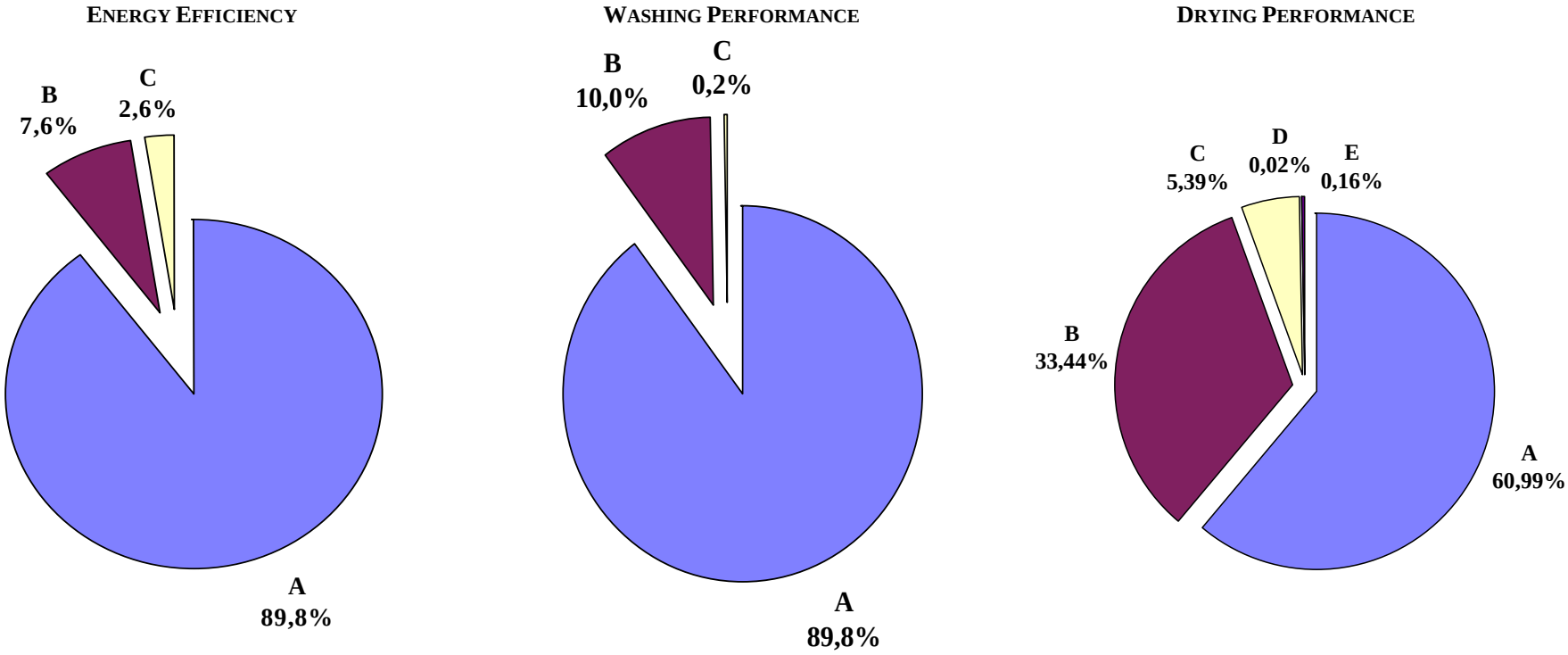
Table 5.1: Distribution of the 2005 dishwasher models by place settings

Standard place settings (number)	Models (number)	(%)
4	25	0,58
5	7	0,16
6	19	0,44
8	17	0,39
9	530	12,2
10	59	1,36
12	3 552	81,8
14	27	0,62
15	106	2,44
Tot.	4 342	100

Table 5.2: Energy and water consumption, energy efficiency, washing and drying performance classes for the dishwasher models in the CECED 2005 technical database

Place settings	Energy consumption			Water consumption			Specific energy consumption			Specific water consumption			Energy Efficiency classes			Washing Performance classes			Drying performance classes					Models
	average	min	max	average	min	max	average	min	max	average	min	max												
(n)	(kWh/cycle)			(litre/cycle)			(kWh/ps cycle)			(litre/ps cycle)			A	B	C	A	B	C	A	B	C	D	E	(n)
4	0,609	0,510	0,700	10,8	9,5	12,0	0,1522	0,1275	0,1750	2,70	2,38	3,00	12		13	12	13			12	13			25
5	0,680	0,680	0,680	12,0	12,0	12,0	0,1360	0,1360	0,1360	2,40	2,40	2,40		7				7					7	7
6	0,649	0,630	0,750	7,3	7,0	9,0	0,1082	0,1050	0,1250	1,22	1,17	1,50	16	3		16	3			19				19
8	0,814	0,740	0,880	12,1	11,0	13,0	0,1018	0,0925	0,1100	1,51	1,38	1,63	8	9		11	6		6	9	2			17
9	**0,828**	0,800	1,100	**13,7**	10,0	19,0	**0,0920**	0,0889	0,1222	1,52	1,11	2,11	453	49	28	427	103		259	228	43			**530**
10	1,050	1,010	1,400	13,5	12,0	19,5	0,1050	0,1010	0,1400	1,35	1,20	1,95	53		6	50	9		25	34				59
12	**1,070**	1,010	1,450	**15,2**	9,0	20,0	**0,0892**	0,0842	0,1208	1,27	0,75	1,67	3 223	263	66	3 251	299	2	2 278	1 097	176	1		**3 552**
14	1,081	1,080	1,090	13,1	11,0	15,0	0,0772	0,0771	0,0779	0,93	0,79	1,07	27			26	1		26	1				27
15	1,100	1,100	1,100	14,4	13,0	15,0	0,0733	0,0733	0,0733	0,96	0,87	1,00	106			106			54	52				106
Aver./Tot.	1,035			14,9			0,0899			1,30			3 898	331	113	3 899	434	9	2 648	1 452	234	1	7	4 342

Figure 5.5: Energy efficiency, washing and drying performance of the dishwasher models in the 2005 CECED technical database



performance and 60% for the drying performance. B class models were 10% or less for energy efficiency and water performance, while for drying performance they were one third. The other classes, where existing are residuals.

The energy efficiency and washing and drying performance for the 9ps and the 12ps models are presented in Tables 5.3-5.4. The 12ps appliances appear to be slightly more "performing" than 9ps ones, especially for the drying, where about half of the models are below A.

Table 5.3: Distribution of the energy efficiency, washing and drying performance classes for the 12ps models

Classes	Energy efficiency		Washing performance		Drying performance	
	(n)	(%)	(n)	(%)	(n)	(%)
A	3 222	90,7	3 251	91,5	2.278	64,1
B	266	7,5	299	8,4	1 097	30,9
C	64	1,8	2	0,1	176	5,0
D					1	0,0
E						
F						
G						
Total	3 552	100	3 552	100	3 552	100

Table 5.4: Distribution of the energy efficiency, washing and drying performance classes for the 9ps models

Classes	Energy efficiency		Washing performance		Drying performance	
	(n)	(%)	(n)	(%)	(n)	(%)
A	453	85,5	427	80,6	259	48,9
B	49	9,2	103	19,4	228	43,0
C	28	5,3			43	8,1
D						
E						
F						
G						
Total	530	100	530	100	530	100

The combination of the energy efficiency, washing and drying performance classes for all the models in the technical database is presented in Table 5.5: AAA, AAB and AAC models are 3 703 over the 4 342 total models, or 85%. AAA models are 2 642 or 60,8%.

The same evaluation for the 9ps and the 12ps machines is presented in Tables 5.6-5.7. For the 9ps category, AAA, AAB and AAC models are 417 over the 530 total models, or 78,7%. AAA models are 258 or 48,7%. For the 12ps, AAA, AAB and AAC models are 3.074 over the 3.552 total models, or 86,5%. AAA models are 2.273 or 64%.

5.1.1.2 The Notary Report of the industry voluntary commitment

The industry voluntary commitment defined by CECED in 1999 for dishwashers foresees that an annual Notary Report is delivered to the Commission and Member States. The Notary Report includes the number of units produced/imported for each place setting and the corresponding weighted average energy consumption (in kWh/cycle). Even if the voluntary commitment expired at the end of 2004, CECED prepared the Notary Report also for 2005.

Table 5.5: Energy efficiency, washing and drying performance class combinations for the dishwasher models in the CECED 2005 technical database

Place settings (n)	Energy efficiency, washing and drying performance classes combinations																			Models (n)
	AAA (n)	AAB (n)	AAC (n)	ABA (n)	ABB (n)	ABC (n)	BAA (n)	BAB (n)	BAC (n)	BBB (n)	BBC (n)	BCE (n)	CAA (n)	CAB (n)	CAC (n)	CBB (n)	CBC (n)	CCC (n)	CCD (n)	
4		12															13			25
5												7								7
6		16								3										19
8	6					2		5		4										17
9	258	157	2	1	25	10		10		35	4					1	27			530
10	25	21			7									4		2				59
12	2 273	750	51		123	26	1	115	24	73	50		4	32	1	4	23	1	1	3 552
14	26				1															27
15	54	52																		106
Total	2 642	1 008	53	1	156	38	1	130	24	115	54	7	4	36	1	7	63	1	1	4 342

Table 5.6: Energy efficiency, washing and drying performance classes combinations for the 9ps dishwasher models in the CECED 2005 technical database

Place settings (n)	Energy efficiency, washing and drying performance classes combinations											Models (n)
	AAA (n)	AAB (n)	AAC (n)	ABA (n)	ABB (n)	ABC (n)	BAB (n)	BBB (n)	BBC (n)	CBB (n)	CBC (n)	
9	258	157	2	1	25	10	10	35	4	1	27	530

Table 5.7: Energy efficiency, washing and drying performance classes combinations for the 12ps dishwasher models in the CECED 2005 technical database

Place settings (n)	Energy efficiency, washing and drying performance classes combinations																	Models (n)
	AAA (n)	AAB (n)	AAC (n)	ABB (n)	ABC (n)	BAA (n)	BAB (n)	BAC (n)	BBB (n)	BBC (n)	CAA (n)	CAB (n)	CAC (n)	CBB (n)	CBC (n)	CCC (n)	CCD (n)	
12	2 273	750	51	123	26	1	115	24	73	50	4	32	1	4	23	1	1	3 552

In 2005, about 8,4 million dishwashers were produced/imported for the EU25 market by the signatories of the voluntary commitment, 7 million of which (82,7%) 12ps units and 0,9 million (10,3%) for 9ps units. In general there is a good correspondence between the number of models in the technical database and the production for 2005. In 2004 the production was of about 8,04 million units.

The comparison of the production weighted average energy consumption with the models average energy consumption, shown respectively in the fourth and the last columns of Table 5.8, demonstrate that the two energy consumptions are very close, with the sales weighted value only slightly higher than the other one. Also the percentage of the appliances per place settings is very close for most of the place setting categories.

Table 5.8: Comparison between the outcome of the Notary Report and the technical database for dishwashers for 2005

Standard place settings	Technical database			Notary report		
	models		Energy consumption	models		Energy consumption
(number)	(number)	(%)	(kWh/cycle)	(number)	(%)	(kWh/cycle)
4	25	0,58	0,609	66 000	0,79	0,581
5	7	0,16	0,680	17 990	0,21	0,750
6	19	0,44	0,649	43 766	0,52	0,662
8	17	0,39	0,814	82 187	0,98	0,837
9	530	12,21	0,828	867 222	10,33	0,840
10	59	1,36	1,050	105 012	1,25	1,160
11	n.a	n.a	n.a	33 490	0,40	1,000
12	3 552	81,81	1,070	6 947 102	82,74	1,078
14	27	0,62	1,081	131 359	1,56	1,082
15	106	2,44	1,100	102 683	1,22	1,100
Total/Average	4 342	100	1,035	8 396 811	100	1,045

5.1.1.3 The sales data by energy efficiency for 2004

Sales data were collected by GfK, a market research firm specialised in household appliances, for 2002 and 2004[9]. Dishwasher sales for 13 Western Europe (AT, BE, DE, DK, ES, FI, FR, GB, GR, IT, NL, PT, SE) and 5 Eastern Europe (CZ, HU, PL, SI, SK) countries were collected by energy efficiency class.

The results are presented in Table 5.9, and compared with the analysis of the technical database for the 2005. In the 18 covered countries 5,8 million dishwashers were sold, 73,5% of which in class A and 15,9% in class B. No distinction is made for place settings.

Compared with the analysis of the CECED 2004 technical database a 7% difference is found for the class A appliances and a 16% with the 2005 technical database. The difference with the 2005 production is 2,5 million units, and 2,1 million units with the 2004 production.

[9] data for 2005 were too costly for the study budget.

Table 5.9: Comparison between the GfK sales data for 2004 and the technical database for dishwashers for 2004/2005

Energy efficiency class	Western Europe (n)	Eastern Europe (n)	EU total (n)	EU total (%)	Technical database 2005 (%)	Technical database 2004 (%)
A	4 097 493	183.414	4 280 907	73,5	89,8	80,7
B	874 658	50 259	924 917	15,9	7,6	13,3
C	446 986	26 428	473 413	8,1	2,6	5,4
D	32 946	2 938	35 884	0,6		0,5
E	2 875	46	2 920	0,1		
F	4	0	4	0,0		
G	165	0	165	0,003		
Unknown	97 333	6 635	103 969	1,8		
Total	5 552 461	269 720	5 822 180	100	100	100

5.1.1.4 The standard base case characteristics for dishwashers

Taking into consideration the analysis developed in the previous paragraph, two standard base cases can be selected for the dishwashers, a 9ps and a 12ps model, with the following characteristics:

- 12 place settings machine:
  - energy consumption: 1,070 kWh/cycle (energy efficiency class A/B, EEI=0,648)
  - water consumption: 15,2 litre/cycle
  - washing performance class: A/B
  - drying performance class: A or B
  - noise: 50 dB(A) [estimated from models available in catalogues]
- 9 place settings machine:
  - energy consumption: 0,828 kWh/cycle (energy efficiency class B, EEI=0,708)
  - water consumption: 13,7 litre/cycle
  - washing performance class: B
  - drying performance class: A or B
  - noise: 50 dB(A) [estimated from models available in catalogues].

In Tables 5.10-5.11 the characteristics of the different average machines are compared for the two place settings categories. The standard base cases of the 1995 GEA study and of the CECED voluntary commitment are also presented. The top of the range machines as found in the CECED technical database and from specialised journals are given in the same Table.

As far as washing cycle time of the standard cycle is concerned, 140-150 minutes are declared by manufacturers for the cycle used for the energy labelling scheme, against a 75 min cycle described in the GEA study.

Table 5.10: Results of the improvements for the 12ps dishwasher in 2003/2005 and comparison with the standard base case in 1995

Model	Place settings	Energy consumption		EE		WP	DP	Water consumption		Noise	Weight
	(n)	(kWh/cycle)	(Wh/ps)	E_I	(class)	(class)	(class)	(litre/cycle)	(litre/ps)	dB(A)	(kg)
Standard base case, 1995[10]	12	1,651	138,3	1,001	E	n.a	n.a	24	2,0	60[a]	50[b]
Base case CECED VA, 1996-97	12	1,692	141,0	1,025	E	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Production wgt. average, 2005	12	1,078	89,83	0,653	B	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Technical db average, 2005	12	1,070	89,21	0,648	A/B	A	A/B	15,2	1,27	50[a]	n.a.
Standard base case, 2005	12	1,070	89,21	0,648	A/B	A	A/B	15,2	1,27	50	n.a.
Top of the range, db 2005:											
energy consumption	12	**1,010**	84,17	0,612	A	A	A	13	1,08	n.a	n.a.
water consumption	12	1,050	87,50	0,617	A	A	A	**9**	0,75	n.a	n.a.
Best available, 2005/2006:											
energy consumption[c]	12	**0,950**	79,17	0,576	A	n.a.	n.a.	14	1,167	45	n.a.
noise[d,e]	12	1,050	87,50	0,636	A	n.a	n.a	14	1,167	**41**	n.a.

[a] estimated
[b] for the free-standing machine
[c] model LG GENIUS LD-2051 SH, Trade Bianco, November 2004, pag. 90.
[d] model AEG FAVORIT 80850, Trade Bianco, November 2004, pag. 88.
[e] AEG dishwashers with a noise in the range 41-45 dB(A) are advertised in Bianco & Bruno, N. 3-2007, pag.20.

[10] Source: GEA, 1995

Table 5.11: Results of the improvements for the 9ps dishwasher in 2003/2005 and comparison with the standard base case in 1995

Model	Place settings	Energy consumption		EE		WP	DP	Water consumption		Noise	Weight
	(n)	(kWh/cycle)	(Wh/ps)	E_I	(class)	(class)	(class)	(litre/cycle)	(litre/ps)	dB(A)	(kg)
Standard base case, 1995	12	1,651	138,3	1,001	E	n.a	n.a	24	2,0	60[a]	50[b]
Base case CECED VA, 1996-97	9	1,485	165,5	1,179	F	n.a	n.a	n.a.	n.a.	n.a.	n.a.
Production wgt. average, 2005	9	0,840	93,33	0,718	B	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Technical db average, 2005	9	0,828	91,98	0,708	B	A	A/B	13,7	1,5	50[a]	n.a.
Standard base case, 2005	9	0,828	91,98	0,708	B	A	A/B	13,7	1,5	50	n.a.
Top of the range, db 2005:	9										
energy	9	**0,800**	88,88	0,635	A	A	A	11	1,2	n.a.	n.a.
water	9	**0,800**	88,88	0,635	A	B	A	**10**	1,1	n.a.	n.a.

[a]estimated
[b]for the free-standing machine

5.1.2 The Standard Base Case for Washing machines

During the already mentioned first stakeholder meeting of the study it was proposed to define only one standard base case for the washing machines, to be selected between a 5kg or a 6 kg load machine, and the final choice done after the analysis of the technical database and the other available information. The proposal to use a specific load capacity machine as representative of the entire product group in Europe came from the knowledge of the market of washing machines in the past decades and has been used as the basis for the policy measures already in place: eco-label, the energy labelling scheme and the industry voluntary commitment described in Task 1.

5.1.2.1 The Analysis of the 2005 technical database

The 2005 technical database collected by CECED includes 5 192 models, with a load capacity from 3,0 kg to 9,0 kg. Also for the washing machines the analysis started with the validation of the collected data, checking the coherence of the declared Energy Efficiency Class. For 22 (0,42%) of the 5 192 models, a lack of coherence was found between the declared energy efficiency class and the calculated one: for 8 models the declared class was better than what should be but in other 14 models the declared class was found worse than the recalculated one. The latter models were at the border between two classes and the manufacturer decided to declare them in the lowest. In any case, for sake of coherence of the statistical analysis, all the "non-coherent" models were corrected and the statistical analysis of the energy efficiency class was based on the validated results.

About 50% of the models have a capacity of 5kg, followed by the 6kg with 28,3% of the models (Table 5.12). These two categories account for 78,3% of the entire database. The third category in order of importance is the 4,5kg accounting for only the 9,3% of the models.

Table 5.12: Distribution of the 2005 washing machines models by load capacity

Machine capacity (kg)	Models (number)	(%)
3,0	17	0,33
3,5	52	1,0
4,0	37	0,71
4,5	481	9,26
5,0	2 597	50,0
5,5	250	4,82
6,0	1 471	28,3
6,5	2	0,04
7,0	182	3,51
7,5	79	1,52
8,0	14	0,27
9,0	10	0,19
Total	5 192	100

The energy and water consumption of the models in the database, in kWh and litre per cycle, is presented in Figures 5.6-5.7, while in Figures 5.8-5.9 the specific energy and water consumption, in kWh and litre per kg load and per cycle, are given. The distribution of the spinning speed is presented in Figure 5.10 again as function of the machines load capacity.

Figure 5.6: Energy consumption as function of the load for the washing machine models in the 2005 CECED technical database

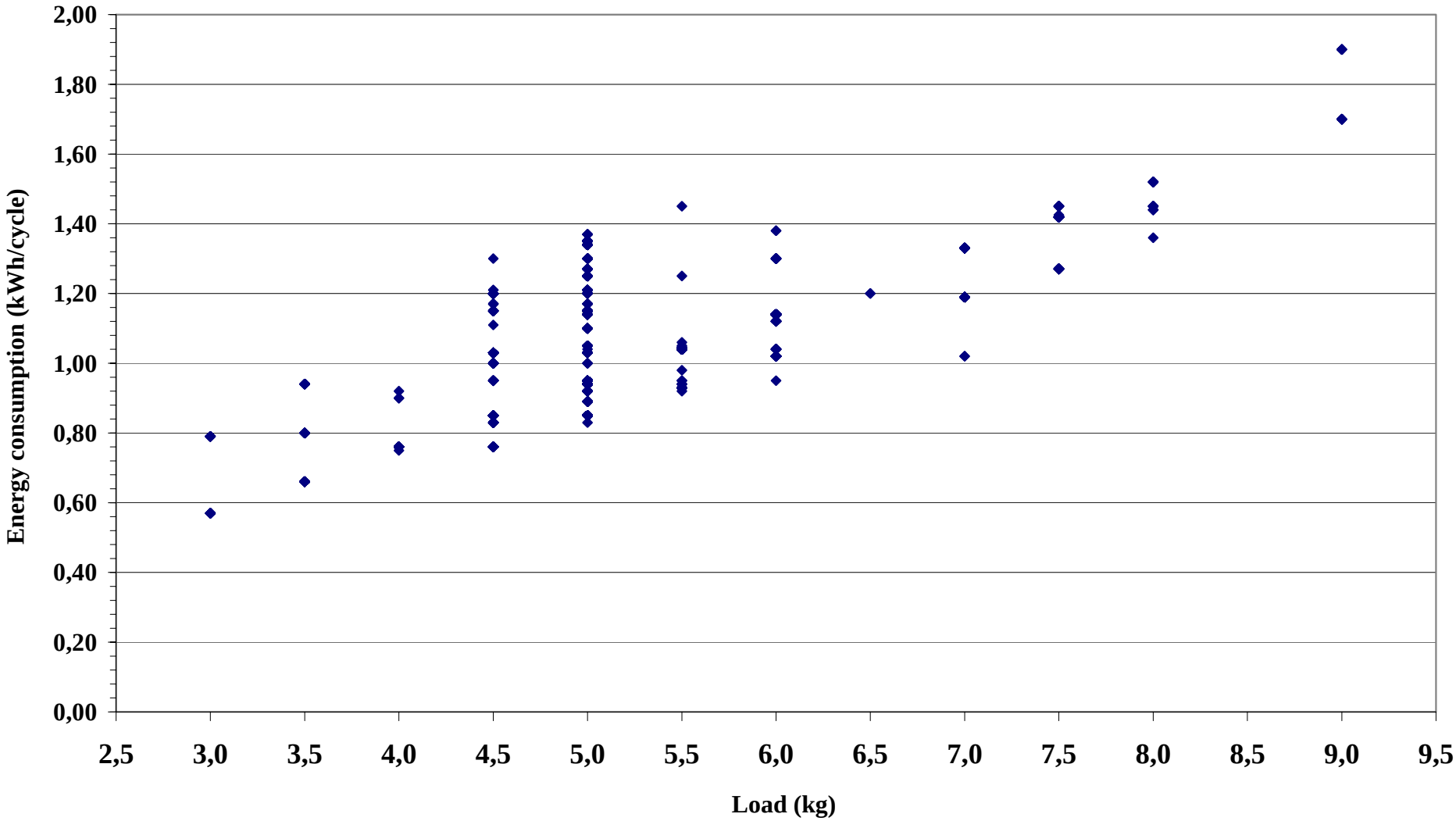


Figure 5.7: Water consumption as function of the load for the washing machine models in the 2005 CECED technical database

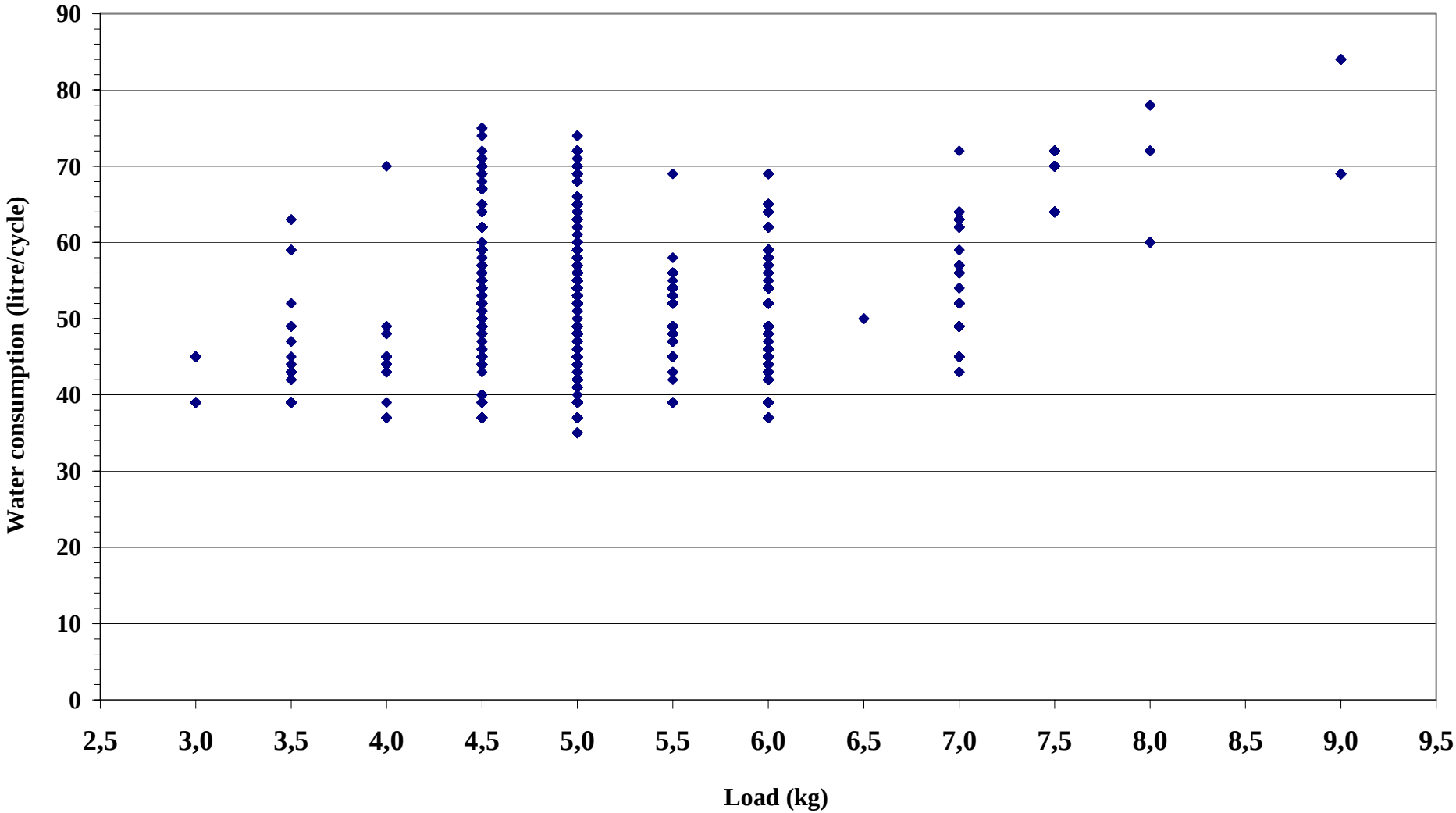


Figure 5.8: Specific energy consumption as function of the load for the washing machine models in the 2005 CECED technical database

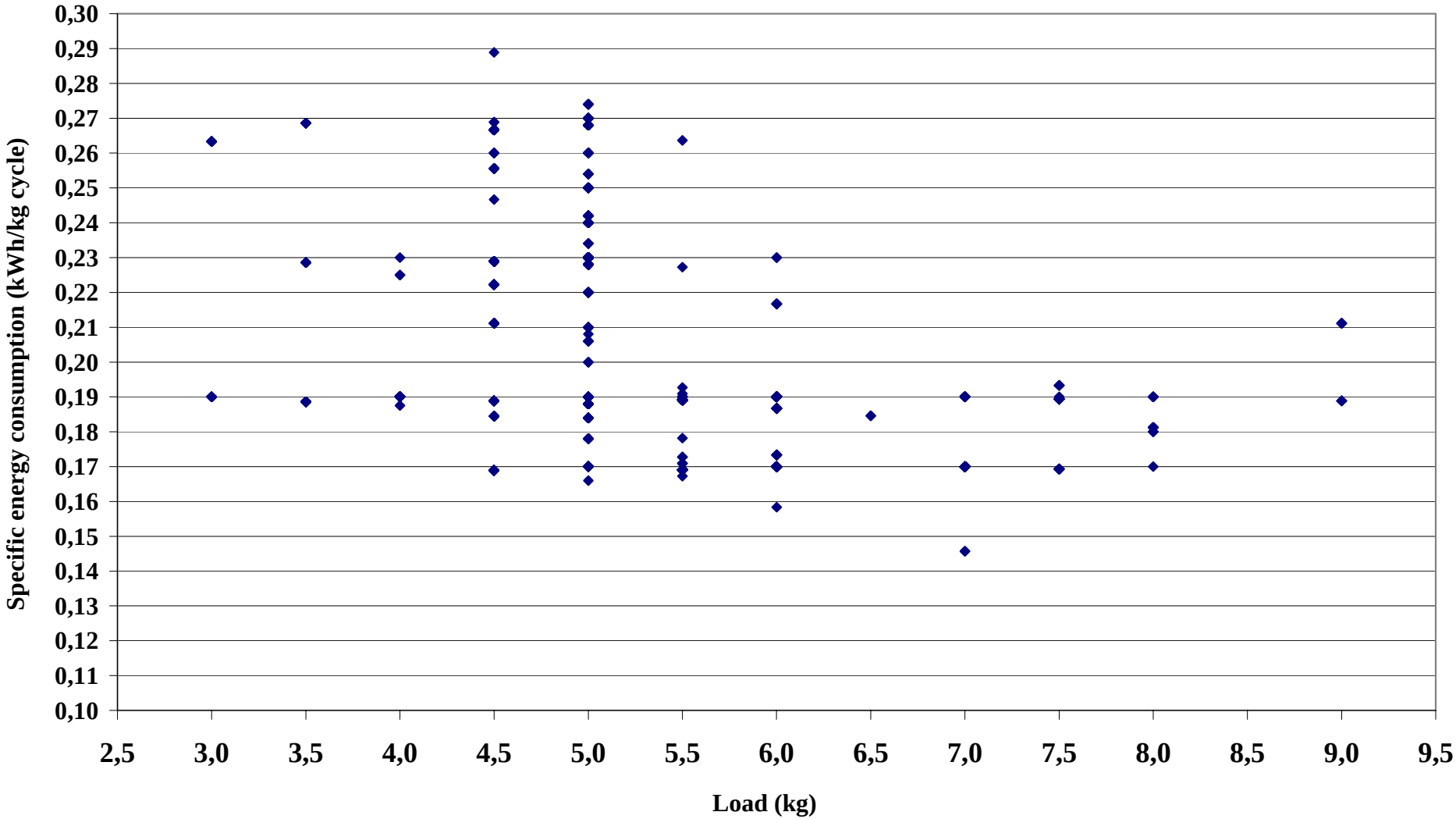


Figure 5.9: Specific water consumption as function of the load for the washing machine models in the 2005 CECED technical database

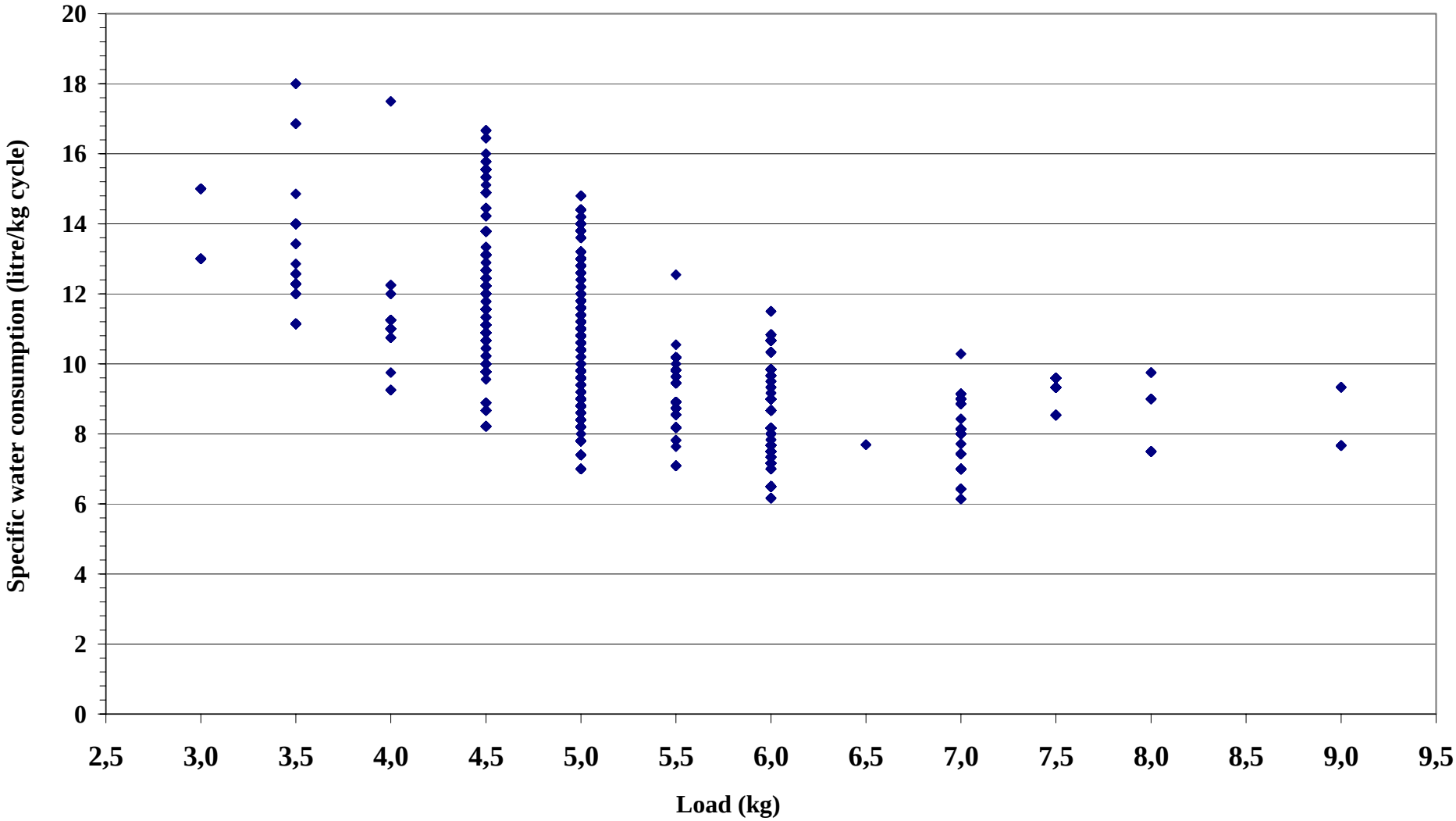
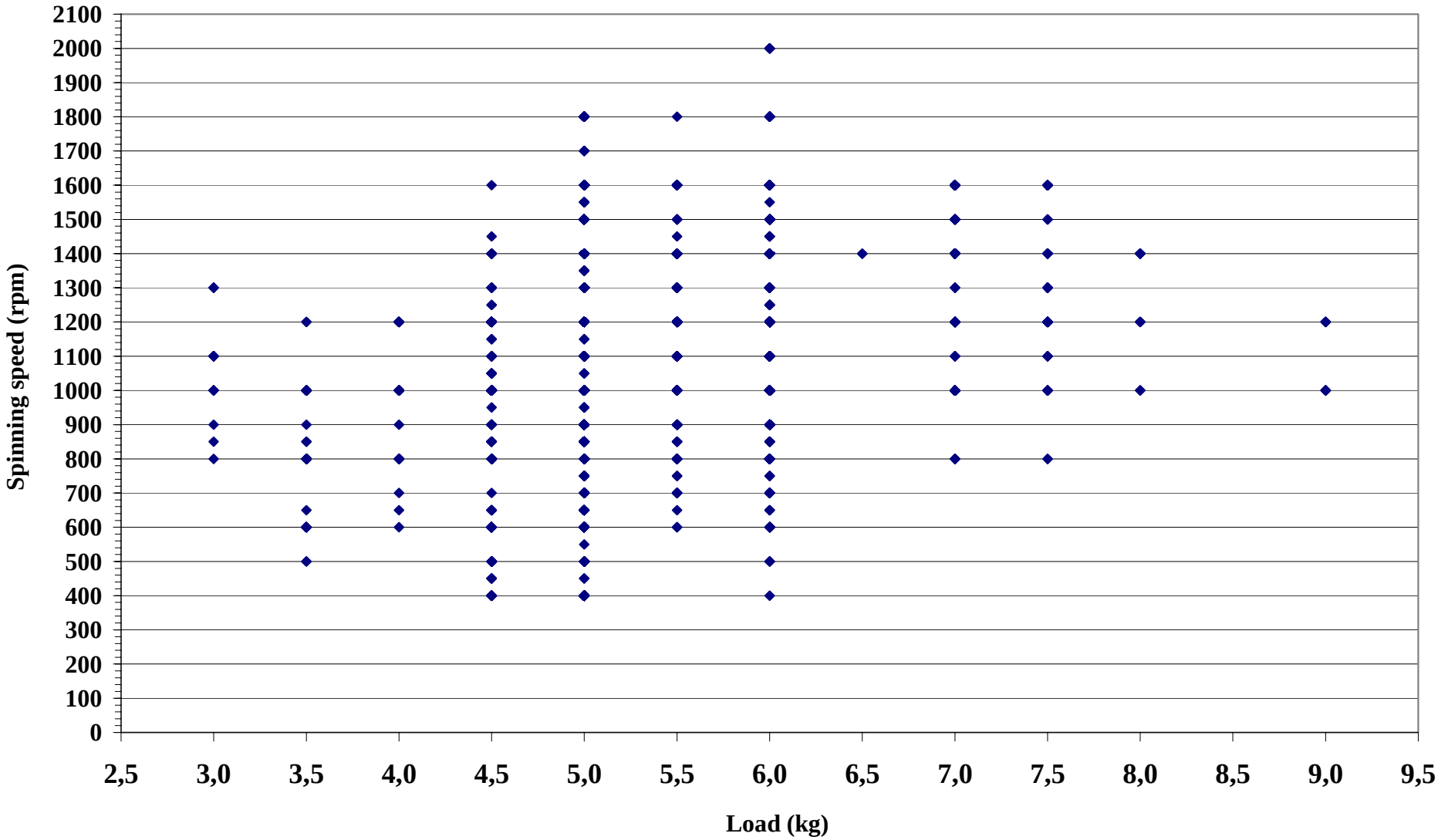


Figure 5.10: Spinning speed as function of the load for the washing machine models in the 2005 CECED technical database



Average, minimum and maximum values for energy and water consumption and spinning speed are presented in Table 5.13 for the different load capacities. The 5kg and the 6kg load capacity machines are highlighted.

In Table 5.14 the break down of the models in the energy efficiency, washing performance and spin drying performance classes is given. As clearly shown also in Figure 5.11, in 2005 the large majority of the models belong to class A+/A for the energy efficiency (89,7%) and for the washing performance (86,8%) while for the spin drying efficiency class A accounts only for 12,6%, class B for 40,8% and class C for one quarter of the models. The other classes, from D to G, are still present even if much less important. Although the "A+" energy efficiency class is not defined in the energy labelling scheme for washing machines, but is based on a commercial agreement among manufacturers, it is anyway indicated in the Tables for a better description of the present situation.

The EU energy labelling scheme does not rate spin speed, but residual moisture content and converts it in spin drying efficiency classes. The spin speed of a machine is a major factor determining the residual moisture content, but not the only factor: drum diameter and geometry of drum-details also are of influence. This influence is highlighted in Table 5.15: class A is reached by machines with at least 1 400 rpm, class B by machines with at least 1 000 rpm, class C from 700 rpm, class D from 600 rpm. The two more frequent spinning speeds are 1 000 rpm and 1 200 rpm, each accounting for about 20% of the models in the database, followed by 1 400 rpm (15% of the models), 1 600 rpm (10% of the models) and 800 rpm (about 9% of the models). The average spinning speed is 1 129 rpm, with a median of 1 200 rpm.

In the same Table also the washing performance and the energy efficiency of the models with the different spinning speeds is presented. A part from the very low spinning (below 600 rpm) A+/A class appliances (for washing performance and energy efficiency) are available for the different speeds.

The energy efficiency, washing performance and spin drying efficiency for the 5kg and the 6kg load capacity models are presented in Tables 5.16- 5.17. The 6kg appliances appear to be slightly more "performing" than 5kg ones, especially from the energy efficiency point of view, since the A+ models are 70,1% against 23,3%.

In Table 5.18 the spinning speed and spin drying efficiency classes for the 5kg load capacity and the 6kg load capacity washing machines is presented: for the 6kg models not all the spinning speeds are available compared to the 5kg load capacity machines.

Most of the machines in the database - 4 626 models out of the 5 192 total ones - present the "automatic load detection option". Only 505 models - or 9,7% - have not and for 61 models it is not specified. This feature allows the machine to evaluate the weight of the load and to adjust consequently the amount of water[11] needed for the washing cycle once the textile type (or the programme to be used) has been selected by the user.

The presence of this option is only partly related to the spinning speed (a higher percentage of low spinning machines has not it compared to the high spinning speed appliances), the energy efficiency and washing performance (almost all machines in energy efficiency classes A/A+ and washing performance classes A/B have it) and the load capacity (again, a higher percentage of low capacity machines has not this option). On the contrary, in practically all load capacity, energy efficiency, washing performance and spinning speed clusters models with this option can be found.

[11] but not the detergent, to be adjusted according to the load following the instruction on the packaging.

Table 5.13: Energy and water consumption, and spinning speed for the washing machine models in the CECED 2005 technical database

Machine load	Energy consumption			Water consumption			Spinning speed			Specific energy consumption			Specific water consumption			Models	
	average	min	max	average	min	max	average	min	max	average	min	max	average	min	max		
(kg)	(kWh/cycle)			(litre/cycle)			(rpm)			(kWh/kg cycle)			(litre/kg cycle)			(n)	
3,0	0,686	0,570	0,790	42,2	39,0	45,0	1 068	800	1 300	0,229	0,190	0,263	14,1	13,0	15,0	17	
3,5	0,722	0,660	0,940	45,3	39,0	63,0	836	500	1 200	0,206	0,189	0,269	12,9	11,1	18,0	52	
4,0	0,772	0,750	0,920	44,6	37,0	70,0	985	600	1 200	0,193	0,188	0,230	11,2	9,3	17,5	37	
4,5	0,917	0,760	1,300	53,2	37,0	75,0	926	400	1 600	0,204	0,169	0,289	11,8	8,2	16,7	481	
5,0	0,956	0,830	1,370	50,4	35,0	74,0	1 073	400	1 800	0,191	0,166	0,274	10,1	7,0	14,8	2 597	
5,5	1,012	0,920	1,450	50,9	39,0	69,0	1 180	600	1 800	0,184	0,167	0,264	9,3	7,1	12,5	250	
6,0	1,057	0,950	1,380	49,2	37,0	69,0	1 262	400	2 000	0,176	0,158	0,230	8,2	6,2	11,5	1 471	
6,5	1,200	1,200	1,200	50,0	50,0	50,0	1 400	1 400	1 400	0,185	0,185	0,185	7,7	7,7	7,7	2	
7,0	1,208	1,020	1,330	52,6	43,0	72,0	1 315	800	1 600	0,173	0,146	0,190	7,5	6,1	10,3	182	
7,5	1,381	1,270	1,450	70,3	64,0	72,0	1 330	800	1 600	0,184	0,169	0,193	9,4	8,5	9,6	79	
8,0	1,466	1,360	1,520	68,1	60,0	78,0	1 300	1 000	1 400	0,183	0,170	0,190	8,5	7,5	9,8	14	
9,0	1,780	1,700	1,900	75,0	69,0	84,0	1 120	1 000	1 200	0,198	0,189	0,211	8,3	7,7	9,3	10	
5,36	**0,998**			**50,7**			**1 129**			**0,187**			**9,6**			5 192	Average/Total

Table 5.14: Energy efficiency, washing and drying performance classes for the washing machine models in the CECED 2005 technical database

Machine load	Energy efficiency classes					Washing performance classes				Spin drying performance classes							Models
(kg)	**A+**	**A**	**B**	**C**	**D**	**A**	**B**	**C**	**D**	**A**	**B**	**C**	**D**	**E**	**F**	**G**	(n)
3,0		8		9			17				3	7	6	1			17
3,5		37	7	8		20	25	7			2	17	22	11			52
4,0		34	3			34	2	1			11	17	6	3			37
4,5	70	247	96	67	1	356	72	48	5	1	111	195	87	55	27	5	481
5,0	604	1 665	202	126		2 137	256	193	11	224	986	695	342	243	77	30	2 597
5,5	69	179	1	1		231	17	2		20	142	58	28	2			250
6,0	1 031	430	10			1 443	21	7		320	720	296	111	20	4		1 471
6,5		2				2				2							2
7,0	156	26				182				48	97	33	4				182
7,5	22	57				79				30	34	13	2				79
8,0	1	13				14				8	4	2					14
9,0		6	4			10					6	4					10
Total	1 953	2 704	323	211	1	4 508	410	258	16	653	2 116	1.337	608	335	108	35	5 192

Figure 5.11: Energy efficiency, washing and spin-drying performance for the washing machine models in the 2005 CECED technical database

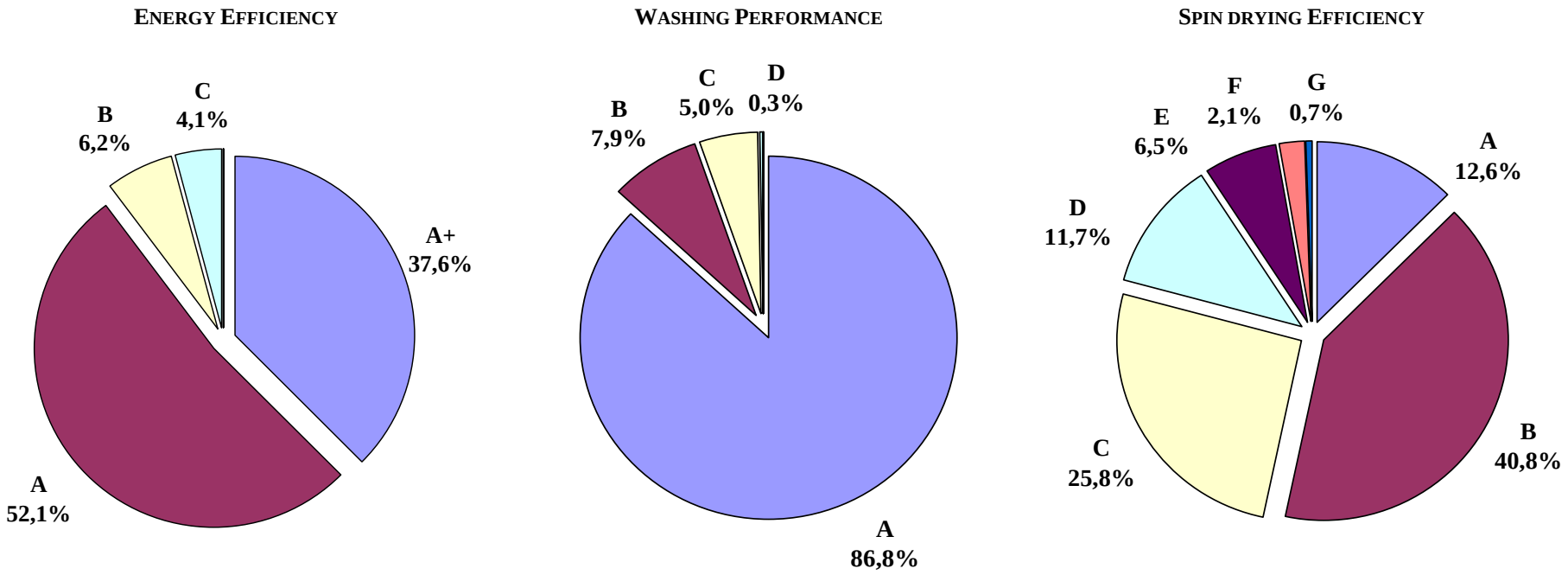


Table 5.15: Relation between spinning speed and spin drying efficiency, washing performance and energy performance for the washing machine models in the CECED 2005 technical database

Spinning speed	Spin drying efficiency							Washing performance				Energy efficiency					Models	
(rpm)	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**A**	**B**	**C**	**D**	**A+**	**A**	**B**	**C**	**D**	(number)	(%)
400						54	33		13	62	12		1	37	49		87	1,7
450						4	2		2	4				2	4		6	0,1
500					65	50		4	37	71	3		18	58	38	1	115	2,2
550					1						1				1		1	0,0
600				20	245			101	78	86		25	120	60	60		265	**5,1**
650				28	5			30	3			6	26	1			33	0,6
700			1	32	17			39	11			11	36	2	1		50	1,0
750			2	10	1			12		1		4	8		1		13	0,3
800			74	383	1			384	59	15		107	309	31	11		458	**8,8**
850			22	50				58	12	2		11	44	10	7		72	1,4
900			59	77				124	12			42	85	8	1		136	2,6
950			4					4					2	2			4	0,1
1 000		4	978	4				857	115	14		294	603	65	24		986	**19,0**
1 050			8					5	3			1	3	1	3		8	0,2
1 100		14	177					179	12			77	98	10	6		191	3,7
1 150		4						4				1	3				4	0,1
1 200		1 016	9	4				995	31	3		413	587	24	5		1 029	**19,8**
1 250		6	2					8				4	4				8	0,2
1 300		230	1					226	5			91	138	2			231	4,4
1 350		4						4				1	3				4	0,1
1 400	67	740						795	12			441	360	6			807	**15,5**
1 450		6						6				2	4				6	0,1
1 500	33	63						91	5			42	53	1			96	1,8
1 550		6						6					5	1			6	0,1
1 600	497	23						520				340	178	2			520	**10,0**
1 700	3							3					3				3	0,1
1 800	47							47				39	8				47	0,9
2 000	6							6				1	5				6	0,1
Total	653	2 116	1 337	608	335	108	35	4 508	410	258	16	204	1 953	323	211	1	5 192	100

Table 5.16: Distribution of the energy efficiency, washing and spin drying efficiency classes for the 5kg models

Classes	Energy efficiency		Washing performance		Spin drying efficiency	
	(n)	(%)	(n)	(%)	(n)	(%)
A+	604	23,3				
A	1.665	64,1	2.137	82,3	224	8,6
B	202	7,8	256	9,9	986	38,0
C	126	4,9	193	7,4	695	26,8
D			11	0,4	342	13,2
E					243	9,4
F					77	3,0
G					30	1,2
Total	2.597	100	2.597	100	2.597	100

Table 5.17: Distribution of the energy efficiency, washing and spin drying efficiency classes for the 6kg models

Classes	Energy efficiency		Washing performance		Spin drying efficiency	
	(n)	(%)	(n)	(%)	(n)	(%)
A+	1 031	70,1				
A	430	29,2	1 443	98,1	320	21,8
B	10	0,7	21	1,4	720	48,9
C			7	0,5	296	20,1
D					111	7,5
E					20	1,4
F					4	0,3
G						
Total	1 471	100	1 471	100	1 471	100

For the 5kg load capacity machines, 2 241 models (86,3%) present the “automatic load detection” option and 304 models (11,7%) do not have this option, while 99,6% - or 1 465 models - of the 6kg load capacity machines present this option.

The combination of the energy efficiency, washing performance and spin drying efficiency classes for the models in the technical database is presented in Table 5.19: combinations from A+AA to AAF account for 4.405 over the 5.192 total models, or 84,8%; A+AA and AAA models are 652 or 12,6%. The two most frequent combinations in 2005 were A+AB and AAB, accounting respectively for 954 (18,4%) and 1.080 (20,8%) models.

The same evaluation for the 5kg machines results in combinations from A+AA to AAF accounting for 2 089 over the 2 597 total models, or 80,4% and for the 6kg machines in 1 442 models over the 1 471 total models, or 98%.

5.1.2.2 The Notary Report of the industry voluntary commitment

The industry voluntary commitment defined by CECED in 2002 for washing machines foresee that an annual Notary Report is delivered to the Commission and Member States.

The Notary Report includes the number of units produced/importer for each energy efficiency class and the corresponding weighted average energy consumption (in kWh/cycle).

Table 5.18: Spinning speed and spin drying efficiency classes for the 5kg and the 6kg washing machines models in CECED 2005 technical database

Spinning speed	Spin drying efficiency class							Models 5kg		Spin drying efficiency class							Models 6kg	
(rpm)	**A**	**B**	**C**	**D**	**E**	**F**	**G**	(n)	(%)	**A**	**B**	**C**	**D**	**E**	**F**	**G**	(n)	(%)
400						46	28	74	2,85						1		1	0,07
450							2	2	0,08									0
500					51	31		82	3,16						3		3	0,20
550					1			1	0,04									0
600				19	178			197	7,59				1	13			14	0,95
650				19	2			21	0,81				1	2			3	0,20
700				22	11			33	1,27			1	4	4			9	0,61
750			2	7				9	0,35				1	1			2	0,14
800			45	207				252	9,70			14	67				81	5,51
850			17	31				48	1,85			2	5				7	0,48
900			37	34				71	2,73			6	31				37	2,52
950			3					3	0,12									0
1 000		2	500					502	19,3			208					208	14,1
1 050			2					2	0,08									0
1 100		9	87					96	3,70			58					58	3,94
1 150		2						2	0,08									0
1 200		458	1	3				462	17,8		318	5	1				324	22,0
1 300		126	1					127	4,89		4	2					6	0,41
1 350		4						4	0,15		61						61	4,15
1 400	14	328						342	13,2	30	307						337	22,9
1 500	10	37						47	1,81		4						4	0,27
1 550		5						5	0,19	15	19						34	2,31
1.600	165	15						180	6,93		1						1	0,07
1 700	3							3	0,12	255	6						261	17,7
1 800	32							32	1,23	14							14	0,95
2 000									0	6							6	0,41
Total	224	986	695	342	243	77	30	2 597	100	320	720	296	111	20	4		1 471	100

Table 5.19: Energy efficiency, washing and spin drying efficiency classes combinations for the washing machine models in the CECED 2005 technical database

Load	Energy efficiency, washing and drying performance classes combinations																			
	A+AA	A+AB	A+AC	A+AD	A+AE	AAA	AAB	AAC	AAD	AAE	AAF	ABB	ABC	ABD	ABE	ABF	ACB	ACC	ACD	ACE	BAA
(n)	(n)	(n)	(n)	(n)	(n)	(n)	(n)	(n)	(n)	(n)	(n)	(n)	(n)	(n)	(n)	(n)	(n)	(n)	(n)	(n)	(n)
3,0												3	1	4							
3,5								9	11			2	6	5	4						
4,0							11	14	5	2			1							1	
4,5		10	30	19	11	1	86	101	42	8			1		6		1	1			
5,0	109	293	122	64	16	114	639	443	230	59		27	72	29	25	1		2	7	17	1
5,5	7	36	18	8		13	101	35	12	1		5	5	7							
6,0	261	519	182	62	7	59	198	100	46	7	1		12	1			2	2	2		
6,5						2															
7,0	38	83	31	4		10	14	2													
7,5	4	13	5			26	21	8	2												
8,0	1					7	4	2													
9,0							6														
Total	420	954	388	157	34	232	1 080	714	348	77	1	37	98	46	35	1	3	5	9	18	1

Load	Energy efficiency, washing and drying performance classes combinations																				Models
	BAB	BAC	BAD	BAE	BBB	BBC	BBD	BBE	BBF	BBG	BCC	BCD	BCE	BCF	BCG	BDE	CAB	CAC	CAD	Other	
(n)	(n)	(n)	(n)	(n)	(n)	(n)	(n)	(n)	(n)	(n)	(n)	(n)	(n)	(n)	(n)	(n)	(n)	(n)	(n)	(n)	(n)
3,0																				9	17
3,5						2	3	2												8	52
4,0		2					1													0	37
4,5	7	22	12	1	5	11	2	11	6		5	4	2	8			1	3	1	63	481
5,0	17	23	4	3	7	22	6	33	10	2	3		25	34	11	1				126	2 597
5,5												1								1	249
6,0	1							5	3				1							0	1 471
6,5																				0	2
7,0																				0	182
7,5																				0	79
8,0																				0	14
9,0		4																		0	10
Total	25	51	16	4	12	35	12	51	19	2	8	5	28	42	11	1	1	3	1	207	5 192

In 2004, about 15,4 million washing machines were produced/imported for the EU25 market by the signatories of the voluntary commitment. The average weighted specific energy consumption was 0,195 kWh/kg cycle. The average specific energy consumption of the models in the 2005 technical database is 0,187 kWh/kg cycle, and is 0,192 kWh/kg cycle in the 2004 technical database, which is very close to the production value.

In general there is a good correspondence between the efficiency/performance distribution of models in the technical database and the 2004 production. The A+/A percentage is higher in the 2005 technical database (Table 5.20).

Table 5.20: Comparison of the energy efficiency distribution of the 2004/2005 technical database and the 2004/2005 production for washing machines

Classes	2005 technical database		Notary report 2005		2004 technical database		Notary report 2004	
	(n)	(%)	(n)	(%)	(n)	(%)	(n)	(%)
A+	1 953	37,6	15 193 708	90,6	1 338	25,9	12 738 810	82,4
A	2 704	52,1			3 067	59,4		
B	323	6,22	635 368	3,79	361	6,99	1 365 151	8,83
C	211	4,06	933 113	5,57	377	7,30	1 344 966	8,70
D	1	0,02			20	0,39	9 473	0,06
E								
F								
G								
Total	5 192	100	16 762 189	100	5 163	100	15 452 400	100

5.1.2.3 The sales data by energy efficiency for 2004

Sales data for washing machines were collected by GfK for 2002 and 2004[12] for 13 Western Europe (AT, BE, DE, DK, ES, FI, FR, GB, GR, IT, NL, PT, SE) and 8 Eastern Europe (CZ, EE, HU, LT, LV, PL, SI, SK) countries by energy efficiency class.

The results are presented in Table 5.21, and compared with the analysis of the technical database for the 2005. In the 21 covered countries 14,0 million dishwashers were sold, 78% of which in class A+/A and 11,9% in class B. No distinction is made for load capacity or front load/top load feature.

A market picture for these characteristics in Italy[13] considers that 70% of the 1,56 million units sold in 2005 was front load and 5kg load capacity, while the 6kg machine should reach 300.000 units at the end of 2006. It is also known that only in France (and partially in Finland) the top loading machines are the majority, compared to the other EU countries where this type of washing machines represents about 10-15% [to be confirmed by further market analysis].

Compared with the analysis of the CECED 2004 technical database, a 7% difference is found for the class A appliances (A+ and A classes together) and a 11% with the 2005 technical database. The difference with the 2004 production and import in the Notary Report is 1,4 million units.

[12] data for 2005 were too costly for the study budget.
[13] Source: “Lavaggio, nuove proposte per il 2006”, Trade Bianco, March 2006, pp.73-78.

Table 5.21: Comparison between the GfK sales data for 2004 and the technical database for washing machines for 2004/2005

Energy efficiency class	Western Europe (n)	Eastern Europe (n)	EU total (n)	EU total (%)	Technical database 2005 (%)	Technical database 2004 (%)
A+	929 227	25 588	954 815	6,80	37,6	25,9
A	8 549 715	1 464 054	10 013 769	71,3	52,1	59,4
B	1 441 018	233 094	1 674 112	11,9	6,22	6,99
C	909 048	64 537	973 585	6,93	4,06	7,30
D	88 656	12 042	100 699	0,72	0,02	0,39
E	15.649	365	16 014	0,11		
F	56.923	13	56 936	0,41		
G	1 438	0	1 438	0,01		
Unknown	174 759	74 610	249 369	1,78		
Total	12 166 433	1 874 304	14 040 737	100	100	100

5.1.2.4 The standard base case characteristics for washing machines

Taking into consideration the analysis developed in the previous paragraph, the average washing machine for 2005 presents the following characteristics:

- Standard base case:
  - load capacity: 5,36 kg
  - energy consumption: 0,998 kWh/cycle (“C” = 0,187)
  - water consumption: 50,7 litre (9,6 litre/kg cycle)
  - detergent consumption: 139,76g (54g + 16g/kg load in EN 60456)
  - spinning speed: 1.129 rpm
  - automatic load detection
  - energy efficiency class: A (0,17 <”C” ≤ 0,19)
  - washing performance class: A
  - drying performance class: B or C
  - noise: 53 dB(A) for washing; 70 dB(A) for spinning

In Table 5.22 the characteristics of the different average machines are compared for the proposed standard base case. The standard base cases of the 1995 GEA study and the WASH-2 study are also presented. The top of the range machines, as found in the 2005 CECED technical database, and from specialised journals are given in the same Table. As far as washing cycle time of the standard cycle is concerned, 90-100 minutes are declared by manufacturers for the cycle used for the energy labelling scheme (cotton, 60°C, full load), against a 100-110 min cycle mentioned in the GEA/WASH-2 studies.

5.1.3 The Real Life Base Case for Dishwashers

The GEA study mentioned two EU base cases for dishwashers:

- a standard 12ps base case, referring to the energy use according to the standard EN 60436, or 1,651 kWh/cycle, a water consumption of 24 litre/cycle and a washing time of 75 min;
- a real-life base case, with a load of 7ps, and energy consumption of 1,517 kWh/cycle (8,1% lower than the standard base case), water consumption of 24 litre/cycle and a washing time of 72,5 min.

Table 5.22: Results of the improvements for the washing machines in 1995-2005 and comparison with the standard base case in 1995 (wash programme 60°C, cotton)

Model	Capacity	Energy consumption		EE		WP	DP	Water consumption		Spin speed	Noise
	(kg)	(kWh/cycle)	(Wh/kg)	C	(class)	(class)	(class)	(litre/cycle)	(litre/kg)	(rpm)	dB(A)
Standard base case, 1995[14]	4,7	1,39	0,309	0,31	D	n.a	n.a	85	18,1	900	n.a.
Standard base case, 1998[15]	4,8	1,15	0,240	0,24	C	n.a	n.a	60	12,5	n.a.	n.a.
Production wgt. average, 2004	n.a.	n.a.	0,195	0,20	B	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Technical db average, 2005	5,36	0,998	0,187	0,19	A	A	B/C	50,7	9,6	1 129	n.a.
Standard base case, 2005	5,36	0,998	0,187	0,19	A	A	B/C	50,7	9,6	1 129	53/70
Average 5kg load capacity	5	0,956	0,191	0,19	A	A	B/C	50,4	10,1	1 073	n.a.
Average 6kg load capacity	6	1,057	0,176	0,18	A	A	B/A	49,2	8,2	1 262	n.a.
Top of the range, db 2005:											
energy consumption	5	**0,830**	0,166	0,17	A+	A	B	45	9,0	1 150	n.a.
water consumption	5	0,850	0,170	0,17	A+	A	A	**35**	7,0	1 800	n.a.
Top of the range, db 2005:											
energy consumption	6	**0,950**	0,158	0,16	A+	A	C	49	8,2	1 100	n.a.
energy consumption	7	**1,020**	0,146	0,15	A+	A	B	52	8,1	1 200	n.a.
water consumption	6	1,020	0,170	0,17	A+	A	A	**37**	6,2	1 800	n.a.
spinning speed	6	1,020	0,170	0,17	A+	A	A	39	6,5	**2 000**	n.a.
Top of the range, market 2006: energy consumption[16]	8	1,2	**0,15**	0,15	A+	A	A	52	6,5	1 400	53/72

[14] Source: GEA2 study, 1995.
[15] Source: WASH-II study, NOVEM, 2001.
[16] LG machine LG-Imperial Flower, sold in UK see:
http://uk.lge.com/prodmodeldetail.do?actType=search&page=1&modelCategoryId=06040902&categoryId=06040902&parentId=060409&modelCodeDisplay=LG-Imperial+Flower&model=1

Taking into consideration the consumer behaviour analysis developed in Task 3, the average real life dishwashers for 2005 presents the following characteristics:

- 12 place settings machine in real life:
  - Load capacity: assumed one third lower than the nominal one or 9ps
  - washing temperature: higher than for the standard base case or 59,3°C
  - energy consumption: 9,1% more than the standard base case or 1,167 kWh/cycle
  - water consumption: one litre more per week corresponding to 15,4 litre/cycle
  - washing performance class: A/B
  - drying performance class: A or B
  - noise: 50 dB(A)

- 9 place settings machine in real life:
  - load capacity: one third lower than the nominal one or 6ps
  - washing temperature: higher than for the standard base case or 59,3°C
  - energy consumption: 9,1% more than the standard base case or 0,903 kWh/cycle
  - water consumption: one litre more per week, corresponding to 13,9 litre/cycle
  - washing performance class: B
  - drying performance class: A or B
  - noise: 50 dB(A).

In particular for the 12ps machine:

- energy consumption: an increase of 0,435 kWh per week (10%) for 4,06 cycle/week results from the use of higher temperature programmes than the temperature of the programme used for the energy labelling declaration; a decrease of 0,406 kWh per week (-9,3%) is due to heating of a lighter load (partial load is estimated to be one third of the nominal load); an increase of 0,236 kWh per week (+5,4%) due to an estimated 10°C water inlet, colder than the 15°C water inlet under standard conditions; finally a 3% increase due to the various standby and low power modes is considered (3-5% were evaluated in Task 3 depending on the considered power levels). In total an increase of (+10-9,3+5,4+3 = 9,1)% occurs for the real life base case energy consumption;
- water: a 1 litre per week increase is considered, due to a possible extra rinse
- chemicals and washing time: detergent, softener, rinsing agent consumption is considered the same as for the standard base case as well as the washing cycle time (140-150 minutes);
- noise, energy efficiency, washing and drying performance: are considered the same as for the standard base case;
- hand pre-rinse: the largest energy consumption increase, +17,4%, which comes from hand pre-rinsing **is not considered for the real-life base case** since it is caused by a specific consumer behaviour outside the machine and not requested in the manufacturers instructions. The pre-rinse will be taken into consideration in the stock model.

The same percentages are applied to the 9ps machine.

5.1.4 The Real Life Base Case for Washing Machines

The GEA study mentioned two EU base cases:

- a standard base case, referring to the energy use according to the standard EN 60456: 1994, based on a 1,3 kWh/cycle calculated energy use in 1995 (since at that time there were insufficient data to issue a statistical average consumption based on measurements) or 0,3 kWh/kg and a water consumption of 85 litres/cycle;

- a real-life base case, referring to the best estimate of energy use when using the programme temperature and the load in practice. The real-life base case was based on a programme setting at almost 60 ºC, but now with a load of 3 kg, instead of the load at rated capacity of 4,7 kg. The AISE data 1996, which covers all EU countries, find an average load of around 2,85 kg.

No real-life base case was addressed in the WASH-II study.

Taking into consideration the consumer behaviour analysis developed in Task 3, the average real life washing machine for 2005 presents the following characteristics:

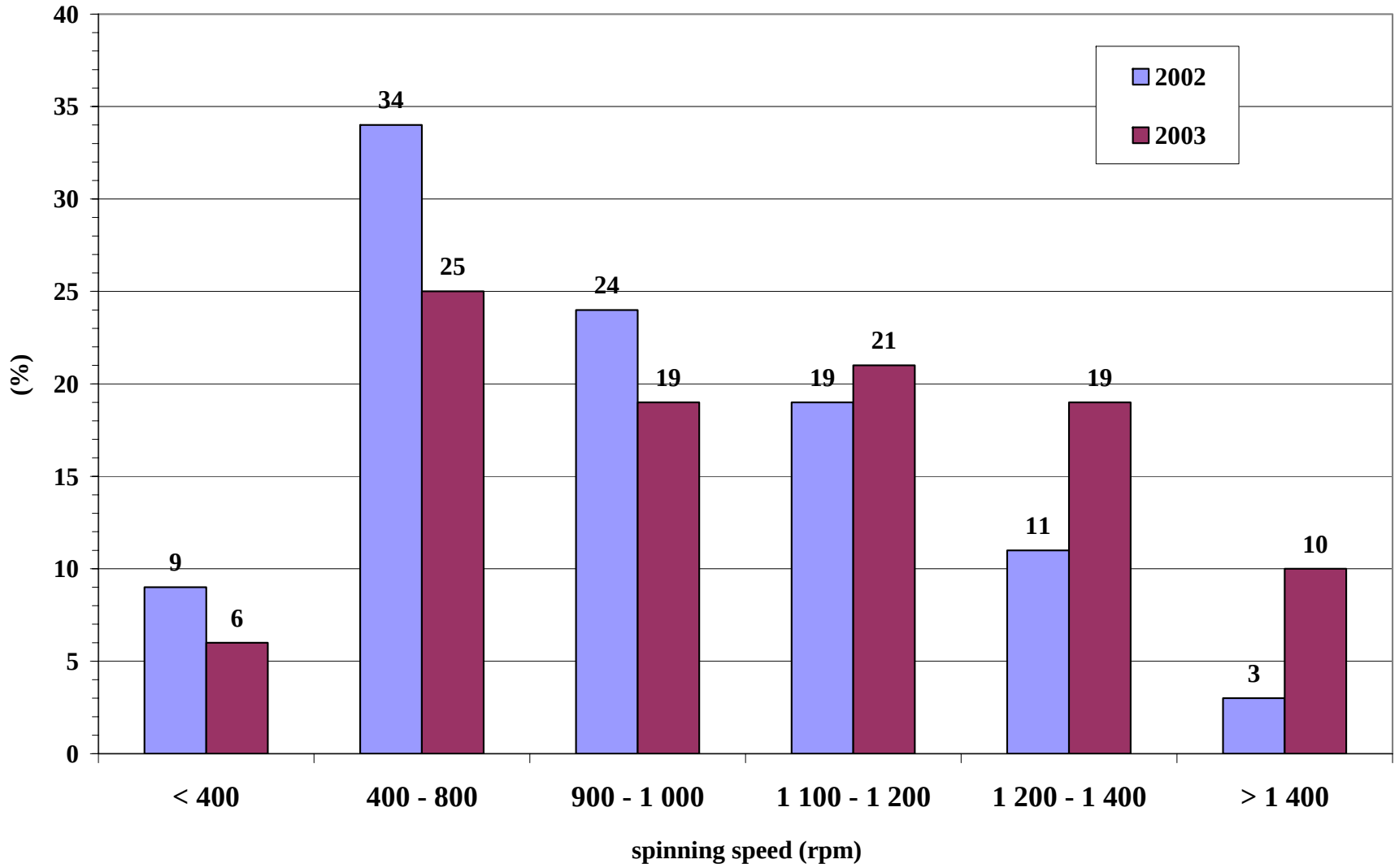
- Real-life base case washing machine:
  - load capacity: 64% of the standard base case 5,36 kg or 3,4 kg
  - washing temperature: 45,8 °C
  - energy consumption: -27,9% of the standard base case or 0,719 kWh/cycle
  - water consumption: -8,7% of the standard base case or 46,3 litre/cycle
  - detergent consumption 139,76g/cycle
  - spinning speed: 1 129 rpm
  - automatic load detection
  - energy efficiency class: A
  - washing performance class: A
  - drying performance class: B or C
  - noise: 53 dB(A) for washing; 70 dB(A) for spinning.

In particular:
- load capacity has been evaluated in 3,2kg, which is the 64% of the most frequent sold washing machine capacity or 5kg; since the standard base case has a load capacity of 5,36 kg, the corresponding real life base case results in a capacity of 3,4kg;
- energy consumption: a decrease of 1,42 kWh per week (-29%) considering 4,9 cycle/week, results form the use of a lower washing temperature (45,8°C) than the temperature under standard conditions (60°C); a decrease of 0,537 kWh per week (-11%) is due to heating of a lighter load; an increase of 0,427 kWh per week (+8,7%) due to an estimated 10°C water inlet, colder than the 15°C water inlet under standard conditions; finally an increase of 0,165 kWh per week (or 3,4% of the standard base case consumption) due to the various standby and low power modes is considered. In total a decrease of (-29-11+8,7+3,4 = -27,9)% occurs for the real life base case energy consumption. Therefore the energy consumption of the real life base case has been considered 72,1% of the standard base case;
- water consumption: a reduction of 26,6 litres per week (-10,7%) occurs due to the reduction in the load and an increase of 4,9 litre (+2%) due to the possible extra rinse, to give a total water consumption of (-10,7+2=-8,7%) or 46,3 litre/cycle;
- detergent consumption: the detergent consumption is considered the same as in the standard base case in absolute value or 139,76g/cyle, because consumers declare to use the machine almost at full load
- washing time (90-100 minutes), spinning speed, noise, energy efficiency, washing and drying performance: are considered the same as for the standard base case.

In Figure 5.12 the spinning speed of front load washing machines in 10 Member States of West Europe (AT, BE, DE, FR, ES, IT, NL, PT, SE, UK) in 2002 and 2003[17] is presented The models on the market are equally split in two groups ≤1 000 rpm and ≥1 100 rpm including 50% of the sales.

[17] Source: "Presente e futuro dell'Europa da vandere", Trade Bianco, December 2003, pp. 39-42.

Figure 5.12: Spinning speed of front load washing machines in West Europe in 2002 and 2003



5.2 SUBTASK 5.2: PRODUCT-SPECIFIC INPUTS

Product-specific inputs are necessary for the development of the LCA and are collected for the following life phases:

- Production (raw materials, components and assembling)
- Distribution of products (average distances and types of transport modes)
- Use phase (average life, specific consumption, maintenance and repairs)
- Packaging (type and weight)
- End of Life (disposal, thermal valorisation, incineration, dismantling…).

These data have been collected and organised according to the "EuP Eco Report" requirements and taking into account the LCA ISO 14040 standards. Similarly, the methodology used for the LCA analysis has been be, at first glance, based on the EuP-Ecoreport settings, but, as far as possible, it has also been compared and aligned with the LCA standard methodology by using others LCA software and data (like, i.e. the SimaPro tool) and databases.

Primary input data have been collected through direct communication with producers and, when not available, from sector specific or commercial data bases for both the standard and the real base cases. Product-specific inputs have been gathered through a specific "BOM and Inventory Data Template" collection form prepared by the study Team to simplify and standardise the elementary information collection. Manufacturers have been requested to provide the information listed in the BOM and Inventory Data Templates basing them on real appliances, whose characteristics are the closest possible to the identified standard (and real life) base cases. A previous analysis has been carried out to make the manufacturers selection simpler by evaluating the type and number of those models in the technical data base.

5.2.1 The Selection of Real Models for Data Collection

5.2.1.1 Availability of real dishwasher models

As already outlined, to facilitate manufacturers data collection task, a specific research has been developed in the CECED 2005 technical database to evaluate (i) how many real models do exist close to the standard base cases and (ii) how close the characteristics of these models are with respect those of the standard base cases. The analysis lead to the identification of a set of 373 9ps and 720 12ps real models with the following characteristics:

<u>12 place settings machine, free standing:</u>

- energy consumption: 1.050 kWh/cycle (energy efficiency class A, EEI ≤ 64)
- water consumption: 15 or 16 litre
- washing performance class: A
- drying performance class: A or B;

<u>9 place settings machine, free standing:</u>

- energy consumption: 0,800 kWh/cycle (energy efficiency class A, EEI ≤ 0,64)
- water consumption: 13 or 14 litre/cycle
- washing performance class: A
- drying performance class: A or B.

These models, a part of the noise not reported in the technical database, are in good agreement with the base cases specifications. Therefore manufacturers should not have encountered major difficulties in selecting a model with the described average characteristics among their own products.

5.2.1.2 Availability of real washing machine models

Taking into consideration the characteristics of the standard base case (especially the capacity of 5,36 kg) two sets of washing machine models have been be selected from the technical database, the 5kg load models and the 6 kg load models with the following average characteristics:

5kg load machine, front loading:

- energy consumption: 0,956 kWh/cycle
- water consumption: 50,4 litre
- spinning speed: 1 073 rpm
- automatic load detection
- energy efficiency class: A
- washing performance class: A
- drying performance class: B or C
- noise: 53 dB(A) in washing /70 dB(A) in spinning;

6kg load machine, front loading:

- energy consumption: 1,057 kWh/cycle
- water consumption: 49,2 litre
- spinning speed: 1.262 rpm
- automatic load detection
- energy efficiency class: A+/A
- washing performance class: A
- drying performance class: B or A
- noise: 53 dB(A) in washing /70 dB(A) in spinning.

Since the greatest number of models in the technical database is that for 5 kg of clothes, and taking in consideration the other relevant data, this machine type has been considered a better “proxy” of the standard base case on the European market than the 6kg machine.

At this point the same procedure discussed and used for the dishwashers was applied to facilitate the manufacturers data collection task. The analysis of the technical database led to the identification of a set of 221 real models with the following characteristics:

- 5kg load machine, front loading:
- energy consumption: 0,950 kWh/cycle (“C” = 0,19)
- water consumption: (50 ± 1) litre
- spinning speed: (1.100 ± 100) rpm
- automatic load detection
- energy efficiency class: A
- washing performance class: A
- drying performance class: B or C
- noise: 53 dB(A) in washing /70 dB(A) in spinning.

These models are very close to the average 5kg machine previously defined, which in turn is the best "proxy" of the standard base case. The selected machines can easily be found in the 2005 technical database, therefore the manufacturers should not have encountered particular difficulties in selecting their own model for BOM and inventory data collection.

5.2.2 The BOM and Inventory Data Collection

Primary input data come from direct communication with manufacturers and/or, if not available, collected on sector specific or commercial data base (secondary data) for both for the standard and (if necessary) the real base cases; information to be collected are related to real appliances whose characteristics are as close as possible to those of the identified standard (and real life) base cases described in Subtask 5.1.

5.2.2.1 The Collected Data for dishwashers and washing machines

Data provided from manufacturers for each appliance base case are:

Appliances	Code	No of models
12 place settings dishwasher standard base case	DW 12ps	6
12 place settings dishwasher standard base case	DW 9ps	4
Washing machine standard base case	WM 5kg	5

In order to define the average model for each standard base case the data collected through the mentioned template have been analysed and the results are briefly summarised. The majority of the collected templates are quite complete.

a) Data from manufacturers of dishwashers

Data collected for dishwashers present the following characteristics (only some manufacturers have provided specific data, like, e.g., information on spare parts, end of life of final product);

- **Production:**
  - Material: data are sufficiently complete; some manufacturers produced data only in terms of "sub-assembled components" (objects) without indications of their material composition.
  - Scrap: generally the data (percentage and EoL) don't represent all materials used;
  - Processing: given information, also if sometimes exhaustive, are often generic and incomplete and without percentage;
  - Transport: data (average kms and medium) are complete only in some cases;
- **Assembling**: the provided data are generally complete, also if sometimes units of measure are not those required by the inventory data sheets;
- **Use phase**: the provided data are sometimes incomplete and units of measure are not those required by the inventory data sheets (generally no indications on cycle/year);
- **End of Life**: although some producers gave congruent indications, data are difficult to understand and to use.

According to the data quality, questions and remarks were sent to the manufacturers. For each phase the following type of remarks and questions were made:

- Production: generally only total weight for "objects" is available; if it is possible also the

composition could be useful. If no data are available from some manufacturers the data of the others have been used.

- Scrap and EoL: information available only for some materials; for the other materials a zero percent has been considered. EoL sometimes is only qualitative and not usable, or indicated also when scrap is not indicated.
- Processing: sometimes only generic data are available; in this case alternative data from other manufacturers have been be used. When no percentage of processing is indicated, 100% has been considered for the psecific process.
- Transport : clarification on "specific" indicators used is required;
- End of life: when no or incomplete indications are found, the use of EU average for each material, or data form others manufacturers has been taken into consideration.

As a general remark, it was reported that when no data or incomplete data from a manufacturer were available, the main solution was to use data from other manufacturers (when complete data are available) or average EU data (when available). A general agreement was reached:

- to use data from other manufacturers when data are not complete or not available;
- to refer to the EU average, mainly for transport and End of Life;
- to use 100% for processing when no specification is provided.

Some manufactures didn't provide materials specification for some sub-components ("objects" in the inventory data sheet).

b) Data from washing machines manufacturers

Data collected for dishwashers presented the following characteristics:

- **Production**
  - *Material Composition*: for some models full indication for each material used have been provided; for other models "objects" are included and data on material composition are available only for some models;
  - *Scrap and EoL*: for some models no figures have been provided; for other models only generic and incomplete data have been provided;
  - *Processing*: is always indicated but generally without any indication on %;
  - *Data on transport*: are complete for most of the models;
- **Assembling:** data are generally complete also if sometimes units of measure are not that required in the inventory data sheets;
- **Use phase:** data are sometimes incomplete and units of measure are not that required in inventory data sheets (generally no indications on cycle/year);
- **End of Life:** specific end of life data per material category have been provided only by few producers.

According to the data quality some questions and remarks were sent to manufacturers. For each phase the following remarks were made:

Production: some producers have provided only total weight for some "objects"; if it is possible, it could be useful to have also the single composition in terms of materials. Without specific data, if available, data from other producers will be used;
Scrap and EoL: information was available only for some materials; for the other materials a zero percent has been considered. EoL sometimes is only qualitative and not usable or indicated. Also scrap is not always indicated.

Processing: sometimes only generic data are available; if possible specify in a detailed way. As an alternative data from other producers will be used. When no percentage is indicated a 100% was considered for the specific process. Sometimes there is no data for compressors and ferrous materials;
Transport: clarification of the "specific " indicators used is required;
End of life: when no or incomplete indications are provided, the use of EU average for each material, or data form others maufacturers are taken into consideration.

A general agreement was reached also in this case:

- to use data from other manufacturers when data are not complete or not available;
- to refer to the EU average, mainly for transport and End of life;
- to use 100% for processing when no percentage specification is provided.

Also for washing machines, some producers didn't provide materials specification for some sub-components ("objects" in the inventory data sheet).

c) Final assumptions for the collected data

Taking into account the "homogeneity" of questions and answers about dishwashers and washing machines, the following assumptions and simplifications were made for the definition of the "average models" for both product groups:

- in general, data have been checked and, if necessary, normalised in order to have a same unit of measure;
- for production phase: in the Bill of Materials scheme, data have been organised into the following material categories:
  - Ferrous metals;
  - Non ferrous metals;
  - Plastics;
  - Various materials;
  - Packaging.
- for manufacturers data, similar or analogous data have been re-organised and re-assembled in the previous material categories;
- some manufacturers provided data in terms of sub-assembled parts. In these cases, the sub-assembled have been disaggregated (when possible) into the single material components and, once again, organised in the previous material categories; when no further material composition break down was possible sub-assemblies were not included in the average data;
- average data for bill of materials have been calculated as the mean of the available values;
- for scrap, the end of life and processing data from the most complete inventory tables have been considered; data used for the average model are not, in general, the mean of the available values but are derived from general considerations regarding the provided values;
- for transport of materials, average kilometres have been calculated, weighted by the weight of singles components, for each model. The average km value for the average model is a second-level averages, weighted on weights of each model;
- for Assembling and Use phases: data provided from manufacturers have been checked and normalised, when necessary for the same unit of measure. Data for the average model for the assembling and use phases, has been calculated as the mean of the available values;
- for End of Life: data from manufacturers are often inhomogeneous: only homogeneous and congruent data have been considered to derive the average model.

In Annex A, Tables with average composition data for DW 9ps, DW 12ps and WM 5kg base cases are shown (Tables from 5.39 to 5.41).

5.3 SUBTASK 5.3: BASE CASE ENVIRONMENTAL IMPACT ASSESSMENT

Product specific inputs, developed in previous Sub-task 5.3 for wash appliances, are used to define environmental profile and impact analysis. The system used is the EuP-EcoReport, version 5[18], with this system it is possible to evaluate the environmental impact analysis for:

- Production (Materials, Manufacturing, transport);
- Distribution;
- Use;
- End-of-Life.

EuP-Ecoreport outputs are expressed as:

- Material consumption;
- Other resources and Waste as:
    - Total energy (including electricity);
    - Water (process and cooling);
    - Waste (hazardous and non-hazardous).
- Emission (air) as:
    - GWP;
    - ODP;
    - Acidification;
    - VOC;
    - POP;
    - Heavy metals;
    - PAHs;
    - Particulate matter (PM, dust).
- Emission (water) as:
    - Heavy metals;
    - Eutrophication;
    - POP.

5.3.1 Considerations and Assumptions to use the inventory data in EuP-Ecoreport

In order to use the inventory data from Subtask 5.2 in the EuP Ecoreport software, some considerations and assumptions are required.

Not all materials requested in the inventory tables are useful to compile the EuP Ecoreport: some additional data have been requested for the development of the parallel LCA through a different LCA software (e.g. SimaPro). This parallel LCA study is scheduled for the second part of the study aimed at complement the results coming from EuP-Ecoreport and somehow make a validation through the comparison with the outcome of an internationally recognised LCA procedure. In particular, following data are not requested as input in the EuP-Ecoreport:

- Production phase: data on scrap (percentage and EoL), data on processing and transport of

[18] See http://www.eupproject.org .

single materials, since those data are defined as assumptions in the Eup-Ecoreport; only the setting of the percentage of sheet metal scrap is allowed;

- Assembling phase: data on consumption during the assembling phase, which are assumptions in the Eup-Ecoreport;
- detailed data on EoL: only the setting of the percentage of land-filled materials, and the percentage of plastics recycled, in terms of materials or thermal utilisation is possible.

In addition, it is worth noting that the in the Data Base available in the EuP Ecoreport many materials are missing. For this reason, only the material composition of the identified average models has been used as input in the Bill of Materials of the EuP Ecoreport. For dishwashers, information about consumables is missing in the EuP Ecoreport, the same occurs also for the detergent and softener for the washing machines.

The materials not mentioned in the Data Base have been re-allocated in the existing material categories. Accordingly, the following assumptions were made:

a) for some materials a direct correspondence with the categories in EuP Ecoreport, data base is possible;
b) for some materials an allocation is possible provided specific assumptions and simplifications are done. The following correspondence table was used.
   - Steel strip as Steel Sheet galv.;
   - Prepainted steel as Stainless 18/8;
   - Steel + PA as Stainless 18/8;
   - Bras (Cu + Zn alloy) as Cu Zn 38;
   - Wiring as Cu wire;
   - Zinc die-casting as Cu Zn 38;
   - PP – K40 as PP;
   - PA 66 – GF as PA 6;
   - PC – G as PC;
   - EPDM – rubber as LDPE
   - POM as HDPE;
   - Wood as cardboard;
   - Gravel as Concrete;
   - Thermostat as Controller board;
   - PPO as PP.
c) for some materials no correspondence is possible; in this case the missing materials' weight is re-allocated in other material categories, according to their percentage. Materials without correspondence are:
   - Plastics, others;
   - Adhesive;
   - Others;
   - Cr;
   - Ni;
   - PBT;
   - Bitumen;
   - Cotton;
   - Cotton + Resins;
   - PPS-GF;
   - Filter;
   - Oil-feet.

5.3.2 LCA of wash appliance base cases using EuP-Ecoreport

Taking into account all the previous assumptions, the EuP environmental profiles for DW 9ps, DW 12ps and WM 5kg models have been evaluated. In Annex B input and output of EuP Ecoreport software are shown. For each model it is reported:

- input tables: Production phase, Assembling, Use, End of life;
- output tables: Materials, Other Resources & Waste, Emissions (Air), Emissions (Water)

As mentioned before, for some materials it was not possible to have correspondence between inventory data from manufacturers data collection and EuP Ecoreport data base: the amount of these materials have been added to the weight of the other materials, according to their percentage. In the following tables the original materials weight is reported in bracket. The final material weight used in EuP Ecoreport is in the central column of input sheet.

5.3.3 Preliminary conclusions and remarks

Some materials have no correspondence in the categories included in the EuP Ecoreport data base. This occurred for the following weight percentage:

- 14,4 % for DW 9ps;
- 15,5 % for DW 12ps;
- 4,4 % for WM 5kg.

Assumptions were made for other materials to find a correspondence with existing categories:

- 14,2 % for DW 9s;
- 12,4 % for DW 12ps;
- 4,8 % for WM 5kg.

This means that between 9% and 29% of the weight of materials in the wash appliances does not have a direct correspondence in the EuP-Ecoreport data base. This has to be taken into consideration for the analysis of the appliances environmental impacts in the EuP-Ecoreport output. Moreover it is also important to remind that in the EuP database:

- the environmental impact for transport is included in materials environmental impacts; this means that the production phase outputs account also for the impact and consumption due to transport;
- in the “distribution” phase the impact due the packaging includes the transport to retailer;
- the data about detergents or other chemicals (e.g. bleaching) for wash appliances are not taken into account;

the extent at which these simplifications affect the final LCA results have also been investigate and are shown later.

On the basis of the described assumptions on the materials substitution and the EuP database, the LCA resulted in:

- the Production and Use phases are responsible for the majority of environmental impacts;
- for the Use phase, energy consumption and water use are the most relevant elements (for both process and cooling), while for the production phase the wastes are more relevant;

- as far as emissions in air are concerned, the Use phase is most relevant for greenhouse gases, acidification and VOC; while the Production phase yields a higher impact of POP, heavy metals and PAHs; and the Distribution phase is relevant for particulate matter (three times the total of production and use phases);
- as far as emissions to water are concerned, the Production phase is the most relevant for heavy metals but not for eutrophication.

5.3.3.1 Impact and consumptions for DW 9

Figures 5.13 to 5.17 show the energy and water consumption as well the air, water and wastes impacts of the DW 9ps model. The Figures indicate that a higher energy and water consumption level are accounted in the Use phase (Figure 5.13) while the Production phase is responsible for the higher quota of the waste production (Figure 5.14).

The emissions to air (Figure 5.15) are shared between the Production and Use phases but in a different way: GWP, acid rain and VOCs are higher in the use phase while POP, Heavy metals and PAH are mainly emitted from the Production one. Particulate matter emissions are finally mainly produced during the Distribution phase (the typical PM10 emitted by diesel motors).

Also the water emissions (Figure 5.16) are mainly due to Production and Use phases. In particular eutrophication pollutants mainly come from the Use phase while heavy metals are produced during the Production phase.

Finally Figure 5.17 provides the overall synthesis of all the environmental impact of this product category.

Figure 5.13: DW 9 ps – Energy and water consumptions

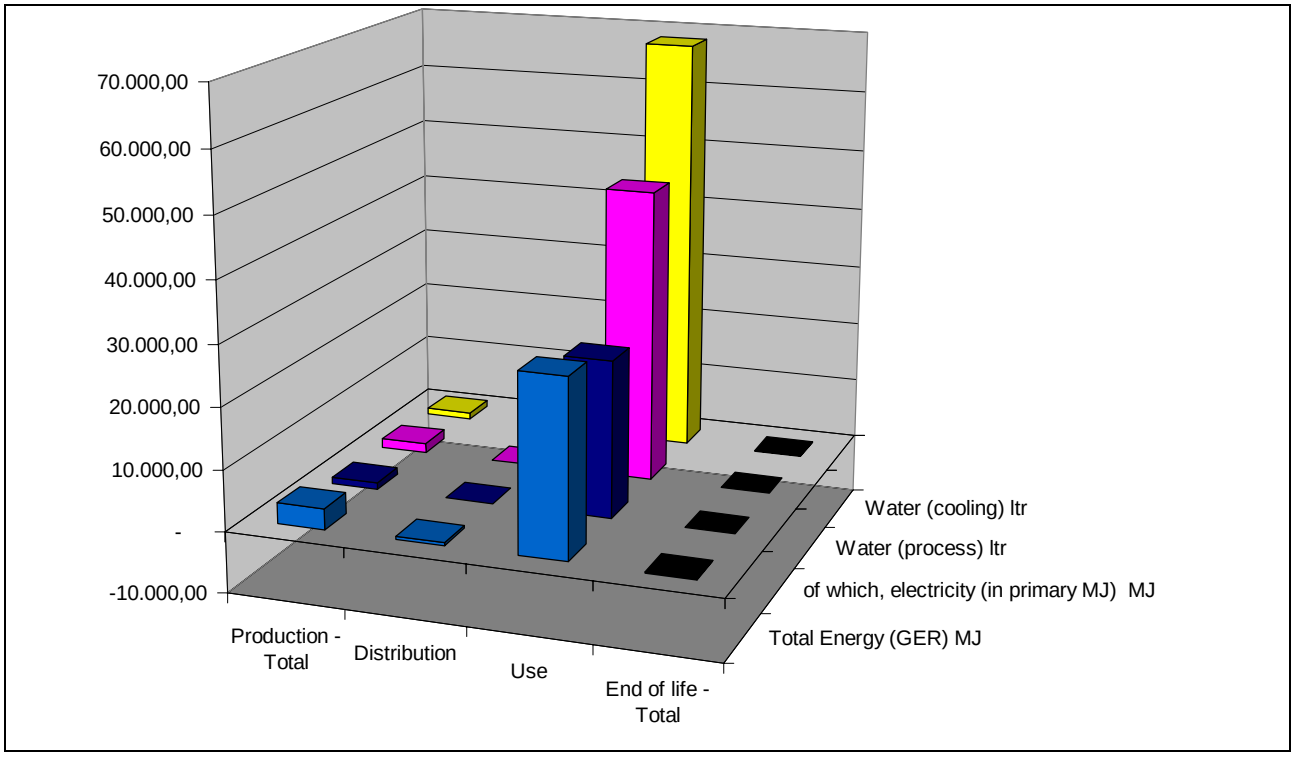


Figure 5.14: DW 9 ps – Waste production

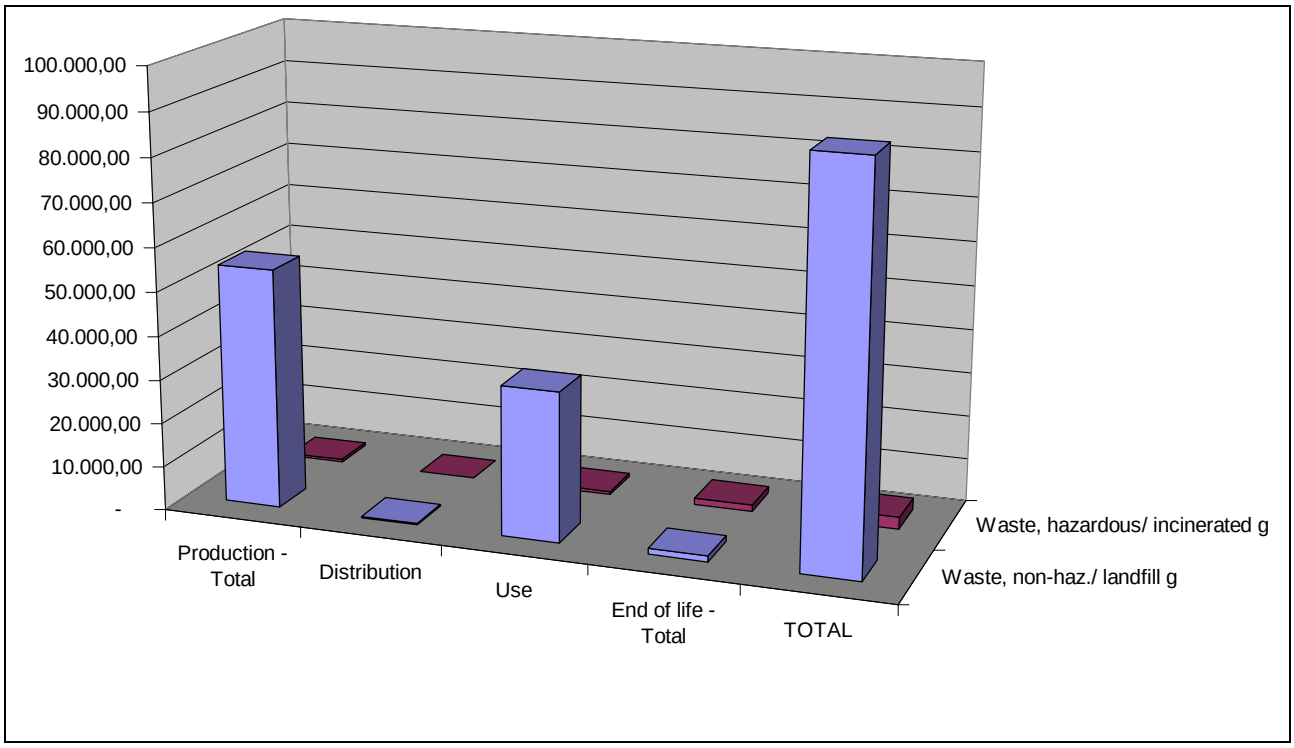


Figure 5.15: DW 9 ps – Emissions (air)

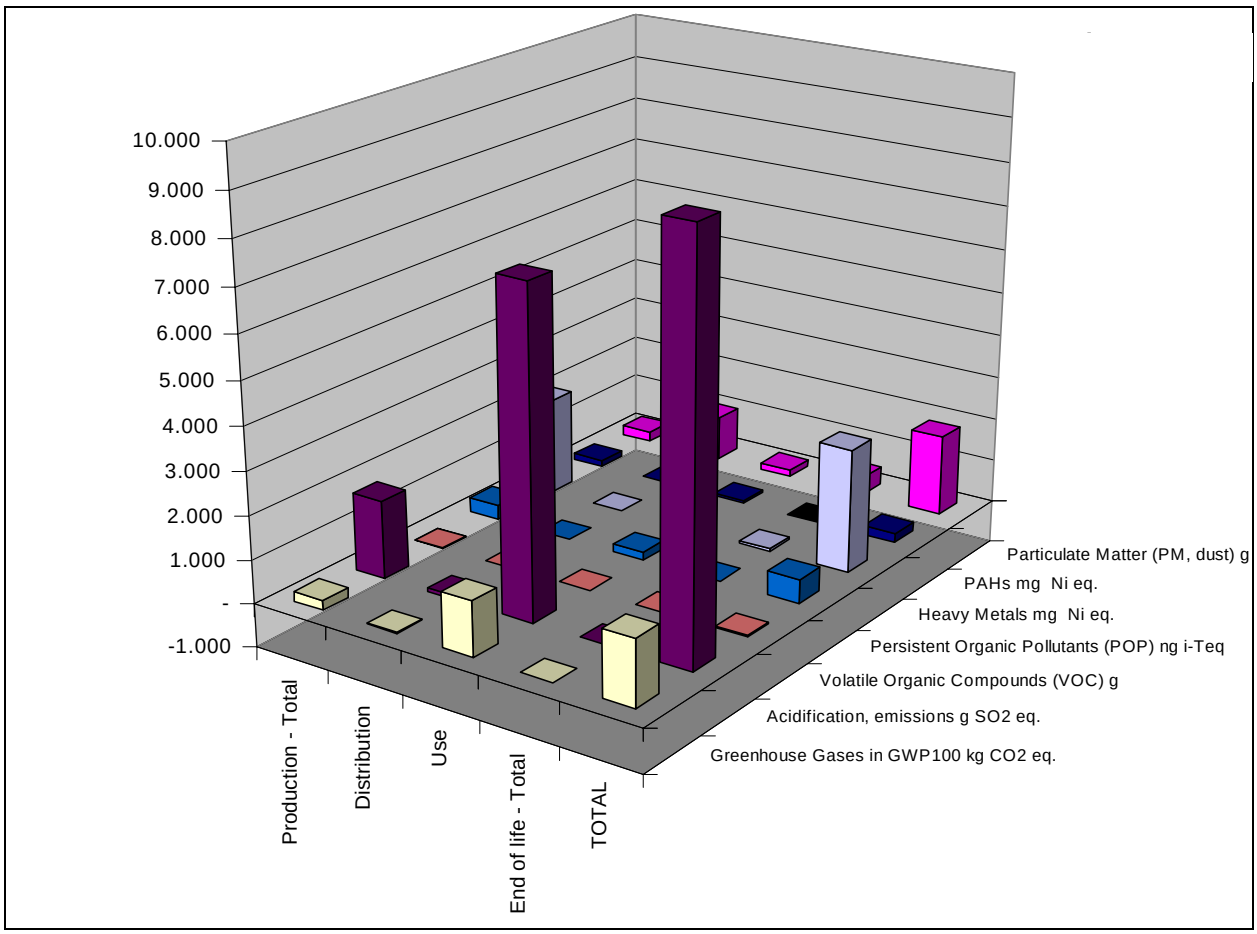


Figure 5.16: DW 9 ps – Emission (water)

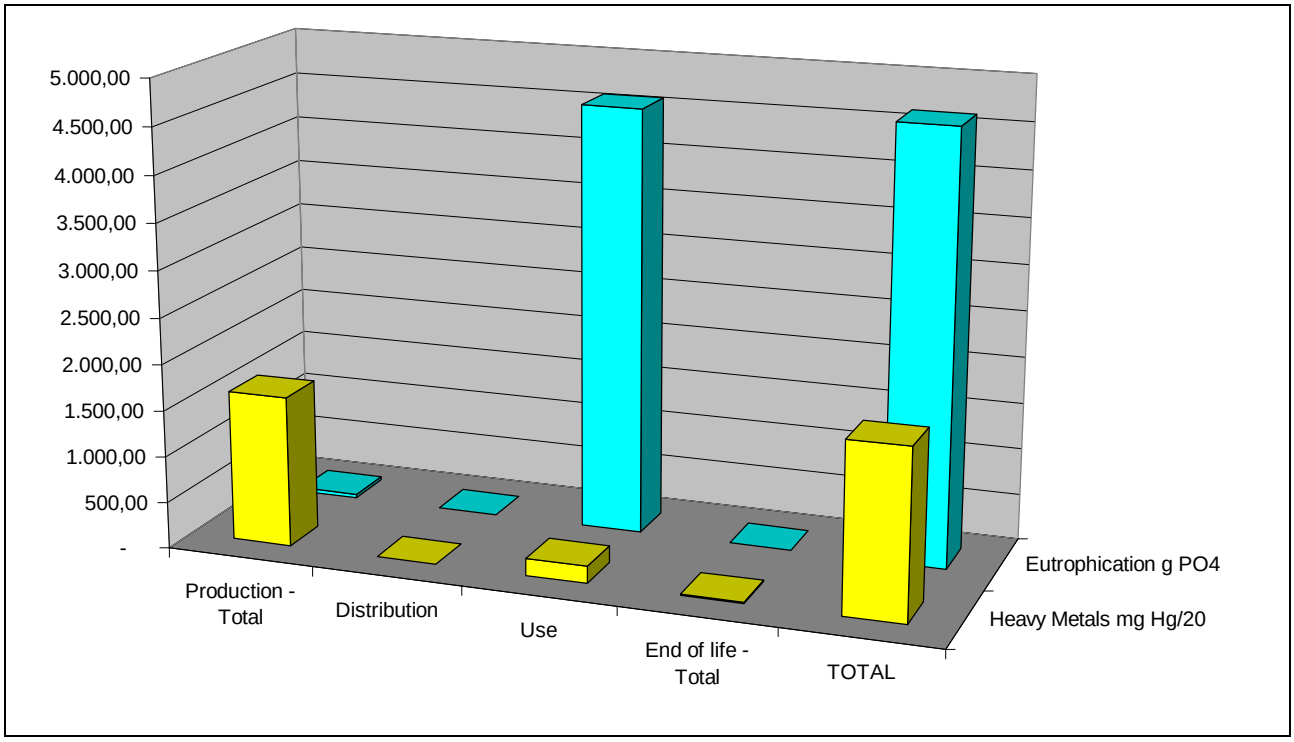
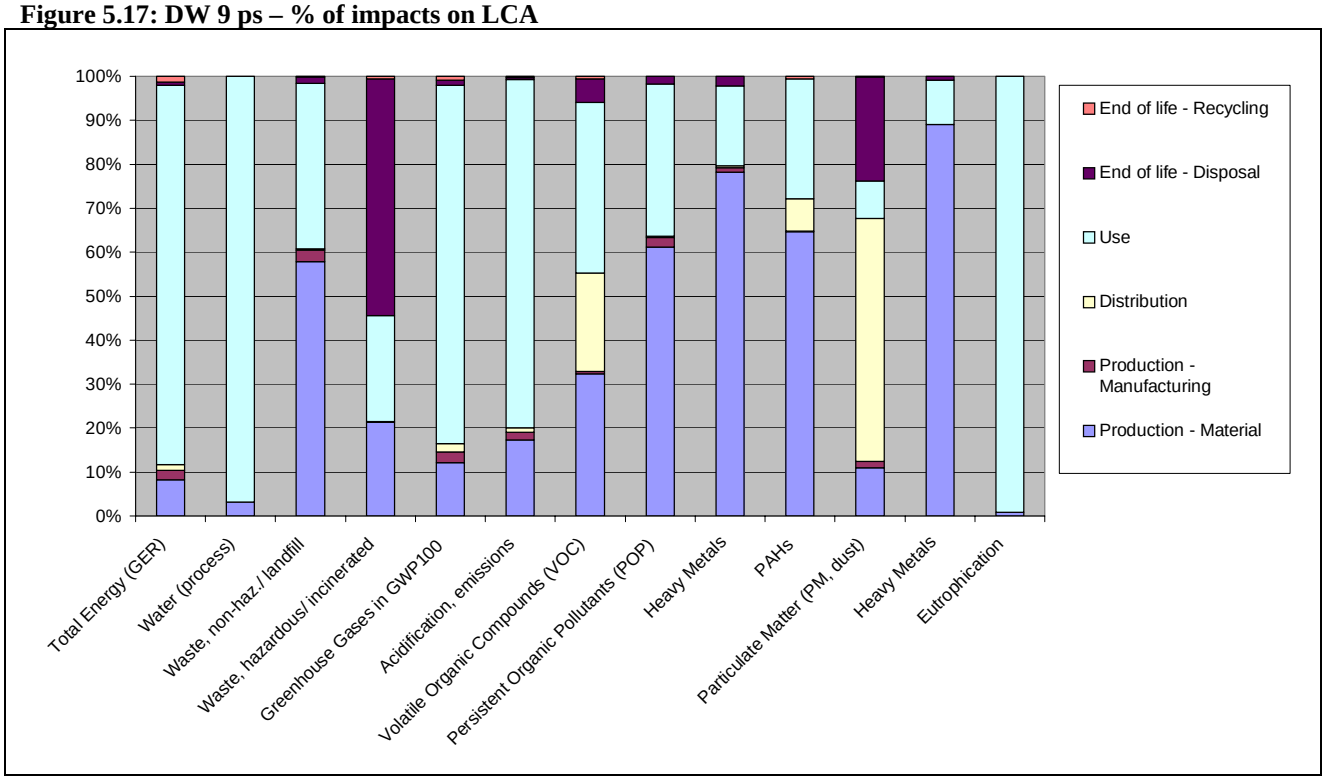


Figure 5.17: DW 9 ps – % of impacts on LCA



5.3.3.2 Impact and consumptions for DW 12

For this appliance type the environmental impact analysis, shown in Figures 5.18-5.21, is practically the same of the DW 9ps model. A difference can only be appreciated for the particulate

matter emissions to air (Figure 5.20). For 12ps dishwashers the Use phase has impact values higher than the Distribution phase, the absolute values are not significantly different. Also for this model the overall impacts are summarised in Figure 5.21.

Figure 5.18: DW 12 ps – Energy and water consumptions

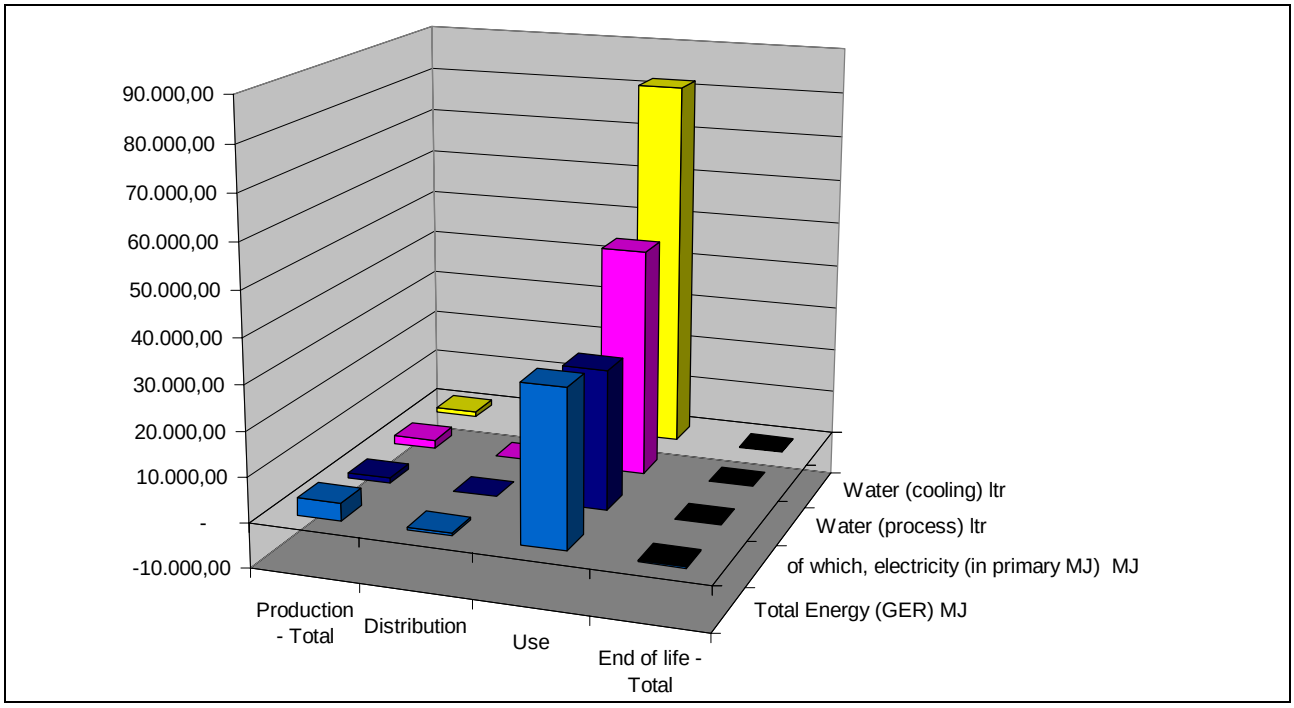


Figure 5.19: DW 12 ps – Waste production

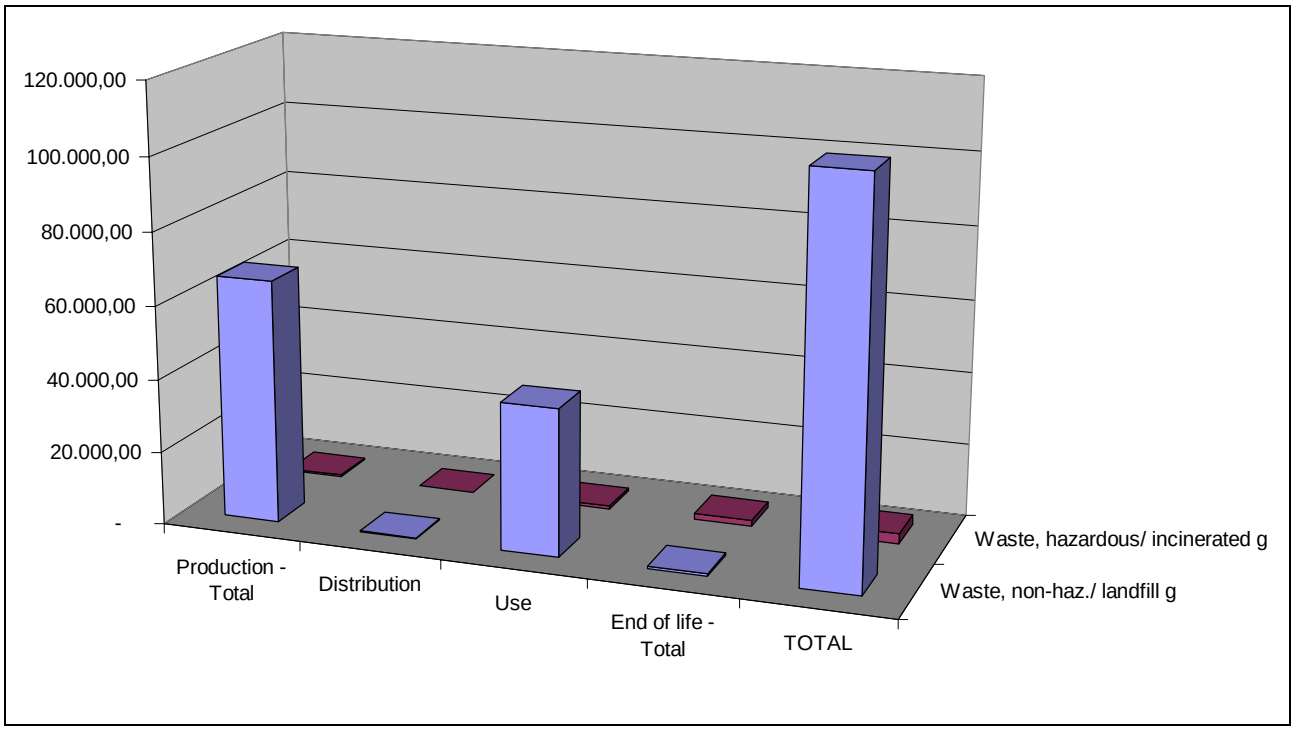


Figure 5.20: DW 12 ps – Emission (air)

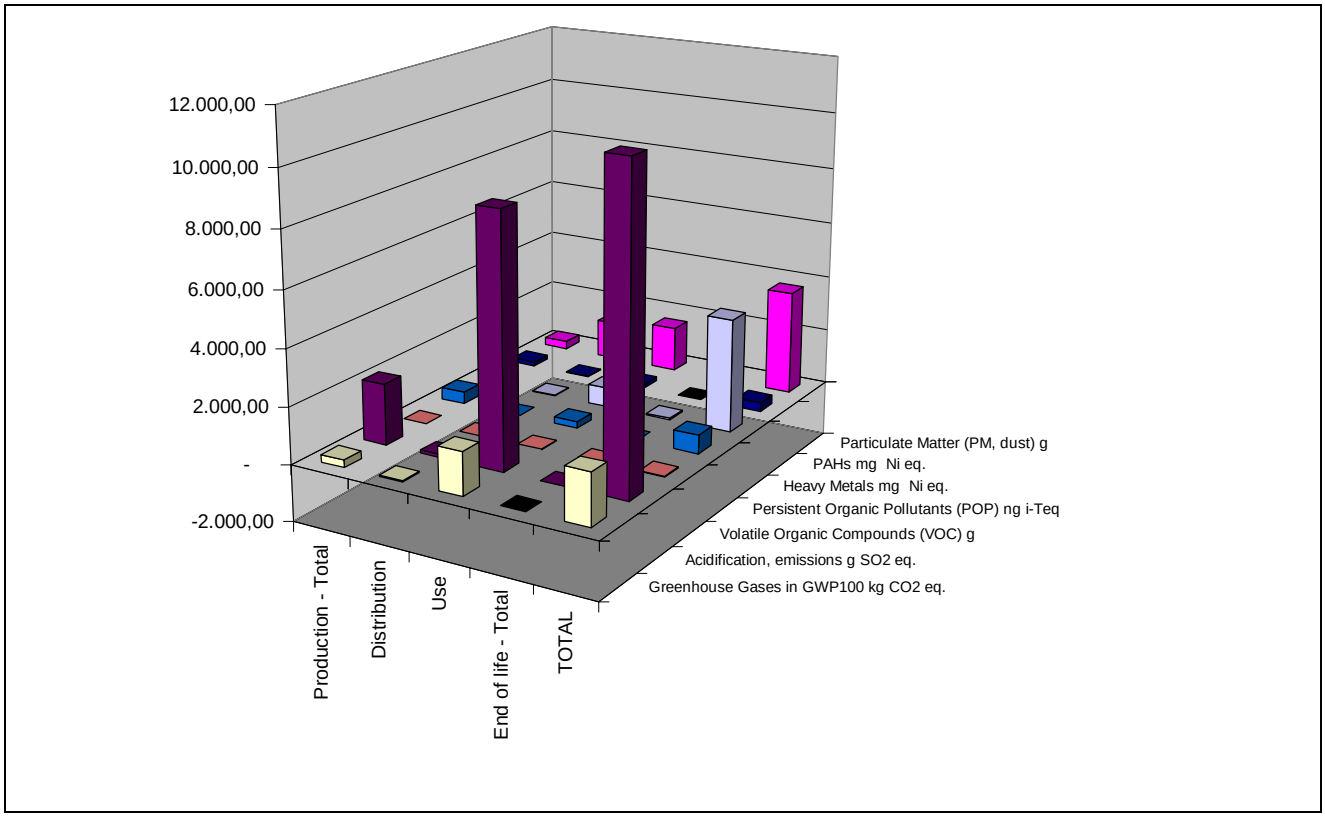


Figure 5.21: DW 12 ps – Emissions (water)

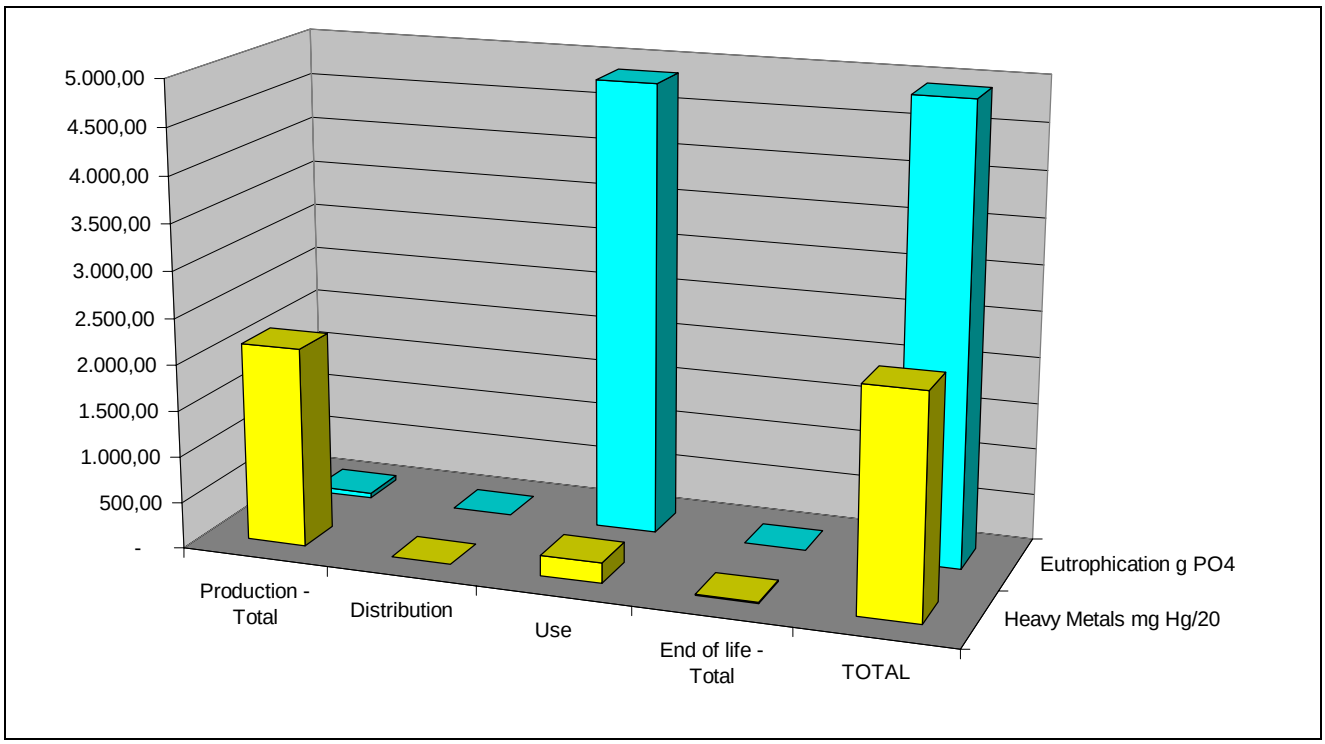
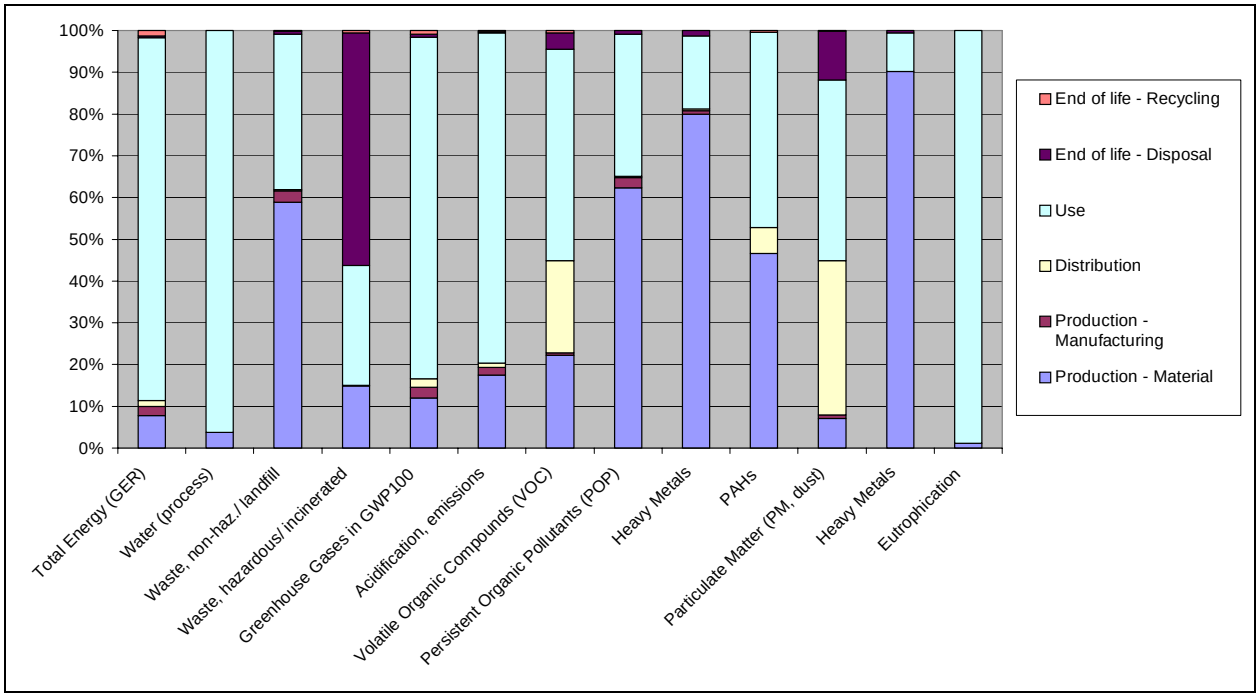


Figure 5.22: DW 12 ps – % of impacts on LCA



5.3.3.3 Impact and consumptions for WM

Also for the washing machines, the impact results, shown in Figures 5.23-5.26, are similar to that of the dishwasher models, with the important exception for the eutrophication effect a very low impact occurs in the Use phase, and apparently some eutrophication only results in the Production phase. Very likely this is more due to the lacking in the EuP database of the washing machines detergents, but a further investigation is needed.

Figure 5.23: WM – Energy and water consumptions

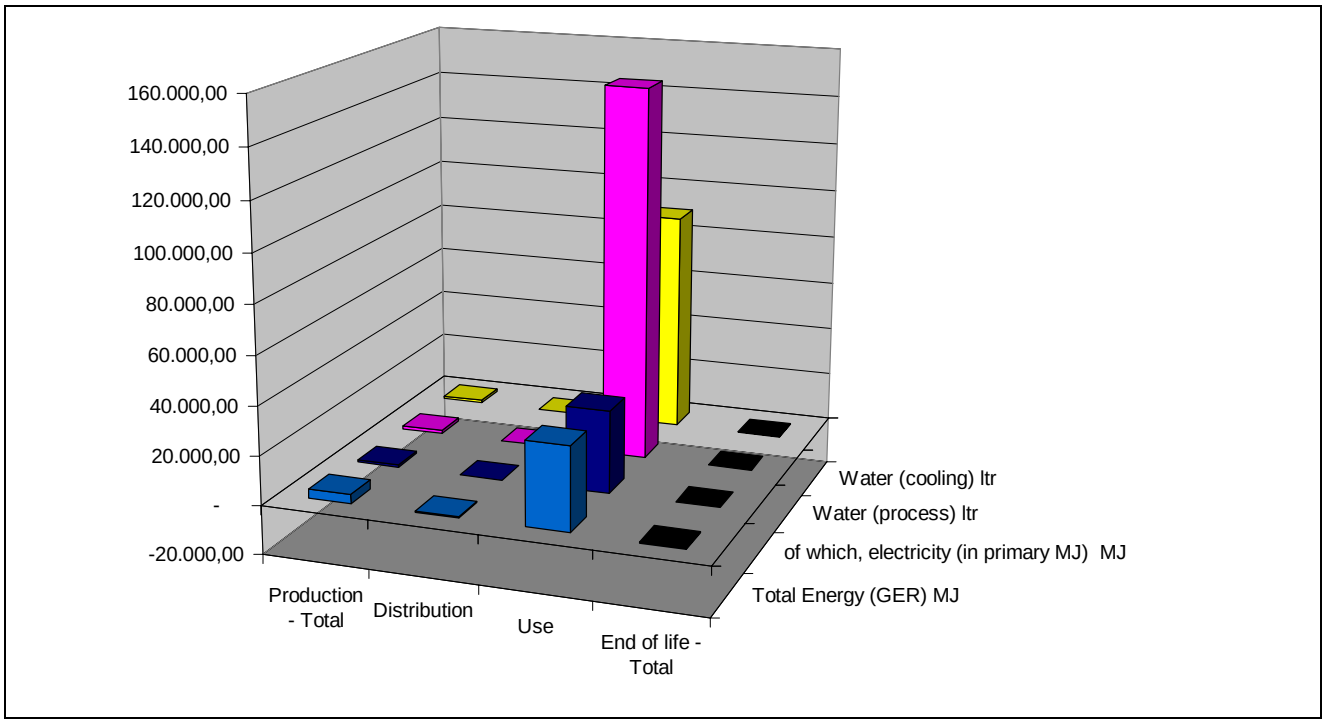


Figure 5.24: WM – Waste production

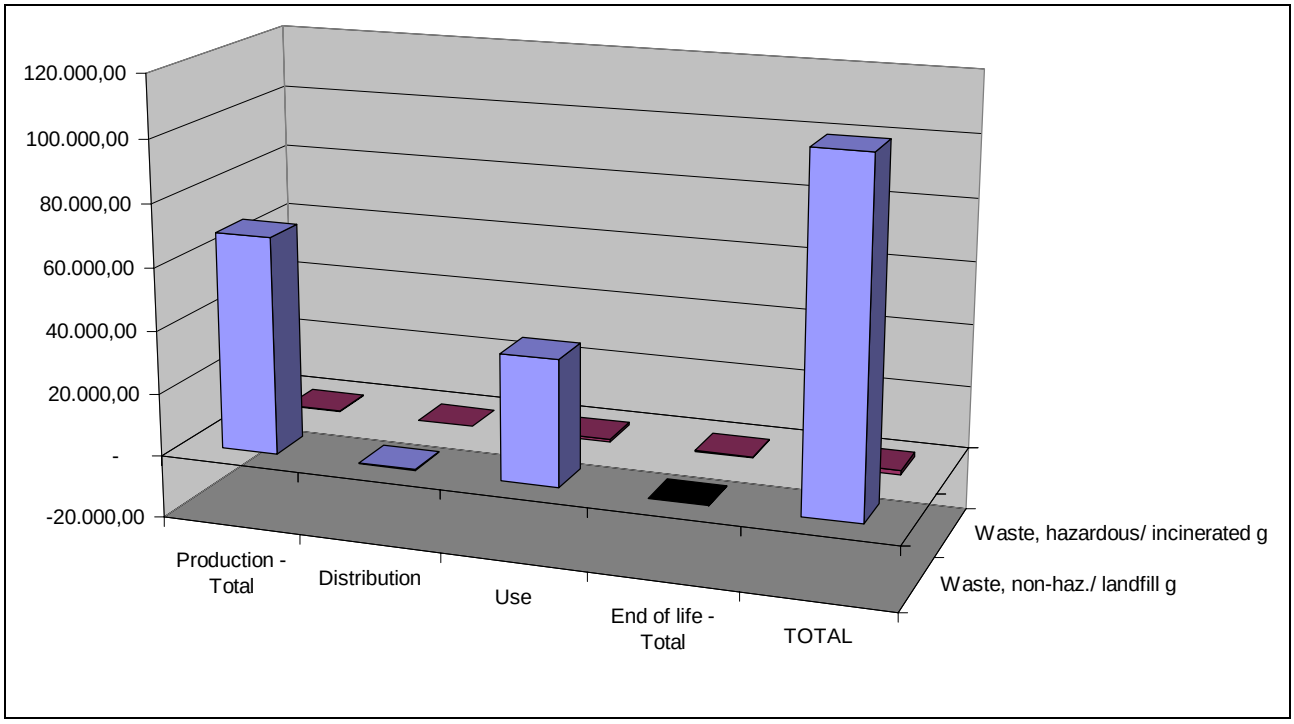


Figure 5.25: WM – Emissions (air)

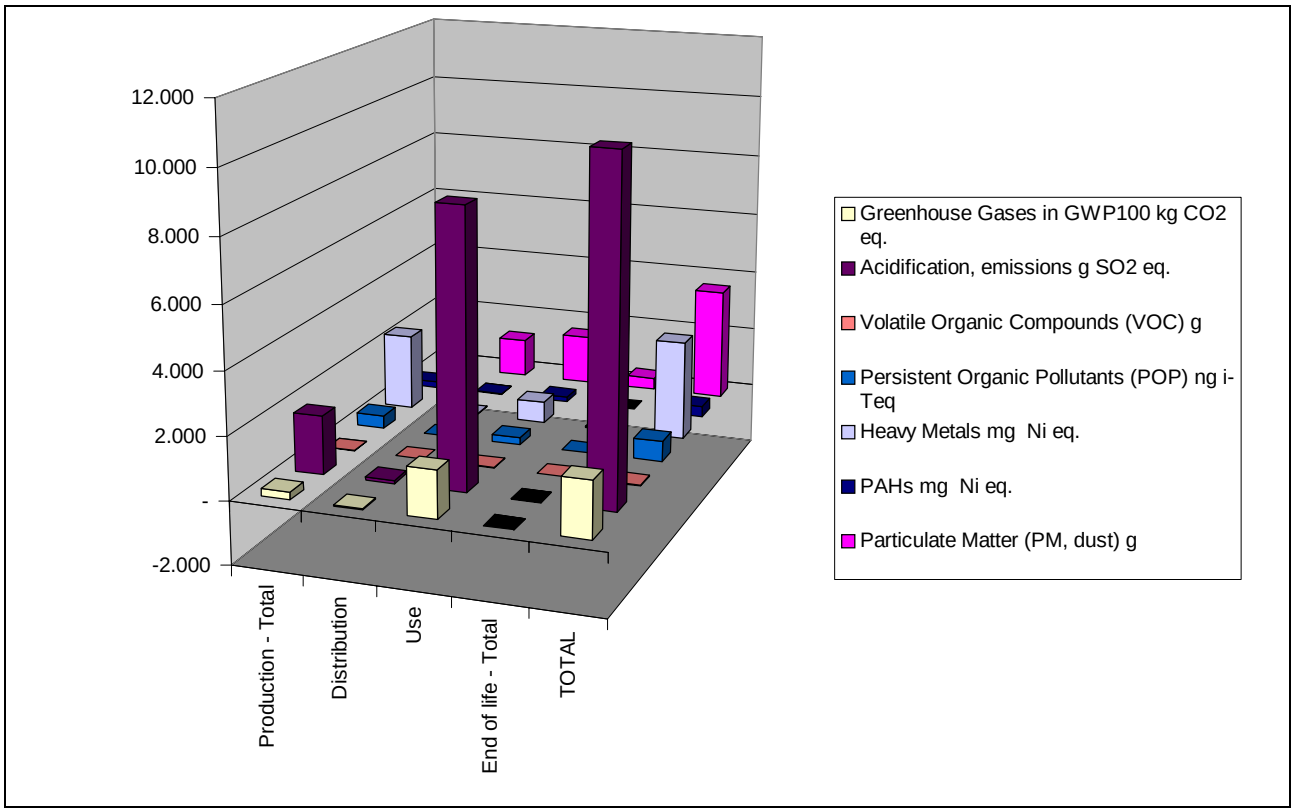


Figure 5.26: WM – Emissions (water)

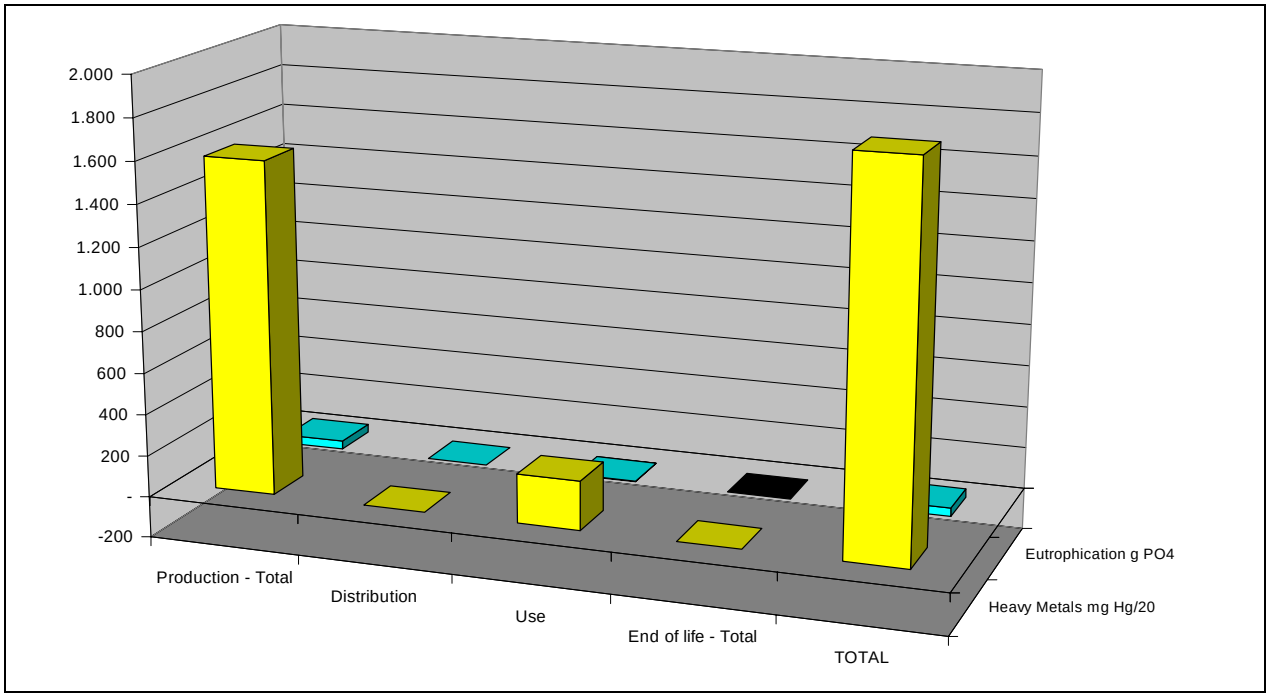
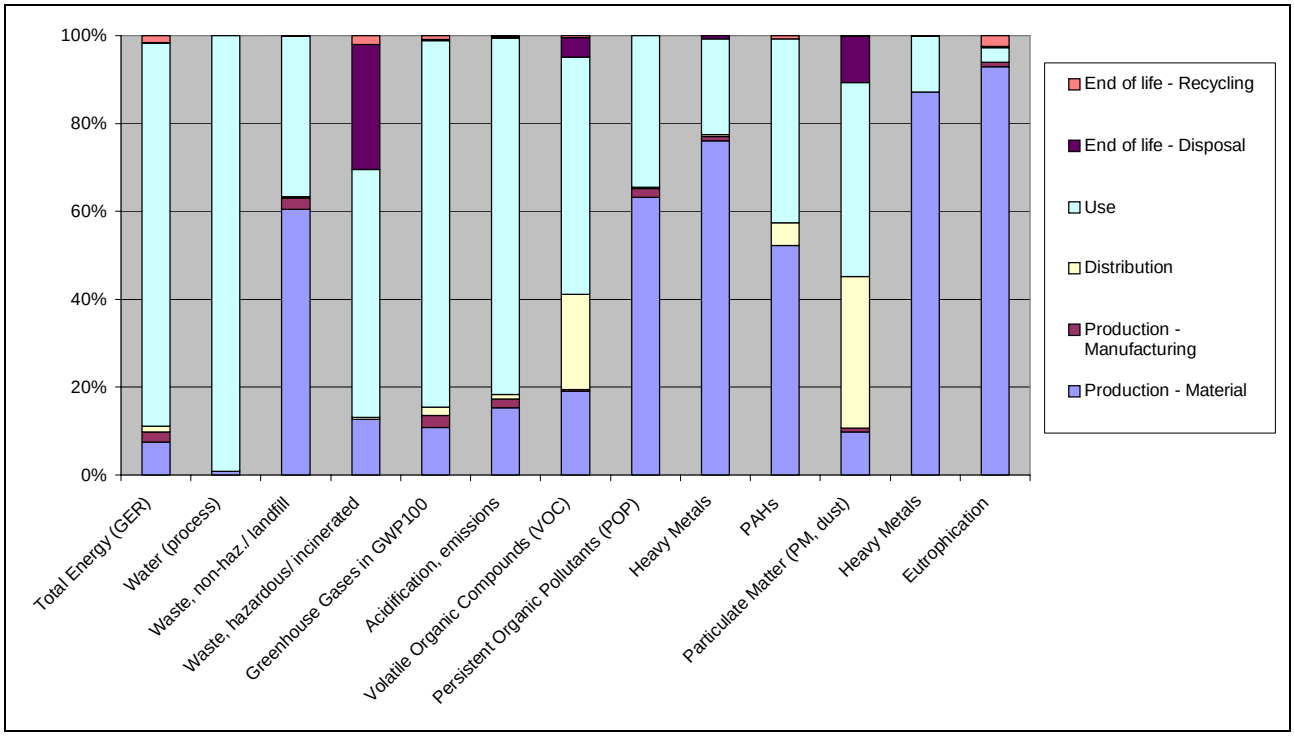


Figure 5.27: WM – % of impacts on LCA



5.3.4 SimaPro analysis results and comparison with the EUP Ecoreport outputs

As explained before, EuP Ecoreport has some limits regarding material data base (lack of data, including detergent for Washing machines), transport (included as a fixed amount in material characteristics) and end of life (only partially considered).

In order to assess the correspondence of EuP-Ecoreport results with appliances real environmental impact, a comparison with the output of a different and well known LCA software (and its database) has been performed. This alternative software is the SimaPro v.7.1, described in Annex C.

The comparison was performed only for DW 12ps and WM 5kg models. In Annex C all SimaPro outputs are reported as characterisation chart: assembling, use and end of life.

5.3.4.1 Steps of the comparison

a) Correspondence of materials used in wash appliance manufacturing with SimaPro database

As already mentioned, several databases are available in SimaPro and it is also possible for the user to create specific records. In this way it was possible to significantly reduce the number of data in the inventory data sheet without any loss of correspondence in the SimaPro implementation. Also the number of materials for which assumptions were made to find a correspondence with existing categories has been reduced.

In Annex C the input Tables in SimaPro are shown for the DW 12ps and for WM 5kg base case models. Comparing these Tables with the original data of the base case models (see Annex A) one can see how through SimaPro it was possible to find a proper correspondence for almost all materials or processes. Only for the following materials a good correspondence could not be found:

- for DW 12 ps - polishing solution and protective layer-cataphoresys;
- for WM 5 kg - Ni, phosphate and bleach.

In these Tables, a note has been included explaining the proper correspondence of the material or processes selected by the SimaPro database with the original data of the base case models.

b) Main assumption in SimaPro application

In order to implement in the SimaPro SW the inventory data of the DW 12ps and for WM 5kg base case models the following assumptions were made:

- for Assembling phase:
  - scraps: through the evaluation of the data provided by manufacturers, it was possible to consider the scrap percentage equal to 5% for metals and to 1% for other materials (mainly plastics). Therefore the simulation of assembly has been made on the material gross weight;
  - processing: manufacturers data gave an average indication for the type of processing needed for each material during the assembly phase (simplified approach); in this way it was possible to find a list of typical processes for different class of materials (steels, iron, plastics, PVCs, expanded plastics). To avoid an over-estimation of the impact deriving from materials processing, as general rule metals have been assumed to be processed as 50% of total weight and plastics as 70%;
  - transport: for each model an average number of km for transport of materials for the assembly phase has been calculated from the collected information. Because of the need in SimaPro to set both the average km (in terms of t km) and the transport system, the average km has been divided in 70% truck and 30% ship;
- for Use phase: all data collected from manufacturers were used; it was also possible to simulate ad hoc detergents and others washing agents or additives (detergent and softener for the washing machine and detergent and rinsing agent for the dishwasher) as reported in Annex C;

- for End of life phase: the percentage of the different treatments at the end of life have been calculated from the data provided by manufacturers and reported in SimaPro data input (Annex C). It has to be highlighted that in the EuP-Ecoreport, end of life was an "internal preassembled calculation methodology" as percentage and final destinations of some materials. For this life phase, EuP-Ecoreport can be considered as a "partially close system", while in SimaPro it is possible to use other data externally collected. For this reason it was decided to show outputs from SimaPro and EuP-Ecoreport "with and without End of life" outputs and to make comparison on outputs "without end of life phase" to reduce the outcome differences.

c) Adapting Ecoindicator95 environmental impact assessment method to EuP-Ecoreport

Environmental indicators (environmental assessment methods) available in SimaPro SW refer to various databases and are different from those used in EuP-Ecoreport. In order to make the environmental indicators more "comparable" a "modified Ecoindicator95 method" has been developed and applied to SimaPro outputs.

In Table 5.23 environmental indicators and related units used as outputs in EuP-Ecoreport have been reported, while in Table 5.24 same data, referred to SimaPro outputs have been reported (as in Ecoindicator 95 method).

Table 5.23: Output indicators in EuP-Ecoreport method

Other Resources & Waste	Unit
Total Energy (GER)	PJ
of which, electricity (in primary PJ)	PJ
Water (process)	mln. m^3
Water (cooling)	mln. m^3
Waste, non-haz./ landfill	kt
Waste, hazardous/ incinerated	kt
Emissions (Air)	
Greenhouse Gases in GWP100	mt CO_2 eq.
Ozone Depletion, emissions	t R-11 eq.
Acidification, emissions	kt SO2 eq.
Volatile Organic Compounds (VOC)	kt
Persistent Organic Pollutants (POP)	g i-Teq
Heavy Metals	ton Ni eq.
PAHs	ton Ni eq.
Particulate Matter (PM, dust)	kt
Emissions (Water)	
Heavy Metals	ton Hg/20
Eutrophication	kt PO4
Persistent Organic Pollutants (POP)	g i-Teq

Table 5.24: Output indicators in Ecoindicator95 method

Environmental impact	Unit
greenhouse	kg CO2
ozone layer	kg CFC11
acidification	kg SO2

eutrophication	kg PO4
heavy metals	kg Pb
carcinogens	kg B(a)P
winter smog	kg SPM
summer smog	kg C2H4
pesticides	kg act. subst.
energy resources	MJ LHV
solid waste	kg

In Annex C the methodology used to compare SimaPro and EuP-Ecoreport outputs is reported and explained. In any case, it was not possible to completely adapt the "Ecoindicator 95 method" to the EuP-Ecoreport method because of lack a complete list of components for many indicators and related weight in EuP methodology.

In Table 5.25 the comparison between EuP-Ecoreport indicators and "modified SimaPro indicators" is shown.

Table 5.25: Comparison between SimaPro (Eco-indicator 95 rev EuP) and EuP-Ecoreport list of output

Eup / Simapro	8 - Total Energy (GER)	12 (+13) - waste	14 - Greenhouse Gases in GWP100	15 - Ozone Depletion, emissions	16 - Acidification, emissions	17 - Volatile Organic Compounds (VOC)	18 - Persistent Organic Pollutants (POP)	19 - Heavy Metals	19,1 - PAHs	20 - Particulate Matter (PM, dust)	21 - Heavy Metals	22 - Eutrophication	23 - Persistent Organic Pollutants (POP)
8 - energy resources	**ok**												
12 (+13) - solid waste		**p**											
14 - Greenhouse			**ok**										
15 - ozone layer				**ok**									
16 - Acidification					**ok**								
17 - summer smog – VOCs						**p**							
18 - POP (air)							**p**						
19 - Heavy metals (air)								**p**					
19,1 - PAHs (air)									**no**				
20 - winter smog - P.M.										**p**			
21 - Heavy metals (water)											**p**		
22 - Eutrophication												**p**	
23 - POP (water)													**p**
- heavy metals													
- Carcinogens													
- Pesticides													

The comparison of the two methods resulted in:

- for SimaPro indicator:
  - **in blue:** the indicator has been modified (in terms of weight factor of some single components) to be in compliance with EuP;
  - **in orange**: a new indicator for SimaPro, "elaborated" so as replicate the EuP one.
- for compliance index:
  - "OK": good compliance between SimaPro and EuP indicators;
  - "P": partial compliance between SimaPro and EuP indicators due to relevant differences in the number of components taken into account and, sometimes, of the type of components;
  - "No": low compliance between SimaPro and EuP indicators. This is true only for PAHs, in fact in EuP methodology a "weight coefficient" equal to 20 for all PAHs has been used, without a list of the considered type of PAH.

5.3.4.2 SimaPro vs. Eup-ecoreport output

a) 12ps dishwashers

In Tables 5.26 the LCA outputs from SimaPro with Ecoindicator95 (revised according to EuP Method) have been reported for a DW 12ps, while Table 5.27 reports the LCA output from EuP-Ecoreport.

Table 5.26: DW12 ps – LCA output from SimaPro with Ecoindicator 95-rev EuP Method, organised so as EuP outputs

Row in EuP-Ecoreport	Impact category	Unit	DW12ps assembling - Production total	USE	DW12 EoL	Total	Total - EoL
8	energy resources	MJ LHV	4,50E+03	4,73E+04	-5,62E+02	5,12E+04	5,18E+04
12 (+13)	solid waste	kg	9,62E+01	50,00E+00	-4,01E+01	10,61E+01	14,62E+01
14	Greenhouse	kg CO2	2,03E+02	2,16E+03	-3,99E+01	2,32E+03	2,36E+03
15	ozone layer	kg CFC11	7,30E-05	1,17E-03	-1,22E-05	1,23E-03	1,24E-03
16	Acidification	kg SO2	3,11E+00	1,69E+01	-1,36E-01	1,98E+01	2,00E+01
17	summer smog – VOCs	kg C2H4	1,70E-01	4,87E-01	-3,27E-02	6,24E-01	6,57E-01
18	POP (air)	kg TE eq	2,23E-09	5,01E-10	9,69E-11	2,83E-09	2,73E-09
19	Heavy metals (air)	kg Ni eq	9,82E-04	4,64E-03	-1,99E-05	5,61E-03	5,63E-03
19,1	PAHs (air)	kg PAH/20 eq	1,72E-06	1,28E-06	-5,94E-07	2,41E-06	3,01E-06
20	winter smog - P.M.	kg SPM	2,74E+00	1,44E+01	-8,31E-02	1,70E+01	1,71E+01
21	Heavy metals (water)	kg Hg/20 eq	3,59E-03	5,43E-02	-8,55E-04	5,71E-02	5,79E-02
22	Eutrophication	kg PO4	2,37E-01	2,46E+00	-1,25E-02	2,68E+00	2,70E+00
23	POP (water)	kg TE eq	1,05E-13	0,00E+00	0,00E+00	1,05E-13	1,05E-13
	heavy metals	kg Pb	3,71E-03	2,78E-02	-2,88E-04	3,12E-02	3,15E-02
	Carcinogens	kg B(a)P	2,69E-05	7,39E-05	-6,89E-06	9,39E-05	1,01E-04
	Pesticides	kg act.subst	4,41E-02	0,00E+00	0,00E+00	4,41E-02	4,41E-02

According to Simapro outputs, the Use and Production phases are the most important from the environmental impact point of view. The same result comes from the EuP Ecoreport outputs. The main difference between the two software is in the evaluation of the environmental impact importance in Use and Production phases. For Simapro, the Use phase has to be considered the most relevant regarding environmental impact.

Analyzing SimaPro outputs, energy consumption, greenhouse gas, acidification and VOC are more relevant in the Use phase while POP and PAH are mainly emitted from production phase. This is in

agreement with EuP-Ecoreport outputs: the main difference being heavy metals, mainly emitted in the Use phase, instead of the Production phase.

Also particulate matter emission is higher in the Use phase, but it should be considered that in Simapro "distribution phase" is not considered in the same wasy that in EuP-Ecoreport (in which PM10 are higher in distribution phase, due to emissions by diesel motors). The only possible comparison with EuP-Ecoreport outputs for water emission is eutrophication: also in this case, according to SimaPro outputs, it has been indicated as more relevant in the Use phase.

The comparison of Simapro and EuP-Ecoreport outputs is reported in Table 5.28.

Table 5.27: DW12 ps – LCA output from EuP-Ecoreport, with a partial Total without Distribution and End of Life contributions

			Production	Distribution	Use	End of Life	TOTAL	Total - distribution - EoL
8	Total Energy (GER)	MJ	3,95E+03	5,95E+02	3,45E+04	-2,91E+02	3,87E+04	3,84E+04
12 (+13)	waste	kg	6,69E+01	3,19E-01	4,09E+01	2,30E+00	1,10E+02	1,08E+02
14	Greenhouse Gases in GWP100	kg CO2 eq.	2,70E+02	3,70E+01	1,52E+03	0,00E+00	1,83E+03	1,79E+03
15	Ozone Depletion, emissions	mg R-11 eq.	negligible					
16	Acidification, emissions	kg SO2 eq.	2,16E+00	1,11E-01	8,83E+00	7,00E-03	1,11E+01	1,10E+01
17	Volatile Organic Compounds (VOC)	kg	9,00E-03	8,00E-03	1,90E-02	1,00E-03	3,70E-02	2,80E-02
18	Persistent Organic Pollutants (POP)	kg i-Teq	4,33E-10	2,00E-12	2,28E-10	6,00E-12	6,69E-10	6,61E-10
19	Heavy Metals	kg Ni eq.	3,25E-03	1,60E-05	7,00E-04	5,30E-05	4,02E-03	3,95E-03
19,1	PAHs	kg Ni eq.	1,52E-04	2,00E-05	1,52E-04	-2,00E-06	3,22E-04	3,04E-04
20	Particulate Matter (PM, dust)	kg	2,95E-01	1,37E+00	1,60E+00	4,31E-01	3,70E+00	1,90E+00
21	Heavy Metals	kg Hg/20	2,15E-03	0,00E+00	2,22E-04	1,30E-05	2,39E-03	2,37E-03
22	Eutrophication	kg PO4	5,70E-02	0,00E+00	4,86E+00	0,00E+00	4,92E+00	4,92E+00
23	Persistent Organic Pollutants (POP)	ng i-Teq	negligible					

Table 5.28: DW12 ps – Comparison for LCA output of EuP-Ecoreport vs. SimaPro

Row in EuP-Ecoreport	Impact category	Unit	Production	Use	Total - distribution - EoL
8	energy resources	MJ LHV	14%	37%	35%
12 (+13)	Solid waste	kg	44%	22%	36%
14	greenhouse	kg CO2	-25%	42%	32%
15	ozone layer	kg CFC11			
16	acidification	kg SO2	44%	91%	82%
17	summer smog - VOCs	kg C2H4	1792%	2463%	2247%
18	POP (air)	kg TE eq	415%	120%	313%
19	Heavy metals (air)	kg Ni eq	-70%	563%	42%
19,1	PAHs (air)	kg PAH/20 eq	-99%	-99%	-99%
20	winter smog - P.M.	kg SPM	827%	797%	801%
21	Heavy metals (water)	kg Hg/20 eq	67%	24375%	2342%
22	eutrophication	kg PO4	316%	-49%	-45%
23	POP (water)	kg TE eq			

Main considerations and remarks on Simapro vs. EuP-Ecoreport outputs for dishwashers are:

- main "classic" indicators (such as energy resources, green house gas and acidification): the total values reported can be considered in compliance with EuP ones; Simapro outputs are higher in

absolute value mainly due to better input data accuracy (mainly on materials and assembling) and better definition of the environmental impact of the energy sources. It is worth noting that these indicators are in compliance with EuP-Ecoreport outputs and it is also confirmed that the Use phase is more relevant than the Production phase, with the same ratio in the two software.

- VOC's and Heavy Metals (water): the difference could be mainly due to the higher number of compounds contributing to the environmental impact considered in Simapro database as compared with a lower number in the EuP-Ecoreport database;
- PAHs: the value in EuP-Ecoreport is higher than in SimaPro output; this could be due to the different calculation methodology used in EuP-Ecoreport (MEEuP report) and SimaPpro (Ecoindicator95 modified);
- Eutrophication: the EuP-Ecoreport total value is higher than in SimaPro; the main reason is apparently the type of detergent used. The eutrophication is higher in the Production phase in SimaPro than in EuP-Ecoreport, but it should be reminded that in SimaPro the detergent production is taken into consideration;
- for all the other indicators: in general higher values in SimaPro output have been reported; this is probably due to a higher number of data considered in SimaPro, but also to the non complete harmonisation between Simapro and EuP indicators.

b) 5kg washing machines

In Table 5.29 the LCA outputs from SimaPro with Ecoindicator95 (revised according to EuP Method) have been reported for a WM 5kg, while Table 5.30 presents the LCA output from EuP-Ecoreport.

Table 5.29: WM 5 kg – LCA output from SimaPro with Ecoindicator 95-rev EuP Method, organised as EuP outputs

Row in EuP-Ecoreport	Impact category	Unit	WM 5kg assembling	Use	WM 5kg EoL	Total	Total - EoL
8	energy resources	MJ LHV	1,23E+04	6,65E+04	-8,43E+02	7,80E+04	7,88E+04
12 (+13)	solid waste	kg	2,09E+02	5,40E+01	-4,01E+01	2,23E+02	2,63E+02
14	greenhouse	kg CO2	6,44E+02	2,83E+03	-5,66E+01	3,42E+03	3,48E+03
15	ozone layer	kg CFC11	1,29E-04	1,34E-03	-2,13E-05	1,44E-03	1,47E-03
16	acidification	kg SO2	6,13E+00	1,87E+01	-2,49E-01	2,46E+01	2,48E+01
17	summer smog -VOCs	kg C2H4	2,91E-01	7,76E-01	-4,62E-02	1,02E+00	1,07E+00
18	POP (air)	kg TE eq	2,15E-09	6,59E-10	2,59E-11	2,84E-09	2,81E-09
19	Heavy metals (air)	kg Ni eq	8,36E-04	7,22E-03	-3,35E-05	8,02E-03	8,06E-03
19,1	PAHs (air)	kg PAH/20eq	2,26E-06	1,47E-06	-7,77E-07	2,96E-06	3,73E-06
20	winter smog - P.M.	kg SPM	5,02E+00	1,56E+01	-1,74E-01	2,04E+01	2,06E+01
21	Heavy metals (water)	kg Hg/20 eq	5,19E-03	6,62E-02	-8,89E-04	7,05E-02	7,13E-02
22	eutrophication	kg PO4	2,50E-01	1,52E+00	-1,66E-02	1,75E+00	1,77E+00
23	POP (water)	kg TE eq	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
	heavy metals	kg Pb	3,83E-03	3,35E-02	-3,75E-04	3,70E-02	3,73E-02
	carcinogens	kg B(a)P	2,88E-05	1,35E-04	-3,67E-05	1,27E-04	1,64E-04
	pesticides	kg act.subst	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

As in the case of for DW 12ps model, according to Simapro outputs, the Use and Production phases are more important than the other phases for the environmental impacts; this is valid also for EuP-Ecoreport outputs, but the main difference lies in the relative importance of the environmental impact between the Use and the Production phases. For SimaPro the use phase is considered the most relevant for the environmental impact.

Analyzing SimaPro outputs, the energy consumption, greenhouse gas, acidification and VOC are more relevant in the Use phase, while POP and PAH are mainly emitted in the Production phase. This is in agreement with EuP-Ecoreport outputs. The main difference lies in heavy metals, mainly emitted in the Use phase, instead of Production phase. Also particulate matter is higher in the Use phase, but in SimaPro the "distribution phase" is not considered in the same way as in EuP-Ecoreport (in which PM10 are higher in the Distribution phase, due to emissions by diesel motors).

The only comparison possible with EuP-Ecoreprot outputs for water emission is eutrophication, where the Use phase is more important according to SimaPro outputs.

Table 5.30: WM 5 kg – LCA output from EuP-Ecoreport, with a partial Total without Distribution and End of Life contributions

	Resources Use and Emissions		Production	Distribution	Use	End of Life	Total	Total - Distribution - EoL
8	Total Energy (GER)	MJ	3,83E+03	5,47E+02	3,42E+04	-5,07E+02	3,81E+04	3,81E+04
12 (+13)	Waste	kg	6,93E+01	2,96E-01	4,07E+01	2,16E-01	1,10E+02	1,10E+02
14	Greenhouse Gases in GWP100	kg CO2 eq.	2,45E+02	3,40E+01	1,51E+03	-8,00E+00	1,78E+03	1,75E+03
15	Ozone Depletion, emissions	mg R-11 eq.						
16	Acidification, emissions	kg SO2 eq.	1,87E+00	1,02E-01	8,75E+00	-1,20E-02	1,07E+01	1,06E+01
17	Volatile Organic Compounds (VOC)	kg	7,00E-03	8,00E-03	1,90E-02	1,00E-03	3,50E-02	2,60E-02
18	Persistent Organic Pollutants (POP)	kg i-Teq	4,27E-10	2,00E-12	2,26E-10	0,00E+00	6,54E-10	6,52E-10
19	Heavy Metals	kg Ni eq.	2,43E-03	1,50E-05	6,87E-04	2,40E-05	3,15E-03	3,12E-03
	PAHs	kg Ni eq.	1,90E-04	1,90E-05	1,53E-04	-2,00E-06	3,60E-04	3,43E-04
20	Particulate Matter (PM, dust)	kg	3,88E-01	1,25E+00	1,60E+00	3,75E-01	3,61E+00	1,99E+00
21	Heavy Metals	kg Hg/20	1,60E-03	0,00E+00	2,34E-04	2,00E-06	1,83E-03	1,83E-03
22	Eutrophication	kg PO4	4,10E-02	0,00E+00	1,00E-03	-1,00E-03	4,10E-02	4,20E-02
23	Persistent Organic Pollutants (POP)	ng i-Teq						

Details comparing SimaPro and EuP-Ecoreport outputs are presented in Table 5.31.

Table 5.31: WM 5 kg – Comparison for LCA output with EuP-Ecoreport vs SimaPro.

Row in EuP-Ecoreport	Impact category	Unit	WM 5kg assembling	Use	Total - EoL
8	energy resources	MJ LHV	221%	94%	107%
12 (+13)	solid waste	kg	201%	33%	139%
14	greenhouse	kg CO2	163%	88%	98%
15	ozone layer	kg CFC11			
16	acidification	kg SO2	228%	113%	133%
17	summer smog - VOCs	kg C2H4	4056%	3986%	4005%
18	POP (air)	kg TE eq	404%	192%	331%
19	Heavy metals (air)	kg Ni eq	-66%	951%	159%
19,1	PAHs (air)	kg PAH/20 eq	-99%	-99%	-99%
20	winter smog - P.M.	kg SPM	1193%	875%	937%
21	Heavy metals (water)	kg Hg/20 eq	225%	28172%	3797%
22	eutrophication	kg PO4	510%	151750%	4110%
23	POP (water)	kg TE eq			

Main considerations and remarks on Simapro vs. EuP-Ecoreport outputs for washing machines are the same already described for dishwashers, with the exception of 'eutrophication'. The EuP-Ecoreport total value for eutrophication is higher than in SimaPro: the main reason is that in EuP-Ecoreport no data are available for washing machines detergent.

5.4 SUBTASK 5.4: BASE CASE LIFE CYCLE COST

The Life Cycle Costs (LCC) for the various base cases are estimated given the economic assumptions, including the consumer prices for various models. The LLC of the base case is the starting point for the optimisation of the technology options in Task 6 and will be re-presented in that context.

Sensitivity analysis will be applied to the main parameters here including purchase price and electricity price and the level of consumption per year of the representative appliances.

5.4.1 Base case LCC for Dishwashers

5.4.1.1 The key technical and financial assumptions

The key technical and financial assumptions for dishwashers are:

– Product life	15 years (also with 10, 12 and 17 years)
– Cycles per year	280 (also 208 and 220 are considered)
– Discount rate	5%/year (PWF = 10,38 for 15years)
– Electricity price	0,17 Euro/kWh
– Water price	3,7 Euro/m^3
– Detergent, softener, rinsing agent:	2,34[19] Euro/kg, 0,6 Euro/kg and 2,4 Euro/kg
– Maintenance & repairs	5,5 Euro/year = 82,5 €/15y
– Disposal & recycling	61 Euro/life (at the end of life)
– Average 12ps machine price	548,4 Euro, with 552 Euro in West EU countries and 464 Euro in East EU countries
– Average 9ps machine price	520 Euro for 9ps machine.

In particular:

- number of washing cycles per year: the value of 208 cycle/year has been kept for sake of comparison with previous results, 220 cycle/year is used is the labelling directive, 280 cycle/year was found in a German study made by STIWA in 2003;
- chemicals: the use of detergent is 30g/cycle, for softener (salt) 20g/cycle and for rinsing agent 4g/cycle;
- the sales weighted average price of the dishwashers sold in 2004 according GfK was 552 Euro in West EU countries and 464 Euro in East EU countries, with an average of 548,4 Euro for the 13 EU member stated where GfK collected the market data. The 9ps machine price is estimated in 520 Euro;
- as far as the disposal and recycling are concerned, no actual reliable data are available for the EU Member States about the effects of the WEEE directive on the costs of household appliances and on the transfer of these costs to the consumers through an improvement of the products purchase price. In Task 2, the recycling and system costs occurred in 1999-2001 were given for six European countries that have experience in recycling of electric and electronic equipment before the WEEE directive came into force[20]. The range is from 1,90 to 0,92 Euro/kg

[19] Low alkaline compact powder with enzymes.

[20] Sources: M. Dempsey , *The WEEE Directive: The UK Experience*, APSWG, 2006 and M. Savage -AEA Technology, *Implementation of the Waste Electric and Electronic Equipment Directive in the EU*, JRC-IPTS, EUR 22231 EN, 2006.

with an average of 1,21 Euro/kg. According to this data, a household appliance having a weight of 50 kilograms has an average recycling and system cost of 61 Euro at the time of recycling (on average 15 years after the purchase). Discussion with the stakeholders revealed that, at least for some appliances such as washing machines and dishwashers and in some countries the value of the recovered metals covers almost completely the disposal and recycling system costs. Since on one side no reliable data are available at EU and Member States level and on the other side the "disposal and recycling costs" are a constant added to the LCC, the following LCC analysis will use the value of 61€, while a lower estimated values will be analysed through the sensitivity analysis.

Using these parameters and the standard and real life base cases characteristics the LCC is calculated in the following paragraph for the basic parameter combination. A sensitivity analysis is here presented only for the appliance lifetime and number of cycles per year, which have an immediate impact on the operating costs, while the sensitivity for the other parameters will be presented in Task 6.

5.4.1.2 The analysis results for dishwashers

The Life Cycle Cost for the consumer is the sum of the purchase price plus the discounted annual costs and the discounted end of life cost of recycling and disposal as shown in Tables 5.32 and 5.33 for the standard and the real life base case respectively.

The life cycle costs for the standard base cases are more than double the purchase price in most cases, a part from when the higher number of cycles is considered, indicating the importance of the annual operating costs in particular the electricity and water, which will be subject to reduction in Task 6. With the present reduced levels of water consumption, the chemical costs are superior to the water costs on a cycle or annual basis. For the real life base cases the life cycle costs are only very slightly higher, since the lighter load well compensate the higher washing temperature and the low power mode(s) additional consumption, when the hand pre-rinse is not taken into consideration. Again the annual operating costs are dominated by the energy costs.

5.4.2 Base case LCC for Washing Machines

5.4.2.1 The key technical and financial assumptions

The key technical and financial assumptions for washing machines are:

- Product life: 15 years (also with 10, 12 and 17 years)
- Cycles per year: 220 (also with 200 and 245 cycles)
- Discount rate: 5%/year (PWF = 10,38 for 15years)
- Electricity price: 0,17 Euro/kWh
- Water price: 3,7 Euro/m^3
- detergent costs: 0,22 Euro/wash for 139,76 g/wash or 1,90 €/kg
- Maintenance & repairs: 5,5 Euro/year = 82,5 €/15y
- Disposal & recycling 61 Euro/life (at end of life)
- Machine price: 443,5 Euro, with 562 Euro in West EU countries and 326 Euro in East EU countries.

In particular:

- number of cycles per year: 200 is the number of washing cycles considered in the energy labelling directive for a four-person household and forecast for 2010 in the WASH-II study; 222 is the number of cycles in the WASH-II study; 245 is the number of cycles used in GEA study;
- the sales weighted average price of the washing machines sold in 2004 according GfK was 562 Euro in West EU countries and 326 Euro in East EU countries, with an average of 443,5 Euro for the 13 EU member stated where GfK collected the market data;
- for disposal and recycling the same note about lack of actual reliable data already discussed for dishwashers applies. In the following LCC analysis the indicated value of 61€ will be used while different estimated values will be analysed through the sensitivity analysis in Task 6.

Using these parameters and the standard and real life base cases characteristics the LCC is calculated in the following paragraph for the basic parameter combination. A sensitivity analysis is here presented only for the appliance lifetime and number of cycles per year, which have an immediate impact on the operating costs, while the sensitivity for the other parameters will be presented in Task 6.

5.4.2.2 The analysis results for washing machines

The results are given in Tables 5.34 and 5.35 for the standard and the real-life base cases.

The LCC for the standard base case varies from a minimum of 1.415 € (lifetime 10y and 200 cycle/year) to a maximum of 2.127 € (lifetime 17y and 245 cycle/year). Not too surprisingly the annual water costs exceed those of electricity, and the chemicals costs exceed those of water and electricity. This is testimony to the achievement in reducing energy costs using the various policy instruments over the last decade. For the real life base case the detergent costs are even more dominating the LCC, with water and energy costs again almost at the same level. The RLBC life cycle cost is -7/7,5% lower than SBC depending on the number of cycles and lifetime considered. Purchase prices are roughly one-third of the total when 200 cycle/year are considered in real life.

5.5 SUBTASK 5.5: EU TOTALS

For the wash appliances the lifetime energy and water consumption, life cycle cost, and life cycle environmental impacts are aggregated for the total units sold in 2005 in EU25.

This is calculated for the standard Base Case and BAT models, using the characteristics of the models developed in the Tasks 5 and 6, together with the stock and market data from Task 2. In addition to the total environmental impacts, the partial impacts are shown, including disposal assuming post-RoHS and post-WEEE conditions.

The 2005 total for the base case represents today's situation of the average models sold. A total for year 2005 was also calculated for the BAT model and these values are subtracted from those of the Base Case, this difference representing the potential maximum of technological savings from the substitution of all the base case models by the BAT model. This is a theoretical maximum savings potential as certainly BAT penetration will not reach 100%, however the number of models sold will increase slowly from the level in year 2005.

The lifetime energy and water consumption together with life cycle costs are shown for the single models and for the total of year 2005 in Table 5.36.

Table 5.32: Life Cycle Cost of standard base cases for dishwashers

Standard Base Case (description)	Consumer price (€)	Energy consumption (kWh/year)	Energy costs (€/year)	Water consumption (litre/cycle)	Water costs (€/year)	Chemicals costs (€/year)	Maintenance costs (€/year)	Recycling & disposal costs at end of life (€)	LCC at 10 years (€)	LCC at 12 years (€)	LCC at 15 years (€)	LCC at 17 years (€)
12ps (208 cycle/y)	548	1,070	37,84	15,20	11,70	19,09	5,50	61,00	1.158	1.239	1.347	1.411
12ps(220 cycle/y)	548	1,070	40,02	15,20	12,37	20,20	5,50	61,00	1.189	1.274	1.388	1.455
12ps (280 cycle/y)	548	1,070	50,93	15,20	15,75	25,70	5,50	61,00	1.342	1.450	1.594	1.679
9ps (208 cycle/y)	520	0,828	29,28	13,70	10,54	17,63	5,50	61,00	1.044	1.112	1.203	1.256
9ps (220 cycle/y	520	0,828	30,97	13,70	11,15	18,65	5,50	61,00	1.069	1.141	1.237	1.294
9ps (280 cycle/y	520	0,828	39,41	13,70	14,19	23,74	5,50	61,00	1.197	1.288	1.409	1.481

Table 5.33: Life Cycle Cost of real-life base cases for dishwashers

Real life Base Case (description)	Consumer price (€)	Energy consumption (kWh/year)	Energy costs (€/year)	Water consumption (litre/cycle)	Water costs (€/year)	Chemicals costs (€/year)	Maintenance costs (€/year)	Recycling & disposal costs at end of life (€)	LCC at 10 years (€)	LCC at 12 years (€)	LCC at 15 years (€)	LCC at 17 years (€)
9ps (208 cycle/y)	548	1,167	41,27	15,40	11,85	15,72	5,50	61,00	1.160	1.241	1.349	1.413
9ps (220 cycle/y)	548	1,167	43,65	15,40	12,54	16,63	5,50	61,00	1.191	1.276	1.391	1.458
9ps (280 cycle/y)	548	1,167	55,55	15,40	15,95	21,17	5,50	61,00	1.344	1.452	1.597	1.682
6ps (208 cycle/y)	520	0,903	31,93	13,90	10,70	14,60	5,50	61,00	1.042	1.110	1.200	1.254
6ps (220 cycle/y	520	0,903	33,77	13,90	11,31	15,44	5,50	61,00	1.067	1.139	1.235	1.291
6ps (280 cycle/y	520	0,903	42,98	13,90	14,40	19,66	5,50	61,00	1.195	1.286	1.406	1.477

Table 5.34: Life Cycle Cost of standard base case washing machine

Standard Base Case (description)	Consumer price (€)	Energy consumption (kWh/year)	Energy costs (€/year)	Water consumption (litre/cycle)	Water costs (€/year)	Chemicals costs (€/year)	Maintenance costs (€/year)	Recycling & disposal costs at end of life (€)	LCC at 10 years (€)	LCC at 12 years (€)	LCC at 15 years (€)	LCC at 17 years (€)
5,36kg (200 cycle/y)	443,5	0,998	33,93	50,70	37,52	44,00	5,50	61,00	1.415	1.549	1.728	1.834
5,36kg (220 cycle/y)	443,5	0,998	37,33	50,70	41,27	48,40	5,50	61,00	1.504	1.652	1.848	1.964
5,36kg (245 cycle/y)	443,5	0,998	41,57	50,70	45,96	53,90	5,50	61,00	1.615	1.780	1.998	2.127

Table 5.35: Life Cycle Cost of real-life base case washing machine

Real life Base Case (description)	Consumer price (€)	Energy consumption (kWh/year)	Energy costs (€/year)	Water consumption (litre/cycle)	Water costs (€/year)	Chemicals costs (€/year)	Maintenance costs (€/year)	Recycling & disposal costs at end of life (€)	LCC at 10 years (€)	LCC at 12 years (€)	LCC at 15 years (€)	LCC at 17 years (€)
3,4kg (200 cycle/y)	443,5	0,719	24,34	46,30	34,26	44,00	5,50	61,00	1.316	1.437	1.596	1.690
3,4kg (220 cycle/y)	443,5	0,719	26,78	46,30	37,69	48,40	5,50	61,00	1.396	1.528	1.703	1.806
3,4kg (245 cycle/y)	443,5	0,719	29,82	46,30	41,97	53,90	5,50	61,00	1.495	1.641	1.836	1.951

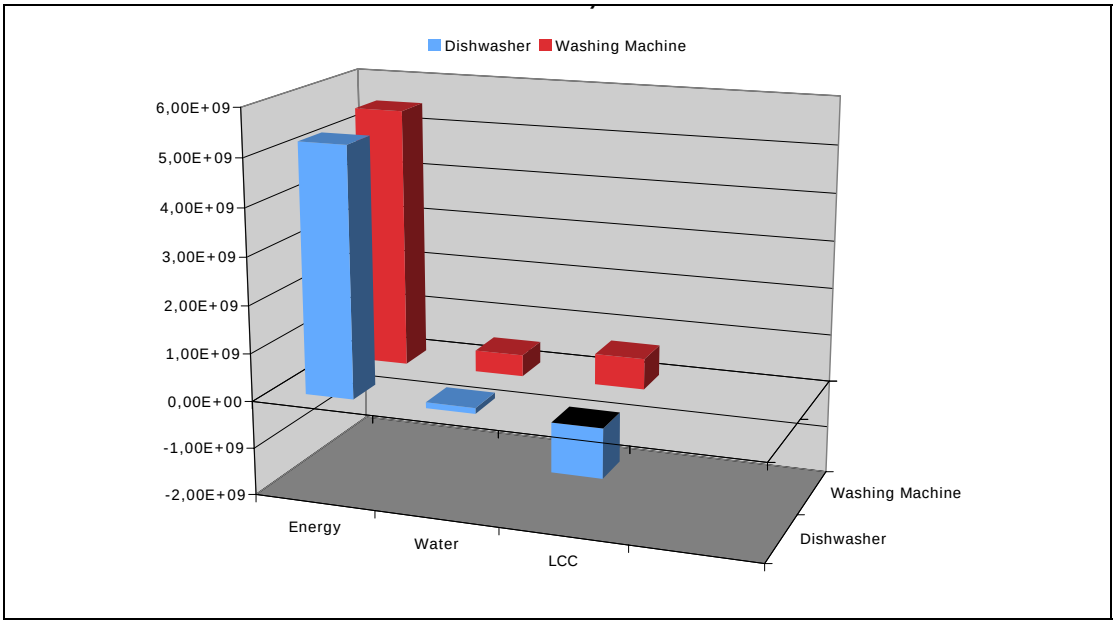
Table 5.36: Washing Machine and Dishwasher: lifetime energy and water consumption and Life Cycle Costs for single models and for total models sold in year 2005 in EU-25

WASHING MACHINES						
	Single Model:			Year 2005 (EU-25 Sales = 11.600.000 units)		
Characteristics	Base	BAT	Potential Savings	100% Base	100% BAT	Potential Savings
Lifetime Energy Consumption (kWh)	3293,4	2821,5	471,9	3,82E+10	3,27E+10	5,47E+09
Lifetime Water Consumption (Cubic Meters)	167,31	127,71	39,6	1,94E+09	1,48E+09	4,59E+08
Life Cycle Costs (Euro)	1952	1896	56	2,26E+10	2,20E+10	6,50E+08

DISHWASHERS (12ps)						
	Single Model:			Year 2005 (EU-25 Sales = 5.800.000 units)		
Characteristics	Base	BAT	Potential Savings	100% Base	100% BAT	Potential Savings (or Cost)
Lifetime Energy Consumption (kWh)	4494	3591	903	2,61E+10	2,08E+10	5,24E+09
Lifetime Water Consumption (Cubic Meters)	63,84	43,05	20,79	3,70E+08	2,50E+08	1,21E+08
Life Cycle Costs (Euro)	1594	1772	-178	9,25E+09	1,03E+10	-1,03E+09

On a unit basis, the potential energy savings is almost double with the dishwasher, due to a higher consumption base model and 280 cycles per year versus 220 for washing machines. Instead the water savings potential is greater for the washing machine with the greater amount of water used in clothes washing. A curious fact is that the LCC is actually lower for the BAT model washing machine. When these unit values are multiplied times the sales in year 2005 in EU25, we have the aggregate totals as shown. The maximum savings potential for the aggregate amount in year 2005 is illustrated in Figure 5.28.

Figure 5.28: Maximum Potential Lifetime Savings for Models Sold in Year 2005 EU25



The relative impact of the washing machine is obviously greater due to the fact that washing machine sales are double that of dishwashers, although maximum energy savings are nearly equal. Water savings are six times greater in the case of washing machines.

5.6 ANNEX A

Table 5.37: Average data for the DW 9ps model life cycle phases

PRODUCTION		
Materials type	**Material**	**DW 9ps (g)**
Ferrous metals	galvanized steel	504
	Iron	2.136
	Prepainted Steel	1.941
	stainless steel	6.866
	Steel	1.828
	Steel strip	6.298
	Steel+PA	1.208
Ferrous metals		***20.781***
Non ferrous metals	Al	172
	Cu	398
	Zn	7
Non ferrous metals		***77***
Packaging	Cardboard	123
	EPS	648
	paper	5
	PE - foil	132
	Wood	47
Packaging		***955***
Plastics	ABS	708
	EPDM - rubber	433
	EPS	88
	PA	172
	PBT polybutylene terephthalate	58
	PE	178
	Plastics, others	121
	PMMA	10
	POM	191
	PP	5.026
	PS	367
	PU Foam - Insulation	3
	PVC (excl. wire insul.)	210
Plastics		***7.564***
Various	adhesive	15
	Bitumen	5.043
	Concrete	2.153
	Cotton+Resins noise absorbers	565
	Electronic, boards, switches, lamp, etc	694
	others	36
	paper	130
	Resins	200
	Thermostat	17
	Wiring	503
	Wood	1.928
Various		***11.284***
TOTAL		**41.160**

TRANSPORT: average km = 706

ASSEMBLING	
Energy (kWh)	
Electricity	11,60
Heat	10,02
Mechanical	0,0005
Water (m3)	0,08
Other materials (g)	
polishing solution	106
protective layer-cataphoresys	143
white painting powder	49
Volume of packaged final product (m^3)	0,303

USE		
Product Life	**12,50**	years
Electricity		
On-mode: Consumption per hour, cycle, setting, etc.	**0,8825**	kWh/cycle
On-mode: n. of hours, cycles, settings, etc. / year	220	
Standby-mode: Consumption per hour	**0,0013**	kWh
Standby-mode: n. of hours / year	200	
Off-mode: Consumption per hour	**0,00010**	kWh
Off-mode: n. of hours / year	8000	
TOTAL over Product Life		
Heat		
Avg. Heat Power Output		
No. of hours / year		
Type and efficiency		
TOTAL over Product Life		
Consumables (excl. spare parts)		
Water	**3,69**	m3/year
Detergent dishwasher.	**6,85**	kg/ year
Rinsing agent dishwasher.	**1,16**	kg/ year
Salt dishwasher.	**8,33**	kg/ year
Maintenance, Repairs, Service		
n. of km over Product-Life		
Spare parts		
or Spare parts (object x)		
Spare parts (object y)		

END OF LIFE (%)	
recycling	80,42
energy recovery	16,80
land filling	2,78
Total	100

Table 5.38: Average data for the DW 12ps model life cycle phases

PRODUCTION		
Materials type	**Material**	**DW12ps (g)**
Ferrous metals	galvanized steel	403,2
	Iron	2302,6
	Prepainted Steel	1269,2
	Stainless Steel	8690,92
	Steel	6535,616
	Steel strip	7097,4
	Steel+PA	966,6
Ferrous metals		***27265,536***
Non ferrous metals	Al	268,624
	Brass (Cu+Zn alloy)	23,4
	Cr	71,3
	Cu	656,14
	Zn	4,2
Non ferrous metals		***1023,664***
Packaging	Cardboard	632,2
	EPS	724,4
	Paper	3
	PE - foil	171,72
	Wood	1011
Packaging		*2542,32*
Plastics	ABS	751,26
	EPDM - rubber	523,96
	EPS	39,7
	PA	398,6
	PBT - polybutylene terephthalate	35
	PE	187,32
	Plastics, other	267,94
	PMMA	5,8
	POM	229,88
	PP	4948,42
	PP Volute	32,2
	PS	511,54
	PU Foam - Insulation	2,4
	PVC	184,2
	PVC (excl. wire insul.)	219
Plastics		***8337,22***
Various	adhesive	10
	Bitumen	6089
	Cement - Gravel	1262,8
	Cotton	452,18
	Cotton+Resins noise absorbers	489
	Electronic, boards, switches, lamp etc	447,5
	Others	59,36
	Paper	205,52
	Resins	120
	Thermostat	10
	Wiring	350
	Wood	2034,4
Various		***11529,76***
TOTAL		**50698,5**

TRANSPORT: average km = 652

ASSEMBLING	
Energy (kWh)	
Electricity	17,31
Heat	9,20
Mechanical	
Water (m3)	0,09
Other materials (g)	
polishing solution	106
protective layer-cataphoresys	156
white painting powder	53
Volume of packaged final product (m3)	0,40

USE		
Product Life	12,5	year
Electricity		
On-mode: Consumption per hour, cycle, setting, etc.	1,058	kWh/cycle
On-mode: n. of hours, cycles, settings, etc. / year	220	
Standby-mode: Consumption per hour	0,00133	kWh
Standby-mode: n. of hours / year	200	
Off-mode: Consumption per hour	0,00016	kWh
Off-mode: n. of hours / year	8000	
TOTAL over Product Life		
Heat		
Avg. Heat Power Output	1,97500	kW
No. of hours / year	0,50	hrs/cycle
Type and efficiency		
TOTAL over Product Life		

USE		
Consumables (excl. spare parts)		
Water	3,85	m3/year
Detergent dishwasher	7,25	kg/year
Rinse agent dishwasher	1,02	kg/year
Salt dishwasher.	7,835	kg/year
Maintenance, Repairs, Service		
n. of km over Product-Life	160,00	km/product life
Spare parts		
or Spare parts (object x)		
Spare parts (object y)		

END OF LIFE (%)	
recycling	82,66
energy recovery	15,86
land filling	1,47
Total	100

Table 5.39: Average data for the WM 5kg model life cycle phases

PRODUCTION		
Materials type	**Material**	**WM5kg (g)**
Ferrous metals	cast iron	6.214
	Iron	4.978
	Stainless Steel	1.939
	Stainless steel sheet	564
	Steel	12.521
	Steel strip	6.145
Ferrous metals		***32.361***
Non ferrous metals	Al	1.503
	Aluminium sheet	1
	Aluminium casting (recycled 80%)	729
	Brass	14
	Copper sheet	0
	Copper wire	348
	Cr	1.761
	Cu	869
	Ni	1
	zinc die-casting	85
Non ferrous metals		***5.311***
Packaging	Cardboard	107
	EPS	678
	Paper (booklets etc)	10
	PE - foil	175
	Plastics, others	56
	PP	8
	Wood	879
Packaging		***1.912***
Plastics	ABS	1.145
	EPDM - rubber	1.675
	PA	6
	PA 66-GF(Glass Fibre Reinforced)	0
	PA66	88
	PC	188
	PC-G (Glass Reinforced)	2
	PE	10
	Plastics, others	1.037
	POM	41
	PP	5.402
	PP-K40	2.533
	PPO (=PPE)	2
	PPS-GF	76
	PVC	221
	PBT	8
Plastics		***12.434***
Various	Bitumen	38
	Concrete	18.180
	Electronic, boards, switches, lamp, etc	165
	Filter	28
	Glass	1.773
	Gravel	25
	Oil - Feet	28
	Others	204
	Paper (booklets etc)	106
	Wiring	88
	Wood	1.573
Various		***22.206***
TOTAL		**74.225**

TRANSPORT: average km = 648

ASSEMBLING	
Energy (kWh)	
Electricity	28,98
Heat	14,79
Water (m3)	0,59
Other materials (g)	
Lubricating oil : ave factory	45
Phosphating : ave factory	47
Volume of packaged final product (m3)	0,36

USE		
Product Life	15,00	years
Electricity		
On-mode: Consumption per cycle	0,93	kWh/cycle
On-mode: n. of hours, /cycle	225,00	cycle/year
Standby-mode: Consumption per hour	0,00320	kW
Standby-mode: n. of hours / year	200	
Off-mode: Consumption per hour	0,00065	kW
Off-mode: n. of hours / year	8.000	
TOTAL over Product Life		
Heat		
Avg. Heat Power Output	1,95	kW
No. of hours / year	0,40	hrs./cycle
Type and efficiency		
TOTAL over Product Life		
Consumables (excl. spare parts)		
Water	10,01	m3/year
Detergent (compact)	24,93	kg/ year
Softening washing machine	20,00	kg/ year
Bleach	1	l/year
Maintenance, Repairs, Service		
n. of km over Product-Life	160,00	km/product life
Spare parts		
or Spare parts (object x)		
Spare parts (object y)		

END OF LIFE (%)	
Dismantling	26,70
recycling	70,00
energy recovery	3,30
Total	100

5.7 ANNEX B

Table 5.1: DW 9ps INPUT - EuP-Ecoreport

Version 5 VHK for European Commission 28 Nov. 2005

Document subject to a legal notice (see below)

ECO-DESIGN OF ENERGY-USING PRODUCTS

EuP EcoReport: INPUTS Assessment of Environmental Impact

Nr	Product name	Date	Author
	DW 9 ps MEDIA	**21/05/2007**	

Pos nr	MATERIALS Extraction & Production Description of component	Weight in g	Category Click &select	Material or Process select Category first !
1	ABS (707,83 g)	828,1	1-BlkPlastics	**10-ABS**
2	adhesive (14,58 g)			
3	Al (171,66 g)	200,8	4-Non-ferro	**26-Al sheet/extrusion**
4	Bitumen (5043,33 g)			
5	Concrete (2153 g)	2518,7	7-Misc.	**58-Concrete**
6	Cotton+Resins noise absorbers (565,41 g)			
7	Cu (397,66 g)	465,2	4-Non-ferro	**29-Cu wire**
8	Electronic, boards, switches, lamp etc (694,16 g)	812,1	6-Electronics	**98-controller board**
9	EPDM - rubber (432,66 g)	506,2	1-BlkPlastics	**1-LDPE**
10	EPS (87,5 g)	102,4	1-BlkPlastics	**6-EPS**
11	galvanized steel (504 g)	589,6	3-Ferro	**21-St sheet galv.**
12	Iron (2136,33 g)	2499,2	3-Ferro	**23-Cast iron**
13	others (35,66 g)			
14	PA (171,66 g)	200,8	2-TecPlastics	**11-PA 6**
15	paper (130 g)	152,1	7-Misc.	**57-Office paper**
16	PBT polybutylene terephthalate (58,33 g)			
17	PE (178,33 g)	208,6	1-BlkPlastics	**2-HDPE**
18	Plastics, others (120,66 g)			
19	PMMA (9,66 g)	11,3	2-TecPlastics	**13-PMMA**
20	POM (191,33 g)	223,8	1-BlkPlastics	**2-HDPE**
21	PP (5026,46 g)	5880,3	1-BlkPlastics	**4-PP**
22	Prepainted Steel (1940,66 g)	2270,3	3-Ferro	**25-Stainless 18/8 coil**
23	PS (367 g)	429,3	1-BlkPlastics	**5-PS**
24	PU Foam - Insulation (3 g)	3,5	2-TecPlastics	**16-Flex PUR**
25	PVC (excl. wire insul.) (209,66 g)	245,3	1-BlkPlastics	**8-PVC**
26	Resins (200 g)	234,0	2-TecPlastics	**14-Epoxy**
27	stainless steel (6866 g)	8032,3	3-Ferro	**25-Stainless 18/8 coil**
28	Steel (1828,16 g)	2138,7	3-Ferro	**25-Stainless 18/8 coil**
29	Steel strip (6297,66 g)	7367,5	3-Ferro	**21-St sheet galv.**
30	Steel+PA (1208,25 g)	1413,5	3-Ferro	**25-Stainless 18/8 coil**
31	Thermostat (16,66 g)	19,5	6-Electronics	**98-controller board**
32	Wiring (503,33 g)	588,8	4-Non-ferro	**29-Cu wire**
33	Wood (1927,66 g)	2255,1	7-Misc.	**56-Cardboard**
34	Zn (6,66 g)	7,8	4-Non-ferro	**31-CuZn38 cast**
	TOTAL	**40205**		

Pos nr	MANUFACTURING Description	Weight in g	Percentage Adjust	Category index (fixed)
201	**OEM Plastics Manufacturing** (fixed)	8874		20
202	**Foundries Fe/Cu/Zn** (fixed)	2507		34
203	**Foundries Al/Mg** (fixed)	0		35
204	**Sheetmetal Manufacturing** (fixed)	22013		36
205	**PWB Manufacturing** (fixed)	0		53
206	**Other materials** (Manufacturing already included)	6812		
207	**Sheetmetal Scrap** (Please adjust percentage only)	1101	**5%**	37

Pos nr	DISTRIBUTION (incl. Final Assembly) Description		Answer	Category index (fixed)
208	**Is it an ICT or Consumer Electronics product <15 kg ?**		NO	59
209	**Is it an installed appliance (e.g. boiler)?**		NO	60
				62
210	**Volume of packaged final product in m^3**	in m3	0,302523432	63

Pos nr	USE PHASE Description		unit	Subtotals
211	Product Life in years	12,5	years	
	Electricity			
212	On-mode: Consumption per hour, cycle, setting, etc.	0,8825	kWh	194,15
213	On-mode: No. Of hours, cycles, settings, etc. / year	220,00	#	
214	Standby-mode: Consumption per hour	0,00125	kWh	0,25
215	Standby-mode: No. Of hours / year	200,00	#	
216	Off-mode: Consumption per hour	9,6333E-05	kWh	0,770666667
217	Off-mode: No. Of hours / year	8000,00	#	
	TOTAL over Product Life	2,44	MWh (=000 kWh)	65
	Heat			
218	Avg. Heat Power Output	0	kW	
219	No. Of hours / year	0	hrs.	
220	Type and efficiency (Click & select)			85-not applicable
	TOTAL over Product Life	0,00	GJ	
	Consumables (excl, spare parts)			material
221	Water	3,69	m^3/year	83-Water per m3
222	Auxilliary material 1 (Click & select)	6,85	kg/ year	80-Detergent dishw.
223	Auxilliary material 2 (Click & select)	1,16	kg/ year	81-Rinsing agent dish
224	Auxilliary material 3 (Click & select)	8,33	kg/ year	82-Regen. Salt dishw
	Maintenance, Repairs, Service			
225	No. of km over Product-Life	0	km / Product Life	86
226	Spare parts (fixed, 1% of product materials & manuf.)	402	g	

Pos nr	DISPOSAL & RECYCLING Description		unit	Subtotals
	Substances released during Product Life and Landfill			
227	Refrigerant in the product (Click & select)	0	g	1-none
228	Percentage of fugitive & dumped refrigerant	0%		
229	Mercury (Hg) in the product	0	g Hg	
230	Percentage of fugitive & dumped mercury	0%		
	Disposal: Environmental Costs perkg final product			
231	Landfill (fraction products not recovered) in g en %	1118	3%	88-fixed
232	Incineration (plastics & PWB not re-used/recycled)	1491	g	91-fixed
233	Plastics: Re-use & Recycling ("cost"-side)	7136	g	92-fixed
	Re-use, Recycling Benefit	in g	% of plastics fraction	
234	Plastics: Re-use, Closed Loop Recycling (please edit%)	0		4
235	Plastics: Materials Recycling (please edit% only)	7136	80%	4
236	Plastics: Thermal Recycling (please edit% only)	1491	17%	72
237	Electronics: PWB Easy to Disassemble ? (Click&select)	0	YES	98
238	Metals & TV Glass & Misc. (95% Recycling)	29765		fixed

Table 5.2: DW 9ps OUTPUT – EuP-Ecoreport

Version 5 VHK for European Commission 28 Nov. 2005

Document subject to a legal notice (see below))

ECO-DESIGN OF ENERGY-USING PRODUCTS

EuP EcoReport: RESULTS

Assessment of Environmental Impact

Table . Life Cycle Impact (per unit) of DW 9 ps MEDIA

Nr	Life cycle Impact per product:	Date	Author
0	DW 9 ps	21/05/07	

	Life Cycle phases -->		PRODUCTION			DISTRI-	USE	END-OF-LIFE*			TOTAL
	Resources Use and Emissions		Material	Manuf.	**Total**	**BUTION**		Disposal	Recycl.	**Total**	
	Materials	**unit**									
1	Bulk Plastics	g			**8424**			1415	7009	**8424**	**0**
2	TecPlastics	g			**450**			76	374	**450**	**0**
3	Ferro	g			**24311**			676	23635	**24311**	**0**
4	Non-ferro	g			**1263**			35	1228	**1263**	**0**
5	Coating	g			**0**			0	0	**0**	**0**
6	Electronics	g			**832**			832	0	**832**	**0**
7	Misc.	g			**4926**			137	4789	**4926**	**0**
	Total weight	g			**40205**			3170	37035	**40205**	**0**
									see note!		
	Other Resources & Waste							debet	credit		
8	Total Energy (GER)	MJ	2735	714	**3450**	**462**	**28839**	223	447	**-224**	**32526**
9	of which, electricity (in primary MJ)	MJ	713	427	**1141**	**1**	**25628**	0	26	**-26**	**26743**
10	Water (process)	ltr	1568	6	**1574**	**0**	**47916**	0	17	**-17**	**49473**
11	Water (cooling)	ltr	866	199	**1065**	**0**	**68320**	0	143	**-143**	**69243**
12	Waste, non-haz./ landfill	g	52215	2395	**54610**	**249**	**33943**	1393	100	**1293**	**90095**
13	Waste, hazardous/ incinerated	g	592	0	**592**	**5**	**670**	1491	16	**1475**	**2742**
	Emissions (Air)										
14	Greenhouse Gases in GWP100	kg CO2 eq.	186	40	**226**	**29**	**1259**	16	14	**2**	**1516**
15	Ozone Depletion, emissions	mg R-11 eq.	negligible								
16	Acidification, emissions	g SO2 eq.	1621	172	**1792**	**87**	**7440**	40	29	**12**	**9331**
17	Volatile Organic Compounds (VOC)	g	9	0	**9**	**6**	**11**	1	0	**1**	**28**
18	Persistent Organic Pollutants (POP)	ng i-Teq	339	12	**351**	**1**	**192**	10	0	**10**	**554**
19	Heavy Metals	mg Ni eq.	2209	28	**2237**	**13**	**517**	60	0	**60**	**2826**
	PAHs	mg Ni eq.	139	0	**139**	**16**	**58**	0	1	**-1**	**211**
20	Particulate Matter (PM, dust)	g	205	26	**232**	**1035**	**161**	442	3	**439**	**1867**
	Emissions (Water)										
21	Heavy Metals	mg Hg/20	1623	0	**1623**	**0**	**184**	15	0	**15**	**1822**
22	Eutrophication	g PO4	42	0	**43**	**0**	**4593**	1	1	**0**	**4636**
23	Persistent Organic Pollutants (POP)	ng i-Teq	negligible								

***=Note: Recycling credits only relate to recycling of plastics and electronics (excl. LCD/CRT). Recycling credits for metals and other fractions are already taken into account in the production phase.**

Table 5.3: DW 12 ps INPUT – EuP-Ecoreport

Version 5 VHK for European Commission 28 Nov. 2005
ECO-DESIGN OF ENERGY-USING PRODUCTS

Document subject to a legal notice (see below)
EuP EcoReport: INPUTS
Assessment of Environmental Impact

Nr	Product name	Date	Author
	DW 12ps MEDIA	**21/05/2007**	

Pos nr	MATERIALS Extraction & Production Description of component	Weight in g	Category Click &select	Material or Process select Category first !
1	galvanized steel (403,2 g)	477,3	3-Ferro	**21-St sheet galv.**
2	Iron (2302,6 g)	2725,6	3-Ferro	**23-Cast iron**
3	Prepainted Steel (1269,2 g)	1502,4	3-Ferro	**25-Stainless 18/8 coil**
4	Stainless Steel (8690,92 g)	10287,5	3-Ferro	**25-Stainless 18/8 coil**
5	Steel (6535,61 g)	7736,3	3-Ferro	**25-Stainless 18/8 coil**
6	Steel strip (7097,4 g)	8401,3	3-Ferro	**21-St sheet galv.**
7	Steel+PA (966,6 g)	1144,2	3-Ferro	**25-Stainless 18/8 coil**
8	Al (268,62 g)	318,0	4-Non-ferro	**26-Al sheet/extrusion**
9	Brass (Cu+Zn alloy) (23,4 g)	27,7	4-Non-ferro	**31-CuZn38 cast**
10	Cr (71,3 g)		4-Non-ferro	
11	Cu (656,14 g)	776,7	4-Non-ferro	**29-Cu wire**
12	Zn (4,2 g)	5,0	4-Non-ferro	**31-CuZn38 cast**
13	ABS (751,26 g)	889,3	1-BlkPlastics	**10-ABS**
14	EPDM - rubber (523,96 g)	620,2	1-BlkPlastics	**1-LDPE**
15	EPS (39,7 g)	47,0	1-BlkPlastics	**6-EPS**
16	PA (398,6 g)	471,8	2-TecPlastics	**11-PA 6**
17	PBT - polybutylene terephthalate (35 g)			
18	PE (187,32 g)	221,7	1-BlkPlastics	**2-HDPE**
19	Plastics, other (267,94 g)			
20	PMMA (5,8 g)	6,9	2-TecPlastics	**13-PMMA**
21	POM (229,88 g)	272,1	1-BlkPlastics	**2-HDPE**
22	PP (4948,42 g)	5857,5	1-BlkPlastics	**4-PP**
23	PP Volute (32,2 g)	38,1	1-BlkPlastics	**4-PP**
24	PS (511,54 g)	605,5	1-BlkPlastics	**5-PS**
25	PU Foam - Insulation (2,4 g)	2,8	2-TecPlastics	**16-Flex PUR**
26	PVC (184,2 g)	218,0	1-BlkPlastics	**8-PVC**
27	PVC (excl. wire insul.) (219 g)	259,2	1-BlkPlastics	**8-PVC**
28	adhesive (10 g)			
29	Bitumen (6089 g)			
30	Cement - Gravel (1262,8 g)	1494,8	7-Misc.	**58-Concrete**
31	Cotton (452,18 g)			
32	Cotton+Resins noise absorbers (489 g)			
33	Electronic, boards, switches, lamp etc (447,5 g)	529,7	6-Electronics	**98-controller board**
34	Others (59,36 g)			
35	Paper (205,52 g)	243,3	7-Misc.	**57-Office paper**
36	Resins (120 g)	142,0	2-TecPlastics	**14-Epoxy**
37	Thermostat (10 g)	11,8	6-Electronics	**98-controller board**
38	Wiring (350 g)	414,3	4-Non-ferro	**29-Cu wire**
39	Wood (2034,4 g)	2408,1	7-Misc.	**56-Cardboard**
	TOTAL	**48156**		

Pos nr	MANUFACTURING Description	Weight in g	Percentage Adjust	Category index (fixed)
201	**OEM Plastics Manufacturing** (fixed)	9652		20
202	**Foundries Fe/Cu/Zn** (fixed)	2758		34
203	**Foundries Al/Mg** (fixed)	0		35
204	**Sheetmetal Manufacturing** (fixed)	29867		36
205	**PWB Manufacturing** (fixed)	0		53
206	**Other materials** (Manufacturing already included)	5879		
207	**Sheetmetal Scrap** (Please adjust percentage only)	1493	**5%**	37

Pos nr	DISTRIBUTION (incl. Final Assembly) Description		Answer	Category index (fixed)
208	**Is it an ICT or Consumer Electronics product <15 kg ?**		NO	59
209	**Is it an installed appliance (e.g. boiler)?**		NO	60
				62
210	**Volume of packaged final product in m^3**	**in m3**	0,400625106	63

Pos nr	USE PHASE Description		unit	Subtotals
211	**Product Life in years**	**12,5**	years	
	Electricity			
212	**On-mode: Consumption per hour, cycle, setting, etc.**	1,05833333	kWh	232,8333333

213	On-mode: No. Of hours, cycles, settings, etc. / year	220,00	#		
214	Standby-mode: Consumption per hour	0,00133333	kWh	0,266666667	
215	Standby-mode: No. Of hours / year	200,00	#		
216	Off-mode: Consumption per hour	0,0001578	kWh	1,2624	
217	Off-mode: No. Of hours / year	8000,00	#		
	TOTAL over Product Life	2,93	MWh (=000 kWh)		65
	Heat				
218	Avg. Heat Power Output	1,975	kW		
219	No. Of hours / year	110	hrs.		
220	Type and efficiency (Click & select)			85-not applicable	
	TOTAL over Product Life	9,78	GJ		
	Consumables (excl, spare parts)			material	
221	Water	3,85	m^3/year	83-Water per m3	
222	Auxilliary material 1 (Click & select)	7,25	kg/ year	80-Detergent dishw.	
223	Auxilliary material 2 (Click & select)	1,02	kg/ year	81-Rinsing agent dish	
224	Auxilliary material 3 (Click & select)	7,84	kg/ year	82-Regen. Salt dishw	
	Maintenance, Repairs, Service				
225	No. of km over Product-Life	160,00	km / Product Life		86
226	Spare parts (fixed, 1% of product materials & manuf.)	482	g		

Pos nr	DISPOSAL & RECYCLING Description		unit	Subtotals
	Substances released during Product Life and Landfill			
227	Refrigerant in the product (Click & select)	0	g	1-none
228	Percentage of fugitive & dumped refrigerant	0%		
229	Mercury (Hg) in the product	0	g Hg	
230	Percentage of fugitive & dumped mercury	0%		
	Disposal: Environmental Costs perkg final product			
231	Landfill (fraction products not recovered) in g en %	708	1%	88-fixed
232	Incineration (plastics & PWB not re-used/recycled)	1531	g	91-fixed
233	Plastics: Re-use & Recycling ("cost"-side)	7979	g	92-fixed
	Re-use, Recycling Benefit	in g	% of plastics fraction	
234	Plastics: Re-use, Closed Loop Recycling (please edit%)	0		4
235	Plastics: Materials Recycling (please edit% only)	7979	83%	4
236	Plastics: Thermal Recycling (please edit% only)	1531	16%	72
237	Electronics: PWB Easy to Disassemble ? (Click&select)	0	YES	98
238	Metals & TV Glass & Misc. (95% Recycling)	36579		fixed

Table 5.4: DW 12 ps OUTPUT – EuP-Ecoreport

Version 5 VHK for European Commission 28 Nov. 2005

Document subject to a legal notice (see below))

ECO-DESIGN OF ENERGY-USING PRODUCTS

EuP EcoReport: RESULTS

Assessment of Environmental Impact

Table . Life Cycle Impact (per unit) of DW 12ps MEDIA

Nr	Life cycle Impact per product:	Date	Author
0	**DW 12ps**	**21/05/07**	**0**

	Life Cycle phases -->		PRODUCTION			DISTRI-	USE	END-OF-LIFE*			TOTAL
	Resources Use and Emissions		Material	Manuf.	**Total**	**BUTION**		Disposal	Recycl.	**Total**	
	Materials	**unit**									
1	Bulk Plastics	g			**9029**			1432	7596	**9029**	**0**
2	TecPlastics	g			**624**			99	525	**624**	**0**
3	Ferro	g			**32274**			474	31800	**32274**	**0**
4	Non-ferro	g			**1542**			23	1519	**1542**	**0**
5	Coating	g			**0**			0	0	**0**	**0**
6	Electronics	g			**542**			542	0	**542**	**0**
7	Misc.	g			**4146**			61	4085	**4146**	**0**
	Total weight	g			**48156**			2631	45525	**48156**	**0**
									see note!		
	Other Resources & Waste							debet	credit		
8	Total Energy (GER)	MJ	3075	870	**3945**	**595**	**34487**	203	494	**-291**	**38736**
9	of which, electricity (in primary MJ)	MJ	622	520	**1142**	**1**	**30771**	0	29	**-29**	**31886**
10	Water (process)	ltr	1947	8	**1955**	**0**	**50274**	0	19	**-19**	**52209**
11	Water (cooling)	ltr	971	242	**1213**	**0**	**82039**	0	160	**-160**	**83093**
12	Waste, non-haz./ landfill	g	63531	2939	**66470**	**313**	**40158**	894	112	**781**	**107723**
13	Waste, hazardous/ incinerated	g	409	0	**409**	**6**	**789**	1532	18	**1514**	**2718**
	Emissions (Air)										
14	Greenhouse Gases in GWP100	kg CO2 eq.	222	48	**270**	**37**	**1519**	15	15	**0**	**1825**
15	Ozone Depletion, emissions	mg R-11 eq.	negligible								
16	Acidification, emissions	g SO2 eq.	1946	209	**2155**	**111**	**8828**	38	31	**7**	**11101**
17	Volatile Organic Compounds (VOC)	g	8	0	**9**	**8**	**19**	1	0	**1**	**37**
18	Persistent Organic Pollutants (POP)	ng i-Teq	417	16	**433**	**2**	**228**	6	0	**6**	**669**
19	Heavy Metals	mg Ni eq.	3211	38	**3249**	**16**	**700**	53	0	**53**	**4018**
	PAHs	mg Ni eq.	152	0	**152**	**20**	**152**	0	2	**-2**	**322**
20	Particulate Matter (PM, dust)	g	262	32	**295**	**1370**	**1601**	435	3	**431**	**3698**
	Emissions (Water)										
21	Heavy Metals	mg Hg/20	2150	0	**2150**	**0**	**222**	13	0	**13**	**2385**
22	Eutrophication	g PO4	57	0	**57**	**0**	**4859**	1	1	**0**	**4917**
23	Persistent Organic Pollutants (POP)	ng i-Teq	negligible								

***=Note: Recycling credits only relate to recycling of plastics and electronics (excl. LCD/CRT). Recycling credits for metals and other fractions are already taken into account in the production phase.**

Table 5.5: WM 5 kg INPUT – EuP-Ecoreport

Version 5 VHK for European Commission 28 Nov. 2005
ECO-DESIGN OF ENERGY-USING PRODUCTS

Document subject to a legal notice (see below)
EuP EcoReport: INPUTS
Assessment of Environmental Impact

Nr	Product name	Date	Author
	WM 5 kg	**21/05/2007**	

Pos nr	MATERIALS Extraction & Production Description of component	Weight in g	Category Click &select	Material or Process select Category first !
1	cast iron (6214 g)	6499,9	3-Ferro	**23-Cast iron**
2	Iron (4977,9 g)	5206,9	3-Ferro	**23-Cast iron**
3	Stainless Steel (1939,2 g)	2028,4	3-Ferro	**25-Stainless 18/8 coil**
4	Stainless steel sheet (564 g)	589,9	3-Ferro	**21-St sheet galv.**
5	Steel (12521,34 g)	13097,4	3-Ferro	**25-Stainless 18/8 coil**
6	Steel strip (6145 g)	6427,7	3-Ferro	**21-St sheet galv.**
7	Al (1502,8 g)	1571,9	4-Non-ferro	**26-Al sheet/extrusion**
8	Alluminium sheet (1,34 g)	1,4	4-Non-ferro	**26-Al sheet/extrusion**
9	Aluminium casting (recycled 80%) (728,8 g)	762,3	4-Non-ferro	**27-Al diecast**
10	Brass (14,24 g)	14,9	4-Non-ferro	**31-CuZn38 cast**
11	Copper sheet (0,46 g)	0,5	4-Non-ferro	**30-Cu tube/sheet**
12	Copper wire (347,76 g)	363,8	4-Non-ferro	**29-Cu wire**
13	Cr (1761,2 g)		4-Non-ferro	
14	Cu (869,2 g)	909,2	4-Non-ferro	**29-Cu wire**
15	Ni (0,8 g)		4-Non-ferro	
16	zinc diecasting (84,8 g)	88,7	4-Non-ferro	**31-CuZn38 cast**
17	ABS (1144,7 g)	1197,4	1-BlkPlastics	**10-ABS**
18	EPDM - rubber (1675,18 g)	1752,3	1-BlkPlastics	**1-LDPE**
19	PA (6 g)	6,3	2-TecPlastics	**11-PA 6**
20	PA 66-GF(Glass Fibre Reinforced) (0,42 g)	0,4	2-TecPlastics	**11-PA 6**
21	PA66 (87,8 g)	91,8	2-TecPlastics	**11-PA 6**
22	PC (187,76 g)	196,4	2-TecPlastics	**12-PC**
23	PC-G (Glass Reinforced) (2,48 g)	2,6	2-TecPlastics	**12-PC**
24	PE (10,2 g)	10,7	1-BlkPlastics	**2-HDPE**
25	Plastics, others (1037,04 g)			
26	POM (40,74 g)	42,6	1-BlkPlastics	**2-HDPE**
27	PP (5401,7 g)	5650,2	1-BlkPlastics	**4-PP**
28	PP-K40 (2532,5 g)	2649,0	1-BlkPlastics	**4-PP**
29	PPO (=PPE) (1,9 g)	2,0	1-BlkPlastics	**4-PP**
30	PPS-GF (76 g)			
31	PVC (221,38 g)	231,6	1-BlkPlastics	**8-PVC**
32	PBT (8 g)			
42	Bitumen (37,8 g)			
43	Concrete (18179,6 g)	19016,0	7-Misc.	**58-Concrete**
44	Electronic, boards, switches, lamp etc (164,88 g)	172,5	6-Electronics	**98-controller board**
45	Filter (28 g)			
46	Glass (1772,6 g)	1854,2	7-Misc.	**54-Glass for lamps**
47	Gravel (25 g)	26,2	7-Misc.	**58-Concrete**
48	Oil - Feet (28 g)			
49	Others (203,8 g)			
50	Paper (booklets etc) (106 g)	110,9	7-Misc.	**57-Office paper**
51	Wiring (87,6 g)	91,6	4-Non-ferro	**29-Cu wire**
52	Wood (1573 g)	1645,4	7-Misc.	**56-Cardboard**
	TOTAL	**72313**		

Pos nr	MANUFACTURING Description	Weight in g	Percentage Adjust	Category index (fixed)
201	**OEM Plastics Manufacturing** (fixed)	11833		20
202	**Foundries Fe/Cu/Zn** (fixed)	11810		34
203	**Foundries Al/Mg** (fixed)	762		35
204	**Sheetmetal Manufacturing** (fixed)	23717		36
205	**PWB Manufacturing** (fixed)	0		53
206	**Other materials** (Manufacturing already included)	24190		

207	Sheetmetal Scrap (Please adjust percentage only)	1186	5%	37

Pos nr	DISTRIBUTION (incl. Final Assembly) Description		Answer	Category index (fixed)
208	Is it an ICT or Consumer Electronics product <15 kg ?		NO	59
209	Is it an installed appliance (e.g. boiler)?		NO	60
				62
210	Volume of packaged final product in m^3	in m3	0,3648	63

Pos nr	USE PHASE Description		unit	Subtotals
211	Product Life in years	15	years	
	Electricity			
212	On-mode: Consumption per hour, cycle, setting, etc.	0,928	kWh	208,8
213	On-mode: No. Of hours, cycles, settings, etc. / year	225	#	
214	Standby-mode: Consumption per hour	0,0032	kWh	0,64
215	Standby-mode: No. Of hours / year	200	#	
216	Off-mode: Consumption per hour	0,00065	kWh	5,2
217	Off-mode: No. Of hours / year	8000	#	
	TOTAL over Product Life	3,22	MWh (=000 kWh)	65
	Heat			
218	Avg. Heat Power Output	1,95	kW	
219	No. Of hours / year	90	hrs.	
220	Type and efficiency (Click & select)			85-not applicable
	TOTAL over Product Life	9,48	GJ	
	Consumables (excl. spare parts)			material
221	Water	10,0125	m^3/year	83-Water per m3
222	Auxilliary material 1 (Click & select)	24,9333333	kg/ year	85-None
223	Auxilliary material 2 (Click & select)	20	kg/ year	85-None
224	Auxilliary material 3 (Click & select)	0	kg/ year	85-None
	Maintenance, Repairs, Service			
225	No. of km over Product-Life	160,00	km / Product Life	86
226	Spare parts (fixed, 1% of product materials & manuf.)	723	g	

Pos nr	DISPOSAL & RECYCLING Description		unit	Subtotals
	Substances released during Product Life and Landfill			
227	Refrigerant in the product (Click & select)	0	g	1-none
228	Percentage of fugitive & dumped refrigerant	0%		
229	Mercury (Hg) in the product	0	g Hg	
230	Percentage of fugitive & dumped mercury	0%		
	Disposal: Environmental Costs perkg final product			
231	Landfill (fraction products not recovered) in g en %	0		88-fixed
232	Incineration (plastics & PWB not re-used/recycled)	390	g	91-fixed
233	Plastics: Re-use & Recycling ("cost"-side)	11443	g	92-fixed
	Re-use, Recycling Benefit	in g	% of plastics fraction	
234	Plastics: Re-use, Closed Loop Recycling (please edit%)	3159	27%	4
235	Plastics: Materials Recycling (please edit% only)	8283	70%	4
236	Plastics: Thermal Recycling (please edit% only)	390	3%	72
237	Electronics: PWB Easy to Disassemble ? (Click&select)	0	YES	98
238	Metals & TV Glass & Misc. (95% Recycling)	57456		fixed

Table 5.6: WM 5 kg OUTPUT – EuP-Ecoreport

Version 5 VHK for European Commission 28 Nov. 2005

Document subject to a legal notice (see below))

EuP EcoReport: RESULTS

ECO-DESIGN OF ENERGY-USING PRODUCTS

Assessment of Environmental Impact

Table . Life Cycle Impact (per unit) of WM 5 kg MEDIA

Nr	**Life cycle Impact per product:**	Date	Author
0	WM 5 kg	21/05/07	0

	Life Cycle phases -->		PRODUCTION			DISTRI-	USE	END-OF-LIFE*			TOTAL
	Resources Use and Emissions		Material	Manuf.	**Total**	**BUTION**		Disposal	Recycl.	**Total**	
	Materials	**unit**									
1	Bulk Plastics	g			**11536**			381	11155	**11536**	**0**
2	TecPlastics	g			**298**			10	288	**298**	**0**
3	Ferro	g			**33850**			0	33850	**33850**	**0**
4	Non-ferro	g			**3804**			0	3804	**3804**	**0**
5	Coating	g			**0**			0	0	**0**	**0**
6	Electronics	g			**172**			172	0	**172**	**0**
7	Misc.	g			**22653**			0	22653	**22653**	**0**
	Total weight	g			**72313**			563	71750	**72313**	**0**
	Other Resources & Waste							debet	see note! credit		
8	Total Energy (GER)	MJ	2943	887	**3830**	**547**	**34230**	101	608	**-507**	**38100**
9	of which, electricity (in primary MJ)	MJ	391	531	**923**	**1**	**33815**	0	47	**-47**	**34692**
10	Water (process)	ltr	1350	8	**1358**	**0**	**152455**	0	31	**-31**	**153782**
11	Water (cooling)	ltr	857	248	**1105**	**0**	**90160**	0	260	**-260**	**91005**
12	Waste, non-haz./ landfill	g	66171	2949	**69120**	**290**	**39889**	37	183	**-146**	**109153**
13	Waste, hazardous/ incinerated	g	175	0	**176**	**6**	**781**	391	29	**362**	**1324**
	Emissions (Air)										
14	Greenhouse Gases in GWP100	kg CO2 eq.	195	49	**245**	**34**	**1508**	7	15	**-8**	**1778**
15	Ozone Depletion, emissions	mg R-11 eq.	negligible								
16	Acidification, emissions	g SO2 eq.	1656	213	**1870**	**102**	**8754**	27	39	**-12**	**10714**
17	Volatile Organic Compounds (VOC)	g	7	0	**7**	**8**	**19**	2	0	**1**	**35**
18	Persistent Organic Pollutants (POP)	ng i-Teq	414	13	**427**	**2**	**226**	0	0	**0**	**654**
19	Heavy Metals	mg Ni eq.	2399	30	**2429**	**15**	**687**	24	0	**24**	**3154**
	PAHs	mg Ni eq.	190	0	**190**	**19**	**153**	0	2	**-2**	**360**
20	Particulate Matter (PM, dust)	g	355	33	**388**	**1248**	**1601**	380	5	**375**	**3612**
	Emissions (Water)										
21	Heavy Metals	mg Hg/20	1597	0	**1597**	**0**	**234**	2	0	**2**	**1833**
22	Eutrophication	g PO4	40	0	**41**	**0**	**1**	0	1	**-1**	**41**
23	Persistent Organic Pollutants (POP)	ng i-Teq	negligible								

***=Note: Recycling credits only relate to recycling of plastics and electronics (excl. LCD/CRT). Recycling credits for metals and other fractions are already taken into account in the production phase.**

5.8 ANNEX C: SIMAPRO DATA

5.8.1 The SimaPro v.7.1 software

Even if it is not in the scope of this study to perform a LCA in full accordance with ISO 14040, the methodology was applied as close as possible. To this end a specialized LCA software tool was used, the SimaPro 7.1, the last version of the software[21].

This software allows one to perform an ecological balance of a product along all its life, taking into account for each material used, raw material extraction, energy and water consumption (with distinction between renewable and non renewable resources) , and related impacts in air, water, soil. Again it is possible to use specific models for energy production, waste treatment, transport and ancillary materials production. It is also possible to use and compare different environmental impact assessment methodologies (Ecoindicator, CML, EPS, Ecopoint…) performing sensitivity analysis. Again in this software many databases are included in a form to be used for a same ecobalance (avoiding double sum of an impact or loss of data).

Using SimaPro it is possible to simulate the LCA of products or services according to the ISO14040 standards.

5.8.2 Input data in SimaPro

5.8.2.1 Dishwashers

Table 5.40: DW12ps assembling

Nome			
DW12ps assembling	as average on data from producers		
Materiali/assemblaggi			Note
Steel I	424	g	galvanized steel
Crude iron I	2421	g	Iron
Steel I	1334	g	Prepainted Steel
X5CrNi18 (304) I	9136	g	Stainless Steel
Steel I	6870	g	Steel
Steel I	7461	g	Steel strip
Steel I	1016	g	Steel+PA
Aluminium rec. I	272	g	
Brass, at plant/CH U	24	g	Brass
Chromium I	72	g	
Copper I	663	g	
Zinc I	4	g	
Cardboard duplex/tripl	639	g	for packaging
PS (EPS) B250 (1998)	733	g	for packaging
Kraft paper, bleached, at plant/RER U	3	g	for packaging
PE (LDPE) I	174	g	for packaging (PE foil) + laminating
Poplar I	1022	g	wood
ABS I	785	g	
EPDM rubber ETH U	547	g	
PS (EPS) B250 (1998)	41	g	

[21] Wdit by Prè, NL, see http://www.pre.nl/simapro/default.htm .

PA 6 I	416	g	
PB B250 (1998)	37	g	as PBT
PE (HDPE) I	196	g	as PE
PMMA I	6	g	
HDPE B250	240	g	
PP I	5170	g	
PP I	34	g	as PP volute
PS (EPS) B250 (1998)	534	g	
PUR semi rigid foam I	3	g	PU foam - insulation
PVC B250	192	g	
PVC B250	229	g	
adhesive - glue	10	g	as adhesive
Bitumen refinery Europe U	6157	g	
Concrete I	1277	g	
Cotton fabric I	457	g	
Liquid epoxy resins E	247	g	cotton+resins noise adsorbers
Cotton fibres I	247	g	cotton+resins noise adsorbers
Electronics for control units/RER U	453	g	electronics
Kraft paper, bleached, at plant/RER U	208	g	
Liquid epoxy resins E	121	g	
Electronics for control units/RER U	10	g	AS THERMOSTAT (10 g)
Copper, at regional storage/RER U	354	g	AS WIRING
Poplar I	2057	g	wood
Water demineralized ETH U	88	kg	PROCESS WATER
Paint ETH S	53	g	white painting powder (53 g)
Processi			
Electricity MV use in UCPTE U	17,31	kWh	during assembling
Heat gas B250	9,2	kWh	
Truck 28t B250	23	tkm	transport for assembling
Sea ship B250	10	tkm	transport for assemnling
Hot rolling, steel/RER U	8511	g	
Sheet rolling, steel/RER U	4398	g	
Extruding alum I	136	g	
Wire drawing, copper/RER U	509	g	
Foaming, expanding/RER U	918	g	
Injection moulding/RER U	5201	g	
Extrusion PVC I	295	g	

Table 5.41: DW12ps consumables (per year)

Nome DW12ps use materials (per year)			
Material/assemblaggi			Note
Tap water, at user/CH U	3,85	ton	
Detergent C - EN 50242 or IEC 60436 DW	7,25	kg	
Rinsing agent DW	1,02	kg	
Sodium chloride, powder, at plant/RER U	7,835	kg	Salt dishw.

Table 5.42: DW12ps Life cycle

Ciclo di vita: Nome DW12			
Assemblaggio DW12ps assembling	1	p	Note

Processi			
Electricity LV use UCPTE U	2930	kWh	consumption of electricity over the life cycle (on-mode, stand-by,
Delivery van (<3.5t) B250	8,11	tkm	transport over product life for maintenance, repairs, service

Table 5.43: DW12ps End of Life Scenario

Name DW12 EoL		
Riferimento ad assemblaggio DW12ps assembling	1	p
Processi		
Scenari di smaltimento Recycling only B250 avoided Incineration B250 (98) avoided Landfill B250 (98)	 82 15 3	

5.8.2.2 Washing machines

Table 5.44: WM5kg assembling

Assembly:				
Nome WM 5kg assembling	as average on data from producers			
Materiali/assemblaggi			Note	
Cast iron ETH U	6524,7	g		
Crude iron I	5226,8	g	Iron	
X5CrNi18 (304) I	2036,16	g	Stainless Steel	
X5CrNi18 (304) I	592	g	Stainless Steel sheet + laminating	
	13147,4			
Steel I	1	g	steel	
Steel I	6452,25	g	steel strip + laminating	
Aluminium rec. I	1519	g		
Aluminium rec. I	736	g	aluminium casting	
Brass, at plant/CH U	14,38	g	Brass	
Copper I	352	g	copper + wiring	
Chromium I	1779	g		
Copper I	878	g		
Nickel I	0,8	g		
Zinc I	85,65	g		
Cardboard duplex/tripl	111	g	for packaging	
PS (EPS) B250 (1998)	705	g	for packaging	
Kraft paper, bleached, at plant/RER U	10,5	g	for packaging	
PE (LDPE) I	182	g	for packaging (PE foil) + laminating	
PP I	8	g		
Poplar I	915	g	wood	
ABS I	1261	g		
EPDM rubber ETH U	1846	g		
PA 6 I	6,6	g		
PA 66 GF30 I	0,5	g		

PA 66 I	96,75	g		
PC I	207	g		
PC 30% glass fibre I	2,73	g		
PE (HDPE) I	11,24	g	as PE	
HDPE B250	45	g	as POM	
PP granulate average B250	5952	g	as PP	
PP granulate average B250	2790,6	g	as PP-k40	
PP granulate average B250	2,1	g	as PPO	
PP GF30 I	83,74	g	as PPS-GF	
PVC B250	244	g		
PB B250 (1998)	8,8	g	as PBT	
Bitumen refinery Europe U	38,53	g		
	18531,4			
Concrete I	7	g		
Electronics for control units/RER U	168,07	g	electronics	
PP granulate average B250	28,54	g	as filter	
Glass (white) B250	1807	g		
Gravel I	25	g		
Lubricating oil, at plant/RER U	28,54	g		
Kraft paper, bleached, at plant/RER U	108	g		
Copper I	89	g	+ wire	
Poplar I	2057	g	wood	
Water demineralized ETH U	590	kg		
Lubricating oil, at plant/RER U	45	g		
Processi				
Electricity MV use in UCPTE U	28,98	kWh	during assembling	
Heat gas B250	14,79	kWh		
Truck 28t B250	34	tkm	transport for assembling	
Sea ship B250	14	tkm	transport for assemnling	
Hot rolling, steel/RER U	10205	g		
Sheet rolling, steel/RER U	3522	g		
Extruding alum I	759	g		
Wire drawing, copper/RER U	220	g		
Foaming, expanding/RER U	552	g		
Injection moulding/RER U	8567	g		
Extrusion PVC I	171	g		

Table 5.45: WM5kg consumables (per year)

Assemblaggio:		
Nome		
WM 5kg use materials (per year)		
Materiali/assemblaggi		
Tap water, at user/CH U	10,01	ton
Detergent powder WM	24,93	kg
Softening WM	20	kg

Table 5.46: WM5kg Life cycle

Ciclo di vita:			
Nome			
WM 5kg			

Assemblaggio			
WM 5kg assembling	1	p	
Processi			
Electricity LV use UCPTE U	3220	kWh	consumption of electricity over the life cycle (on-mode, stand-by,
Delivery van (<3.5t) B250	11,88	tkm	transport over product life for maintenance, repairs, service
Scenario smaltimento/fine vita			
WM 5kg EoL			
Cicli di vita supplementari			
WM 5kg use materials (per LC)	1		

Table 5.47: WM5kg End of Life Scenario

Scenario di fine vita:		
Nome		
WM 5kg EoL		
Riferimento ad assemblaggio		
WM 5kg assembling	1	p
Processi		
Scenari di smaltimento		
Recycling only B250 avoided	82	
Incineration B250 (98) avoided	3	
Landfill B250 (98)	15	

5.8.3 Detergents and other Washing chemicals simulation

Table 5.48: Average composition of detergent for washing machine

Detergent for washing mashine	
COMPOSITION %	100
tensioattivi anionici 7-13	12
tensioattivi non ionici 1-5	4
sapone sodico 0-10	7
zeolite A 15-25	22
silicato sodico 1-5	4
carbonato sodico 0-10	7
solfato sodico 0-30	24
perborato sodico 10-25	20
attivatore del perborato 0-4	
componenti minori 0,2-0,5	

Table 5.49: Average composition of softening agent for washing machine

Softening for washing mashine	
COMPOSIZIONE %	100,00
Tensioattivi cationici 5-15	15,00
Alcool isopropilico 2-5	5,00
Acidi grassi 0-4	4,00
Citrato sodico 0-2	2,00
Componenti minori: profumo, acidificanti 0,2-0,5	
water up to 100	74,00

Table 5.50: Average composition of detergent for dish washer

Detergent for Dish Washer		
Composition		100
sodium tripoliphosphate	23	55
tri-sodium citrate diydrate	22,3	6
sodium perborate monoydrate	6	2
tetraacetyl etilen diammina	2	5
sodium disilicate	5	2
linear fatty alcoholo etoxillate	2	30
maleic acid	4	
protease	1	
amilase	0,7	
sodium carbonate		

Table 5.51: Average composition of rinsing agent for dish washer

Rinsing agent for Dish Washer	
Components	100
linear fatty alcohol ethoxilate	15
cumene sulfonate	11,5
cytric acid	3
H2O	70,5

Table 5.52: Input data on SimaPro for Detergent for washing machine

Products			
Detergent powder WM	100	kg	Chemicals\Washing agents
Resources			
Materials/fuels			
Fatty alcohol sulfonate, mix, at plant/RER U	16	kg	
Soap, at plant/RER U	7	kg	
Zeolite, powder, at plant/RER U	22	kg	
Sodium silicate, spray powder 80%, at plant/RER U	4	kg	
Sodium percarbonate, powder, at plant/RER U	7	kg	
Sodium sulphate, powder, production mix, at plant/RER U	24	kg	
Sodium perborate, tetrahydrate, powder, at plant/RER U	20	kg	

Table 5.53: Input data on SimaPro for Softening for washing machine

Products			
Softening WM	100	kg	Chemicals\Washing agents
Avoided products			
Materials/fuels			
Fatty alcohol sulfonate, mix, at plant/RER U	15	kg	as cationic tensides
Fatty alcohol sulfonate, mix, at plant/RER U	5	kg	as isopropilic acid
Fatty acids, from vegetarian oil, at plant/RER U	4	kg	
Sodium perborate, monohydrate, powder, at plant/RER U	2	kg	as sodium citrate
Water demineralized ETH U	74	kg	

Table 5.54: Input data on SimaPro for Detergent for Dish washer

Products			
Detergent C - EN 50242 or IEC 60436 DW	100	kg	Chemicals\Washing agents
Resources			
Materials/fuels			
Sodium tripolyphosphate, at plant/RER U	55	kg	
Sodium perborate, monohydrate, powder, at plant/RER U	6	kg	sodium perborate monohydrate
EDTA, ethylenediaminetetraacetic acid, at plant/RER U	2	kg	Tetraacetyl ethylendiamine
Sodium silicate, spray powder 80%, at plant/RER U	5	kg	sodium disilicate
Ethoxylated alcohols, unspecified, at plant/RER U	2	kg	linear fatty alcohol ethoxylate (non ionic surfactant, low foaming)
Sodium percarbonate, powder, at plant/RER U	30	kg	sodium carbonate

Table 5.55: Input data on SimaPro for Rinsing agent for Dish washer

Products			
Rinsing agent DW	100	kg	Chemicals\Washing agents
Avoided products			
Resources			
Materials/fuels			
Ethoxylated alcohols, unspecified, at plant/RER U	15	kg	
Cumene, at plant/RER U	11,5	kg	
Acetic acid, 98% in H2O, at plant/RER U	3	kg	as citric acid (anhydrous)
Water, deionised, at plant/CH U	70,5	kg	H2O

5.8.4 Eco-indocator95 – rev. EuP v.2.03

The Eco-indicator 95 method was developed under the Dutch NOH programme by PRé consultants in a joint project with Philips Consumer Electronics, NedCar, Océ Copiers, Schuurink, CML Leiden, TU-Delft, IVAM-ER (Amsterdam) and CE Delft.

This V2 version is adapted for SimaPro 6.0. All characterisation factors in this method are entered for the 'unspecified' sub-compartment of each compartment (raw materials, air, water, soil) and thus applicable on all sub-compartments.

Other adaptations (V2.1):
- Solid waste expanded with all mass waste flows in SimaPro 6 database
- Energy expanded with energy resources in SimaPro 6 database
- Pesticides to water expanded with pesticides to water in SimaPro 6 database
- Carbon dioxide, biogenic and uptake from carbon dioxide from air (carbon dioxide, in air) are added to the methodology. Similar for 'Carbon monoxide, fossil' and 'carbon monoxide, biogenic'.

Other adaptations (August 2004):

- Energy expanded with energy resources in SimaPro not adapted in V2.1 (values taken from Cumulative energy demand V1.2 method)
- Greenhouse, Summer smog: Methane, biogenic and Methane, fossil added
- Euthrophication: phosphorus compounds completed.
- Acidification, Euthrophication: nitrogen compounds completed.
- Acidification: sulphur compounds completed.
- "Particulates, > 2,5 um, and < 10um" added with the assumption that the characterization factor is the same as for "Particulates, < 10 um"

Other adaptations (March 2005):
- Eutrophication: dinitrogen monoxide removed; nitrogen, to water added (equal to nitrogen, total, to water)
- Solid waste: waste, from drilling, unspecified added.

Other adaptations (August 2005, v.2.03):
- In impact category energy resources the characterisation value for "Gas, natural in ground" has been changed from 40,3 to 38,3 MJ LHV/m^3 following the ecoinvent 1.2 update.

This method is not fully adapted for inventory data from the ecoinvent library and the USA Input Output Database 98, and therefore omits emissions that could have been included in impact assessment.
The characterisation conforms to the CML guide used in the SimaPro2 method; however the toxicity scores are specified into heavy metals, carcinogenic substances, pesticides and winter smog.
Normalisation is based on 1990 levels for Europe excl. former USSR. In Europe 'g' missing data was extrapolated using GNP's (gross national product); 'e' missing data was extrapolated using energy use. The Europe 'e' normalisation is used in the Eco-indicator method.

Weighting is based on distance to target. Criteria for target levels are:
- One excess death per million per year
- 5% ecosystem degradation
- Avoidance of smog periods.

Due to continual adjustments of the method and/or inventory data sets the Eco-indicator 95 in SimaPro will not give the same result as the original printed version. See database manual for further information[22].

SimaPro 7.1	Method	Date:	08/08/2007	Period:	16.11.31
Project	EupProject				
Name	Eco-indicator 95 - rev EuP V2.03				
Comment	Revised by Laura Cutaia (29.07.07) to convert output in form of the software EuP Ecoreport				
Use Damage Assessment	No				
Use Normalization	Yes				
Use Weighting	Yes				
Use Addition	Yes				
Weighting	Pt				

[22] More information and the "Manual for Designers" can also be downloaded from http://www.pre.nl

unit					
Impact category	greenhouse	kg CO2			
Air	(unspecified)	Carbon dioxide	000124-38-9	1	kg CO2 / kg
Air	(unspecified)	Carbon dioxide, biogenic	000124-38-9	1	kg CO2 / kg
Air	(unspecified)	Carbon dioxide, fossil	000124-38-9	1	kg CO2 / kg
Air	(unspecified)	Carbon dioxide, in air	000124-38-9	-1	kg CO2 / kg
Air	(unspecified)	Carbon monoxide	000630-08-0	1,57	kg CO2 / kg
Air	(unspecified)	Carbon monoxide, biogenic	000630-08-0	1,57	kg CO2 / kg
Air	(unspecified)	Carbon monoxide, fossil	000630-08-0	1,57	kg CO2 / kg
Air	(unspecified)	Chlorinated fluorocarbons, hard		7100	kg CO2 / kg
Air	(unspecified)	Chlorinated fluorocarbons, soft		1600	kg CO2 / kg
Air	(unspecified)	Chloroform	000067-66-3	25	kg CO2 / kg
Air	(unspecified)	Dinitrogen monoxide	010024-97-2	296	kg CO2 / kg
Air	(unspecified)	Ethane, 1-chloro-1,1-difluoro-, HCFC-142	000075-68-3	1800	kg CO2 / kg
Air	(unspecified)	Ethane, 1,1-dichloro-1-fluoro-, HCFC-141b	001717-00-6	580	kg CO2 / kg
Air	(unspecified)	Ethane, 1,1-difluoro-, HFC-152a	000075-37-6	150	kg CO2 / kg
Air	(unspecified)	Ethane, 1,1,1-trichloro-, HCFC-140	000071-55-6	100	kg CO2 / kg
Air	(unspecified)	Ethane, 1,1,1-trifluoro-, HCFC-143a	000420-46-2	3800	kg CO2 / kg
Air	(unspecified)	Ethane, 1,1,1,2-tetrafluoro-, HFC-134a	000811-97-2	1300	kg CO2 / kg
Air	(unspecified)	Ethane, 1,1,2-trichloro-1,2,2-trifluoro-, CFC-113	000076-13-1	4500	kg CO2 / kg
Air	(unspecified)	Ethane, 1,2-dichloro-1,1,2,2-tetrafluoro-, CFC-114	000076-14-2	7000	kg CO2 / kg
Air	(unspecified)	Ethane, 2-chloro-1,1,1,2-tetrafluoro-, HCFC-124	002837-89-0	440	kg CO2 / kg
Air	(unspecified)	Ethane, 2,2-dichloro-1,1,1-trifluoro-, HCFC-123	000306-83-2	90	kg CO2 / kg
Air	(unspecified)	Ethane, chloropentafluoro-, CFC-115	000076-15-3	7000	kg CO2 / kg
Air	(unspecified)	Ethane, hexafluoro-, HFC-116	000076-16-4	9200	kg CO2 / kg
Air	(unspecified)	Ethane, pentafluoro-, HFC-125	000354-33-6	3400	kg CO2 / kg
Air	(unspecified)	Methane	000074-82-8	21	kg CO2 / kg
Air	(unspecified)	Methane, biogenic	000074-82-8	21	kg CO2 / kg
Air	(unspecified)	Methane, bromochlorodifluoro-, Halon 1211	000353-59-3	4900	kg CO2 / kg
Air	(unspecified)	Methane, bromotrifluoro-, Halon 1301	000075-63-8	4900	kg CO2 / kg
Air	(unspecified)	Methane, chlorodifluoro-, HCFC-22	000075-45-6	1600	kg CO2 / kg
Air	(unspecified)	Methane, chlorotrifluoro-, CFC-13	000075-72-9	13000	kg CO2 / kg
Air	(unspecified)	Methane, dichloro-, HCC-30	000075-09-2	15	kg CO2 / kg
Air	(unspecified)	Methane, dichlorodifluoro-, CFC-12	000075-71-8	7100	kg CO2 / kg
Air	(unspecified)	Methane, fossil	000074-82-8	11	kg CO2 / kg
Air	(unspecified)	Methane, tetrachloro-, CFC-10	000056-23-5	1300	kg CO2 / kg
Air	(unspecified)	Methane, tetrafluoro-, FC-14	000075-73-0	6500	kg CO2 / kg
Air	(unspecified)	Methane, trichlorofluoro-, CFC-11	000075-69-4	3400	kg CO2 / kg
Air					
Air	ozone layer	kg CFC11			
Air	(unspecified)	Chlorinated fluorocarbons, hard		1	kg CFC11 / kg
Air	(unspecified)	Chlorinated fluorocarbons, soft		0,055	kg CFC11 / kg
Air	(unspecified)	Ethane, 1-chloro-1,1-difluoro-, HCFC-142	000075-68-3	0,065	kg CFC11 / kg
Air	(unspecified)	Ethane, 1,1-dichloro-1-fluoro-, HCFC-141b	001717-00-6	0,11	kg CFC11 / kg
Air	(unspecified)	Ethane, 1,1,1-trichloro-, HCFC-140	000071-55-6	0,12	kg CFC11 / kg
Air	(unspecified)	Ethane, 1,1,1-trifluoro-2,2-chlorobromo-, Halon 2311	000151-67-7	0,14	kg CFC11 / kg
Air	(unspecified)	Ethane, 1,1,1,2-tetrafluoro-2-bromo-, Halon 2401	000124-72-1	0,25	kg CFC11 / kg
Air	(unspecified)	Ethane, 1,1,2-trichloro-1,2,2-trifluoro-, CFC-113	000076-13-1	1,07	kg CFC11 / kg
Air	(unspecified)	Ethane, 1,2-dibromotetrafluoro-, Halon 2402	000124-73-2	7	kg CFC11 / kg
Air	(unspecified)	Ethane, 1,2-dichloro-1,1,2,2-tetrafluoro-, CFC-114	000076-14-2	0,8	kg CFC11 / kg
Air	(unspecified)	Ethane, 2-chloro-1,1,1,2-tetrafluoro-, HCFC-124	002837-89-0	0,022	kg CFC11 / kg
Air	(unspecified)	Ethane, 2,2-dichloro-1,1,1-trifluoro-, HCFC-123	000306-83-2	0,02	kg CFC11 / kg
Air	(unspecified)	Ethane, chloropentafluoro-, CFC-115	000076-15-3	0,5	kg CFC11 / kg
Air	(unspecified)	Methane, bromo-, Halon 1001	000074-83-9	0,6	kg CFC11 / kg
Air	(unspecified)	Methane, bromochlorodifluoro-, Halon 1211	000353-59-3	4	kg CFC11 / kg
Air	(unspecified)	Methane, bromodifluoro-, Halon 1201	001511-62-2	1,4	kg CFC11 / kg
Air	(unspecified)	Methane, bromotrifluoro-, Halon 1301	000075-63-8	16	kg CFC11 / kg
Air	(unspecified)	Methane, chlorodifluoro-, HCFC-22	000075-45-6	0,055	kg CFC11 / kg
Air	(unspecified)	Methane, chlorotrifluoro-, CFC-13	000075-72-9	1	kg CFC11 / kg
Air	(unspecified)	Methane, dibromodifluoro-, Halon 1202	000075-61-6	1,25	kg CFC11 / kg
Air	(unspecified)	Methane, dichlorodifluoro-, CFC-12	000075-71-8	1	kg CFC11 / kg
Air	(unspecified)	Methane, tetrachloro-, CFC-10	000056-23-5	1,08	kg CFC11 / kg
Air	(unspecified)	Methane, trichlorofluoro-, CFC-11	000075-69-4	1	kg CFC11 / kg
Air	(unspecified)	Propane, 1,3-dichloro-1,1,2,2,3-pentafluoro-, HCFC-225cb	000507-55-1	0,033	kg CFC11 / kg
Air	(unspecified)	Propane, 3,3-dichloro-1,1,1,2,2-pentafluoro-, HCFC-	000422-56-0	0,025	kg CFC11 / kg

		225ca			
Impact category	acidification	kg SO2			
Air	(unspecified)	Ammonia	007664-41-7	1,88	kg SO2 / kg
Air	(unspecified)	Ammonium carbonate	000506-87-6	0,67	kg SO2 / kg
Air	(unspecified)	Ammonium nitrate	006484-52-2	0,4	kg SO2 / kg
Air	(unspecified)	Ammonium, ion	014798-03-9	1,78	kg SO2 / kg
Air	(unspecified)	Dinitrogen monoxide	010024-97-2	1,78	kg SO2 / kg
Air	(unspecified)	Hydrogen chloride	007647-01-0	0,88	kg SO2 / kg
Air	(unspecified)	Hydrogen fluoride	007664-39-3	1,6	kg SO2 / kg
Air	(unspecified)	Hydrogen sulfide	007783-06-4	1,88	kg SO2 / kg
Air	(unspecified)	Nitric acid	007697-37-2	0,51	kg SO2 / kg
Air	(unspecified)	Nitric oxide	010102-43-9	1,07	kg SO2 / kg
Air	(unspecified)	Nitrogen dioxide	010102-44-0	0,7	kg SO2 / kg
Air	(unspecified)	Nitrogen oxides	011104-93-1	0,7	kg SO2 / kg
Air	(unspecified)	Sulfur dioxide	007446-09-5	1	kg SO2 / kg
Air	(unspecified)	Sulfur oxides		1	kg SO2 / kg
Air	(unspecified)	Sulfur trioxide	007446-11-9	0,8	kg SO2 / kg
Air	(unspecified)	Sulfuric acid	007664-93-9	0,65	kg SO2 / kg
Impact category	eutrophication	kg PO4			
Ground	(unspecified)	Ammonia	007664-41-7	0,33	kg PO4 / kg
Water	(unspecified)	Ammonia	007664-41-7	0,33	kg PO4 / kg
Air	(unspecified)	Ammonia	007664-41-7	0,33	kg PO4 / kg
Air	(unspecified)	Ammonium carbonate	000506-87-6	0,12	kg PO4 / kg
Ground	(unspecified)	Ammonium nitrate	006484-52-2	0,074	kg PO4 / kg
Air	(unspecified)	Ammonium nitrate	006484-52-2	0,074	kg PO4 / kg
Water	(unspecified)	Ammonium, ion	014798-03-9	0,33	kg PO4 / kg
Ground	(unspecified)	Ammonium, ion	014798-03-9	0,33	kg PO4 / kg
Air	(unspecified)	Ammonium, ion	014798-03-9	0,33	kg PO4 / kg
Water	(unspecified)	BOD5, Biological Oxygen Demand		0,11	kg PO4 / kg
Water	(unspecified)	COD, Chemical Oxygen Demand		0,05	kg PO4 / kg
Water	(unspecified)	DOC, Dissolved Organic Carbon		0,066	kg PO4 / kg
Water	(unspecified)	Kjeldahl-N		0,42	kg PO4 / kg
Air	(unspecified)	Nitrate	014797-55-8	0,1	kg PO4 / kg
Ground	(unspecified)	Nitrate	014797-55-8	0,1	kg PO4 / kg
Water	(unspecified)	Nitrate	014797-55-8	0,1	kg PO4 / kg
Ground	(unspecified)	Nitric acid	007697-37-2	0,093	kg PO4 / kg
Water	(unspecified)	Nitric acid	007697-37-2	0,093	kg PO4 / kg
Air	(unspecified)	Nitric acid	007697-37-2	0,093	kg PO4 / kg
Air	(unspecified)	Nitric oxide	010102-43-9	0,2	kg PO4 / kg
Water	(unspecified)	Nitrite	014797-65-0	0,13	kg PO4 / kg
Air	(unspecified)	Nitrite	014797-65-0	0,13	kg PO4 / kg
Water	(unspecified)	Nitrogen	007727-37-9	0,42	kg PO4 / kg
Air	(unspecified)	Nitrogen dioxide	010102-44-0	0,13	kg PO4 / kg
Air	(unspecified)	Nitrogen oxides	011104-93-1	0,13	kg PO4 / kg
Ground	(unspecified)	Nitrogen oxides	011104-93-1	0,13	kg PO4 / kg
Water	(unspecified)	Nitrogen oxides	011104-93-1	0,13	kg PO4 / kg
Ground	(unspecified)	Nitrogen, total		0,42	kg PO4 / kg
Water	(unspecified)	Nitrogen, total		0,42	kg PO4 / kg
Air	(unspecified)	Nitrogen, total		0,42	kg PO4 / kg
Ground	(unspecified)	Phosphate	014265-44-2	1	kg PO4 / kg
Air	(unspecified)	Phosphate	014265-44-2	1	kg PO4 / kg
Water	(unspecified)	Phosphate	014265-44-2	1	kg PO4 / kg
Ground	(unspecified)	Phosphoric acid	007664-38-2	0,97	kg PO4 / kg
Air	(unspecified)	Phosphoric acid	007664-38-2	0,97	kg PO4 / kg
Water	(unspecified)	Phosphoric acid	007664-38-2	0,97	kg PO4 / kg
Water	(unspecified)	Phosphorus	007723-14-0	3,06	kg PO4 / kg
Ground	(unspecified)	Phosphorus	007723-14-0	3,06	kg PO4 / kg
Air	(unspecified)	Phosphorus	007723-14-0	3,06	kg PO4 / kg
Ground	(unspecified)	Phosphorus pentoxide	001314-56-3	1,34	kg PO4 / kg
Water	(unspecified)	Phosphorus pentoxide	001314-56-3	1,34	kg PO4 / kg
Air	(unspecified)	Phosphorus pentoxide	001314-56-3	1,34	kg PO4 / kg
Ground	(unspecified)	Phosphorus, total		3,06	kg PO4 / kg
Water	(unspecified)	Phosphorus, total		3,06	kg PO4 / kg
Air	(unspecified)	Phosphorus, total		3,06	kg PO4 / kg

Water	(unspecified)	Suspended solids, inorganic		0,08	kg PO4 / kg
Water	(unspecified)	Suspended solids, unspecified		0,08	kg PO4 / kg
Water	(unspecified)	TOC, Total Organic Carbon		0,066	kg PO4 / kg
Impact category	heavy metals	kg Pb			
Water	(unspecified)	Antimony	007440-36-0	2	kg Pb / kg
Water	(unspecified)	Arsenic, ion	017428-41-0	1	kg Pb / kg
Water	(unspecified)	Barium	007440-39-3	0,014	kg Pb / kg
Water	(unspecified)	Boron	007440-42-8	0,03	kg Pb / kg
Air	(unspecified)	Cadmium	007440-43-9	50	kg Pb / kg
Air	(unspecified)	Cadmium oxide	001306-19-0	50	kg Pb / kg
Water	(unspecified)	Cadmium, ion	022537-48-0	3	kg Pb / kg
Water	(unspecified)	Chromium	007440-47-3	0,2	kg Pb / kg
Water	(unspecified)	Copper, ion	017493-86-6	0,005	kg Pb / kg
Air	(unspecified)	Heavy metals, unspecified		1	kg Pb / kg
Water	(unspecified)	Lead	007439-92-1	1	kg Pb / kg
Air	(unspecified)	Lead	007439-92-1	1	kg Pb / kg
Water	(unspecified)	Manganese	007439-96-5	0,02	kg Pb / kg
Air	(unspecified)	Manganese	007439-96-5	1	kg Pb / kg
Water	(unspecified)	Mercury	007439-97-6	10	kg Pb / kg
Air	(unspecified)	Mercury	007439-97-6	1	kg Pb / kg
				0,0022	
Water	(unspecified)	Metallic ions, unspecified		23	kg Pb / kg
				0,0386	
Air	(unspecified)	Metals, unspecified		7	kg Pb / kg
Water	(unspecified)	Molybdenum	007439-98-7	0,14	kg Pb / kg
Water	(unspecified)	Nickel, ion	014701-22-5	0,5	kg Pb / kg
Impact category	carcinogens	kg B(a)P			
				0,0002	
Air	(unspecified)	Acrylonitrile	000107-13-1	2	kg B(a)P / kg
Air	(unspecified)	Arsenic	007440-38-2	0,044	kg B(a)P / kg
				0,0000	
Air	(unspecified)	Benzene	000071-43-2	44	kg B(a)P / kg
				0,0000	
Air	(unspecified)	Benzene, ethyl-	000100-41-4	44	kg B(a)P / kg
Air	(unspecified)	Benzo(a)pyrene	000050-32-8	1	kg B(a)P / kg
Air	(unspecified)	Chromium VI	018540-29-9	0,44	kg B(a)P / kg
				0,0000	
Air	(unspecified)	Ethene, chloro-	000075-01-4	11	kg B(a)P / kg
Air	(unspecified)	Fluoranthene	000206-44-0	1	kg B(a)P / kg
				0,0000	
Air	(unspecified)	Hydrocarbons, aromatic		44	kg B(a)P / kg
				0,0001	
Air	(unspecified)	Metals, unspecified		79	kg B(a)P / kg
Air	(unspecified)	Nickel	007440-02-0	0,0044	kg B(a)P / kg
Air	(unspecified)	PAH, polycyclic aromatic hydrocarbons	130498-29-2	0,4792	kg B(a)P / kg
				0,0000	
Air	(unspecified)	Tar	008007-45-2	44	kg B(a)P / kg
Impact category	winter smog - P.M.	kg SPM			
Air	(unspecified)	Carbon black	001333-86-4	1	kg SPM / kg
Air	(unspecified)	Iron dust		1	kg SPM / kg
Air	(unspecified)	Particulates, < 10 um		1	kg SPM / kg
Air	(unspecified)	Particulates, < 10 um (mobile)		1	kg SPM / kg
Air	(unspecified)	Particulates, < 10 um (stationary)		1	kg SPM / kg
Air	(unspecified)	Particulates, < 2.5 um		1	kg SPM / kg
Air	(unspecified)	Particulates, > 2.5 um, and < 10um		1	kg SPM / kg
Air	(unspecified)	Particulates, diesel soot		1	kg SPM / kg
Air	(unspecified)	Particulates, SPM		1	kg SPM / kg
Air	(unspecified)	Soot		1	kg SPM / kg
Air	(unspecified)	Sulfur dioxide	007446-09-5	1	kg SPM / kg
Air	(unspecified)	Sulfur oxides		1	kg SPM / kg
Impact	summer smog	kg C2H4			

category	- VOCs				
Air	(unspecified)	2-Propanol	000067-63-0	0,196	kg C2H4 / kg
Air	(unspecified)	Acetaldehyde	000075-07-0	0,527	kg C2H4 / kg
Air	(unspecified)	Acetone	000067-64-1	0,178	kg C2H4 / kg
Air	(unspecified)	Acetonitrile	000075-05-8	0,416	kg C2H4 / kg
Air	(unspecified)	Acrolein	000107-02-8	0,603	kg C2H4 / kg
Air	(unspecified)	Acrylonitrile	000107-13-1	0,416	kg C2H4 / kg
Air	(unspecified)	Alcohols, unspecified		0,196	kg C2H4 / kg
Air	(unspecified)	Aldehydes, unspecified		0,443	kg C2H4 / kg
Air	(unspecified)	Benzaldehyde	000100-52-7	0,334	kg C2H4 / kg
Air	(unspecified)	Benzene	000071-43-2	0,189	kg C2H4 / kg
Air	(unspecified)	Benzene, ethyl-	000100-41-4	0,593	kg C2H4 / kg
Air	(unspecified)	Benzo(a)pyrene	000050-32-8	0,761	kg C2H4 / kg
Air	(unspecified)	Biphenyl	000092-52-4	0,761	kg C2H4 / kg
Air	(unspecified)	Biphenyl, hexachloro-	026601-64-9	0,761	kg C2H4 / kg
Air	(unspecified)	Butane	000106-97-8	0,41	kg C2H4 / kg
Air	(unspecified)	Butene	025167-67-3	0,992	kg C2H4 / kg
Air	(unspecified)	Caprolactam	000105-60-2	0,761	kg C2H4 / kg
Air	(unspecified)	Chloroform	000067-66-3	0,021	kg C2H4 / kg
Air	(unspecified)	Crude oil		0,398	kg C2H4 / kg
Air	(unspecified)	Diethyl ether	000060-29-7	0,398	kg C2H4 / kg
Air	(unspecified)	Ethane	000074-84-0	0,082	kg C2H4 / kg
Air	(unspecified)	Ethane, 1,1,1-trichloro-, HCFC-140	000071-55-6	0,021	kg C2H4 / kg
Air	(unspecified)	Ethane, 1,2-dichloro-	000107-06-2	0,021	kg C2H4 / kg
Air	(unspecified)	Ethanol	000064-17-5	0,268	kg C2H4 / kg
Air	(unspecified)	Ethene	000074-85-1	1	kg C2H4 / kg
Air	(unspecified)	Ethene, chloro-	000075-01-4	0,021	kg C2H4 / kg
Air	(unspecified)	Ethene, tetrachloro-	000127-18-4	0,005	kg C2H4 / kg
Air	(unspecified)	Ethene, trichloro-	000079-01-6	0,021	kg C2H4 / kg
Air	(unspecified)	Ethylene glycol	000107-21-1	0,196	kg C2H4 / kg
Air	(unspecified)	Ethylene oxide	000075-21-8	0,377	kg C2H4 / kg
Air	(unspecified)	Ethyne	000074-86-2	0,168	kg C2H4 / kg
Air	(unspecified)	Formaldehyde	000050-00-0	0,421	kg C2H4 / kg
Air	(unspecified)	Heptane	000142-82-5	0,529	kg C2H4 / kg
Air	(unspecified)	Hexane	000110-54-3	0,421	kg C2H4 / kg
Air	(unspecified)	Hydrocarbons, aliphatic, alkanes, cyclic		0,398	kg C2H4 / kg
Air	(unspecified)	Hydrocarbons, aliphatic, alkanes, unspecified		0,398	kg C2H4 / kg
Air	(unspecified)	Hydrocarbons, aliphatic, alkenes, unspecified		0,906	kg C2H4 / kg
Air	(unspecified)	Hydrocarbons, aliphatic, unsaturated		0,398	kg C2H4 / kg
Air	(unspecified)	Hydrocarbons, aromatic		0,761	kg C2H4 / kg
Air	(unspecified)	Hydrocarbons, chlorinated		0,021	kg C2H4 / kg
Air	(unspecified)	Hydrocarbons, halogenated		0,021	kg C2H4 / kg
Air	(unspecified)	Hydrocarbons, unspecified		0,398	kg C2H4 / kg
Air	(unspecified)	Hydroxy compounds, unspecified		0,377	kg C2H4 / kg
Air	(unspecified)	Kerosene	064742-81-0	0,398	kg C2H4 / kg
Air	(unspecified)	Ketones, unspecified		0,326	kg C2H4 / kg
Air	(unspecified)	Methane	000074-82-8	0,007	kg C2H4 / kg
Air	(unspecified)	Methane, biogenic	000074-82-8	0,007	kg C2H4 / kg
Air	(unspecified)	Methane, dichloro-, HCC-30	000075-09-2	0,021	kg C2H4 / kg
Air	(unspecified)	Methane, fossil	000074-82-8	0,007	kg C2H4 / kg
Air	(unspecified)	Methane, tetrachloro-, CFC-10	000056-23-5	0,021	kg C2H4 / kg
Air	(unspecified)	Methanol	000067-56-1	0,123	kg C2H4 / kg
Air	(unspecified)	Methyl ethyl ketone	000078-93-3	0,473	kg C2H4 / kg
Air	(unspecified)	Methyl mercaptan	000074-93-1	0,377	kg C2H4 / kg
Air	(unspecified)	Naphthalene	000091-20-3	0,761	kg C2H4 / kg
Air	(unspecified)	NMVOC, non-methane volatile organic compounds, unspecified origin		0,416 0,0493	kg C2H4 / kg
Air	(unspecified)	PAH, polycyclic aromatic hydrocarbons	130498-29-2	2	kg C2H4 / kg
Air	(unspecified)	Pentane	000109-66-0	0,408	kg C2H4 / kg
Air	(unspecified)	Petrol	008006-61-9	0,398	kg C2H4 / kg
Air	(unspecified)	Phenol	000108-95-2	0,761	kg C2H4 / kg
Air	(unspecified)	Phenol, chloro-	025167-80-0	0,021	kg C2H4 / kg
Air	(unspecified)	Phenol, pentachloro-	000087-86-5	0,021	kg C2H4 / kg
Air	(unspecified)	Phthalic anhydride	000085-44-9	0,761	kg C2H4 / kg
Air	(unspecified)	Propane	000074-98-6	0,42	kg C2H4 / kg
Air	(unspecified)	Propene	000115-07-1	1,03	kg C2H4 / kg
Air	(unspecified)	Propionic acid	000079-09-4	0,377	kg C2H4 / kg

Air	(unspecified)	Styrene	000100-42-5	0,761	kg C2H4 / kg
Air	(unspecified)	Tar	008007-45-2	0,416	kg C2H4 / kg
Air	(unspecified)	Terpentine		0,377	kg C2H4 / kg
Air	(unspecified)	Toluene	000108-88-3	0,563	kg C2H4 / kg
Air	(unspecified)	Vinyl acetate	000108-05-4	0,223	kg C2H4 / kg
Air	(unspecified)	VOC, volatile organic compounds		0,398	kg C2H4 / kg
Impact category	pesticides	kg act.subst			
Water	(unspecified)	2,4-D	000094-75-7	1	kg act.subst/kg
Water	(unspecified)	2,4,5-T	000093-76-5	1	kg act.subst / kg
Water	(unspecified)	Acephate	030560-19-1	1	kg act.subst / kg
Water	(unspecified)	Aldicarb	000116-06-3	1	kg act.subst / kg
Water	(unspecified)	Aldrin	000309-00-2	1	kg act.subst / kg
Water	(unspecified)	Anilazine	000101-05-3	1	kg act.subst / kg
Water	(unspecified)	Atrazine	001912-24-9	1	kg act.subst / kg
Water	(unspecified)	Azinphos-ethyl	002642-71-9	1	kg act.subst / kg
Water	(unspecified)	Azinphos-methyl	000086-50-0	1	kg act.subst / kg
Water	(unspecified)	Benomyl	017804-35-2	1	kg act.subst / kg
Water	(unspecified)	Bentazone	025057-89-0	1	kg act.subst / kg
Water	(unspecified)	Bifenthrin	082657-04-3	1	kg act.subst / kg
Water	(unspecified)	Bis(2-chloroethyl)ether	000111-44-4	1	kg act.subst / kg
Water	(unspecified)	Bis(chloromethyl)ether	000542-88-1	1	kg act.subst / kg
Water	(unspecified)	Captafol	002939-80-2	1	kg act.subst / kg
Water	(unspecified)	Captan	000133-06-2	1	kg act.subst / kg
Water	(unspecified)	Carbaryl	000063-25-2	1	kg act.subst / kg
Water	(unspecified)	Carbendazim	010605-21-7	1	kg act.subst / kg
Water	(unspecified)	Carbofuran	001563-66-2	1	kg act.subst / kg
Water	(unspecified)	Chlordane	012789-03-6	1	kg act.subst / kg
Water	(unspecified)	Chlorfenvinphos	000470-90-6	1	kg act.subst / kg
Water	(unspecified)	Chloridazon	001698-60-8	1	kg act.subst / kg
Water	(unspecified)	Chlorothalonil	001897-45-6	1	kg act.subst / kg
Water	(unspecified)	Chlorpropham	000101-21-3	1	kg act.subst / kg
Water	(unspecified)	Chlorpyrifos	002921-88-2	1	kg act.subst / kg
Water	(unspecified)	Coumafos	000056-72-4	1	kg act.subst / kg
Water	(unspecified)	Cyanazine	021725-46-2	1	kg act.subst / kg
Water	(unspecified)	Cypermethrin	052315-07-8	1	kg act.subst / kg
Water	(unspecified)	Cyromazine	066215-27-8	1	kg act.subst / kg
Water	(unspecified)	DDT	000050-29-3	1	kg act.subst / kg
Water	(unspecified)	Deltamethrin	052918-63-5	1	kg act.subst / kg
Water	(unspecified)	Demeton	008065-48-3	1	kg act.subst / kg
Water	(unspecified)	Desmetryn	001014-69-3	1	kg act.subst / kg
Water	(unspecified)	Diazinon	000333-41-5	1	kg act.subst / kg
Water	(unspecified)	Dichlorprop	000120-36-5	1	kg act.subst / kg
Water	(unspecified)	Dichlorvos	000062-73-7	1	kg act.subst / kg
Water	(unspecified)	Dieldrin	000060-57-1	1	kg act.subst / kg
Water	(unspecified)	Dimethoate	000060-51-5	1	kg act.subst / kg
Water	(unspecified)	Dinoseb	000088-85-7	1	kg act.subst / kg
Water	(unspecified)	Dinoterb	001420-07-1	1	kg act.subst / kg
Water	(unspecified)	Diquat dibromide	000085-00-7	1	kg act.subst / kg
Water	(unspecified)	Disinfectants, unspecified		1	kg act.subst / kg
Water	(unspecified)	Disulfothon	000298-04-4	1	kg act.subst / kg
Water	(unspecified)	Diuron	000330-54-1	1	kg act.subst / kg
Water	(unspecified)	DNOC	000534-52-1	1	kg act.subst / kg
Water	(unspecified)	Endosulfan	000115-29-7	1	kg act.subst / kg
Water	(unspecified)	Endrin	000072-20-8	1	kg act.subst / kg
Water	(unspecified)	Ethoprop	013194-48-4	1	kg act.subst / kg
Water	(unspecified)	Fenitrothion	000122-14-5	1	kg act.subst / kg
Water	(unspecified)	Fenthion	000055-38-9	1	kg act.subst / kg
Water	(unspecified)	Fentin acetate	000900-95-8	1	kg act.subst / kg
Water	(unspecified)	Fentin chloride	000639-58-7	1	kg act.subst / kg
Water	(unspecified)	Fentin hydroxide	000076-87-9	1	kg act.subst / kg
Water	(unspecified)	Folpet	000133-07-3	1	kg act.subst / kg
Water	(unspecified)	Fungicides, unspecified		1	kg act.subst / kg
Water	(unspecified)	Glyphosate	001071-83-6	1	kg act.subst / kg
Water	(unspecified)	Heptachlor	000076-44-8	1	kg act.subst / kg
Water	(unspecified)	Heptenophos	023560-59-0	1	kg act.subst / kg
Water	(unspecified)	Herbicides, unspecified		1	kg act.subst / kg

Water	(unspecified)	Insecticides, unspecified		1	kg act.subst / kg
Water	(unspecified)	Iprodione	036734-19-7	1	kg act.subst / kg
Water	(unspecified)	Isoproturon	034123-59-6	1	kg act.subst / kg
Water	(unspecified)	Lindane	000058-89-9	1	kg act.subst / kg
Water	(unspecified)	Lindane, alpha-	000319-84-6	1	kg act.subst / kg
Water	(unspecified)	Lindane, beta-	000319-85-7	1	kg act.subst / kg
Water	(unspecified)	Linuron	000330-55-2	1	kg act.subst / kg
Water	(unspecified)	Malathion	000121-75-5	1	kg act.subst / kg
Water	(unspecified)	Maneb	012427-38-2	1	kg act.subst / kg
Water	(unspecified)	MCPA	000094-74-6	1	kg act.subst / kg
Water	(unspecified)	Mecoprop	000093-65-2	1	kg act.subst / kg
Water	(unspecified)	Metamitron	041394-05-2	1	kg act.subst / kg
Water	(unspecified)	Metazachlor	067129-08-2	1	kg act.subst / kg
Water	(unspecified)	Methabenzthiazuron	018691-97-9	1	kg act.subst / kg
Water	(unspecified)	Methomyl	016752-77-5	1	kg act.subst / kg
Water	(unspecified)	Metobromuron	003060-89-7	1	kg act.subst / kg
Water	(unspecified)	Metolachlor	051218-45-2	1	kg act.subst / kg
Water	(unspecified)	Metribuzin	021087-64-9	1	kg act.subst / kg
Water	(unspecified)	Mevinfos	007786-34-7	1	kg act.subst / kg
Water	(unspecified)	Monolinuron	001746-81-2	1	kg act.subst / kg
Water	(unspecified)	Oxamyl	023135-22-0	1	kg act.subst / kg
Water	(unspecified)	Oxydemethon methyl	000301-12-2	1	kg act.subst / kg
Water	(unspecified)	Parathion	000056-38-2	1	kg act.subst / kg
Water	(unspecified)	Parathion, methyl	000298-00-0	1	kg act.subst / kg
Water	(unspecified)	Permethrin	052645-53-1	1	kg act.subst / kg
Water	(unspecified)	Pesticides, unspecified		1	kg act.subst / kg
Water	(unspecified)	Phoxim	014816-18-3	1	kg act.subst / kg
Water	(unspecified)	Pirimicarb	023103-98-2	1	kg act.subst / kg
Water	(unspecified)	Propachlor	001918-16-7	1	kg act.subst / kg
Water	(unspecified)	Propoxur	000114-26-1	1	kg act.subst / kg
Water	(unspecified)	Pyrazophos	013457-18-6	1	kg act.subst / kg
Water	(unspecified)	Simazine	000122-34-9	1	kg act.subst / kg
Water	(unspecified)	Thiram	000137-26-8	1	kg act.subst / kg
Water	(unspecified)	Tolclophos-methyl	057018-04-9	1	kg act.subst / kg
Water	(unspecified)	Triallate	002303-17-5	1	kg act.subst / kg
Water	(unspecified)	Triazofos	024017-47-8	1	kg act.subst / kg
Water	(unspecified)	Trichlorfon	000052-68-6	1	kg act.subst / kg
Water	(unspecified)	Trifluralin	001582-09-8	1	kg act.subst / kg
Water	(unspecified)	Zineb	012122-67-7	1	kg act.subst / kg
Impact category	energy resources	MJ LHV			
Prima	(unspecified)	Biomass, feedstock		1	MJ LHV / MJ
Prima	(unspecified)	Coal, 18 MJ per kg, in ground		18	MJ LHV / kg
Prima	(unspecified)	Coal, 26.4 MJ per kg, in ground		26,4	MJ LHV / kg
Prima	(unspecified)	Coal, 29.3 MJ per kg, in ground		29,3	MJ LHV / kg
Prima	(unspecified)	Coal, brown, 10 MJ per kg, in ground		10	MJ LHV / kg
Prima	(unspecified)	Coal, brown, 8 MJ per kg, in ground		8	MJ LHV / kg
Prima	(unspecified)	Coal, brown, in ground		10	MJ LHV / kg
Prima	(unspecified)	Coal, feedstock, 26.4 MJ per kg, in ground		26,4	MJ LHV / kg
Prima	(unspecified)	Coal, hard, unspecified, in ground		19,1	MJ LHV / kg
Prima	(unspecified)	Energy, from biomass		1	MJ LHV / MJ
Prima	(unspecified)	Energy, from coal		1	MJ LHV / MJ
Prima	(unspecified)	Energy, from coal, brown		1	MJ LHV / MJ
Prima	(unspecified)	Energy, from gas, natural		1	MJ LHV / MJ
Prima	(unspecified)	Energy, from hydro power		1	MJ LHV / MJ
Prima	(unspecified)	Energy, from hydrogen		1	MJ LHV / MJ
Prima	(unspecified)	Energy, from oil		1	MJ LHV / MJ
Prima	(unspecified)	Energy, from peat		1	MJ LHV / MJ
Prima	(unspecified)	Energy, from sulfur		1	MJ LHV / MJ
Prima	(unspecified)	Energy, from uranium		1	MJ LHV / MJ
Prima	(unspecified)	Energy, from wood		1	MJ LHV / MJ
Prima	(unspecified)	Energy, geothermal		1	MJ LHV / MJ
Prima	(unspecified)	Energy, gross calorific value, in biomass		1	MJ LHV / MJ
Prima	(unspecified)	Energy, kinetic, flow, in wind		1	MJ LHV / MJ
Prima	(unspecified)	Energy, potential, stock, in barrage water		1	MJ LHV / MJ
Prima	(unspecified)	Energy, recovered		1	MJ LHV / MJ
Prima	(unspecified)	Energy, solar		1	MJ LHV / MJ

Prima	(unspecified)	Energy, unspecified		1	MJ LHV / MJ
Prima	(unspecified)	Gas, mine, off-gas, process, coal mining/kg	008006-14-2	49,8	MJ LHV / kg
Prima	(unspecified)	Gas, mine, off-gas, process, coal mining/m3	008006-14-2	39,8	MJ LHV / m3
Prima	(unspecified)	Gas, natural, 30.3 MJ per kg, in ground	008006-14-2	30,3	MJ LHV / kg
Prima	(unspecified)	Gas, natural, 35 MJ per m3, in ground	008006-14-2	35	MJ LHV / m3
Prima	(unspecified)	Gas, natural, 36.6 MJ per m3, in ground	008006-14-2	36,6	MJ LHV / m3
Prima	(unspecified)	Gas, natural, 46.8 MJ per kg, in ground	008006-14-2	46,8	MJ LHV / kg
Prima	(unspecified)	Gas, natural, feedstock, 35 MJ per m3, in ground	008006-14-2	35	MJ LHV / m3
Prima	(unspecified)	Gas, natural, feedstock, 46.8 MJ per kg, in ground	008006-14-2	46,8	MJ LHV / kg
Prima	(unspecified)	Gas, natural, in ground	008006-14-2	38,3	MJ LHV / m3
Prima	(unspecified)	Gas, off-gas, oil production, in ground	008006-14-2	40,9	MJ LHV / m3
Prima	(unspecified)	Gas, petroleum, 35 MJ per m3, in ground		35	MJ LHV / m3
Prima	(unspecified)	Methane	000074-82-8	35,9	MJ LHV / kg
Prima	(unspecified)	Oil, crude, 38400 MJ per m3, in ground		38400	MJ LHV / m3
Prima	(unspecified)	Oil, crude, 41 MJ per kg, in ground		41	MJ LHV / kg
Prima	(unspecified)	Oil, crude, 42 MJ per kg, in ground		42	MJ LHV / kg
Prima	(unspecified)	Oil, crude, 42.6 MJ per kg, in ground		42,6	MJ LHV / kg
Prima	(unspecified)	Oil, crude, 42.7 MJ per kg, in ground		42,7	MJ LHV / kg
Prima	(unspecified)	Oil, crude, feedstock, 41 MJ per kg, in ground		41	MJ LHV / kg
Prima	(unspecified)	Oil, crude, feedstock, 42 MJ per kg, in ground		42	MJ LHV / kg
Prima	(unspecified)	Oil, crude, in ground		45,8	MJ LHV / kg
Prima	(unspecified)	Peat, in ground		13	MJ LHV / kg
Prima	(unspecified)	Steam from waste incineration		1	MJ LHV / MJ
Prima	(unspecified)	Uranium ore, 1.11 GJ per kg, in ground		1110	MJ LHV / kg
				229100	
Prima	(unspecified)	Uranium, 2291 GJ per kg, in ground	007440-61-1	0	MJ LHV / kg
Prima	(unspecified)	Uranium, 451 GJ per kg, in ground	007440-61-1	451000	MJ LHV / kg
Prima	(unspecified)	Uranium, 560 GJ per kg, in ground	007440-61-1	560000	MJ LHV / kg
Prima	(unspecified)	Uranium, in ground	007440-61-1	560000	MJ LHV / kg
Prima	(unspecified)	Water, barrage		0,01	MJ LHV / kg
Prima	(unspecified)	Wood and wood waste, 9.5 MJ per kg		9,5	MJ LHV / kg
Prima	(unspecified)	Wood, feedstock		15,3	MJ LHV / kg
Prima	(unspecified)	Wood, unspecified, standing/kg		15,3	MJ LHV / kg
Impact category	solid waste	kg			
Waste	(unspecified)	Aluminium waste		1	kg / kg
Waste	(unspecified)	Asbestos		1	kg / kg
Waste	(unspecified)	Asphalt waste		1	kg / kg
Waste	(unspecified)	Bilge oil		1	kg / kg
Waste	(unspecified)	Bitumen waste		1	kg / kg
Waste	(unspecified)	Bulk waste, unspecified		1	kg / kg
Waste	(unspecified)	Calcium fluoride waste		1	kg / kg
Waste	(unspecified)	Cardboard waste		1	kg / kg
Waste	(unspecified)	Carton waste		1	kg / kg
Waste	(unspecified)	Catalyst waste		1	kg / kg
Waste	(unspecified)	Cathode iron ingots waste		1	kg / kg
Waste	(unspecified)	Cathode loss		1	kg / kg
Waste	(unspecified)	Chemical waste, inert		1	kg / kg
Waste	(unspecified)	Chemical waste, regulated		1	kg / kg
Waste	(unspecified)	Chemical waste, unspecified		1	kg / kg
Waste	(unspecified)	Chromium waste		1	kg / kg
Waste	(unspecified)	Coal ash		1	kg / kg
Waste	(unspecified)	Coal tailings		1	kg / kg
Waste	(unspecified)	Construction waste		1	kg / kg
Waste	(unspecified)	Copper absorbent waste		1	kg / kg
Waste	(unspecified)	Copper waste		1	kg / kg
Waste	(unspecified)	Dross		1	kg / kg
Waste	(unspecified)	Dross for recycling		1	kg / kg
Waste	(unspecified)	Dust, break-out		1	kg / kg
Waste	(unspecified)	Dust, unspecified		1	kg / kg
Waste	(unspecified)	E-saving bulb plastic waste		1	kg / kg
Waste	(unspecified)	E-saving bulb waste		1	kg / kg
Waste	(unspecified)	Electronic waste		1	kg / kg
Waste	(unspecified)	Electrostatic filter dust		1	kg / kg
Waste	(unspecified)	Fluoride waste		1	kg / kg
Waste	(unspecified)	Fly ash		1	kg / kg
Waste	(unspecified)	Gas pipe waste		1	kg / kg

Waste	(unspecified)	Glass waste		1	kg / kg
Waste	(unspecified)	Ion exchanger sludge		1	kg / kg
Waste	(unspecified)	Iron waste		1	kg / kg
Waste	(unspecified)	Light bulb waste		1	kg / kg
Waste	(unspecified)	Limestone waste		1	kg / kg
Waste	(unspecified)	Metal waste		1	kg / kg
Waste	(unspecified)	Mineral waste		1	kg / kg
Waste	(unspecified)	Mineral waste, from mining		1	kg / kg
Waste	(unspecified)	Mineral wool waste		1	kg / kg
Waste	(unspecified)	Oil separator sludge		1	kg / kg
Waste	(unspecified)	Oil waste		1	kg / kg
Waste	(unspecified)	Packaging waste, paper and board		1	kg / kg
Waste	(unspecified)	Packaging waste, plastic		1	kg / kg
Waste	(unspecified)	Packaging waste, steel		1	kg / kg
Waste	(unspecified)	Packaging waste, unspecified		1	kg / kg
Waste	(unspecified)	Packaging waste, wood		1	kg / kg
Waste	(unspecified)	Paint waste		1	kg / kg
Waste	(unspecified)	Photovoltaic cell waste		1	kg / kg
Waste	(unspecified)	Photovoltaic panel waste		1	kg / kg
Waste	(unspecified)	Photovoltaic production waste		1	kg / kg
Waste	(unspecified)	Photovoltaic/EVA cell waste		1	kg / kg
Waste	(unspecified)	Plastic waste		1	kg / kg
Waste	(unspecified)	Polyethylene waste		1	kg / kg
Waste	(unspecified)	Polystyrene waste		1	kg / kg
Waste	(unspecified)	Polyvinyl chloride waste		1	kg / kg
Waste	(unspecified)	Printed circuitboards waste		1	kg / kg
Waste	(unspecified)	Process waste		1	kg / kg
Waste	(unspecified)	Production waste		1	kg / kg
Waste	(unspecified)	Production waste, not inert		1	kg / kg
Waste	(unspecified)	Propylene glycol waste		1	kg / kg
Waste	(unspecified)	Refinery sludge		1	kg / kg
Waste	(unspecified)	Rejects		1	kg / kg
Waste	(unspecified)	Rejects, corrugated cardboard		1	kg / kg
Waste	(unspecified)	Residues		1	kg / kg
Waste	(unspecified)	Slags		1	kg / kg
Waste	(unspecified)	Slags and ashes		1	kg / kg
Waste	(unspecified)	Sludge		1	kg / kg
Waste	(unspecified)	Soot		1	kg / kg
Waste	(unspecified)	Steel waste		1	kg / kg
Waste	(unspecified)	Stones and rubble		1	kg / kg
Waste	(unspecified)	Tin waste		1	kg / kg
Waste	(unspecified)	Tinder from rolling drum		1	kg / kg
Waste	(unspecified)	Waste in bioactive landfill		1	kg / kg
Waste	(unspecified)	Waste in incineration		1	kg / kg
Waste	(unspecified)	Waste in inert landfill		1	kg / kg
Waste	(unspecified)	Waste to recycling		1	kg / kg
Waste	(unspecified)	Waste, final, inert		1	kg / kg
Waste	(unspecified)	Waste, from drilling, unspecified		1	kg / kg
Waste	(unspecified)	Waste, from incinerator		1	kg / kg
Waste	(unspecified)	Waste, industrial		1	kg / kg
Waste	(unspecified)	Waste, inorganic		1	kg / kg
Waste	(unspecified)	Waste, nuclear, unspecified/kg		1	kg / kg
Waste	(unspecified)	Waste, solid		1	kg / kg
Waste	(unspecified)	Waste, toxic		1	kg / kg
Waste	(unspecified)	Waste, unspecified		1	kg / kg
Waste	(unspecified)	Welding dust		1	kg / kg
Waste	(unspecified)	Wood ashes		1	kg / kg
Waste	(unspecified)	Wood waste		1	kg / kg
Waste	(unspecified)	Wood, sawdust		1	kg / kg
Waste	(unspecified)	Zeolite waste		1	kg / kg
Waste	(unspecified)	Zinc waste		1	kg / kg
Impact category	Heavy metals (air)	kg Ni eq			
Air	(unspecified)	Arsenic	007440-38-2	3,33	kg Ni eq / kg
Air	(unspecified)	Cadmium	007440-43-9	5	kg Ni eq / kg
Air	(unspecified)	Chromium	007440-47-3	0,5	kg Ni eq / kg
Air	(unspecified)	Chromium-51	014392-02-0	0,5	kg Ni eq / kBq

Air	(unspecified)	Chromium VI	018540-29-9	0,5	kg Ni eq / kg
Air	(unspecified)	Copper	007440-50-8	0,5	kg Ni eq / kg
Air	(unspecified)	Lead	007439-92-1	0,04	kg Ni eq / kg
Air	(unspecified)	Mercury	007439-97-6	5	kg Ni eq / kg
Air	(unspecified)	Nickel	007440-02-0	1	kg Ni eq / kg
Air	(unspecified)	Zinc	007440-66-6	0,04	kg Ni eq / kg
Impact category	PAHs (air)	kg PAH/20 eq			
				0,0000	
Air	(unspecified)	Carbon monoxide	000630-08-0	02	kg PAH/20eq/ kg
Air	(unspecified)	Hydrocarbons, aromatic, naphthalenes, C13, trisubstituted		20	kg PAH/20eq/ kg
Air	(unspecified)	Hydrocarbons, aromatic, styrenes, C10		20	kg PAH/20eq/ kg
Air	(unspecified)	Hydrocarbons, aromatic, styrenes, C9		20	kg PAH/20eq/ kg
Air	(unspecified)	Polycyclic organic matter, as 15-PAH		20	kg PAH/20eq/ kg
Air	(unspecified)	Polycyclic organic matter, as 7-PAH		20	kg PAH/20eq/ kg
Air	(unspecified)	Polycyclic organic matter, unspecified		20	kg PAH/20eq/ kg
Impact category	Heavy metals (water)	kg Hg/20 eq			
Water	(unspecified)	Arsenic, ion	017428-41-0	3	kg Hg/20 eq / kg
Water	(unspecified)	Cadmium, ion	022537-48-0	7	kg Hg/20 eq / kg
Water	(unspecified)	Chromium	007440-47-3	0,4	kg Hg/20 eq / kg
Water	(unspecified)	Copper, ion	017493-86-6	2,8	kg Hg/20 eq / kg
Water	(unspecified)	Lead	007439-92-1	0,5	kg Hg/20 eq / kg
Water	(unspecified)	Mercury	007439-97-6	20	kg Hg/20 eq / kg
Water	(unspecified)	Nickel	007440-02-0	7	kg Hg/20 eq / kg
Water	(unspecified)	Zinc	007440-66-6	0,2	kg Hg/20 eq / kg
Water	(unspecified)	Zinc, ion	023713-49-7	0,2	kg Hg/20 eq / kg
Impact category	POP (air)	kg TE eq			
Air	(unspecified)	Dioxin, 1,2,3,7,8,9-hexachlorodibenzo-	019408-74-3	0,1	kg TE eq / kg
Air	(unspecified)	Dioxins, measured as 2,3,7,8-tetrachlorodibenzo-p-dioxin		1	kg TE eq / kg
Air	(unspecified)	Furan	000110-00-9	0,1	kg TE eq / kg
Impact category	POP (water)	kg TE eq			
Water	(unspecified)	Dioxin, 1,2,3,7,8,9-hexachlorodibenzo-	019408-74-3	0,1	kg TE eq / kg
Water	(unspecified)	Dioxins, measured as 2,3,7,8-tetrachlorodibenzo-p-dioxin		1	kg TE eq / kg
Water	(unspecified)	Furan	000110-00-9	0,1	kg TE eq / kg
Normalisation-Weighting set	Europe g				
Normalisation					
greenhouse	7,42E-05				
ozone layer	1,24				
acidification	0,00888				
eutrophication	0,0262				
heavy metals	17,8				
carcinogens	106				
winter smog - P.M.	0,0106				
summer smog - VOCs	0,0507				
pesticides	1,21				
energy resources	6,29E-06				
solid waste	0				
Heavy metals (air)	0				
PAHs (air)	0				
Heavy metals (water)	0				

POP (air)	0				
POP (water)	0				
Pesa					
greenhouse	2,5				
ozone layer	100				
acidification	10				
eutrophicatio n	5				
heavy metals	5				
carcinogens	10				
winter smog - P.M.	5				
summer smog - VOCs	2,5				
pesticides	25				
energy resources	0				
solid waste	0				
Heavy metals (air)	0				
PAHs (air)	0				
Heavy metals (water)	0				
POP (air)	0				
POP (water)	0				
Normalisatio n-Weighting set	Europe e				
Normalisatio n					
greenhouse	7,65E-05				
ozone layer	1,08				
acidification	0,00888				
eutrophicatio n	0,0262				
heavy metals	18,4				
carcinogens	92				
winter smog - P.M.	0,0106				
summer smog - VOCs	0,0558				
pesticides	1,04				
energy resources	6,29E-06				
solid waste	0				
Heavy metals (air)	18,4				
PAHs (air)	92				
Heavy metals (water)	18,4				
POP (air)	0				
POP (water)	0				
Pesa					
greenhouse	2,5				
ozone layer	100				
acidification	10				
eutrophicatio n	5				
heavy metals	5				
carcinogens	10				
winter smog - P.M.	5				
summer smog - VOCs	2,5				

pesticides	25				
energy resources	0				
solid waste	0				
Heavy metals (air)	5				
PAHs (air)	10				
Heavy metals (water)	5				
POP (air)	0				
POP (water)	0				

5.8.5 SimaPro vs. EuP-Ecoreport output

According to "MEUUP Report" by R. Kemna on methodology used in sw EuP-Ecoreport set up, it was possible to have SimaPro outputs in compliance with EuP ones (MEEuP Methodology Report, Final, table 25 and Eco-indicator 95 - rev EuP V2.03).

In 8.4 Eco-indicator 95 - rev EuP V2.03 methodology was fully reported, while in the following table the main indicators used for Simapro outputs, in compliance with EuP- Ecoreport outputs, were reported.

Table 5.56: Output indicators in Ecoindicator95-rev EuP method

Eco-indicator 95 - rev EuP V2.03 (Revised by Laura Cutaia)

Environmental impact	Unit
greenhouse	kg CO2
ozone layer	kg CFC11
acidification	kg SO2
eutrophication	kg PO4
heavy metals	kg Pb
carcinogens	kg B(a)P
winter smog - P.M.	kg SPM
summer smog - VOCs	kg C2H4
pesticides	kg act.subst
energy resources	MJ LHV
solid waste	kg
Heavy metals (air)	kg Ni eq
PAHs (air)	kg PAH/20 eq
Heavy metals (water)	kg Hg/20 eq
POP (air)	kg TE eq
POP (water)	kg TE eq

Hereinafter outputs from LCA of DW12 ps and WM 5 kgs have been reported, using SimaPro sw and revised Ecoindicator 95 methodology explained before.

In summary using SimaPro it was possible:
- to use quite all inventory data from producers (BOM) ;
- to use data input in the software in compliance with that available by producers (SimaPro data base contains many more data than EuP and makes possible the "simulation" of new record with new "components" or "materials" – as for detergents and washing agents according to data from producers) ;

- to have compliance between outputs from characterization phase of Eco-Indicator 95 (one of the most used methodology in impact assessment) and EuP-Ecoreport outputs, according to the "chracterisation factors" used in this method (MEEuP by R. Kemna). See the following figure.

Figure 5.29: MEEuP Report – Summary of MEEUP weighting factors used to adapting Ecoindicator 95 to EuP-Ecoreport evaluating method

Table 25. Summary MEEUP weighting factors

GHG emissions (air)	CO_2	CO	N_2O	CH_4	CF_4	C_2F_6	SF_6	R134a	other
weighting → CO_2 eq. GWP-100	**1**	**1.57**	**296**	**21**	**6500**	**9200**	**22200**	**1300**	**IPCC**

Acidification emissions (air)	SO_X	NO_X	N_2O	NH_3	HF	HCl	H_2S	H_2SO_4
AP weighting → SO_2 equivalent	**1**	**0.7**	**1.78**	**1.88**	**1.6**	**0.88**	**1.88**	**0.65**

Heavy Metals (air)	Cd	Hg	As	HMU	Ni	Cr	Cu	Pb	Zn	MU
HM weighting -> Ni eq.	**5**	**5**	**3.33**	**2**	**1**	**0.5**	**0.5**	**0.04**	**0.04**	**0.01**

PAHs (air)	PAHs	C6H6	CO
HM weighting -> Ni eq.	**20**	**0.004**	**0.000002**

MU= Metals Unspecified
HMU= Heavy Metals Unspecified. *=preliminary factors

Heavy Metals (water)	Hg	Cd	Ni*	As	HMU	Cu*	Pb*	Cr	Zn
HM Weighting factor → Hg/20 eq.	**20**	**7**	**7**	**3**	**3**	**2.8**	**0.5**	**0.4**	**0.2**

Eutrophication (water)	P	P_2O_5	PO_4	N	NH_4+	NO_3-	BOD	Suspended Solids	DOC	TOC	COD
EP weighting → PO_4 equivalent	**3.07**	**1.34**	**1**	**0.42**	**0.33**	**0.1**	**0.11**	**0.08**	**0.066**	**0.066**	**0.05**

EC Directives and official EU references with threshold and conversion values from which the weighting factors are derived: *IPCC* (GWP), *EC 850/2004* (POP), *2001/81/EC* (SO_x, NO_x, NH_3, VOC), *1999/30/EC* (SO_2, NO_x, PM and Pb), *2000/69/EC* (aromatics, CO), *COM(2003)423* (As, Cd, Hg, Ni, PAHs), *1999/13/EC* & 2002/3/EC (VOC), *EC 2037/2000* (ODP), *91/271/EC & 98/15/EEC* (BOD, COD, P, N, susp. Solids to water), *76/464/EEC* (Metals etc. to water).

In any case in SimaPro it was not possibile to "simulate" distribution phase for final products, for lack of data from producers or from other sources; on the countrary in EuP-Ecoreport simulation of impacts due to distribution is considered by an "internal system".

5.8.5.1 12 place settings dishwasher

In the following table outputs for DW12 ps have been reported. In ored to compare it with that from EuP-Ecoreport outputs it has to be underlined:

- "DW12ps assembling" in Simapro corresponds to "Production total" in EuP; "assembling" for Simapro includes materials production, transport, forming and assembling also if these items have been calculated separately as in the outputs in 8.6;
- "Electricity LV use UCPTE U"+ "Delivery van (<3.5t) B250" + "DW12 ps Use consumables (per LC)" corresponds to "Use" in EuP;
- "DW12 EoL" corresponds to "End of Life".

According to the methodology explained and on the correspondence of the outputs (as in the first row - Row in EuP-Ecoreport) it has been possibile to make comparable SimaPro and EuP-Ecoreport outputs.
Main results are in the following table (LCA output by SimaPro according to Ecoindicator 95).

Table 5.57: DW12 ps – LCA output (Ecoindicator95-rev EuP method)

Row in	Categoria d'impatto	Unità	Totale	DW12ps	Electricity	Delivery	DW12	DW12 ps

EuP-Ecoreport				assembling	LV use UCPTE U	van (<3.5t) B250	EoL	Use consumables (per LC)
14	greenhouse	kg CO2	2.318,08	202,89	1.756,35	4,68	-39,90	394,06
15	ozone layer	kg CFC11	0,00	0,00	0,00	0,00	-0,00	0,00
16	acidification	kg SO2	19,83	3,11	12,80	0,02	-0,14	4,04
22	eutrophication	kg PO4	2,68	0,24	0,43	0,00	-0,01	2,02
	heavy metals	kg Pb	0,03	0,00	0,01	0,00	-0,00	0,01
	carcinogens	kg B(a)P	0,00	0,00	0,00	0,00	-0,00	0,00
20	winter smog - P.M.	kg SPM	17,01	2,74	10,73	0,01	-0,08	3,62
17	summer smog - VOCs	kg C2H4	0,62	0,17	0,39	0,01	-0,03	0,08
	pesticides	kg act.subst	0,04	0,04	0,00	0,00	0,00	0,00
8	energy resources	MJ LHV	51.242,25	4.502,73	41.615,08	59,86	-562,20	5.626,78
12 (+13)	solid waste	kg	106,10	96,18	50,00	0,00	-40,08	0,00
19	Heavy metals (air)	kg Ni eq	0,01	0,00	0,00	0,00	-0,00	0,00
19,1	PAHs (air)	kg PAH/20 eq	0,00	0,00	0,00	0,00	-0,00	0,00
21	Heavy metals (water)	kg Hg/20 eq	0,06	0,00	0,02	0,00	-0,00	0,04
18	POP (air)	kg TE eq	0,00	0,00	0,00	0,00	0,00	0,00
23	POP (water)	kg TE eq	0,00	0,00	0,00	0,00	0,00	0,00

In the following table the same LCA output by SimaPro according to Ecoindicator 95 revised accordingly to EuP-Ecoreports outputs has been reported.

Table 5.58: DW12 ps – LCA output (Ecoindicator95-rev EuP method) adapted to them of EuP-Ecoreport

Row in EuP-Ecoreport	Impact category	Unit	DW12ps assembling - Production total	USE	DW12 EoL	Total
8	energy resources	MJ LHV	4.502,73	47.301,72	-562,20	51.242,25
12 (+13)	solid waste	kg	96,18	50,00	-40,08	106,10
14	greenhouse	kg CO2	202,89	2.155,09	-39,90	2.318,08
15	ozone layer	kg CFC11	0,00	0,00	-0,00	0,00
16	acidification	kg SO2	3,11	16,85	-0,14	19,83
17	summer smog - VOCs	kg C2H4	0,17	0,49	-0,03	0,62
18	POP (air)	kg TE eq	0,00	0,00	0,00	0,00
19	Heavy metals (air)	kg Ni eq	0,00	0,00	-0,00	0,01
19,1	PAHs (air)	kg PAH/20 eq	0,00	0,00	-0,00	0,00
20	winter smog - P.M.	kg SPM	2,74	14,36	-0,08	17,01
21	Heavy metals (water)	kg Hg/20 eq	0,00	0,05	-0,00	0,06
22	eutrophication	kg PO4	0,24	2,46	-0,01	2,68
23	POP (water)	kg TE eq	0,00	0,00	0,00	0,00
	heavy metals	kg Pb	0,00	0,03	-0,00	0,03
	carcinogens	kg B(a)P	0,00	0,00	-0,00	0,00
	pesticides	kg act.subst	0,04	0,00	0,00	0,04

In the following table outputs by SW EuP-Ecoreport has been reported, in a way to be compared with that in tables below .

Table 5.59: DW12 ps – LCA output from EuP-Ecoreport

			PRODUCTION Total	**DISTRIBUTION**	**USE**	**END-OF-LIFE**	Total
8	Total Energy (GER)	MJ	**3945**	**595**	**34487**	**-291**	**38736**
9	of which, electricity (in primary MJ)	MJ	**1142**	**1**	**30771**	**-29**	**31886**
10	Water (process)	ltr	**1955**	**0**	**50274**	**-19**	**52209**
11	Water (cooling)	ltr	**1213**	**0**	**82039**	**-160**	**83093**
12	Waste, non-haz./ landfill	g	**66470**	**313**	**40158**	**781**	**107723**
13	Waste, hazardous/ incinerated	g	**409**	**6**	**789**	**1514**	**2718**

14	Greenhouse Gases in GWP100	kg CO2 eq.	**270**	**37**	**1519**	**0**	**1825**
15	Ozone Depletion, emissions	mg R-11 eq.					
16	Acidification, emissions	g SO2 eq.	**2155**	**111**	**8828**	**7**	**11101**
17	Volatile Organic Compounds (VOC)	g	**9**	**8**	**19**	**1**	**37**
18	Persistent Organic Pollutants (POP)	ng i-Teq	**433**	**2**	**228**	**6**	**669**
19	Heavy Metals	mg Ni eq.	**3249**	**16**	**700**	**53**	**4018**
	PAHs	mg Ni eq.	**152**	**20**	**152**	**-2**	**322**
20	Particulate Matter (PM, dust)	g	**295**	**1370**	**1601**	**431**	**3698**
21	Heavy Metals	mg Hg/20	**2150**	**0**	**222**	**13**	**2385**
22	Eutrophication	g PO4	**57**	**0**	**4859**	**0**	**4917**
23	Persistent Organic Pollutants (POP)	ng i-Teq					

5.8.5.2 5kg washing machine

In the following Tables Simapro and EuP-Ecoreport outputs have been reported; methodology, remarks and considerations are the same than DW12 ps described before

Table 5.60: WM 5 kg – LCA output (Ecoindicator95-rev EuP method)

Row in EuP-Ecoreport	Categoria d'impatto	Unità	Totale	WM 5kg assembling	Electricity LV use UCPTE U	Delivery van (<3.5t) B250	WM 5kg EoL	WM 5kg use materials (per LC)
14	greenhouse	kg CO2	3,42E+03	6,44E+02	1,93E+03	6,86E+00	-5,66E+01	8,95E+02
15	ozone layer	kg CFC11	1,44E-03	1,29E-04	1,25E-03	7,29E-06	-2,13E-05	7,73E-05
16	acidification	kg SO2	2,46E+01	6,13E+00	1,41E+01	2,55E-02	-2,49E-01	4,59E+00
22	eutrophication	kg PO4	1,75E+00	2,50E-01	4,74E-01	2,93E-03	-1,66E-02	1,04E+00
	heavy metals	kg Pb	3,70E-02	3,83E-03	1,52E-02	2,11E-05	-3,75E-04	1,83E-02
	carcinogens	kg B(a)P	1,27E-04	2,88E-05	4,64E-05	8,63E-08	-3,67E-05	8,81E-05
20	winter smog - P.M.	kg SPM	2,04E+01	5,02E+00	1,18E+01	1,03E-02	-1,74E-01	3,81E+00
17	summer smog - VOCs	kg C2H4	1,02E+00	2,91E-01	4,34E-01	1,91E-02	-4,62E-02	3,23E-01
	pesticides	kg act.subst	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
8	energy resources	MJ LHV	7,80E+04	1,23E+04	4,57E+04	8,77E+01	-8,43E+02	2,07E+04
12 (+13)	solid waste	kg	2,32E+02	2,09E+02	54,00E+00	0,00E+00	-4,01E+01	0,00E+00
19	Heavy metals (air)	kg Ni eq	8,02E-03	8,36E-04	3,67E-03	6,30E-06	-3,35E-05	3,55E-03
19,1	PAHs (air)	kg PAH/20 eq	2,96E-06	2,26E-06	1,23E-06	2,41E-07	-7,77E-07	1,00E-10
21	Heavy metals (water)	kg Hg/20 eq	7,05E-02	5,19E-03	1,95E-02	3,31E-06	-8,89E-04	4,66E-02
18	POP (air)	kg TE eq	2,84E-09	2,15E-09	4,08E-10	0,00E+00	2,59E-11	2,52E-10
23	POP (water)	kg TE eq	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

Table 5.61: WM 5 kg – LCA output (Ecoindicator95-rev EuP method) adapted to them of EuP-Ecoreport

Row in EuP-Ecoreport	Categoria d'impatto	Unità	Totale	WM 5kg assembling	Electricity LV use UCPTE U	Delivery van (<3.5t) B250	WM 5kg EoL	WM 5kg use materials (per LC)
8	energy resources	MJ LHV	7,80E+04	1,23E+04	4,57E+04	8,77E+01	-8,43E+02	2,07E+04
12 (+13)	solid waste	kg	2,32E+02	2,09E+02	54,00E+00	0,00E+00	-4,01E+01	0,00E+00
14	greenhouse	kg CO2	3,42E+03	6,44E+02	1,93E+03	6,86E+00	-5,66E+01	8,95E+02
15	ozone layer	kg CFC11	1,44E-03	1,29E-04	1,25E-03	7,29E-06	-2,13E-05	7,73E-05
16	acidification	kg SO2	2,46E+01	6,13E+00	1,41E+01	2,55E-02	-2,49E-01	4,59E+00
17	summer smog - VOCs	kg C2H4	1,02E+00	2,91E-01	4,34E-01	1,91E-02	-4,62E-02	3,23E-01
18	POP (air)	kg TE eq	2,84E-09	2,15E-09	4,08E-10	0,00E+00	2,59E-11	2,52E-10
19	Heavy metals (air)	kg Ni eq	8,02E-03	8,36E-04	3,67E-03	6,30E-06	-3,35E-05	3,55E-03
19,1	PAHs (air)	kg PAH/20 eq	2,96E-06	2,26E-06	1,23E-06	2,41E-07	-7,77E-07	1,00E-10
20	winter smog - P.M.	kg SPM	2,04E+01	5,02E+00	1,18E+01	1,03E-02	-1,74E-01	3,81E+00

21	Heavy metals (water)	kg Hg/20 eq	7,05E-02	5,19E-03	1,95E-02	3,31E-06	-8,89E-04	4,66E-02
22	eutrophication	kg PO4	1,75E+00	2,50E-01	4,74E-01	2,93E-03	-1,66E-02	1,04E+00
23	POP (water)	kg TE eq	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
	heavy metals	kg Pb	3,70E-02	3,83E-03	1,52E-02	2,11E-05	-3,75E-04	1,83E-02
	carcinogens	kg B(a)P	1,27E-04	2,88E-05	4,64E-05	8,63E-08	-3,67E-05	8,81E-05
	pesticides	kg act.subst	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

Table 5.62: DW12 ps – LCA output from EuP-Ecoreport

	Resources Use and Emissions		Production	Distribution	Use	End of Life	Total
8	Total Energy (GER)	MJ	**3830**	**547**	**34230**	**-507**	**38100**
9	of which, electricity (in primary MJ)	MJ	**923**	**1**	**33815**	**-47**	**34692**
10	Water (process)	ltr	**1358**	**0**	**152455**	**-31**	**153782**
11	Water (cooling)	ltr	**1105**	**0**	**90160**	**-260**	**91005**
12	Waste, non-haz./ landfill	g	**69120**	**290**	**39889**	**-146**	**109153**
13	Waste, hazardous/ incinerated	g	**176**	**6**	**781**	**362**	**1324**
14	Greenhouse Gases in GWP100	kg CO2 eq.	**245**	**34**	**1508**	**-8**	**1778**
15	Ozone Depletion, emissions	mg R-11 eq.					
16	Acidification, emissions	g SO2 eq.	**1870**	**102**	**8754**	**-12**	**10714**
17	Volatile Organic Compounds (VOC)	g	**7**	**8**	**19**	**1**	**35**
18	Persistent Organic Pollutants (POP)	ng i-Teq	**427**	**2**	**226**	**0**	**654**
19	Heavy Metals	mg Ni eq.	**2429**	**15**	**687**	**24**	**3154**
	PAHs	mg Ni eq.	**190**	**19**	**153**	**-2**	**360**
20	Particulate Matter (PM, dust)	g	**388**	**1248**	**1601**	**375**	**3612**
21	Heavy Metals	mg Hg/20	**1597**	**0**	**234**	**2**	**1833**
22	Eutrophication	g PO4	**41**	**0**	**1**	**-1**	**41**
23	Persistent Organic Pollutants (POP)	ng i-Teq					

5.8.6 SimaPro output

5.8.6.1 12 place settings dishwasher

Table 5.63: DW 12 ps – Assembling phase – Output of SimaPro with "Ecoindicator 95 rev EuP method"

Impact category	greenhouse	ozone layer	acidification	eutrophication	heavy metals	carcinogens	winter smog - P.M.	summer smog - VOCs	pesticides	energy resources	solid waste	Heavy metals (air)	PAHs (air)	Heavy metals (water)	POP (air)	POP (water)
Unit	kg CO2	kg CFC11	kg SO2	kg PO4	kg Pb	kg B(a)P	kg SPM	kg C2H4	kg act.subst	MJ LHV	kg	kg Ni eq	kg PAH/20 eq	kg Hg/20 eq	kg TE eq	kg TE eq
Total	2,03E+02	7,30E-05	3,11E+00	2,37E-01	3,71E-03	2,69E-05	2,74E+00	1,70E-01	4,41E-02	4,50E+03	9,62E+01	9,82E-04	1,72E-06	3,59E-03	2,23E-09	1,05E-13
Steel I	4,54E-01	2,11E-09	4,33E-03	3,86E-04	9,46E-06	3,08E-07	2,84E-03	2,05E-04	0,00E+00	8,97E+00	4,85E-03	1,38E-06	2,86E-08	7,48E-07	4,24E-11	0,00E+00
Crude iron I	2,67E+00	1,24E-08	2,78E-02	2,49E-03	2,93E-05	1,76E-06	1,71E-02	1,28E-03	0,00E+00	6,06E+01	6,04E-01	4,99E-06	1,09E-07	3,87E-06	3,15E-15	0,00E+00
Steel I	1,43E+00	6,63E-09	1,36E-02	1,21E-03	2,98E-05	9,68E-07	8,93E-03	6,45E-04	0,00E+00	2,82E+01	1,52E-02	4,34E-06	9,01E-08	2,35E-06	1,33E-10	0,00E+00
X5CrNi18 (304) I	3,36E+01	6,41E-08	1,30E+00	1,18E-02	1,16E-04	3,65E-06	1,29E+00	4,28E-03	0,00E+00	4,87E+02	1,12E-01	1,68E-05	3,46E-07	1,50E-05	5,01E-10	0,00E+00
Steel I	7,36E+00	3,41E-08	7,02E-02	6,25E-03	1,53E-04	4,99E-06	4,60E-02	3,32E-03	0,00E+00	1,45E+02	7,85E-02	2,24E-05	4,64E-07	1,21E-05	6,87E-10	0,00E+00
Steel I	7,99E+00	3,71E-08	7,62E-02	6,79E-03	1,66E-04	5,42E-06	4,99E-02	3,61E-03	0,00E+00	1,58E+02	8,53E-02	2,43E-05	5,04E-07	1,32E-05	7,46E-10	0,00E+00
Steel I	1,09E+00	5,05E-09	1,04E-02	9,24E-04	2,27E-05	7,38E-07	6,80E-03	4,92E-04	0,00E+00	2,15E+01	1,16E-02	3,31E-06	6,86E-08	1,79E-06	1,02E-10	0,00E+00
Aluminium rec. I	3,63E-01	0,00E+00	6,07E-03	7,90E-05	8,31E-10	2,99E-11	5,96E-03	4,60E-04	0,00E+00	4,81E+00	5,36E-02	3,79E-08	6,71E-10	0,00E+00	0,00E+00	0,00E+00
Brass, at plant/CH U	4,81E-02	3,73E-09	2,36E-03	1,08E-04	6,82E-05	1,71E-07	2,30E-03	3,35E-05	0,00E+00	9,77E-01	0,00E+00	2,79E-05	0,00E+00	2,36E-06	2,94E-13	0,00E+00
Chromium I	8,90E-01	1,17E-09	4,03E-03	2,26E-04	1,42E-07	6,89E-10	4,14E-03	6,38E-05	0,00E+00	1,37E+01	1,68E-03	2,18E-08	2,21E-10	1,85E-07	2,97E-16	0,00E+00
Copper I	4,98E+00	3,09E-10	4,58E-01	2,12E-03	7,53E-08	3,45E-10	4,46E-01	1,84E-04	0,00E+00	6,29E+01	8,88E+01	2,25E-08	4,29E-09	4,90E-08	7,88E-17	0,00E+00
Zinc I	1,87E-02	1,18E-09	2,61E-04	9,06E-06	1,94E-07	5,21E-10	2,19E-04	3,57E-06	0,00E+00	2,51E-01	4,02E-03	4,12E-08	1,74E-11	1,94E-07	3,01E-16	0,00E+00
Cardboard duplex/tripl	4,13E-01	1,05E-07	2,03E-03	2,05E-04	1,99E-06	2,61E-08	1,48E-03	1,57E-04	0,00E+00	7,89E+00	7,81E-02	7,85E-07	4,20E-10	5,93E-07	0,00E+00	0,00E+00
PS (EPS) B250 (1998)	1,93E+00	1,06E-06	1,42E-02	1,20E-03	4,19E-06	5,34E-08	8,06E-03	1,61E-03	0,00E+00	5,65E+01	3,07E-02	6,94E-07	1,41E-09	1,56E-06	0,00E+00	0,00E+00

Kraft paper, bleached, at plant/RER U	-1,41E-03	5,06E-10	2,92E-05	1,46E-05	6,81E-08	5,04E-10	1,73E-05	1,73E-06	0,00E+00	2,43E-01	0,00E+00	9,38E-09	0,00E+00	2,23E-07	1,55E-14	0,00E+00
PE (LDPE) I	1,96E-01	0,00E+00	3,04E-03	2,90E-04	1,30E-07	1,55E-10	2,09E-03	1,45E-03	0,00E+00	1,45E+01	6,86E-03	0,00E+00	3,13E-10	0,00E+00	0,00E+00	0,00E+00
Poplar I	1,25E-01	2,55E-09	1,61E-03	2,61E-04	2,19E-07	1,45E-09	3,58E-04	1,88E-04	0,00E+00	2,57E+01	1,06E-01	4,43E-07	8,22E-10	4,04E-07	6,51E-16	0,00E+00
ABS I	2,64E+00	7,85E-07	1,39E-02	1,49E-03	8,37E-07	1,61E-08	7,85E-03	1,65E-03	0,00E+00	6,81E+01	9,54E-02	0,00E+00	5,97E-09	0,00E+00	0,00E+00	0,00E+00
EPDM rubber ETH U	1,75E+00	5,74E-06	1,47E-02	1,10E-03	4,73E-05	1,85E-07	1,21E-02	8,45E-03	0,00E+00	5,67E+01	0,00E+00	8,87E-06	1,50E-09	3,52E-05	7,03E-13	0,00E+00
PS (EPS) B250 (1998)	1,08E-01	5,90E-08	7,97E-04	6,70E-05	2,34E-07	2,99E-09	4,51E-04	9,02E-05	0,00E+00	3,16E+00	1,71E-03	3,88E-08	7,87E-11	8,71E-08	0,00E+00	0,00E+00
PA 6 I	3,30E+00	0,00E+00	7,03E-03	1,04E-03	4,52E-06	1,62E-08	2,09E-03	2,63E-03	0,00E+00	6,59E+01	5,32E-03	2,86E-06	7,59E-10	0,00E+00	0,00E+00	0,00E+00
PB B250 (1998)	1,33E-01	4,80E-08	1,05E-03	7,94E-05	1,14E-07	4,59E-10	6,29E-04	2,20E-04	0,00E+00	3,19E+00	3,51E-03	3,74E-08	8,88E-11	8,86E-08	0,00E+00	0,00E+00
PE (HDPE) I	1,84E-01	0,00E+00	2,56E-03	2,61E-04	1,38E-07	3,50E-11	1,57E-03	1,64E-03	0,00E+00	1,48E+01	6,28E-03	0,00E+00	2,35E-10	0,00E+00	0,00E+00	0,00E+00
PMMA I	3,67E-02	6,00E-09	2,67E-04	4,15E-05	5,82E-09	1,39E-11	1,74E-04	1,87E-05	0,00E+00	5,96E-01	7,46E-04	0,00E+00	2,88E-11	0,00E+00	0,00E+00	0,00E+00
HDPE B250	5,14E-01	2,57E-07	3,13E-03	3,22E-04	8,31E-07	2,41E-09	1,44E-03	1,73E-03	0,00E+00	1,78E+01	7,66E-03	2,28E-07	2,88E-10	7,69E-07	0,00E+00	0,00E+00
PP I	5,69E+00	0,00E+00	9,33E-02	7,02E-03	4,45E-06	4,62E-09	6,72E-02	2,67E-02	0,00E+00	4,08E+02	1,60E-01	0,00E+00	7,24E-09	0,00E+00	0,00E+00	0,00E+00
PP I	3,74E-02	0,00E+00	6,14E-04	4,62E-05	2,92E-08	3,04E-11	4,42E-04	1,76E-04	0,00E+00	2,69E+00	1,06E-03	0,00E+00	4,76E-11	0,00E+00	0,00E+00	0,00E+00
PS (EPS) B250 (1998)	1,41E+00	7,69E-07	1,04E-02	8,73E-04	3,05E-06	3,89E-08	5,87E-03	1,18E-03	0,00E+00	4,11E+01	2,23E-02	5,06E-07	1,03E-09	1,13E-06	0,00E+00	0,00E+00
PUR semi rigid foam I	1,37E-02	9,15E-11	1,23E-04	1,69E-05	6,46E-07	4,82E-11	9,47E-05	1,88E-05	0,00E+00	2,71E-01	2,33E-03	8,80E-10	1,48E-11	1,45E-08	2,33E-17	0,00E+00
PVC B250	3,97E-01	1,14E-07	4,69E-03	4,39E-04	1,96E-06	2,74E-09	2,50E-03	1,15E-03	0,00E+00	1,19E+01	2,49E-02	2,12E-07	1,04E-09	3,61E-06	0,00E+00	0,00E+00
PVC B250	4,73E-01	1,36E-07	5,59E-03	5,24E-04	2,34E-06	3,27E-09	2,98E-03	1,38E-03	0,00E+00	1,42E+01	2,97E-02	2,53E-07	1,24E-09	4,30E-06	0,00E+00	0,00E+00
adhesive - glue	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Bitumen refinery Europe U	3,27E+00	4,10E-05	2,48E-02	2,18E-03	3,23E-05	5,82E-08	1,72E-02	2,18E-02	0,00E+00	3,05E+02	0,00E+00	9,14E-06	7,82E-09	1,24E-05	1,24E-13	0,00E+00
Concrete I	8,55E-02	1,58E-09	4,46E-04	5,65E-05	1,30E-07	6,96E-10	1,47E-02	1,76E-05	0,00E+00	1,06E+00	2,21E-03	1,50E-08	1,02E-10	2,51E-07	4,03E-16	0,00E+00
Cotton fabric I	9,56E-01	5,70E-08	6,85E-03	8,72E-02	2,00E-04	2,53E-08	2,44E-02	3,05E-02	3,04E-02	4,91E+01	2,76E-01	5,40E-07	8,23E-10	2,13E-04	1,45E-14	0,00E+00
Liquid epoxy resins E	1,94E+00	1,23E-07	5,35E-03	3,04E-03	4,55E-07	8,60E-08	5,07E-03	5,57E-04	0,00E+00	3,39E+01	7,79E-02	6,37E-07	2,32E-09	5,94E-07	8,79E-28	7,05E-14
Cotton fibres I	9,76E-02	4,52E-10	9,03E-04	3,79E-02	1,46E-06	3,15E-10	9,03E-03	4,59E-05	1,37E-02	9,70E+00	2,54E-02	4,28E-09	1,69E-11	3,63E-06	1,15E-16	0,00E+00
Electronics for control	4,24E+00	2,29E-07	3,48E-02	6,23E-03	5,85E-04	2,77E-06	3,05E-02	1,61E-03	0,00E+00	9,90E+01	0,00E+00	1,63E-04	0,00E+00	9,53E-04	3,92E-12	0,00E+00

units/RER U																
Kraft paper, bleached, at plant/RER U	-9,79E-02	3,51E-08	2,03E-03	1,01E-03	4,72E-06	3,50E-08	1,20E-03	1,20E-04	0,00E+00	1,69E+01	0,00E+00	6,50E-07	0,00E+00	1,54E-05	1,08E-12	0,00E+00
Liquid epoxy resins E	9,52E-01	6,05E-08	2,62E-03	1,49E-03	2,23E-07	4,21E-08	2,49E-03	2,73E-04	0,00E+00	1,66E+01	3,81E-02	3,12E-07	1,14E-09	2,91E-07	4,30E-28	3,46E-14
Electronics for control units/RER U	9,36E-02	5,05E-09	7,69E-04	1,37E-04	1,29E-05	6,12E-08	6,74E-04	3,54E-05	0,00E+00	2,19E+00	0,00E+00	3,60E-06	0,00E+00	2,10E-05	8,65E-14	0,00E+00
Copper, at regional storage/RER U	5,92E-01	4,89E-08	4,32E-02	1,76E-03	1,33E-03	3,44E-06	4,30E-02	5,39E-04	0,00E+00	1,18E+01	0,00E+00	5,45E-04	0,00E+00	3,41E-05	4,48E-12	0,00E+00
Poplar I	2,52E-01	5,14E-09	3,24E-03	5,26E-04	4,41E-07	2,92E-09	7,21E-04	3,78E-04	0,00E+00	5,17E+01	2,13E-01	8,92E-07	1,66E-09	8,14E-07	1,31E-15	0,00E+00
Water demineralized ETH U	4,96E-02	6,52E-08	3,77E-04	1,48E-05	5,05E-07	1,25E-09	3,00E-04	1,57E-05	0,00E+00	1,13E+00	0,00E+00	2,48E-07	3,97E-11	1,08E-06	3,25E-15	0,00E+00
Paint ETH S	9,45E-02	8,07E-08	6,72E-04	2,65E-05	1,09E-05	6,67E-08	5,74E-04	4,31E-05	0,00E+00	1,81E+00	0,00E+00	3,66E-06	6,55E-11	7,05E-07	4,87E-15	0,00E+00
Electricity MV use in UCPTE U	9,19E+00	4,54E-06	6,57E-02	2,24E-03	6,24E-05	2,05E-07	5,49E-02	2,01E-03	0,00E+00	2,18E+02	0,00E+00	1,57E-05	4,48E-09	9,17E-05	5,70E-13	0,00E+00
Heat gas B250	2,01E+00	2,29E-08	2,46E-03	3,14E-04	7,49E-07	1,49E-07	1,06E-03	2,29E-04	0,00E+00	3,39E+01	0,00E+00	3,89E-07	1,60E-09	9,32E-07	0,00E+00	0,00E+00
Truck 28t B250	3,64E+00	4,06E-06	4,94E-02	8,31E-03	5,54E-06	2,84E-08	5,26E-03	9,13E-03	0,00E+00	4,77E+01	0,00E+00	1,92E-06	3,83E-08	1,52E-06	0,00E+00	0,00E+00
Sea ship B250	8,55E-02	9,51E-08	1,30E-03	2,91E-05	1,81E-06	3,96E-09	1,15E-03	8,36E-05	0,00E+00	1,18E+00	0,00E+00	7,83E-07	5,72E-11	6,86E-08	0,00E+00	0,00E+00
Hot rolling, steel/RER U	2,08E+00	1,71E-07	7,04E-03	3,11E-03	2,19E-04	2,41E-07	6,90E-03	1,51E-03	0,00E+00	4,39E+01	0,00E+00	6,11E-06	0,00E+00	2,24E-04	3,05E-12	0,00E+00
Sheet rolling, steel/RER U	1,33E+00	9,58E-08	6,19E-03	2,42E-03	1,81E-04	1,66E-07	5,93E-03	3,65E-04	0,00E+00	2,86E+01	0,00E+00	1,91E-06	0,00E+00	1,36E-03	2,95E-12	0,00E+00
Extruding alum I	8,40E+01	9,07E-06	6,56E-01	2,65E-02	2,63E-04	4,77E-07	4,83E-01	2,80E-02	0,00E+00	1,54E+03	5,15E+00	6,29E-05	2,64E-08	4,22E-04	7,52E-13	0,00E+00
Wire drawing, copper/RER U	9,93E-01	5,35E-08	7,22E-03	5,52E-04	8,53E-05	2,54E-07	6,22E-03	2,96E-04	0,00E+00	2,34E+01	0,00E+00	3,24E-05	0,00E+00	4,74E-05	4,43E-13	0,00E+00
Foaming, expanding/RER U	5,89E-01	7,79E-08	3,18E-03	2,28E-04	2,81E-06	3,22E-08	2,53E-03	5,75E-03	0,00E+00	1,19E+01	0,00E+00	1,93E-06	0,00E+00	2,69E-06	3,61E-14	0,00E+00
Injection moulding/RER U	6,08E+00	3,79E-06	2,82E-02	4,08E-03	4,80E-05	4,36E-07	2,05E-02	1,58E-03	0,00E+00	1,52E+02	0,00E+00	9,05E-06	0,00E+00	8,70E-05	7,87E-13	0,00E+00
Extrusion PVC I	1,16E-01	0,00E+00	1,77E-03	1,31E-04	1,14E-08	5,27E-11	1,44E-03	3,39E-04	0,00E+00	1,63E+00	4,99E-03	1,27E-12	1,12E-10	0,00E+00	0,00E+00	0,00E+00

Table 5.64: DW 12 ps – EoL phase – Output of SimaPro with "Ecoindicator 95 rev EuP method"

Impact category	Unit	Total	Recycling only B250 avoided	Incineration B250 (98) avoided	Landfill B250 (98)
greenhouse	kg CO2	-3,99E+01	-4,32E+01	3,23E+00	1,14E-01
ozone layer	kg CFC11	-1,25E-05	-1,23E-05	-2,06E-07	5,34E-09
acidification	kg SO2	-1,37E-01	-1,34E-01	-2,71E-03	9,05E-05
eutrophication	kg PO4	-1,29E-02	-1,29E-02	-4,06E-05	3,45E-05
heavy metals	kg Pb	-2,84E-04	-2,82E-04	-1,42E-06	7,99E-08
carcinogens	kg B(a)P	-6,88E-06	-6,86E-06	-2,34E-08	4,10E-11
winter smog - P.M.	kg SPM	-8,24E-02	-7,84E-02	-4,03E-03	3,91E-05
summer smog - VOCs	kg C2H4	-3,53E-02	-3,53E-02	-1,67E-05	3,88E-05
pesticides	kg act.subst	0,00E+00	0,00E+00	0,00E+00	0,00E+00
energy resources	MJ LHV	-5,81E+02	-5,60E+02	-2,08E+01	6,94E-02
solid waste	kg	-4,00E+01	-4,00E+01	0,00E+00	0,00E+00
Heavy metals (air)	kg Ni eq	-1,92E-05	-2,00E-05	6,97E-07	2,73E-08
PAHs (air)	kg PAH/20 eq	-5,94E-07	-5,99E-07	5,54E-09	5,29E-11
Heavy metals (water)	kg Hg/20 eq	-8,49E-04	-8,42E-04	-8,00E-06	9,65E-07
POP (air)	kg TE eq	1,04E-10	0,00E+00	1,04E-10	1,29E-14
POP (water)	kg TE eq	0,00E+00	0,00E+00	0,00E+00	0,00E+00

Table 5.65: DW 12 ps – Life Cycle – Output of SimaPro with "Ecoindicator 95 rev EuP method"

Impact category	Unit	Total	DW12ps assembling	Electricity LV use UCPTE U	Delivery van (<3.5t) B250	DW12 EoL	DW12 ps Use consumables (per LC)
greenhouse	kg CO2	2,32E+03	2,03E+02	1,76E+03	4,68E+00	-3,99E+01	3,94E+02
ozone layer	kg CFC11	1,23E-03	7,30E-05	1,14E-03	4,98E-06	-1,22E-05	2,69E-05
acidification	kg SO2	1,98E+01	3,11E+00	1,28E+01	1,74E-02	-1,36E-01	4,04E+00
eutrophication	kg PO4	2,68E+00	2,37E-01	4,32E-01	2,00E-03	-1,25E-02	2,02E+00
heavy metals	kg Pb	3,12E-02	3,71E-03	1,38E-02	1,44E-05	-2,88E-04	1,40E-02
carcinogens	kg B(a)P	9,39E-05	2,69E-05	4,23E-05	5,89E-08	-6,89E-06	3,16E-05
winter smog - P.M.	kg SPM	1,70E+01	2,74E+00	1,07E+01	7,02E-03	-8,31E-02	3,62E+00
summer smog - VOCs	kg C2H4	6,24E-01	1,70E-01	3,95E-01	1,31E-02	-3,27E-02	7,89E-02
pesticides	kg act.subst	4,41E-02	4,41E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00
energy resources	MJ LHV	5,12E+04	4,50E+03	4,16E+04	5,99E+01	-5,62E+02	5,63E+03
solid waste	kg	5,61E+01	9,62E+01	0,00E+00	0,00E+00	-4,01E+01	0,00E+00
Heavy metals (air)	kg Ni eq	5,61E-03	9,82E-04	3,34E-03	4,30E-06	-1,99E-05	1,30E-03
PAHs (air)	kg PAH/20 eq	2,41E-06	1,72E-06	1,12E-06	1,64E-07	-5,94E-07	0,00E+00
Heavy metals (water)	kg Hg/20 eq	5,71E-02	3,59E-03	1,78E-02	2,26E-06	-8,55E-04	3,65E-02
POP (air)	kg TE eq	2,83E-09	2,23E-09	3,71E-10	0,00E+00	9,69E-11	1,30E-10
POP (water)	kg TE eq	1,05E-13	1,05E-13	0,00E+00	0,00E+00	0,00E+00	0,00E+00

5.8.6.2 5kg washing machine

Table 5.66: WM 5 – Assembling phase – Output of SimaPro with "Ecoindicator 95 rev EuP method"

Impact category	greenhouse	ozone layer	acidification	eutrophication	heavy metals	carcinogens	winter smog - P.M.	summer smog - VOCs	pesticides	energy resources	solid waste	Heavy metals (air)	PAHs (air)	Heavy metals (water)	POP (air)	POP (water)
Unit	kg CO2	kg CFC11	kg SO2	kg PO4	kg Pb	kg B(a)P	kg SPM	kg C2H4	kg act.subst	MJ LHV	kg	kg Ni eq	kg PAH/20 eq	kg Hg/20 eq	kg TE eq	kg TE eq
Total	6,44E+02	1,29E-04	6,13E+00	2,50E-01	3,83E-03	2,88E-05	5,02E+00	2,91E-01	0,00E+00	1,23E+04	2,09E+02	8,36E-04	2,26E-06	5,19E-03	2,15E-09	0,00E+00
Cast iron ETH U	2,80E+01	2,00E-05	2,04E-01	7,46E-03	6,20E-04	3,17E-06	1,77E-01	1,38E-02	0,00E+00	4,29E+02	0,00E+00	2,07E-04	3,32E-07	5,53E-04	3,03E-11	0,00E+00
Crude iron I	5,76E+00	2,67E-08	6,00E-02	5,37E-03	6,32E-05	3,79E-06	3,68E-02	2,77E-03	0,00E+00	1,31E+02	1,30E+00	1,08E-05	2,36E-07	8,35E-06	6,81E-15	0,00E+00
X5CrNi18 (304) I	7,50E+00	1,43E-08	2,90E-01	2,62E-03	2,57E-05	8,14E-07	2,87E-01	9,54E-04	0,00E+00	1,09E+02	2,50E-02	3,75E-06	7,71E-08	3,35E-06	1,12E-10	0,00E+00
X5CrNi18 (304) I	2,18E+00	4,16E-09	8,44E-02	7,62E-04	7,49E-06	2,37E-07	8,35E-02	2,77E-04	0,00E+00	3,15E+01	7,26E-03	1,09E-06	2,24E-08	9,75E-07	3,24E-11	0,00E+00
Steel I	1,41E+01	6,53E-08	1,34E-01	1,20E-02	2,93E-04	9,54E-06	8,80E-02	6,36E-03	0,00E+00	2,78E+02	1,50E-01	4,28E-05	8,88E-07	2,32E-05	1,31E-09	0,00E+00
Steel I	6,91E+00	3,21E-08	6,59E-02	5,87E-03	1,44E-04	4,68E-06	4,32E-02	3,12E-03	0,00E+00	1,36E+02	7,38E-02	2,10E-05	4,36E-07	1,14E-05	6,45E-10	0,00E+00
Aluminium rec. I	2,02E+00	0,00E+00	3,39E-02	4,41E-04	4,64E-09	1,67E-10	3,33E-02	2,57E-03	0,00E+00	2,69E+01	2,99E-01	2,12E-07	3,75E-09	0,00E+00	0,00E+00	0,00E+00
Aluminium rec. I	9,81E-01	0,00E+00	1,64E-02	2,14E-04	2,25E-09	8,10E-11	1,61E-02	1,24E-03	0,00E+00	1,30E+01	1,45E-01	1,03E-07	1,82E-09	0,00E+00	0,00E+00	0,00E+00
Brass, at plant/CH U	2,88E-02	2,23E-09	1,42E-03	6,46E-05	4,09E-05	1,02E-07	1,38E-03	2,01E-05	0,00E+00	5,85E-01	0,00E+00	1,67E-05	0,00E+00	1,41E-06	1,76E-13	0,00E+00
Copper I	2,65E+00	1,64E-10	2,43E-01	1,12E-03	4,00E-08	1,83E-10	2,37E-01	9,76E-05	0,00E+00	3,34E+01	4,72E+01	1,20E-08	2,28E-09	2,60E-08	4,18E-17	0,00E+00
Chromium I	2,20E+01	2,89E-08	9,95E-02	5,60E-03	3,51E-06	1,70E-08	1,02E-01	1,58E-03	0,00E+00	3,39E+02	4,15E-02	5,39E-07	5,47E-09	4,57E-06	7,35E-15	0,00E+00
Copper I	6,60E+00	4,10E-10	6,06E-01	2,80E-03	9,97E-08	4,56E-10	5,91E-01	2,44E-04	0,00E+00	8,33E+01	1,18E+02	2,98E-08	5,68E-09	6,48E-08	1,04E-16	0,00E+00
Nickel I	2,13E-02	1,83E-11	1,32E-03	5,38E-06	1,69E-09	8,76E-12	1,33E-03	1,30E-06	0,00E+00	2,72E-01	2,54E-05	2,17E-10	6,18E-12	2,89E-09	4,66E-18	0,00E+00
Zinc I	4,00E-01	2,53E-08	5,60E-03	1,94E-04	4,16E-06	1,12E-08	4,70E-03	7,64E-05	0,00E+00	5,37E+00	8,61E-02	8,83E-07	3,72E-10	4,15E-06	6,45E-15	0,00E+00
Cardboard duplex/tripl	7,17E-02	1,83E-08	3,52E-04	3,56E-05	3,45E-07	4,53E-09	2,56E-04	2,72E-05	0,00E+00	1,37E+00	1,36E-02	1,36E-07	7,30E-11	1,03E-07	0,00E+00	0,00E+00
PS (EPS) B250 (1998)	1,86E+00	1,02E-06	1,37E-02	1,15E-03	4,03E-06	5,14E-08	7,75E-03	1,55E-03	0,00E+00	5,43E+01	2,95E-02	6,68E-07	1,35E-09	1,50E-06	0,00E+00	0,00E+00

Kraft paper, bleached, at plant/RER U	-4,94E-03	1,77E-09	1,02E-04	5,11E-05	2,39E-07	1,77E-09	6,04E-05	6,06E-06	0,00E+00	8,51E-01	0,00E+00	3,28E-08	0,00E+00	7,80E-07	5,44E-14	0,00E+00
PE (LDPE) I	2,05E-01	0,00E+00	3,18E-03	3,03E-04	1,36E-07	1,63E-10	2,18E-03	1,52E-03	0,00E+00	1,52E+01	7,17E-03	0,00E+00	3,28E-10	0,00E+00	0,00E+00	0,00E+00
PP I	8,81E-03	0,00E+00	1,44E-04	1,09E-05	6,88E-09	7,14E-12	1,04E-04	4,14E-05	0,00E+00	6,32E-01	2,48E-04	0,00E+00	1,12E-11	0,00E+00	0,00E+00	0,00E+00
Poplar I	1,12E-01	2,29E-09	1,44E-03	2,34E-04	1,96E-07	1,30E-09	3,21E-04	1,68E-04	0,00E+00	2,30E+01	9,48E-02	3,97E-07	7,36E-10	3,62E-07	5,83E-16	0,00E+00
ABS I	4,24E+00	1,26E-06	2,24E-02	2,39E-03	1,34E-06	2,59E-08	1,26E-02	2,65E-03	0,00E+00	1,09E+02	1,53E-01	0,00E+00	9,58E-09	0,00E+00	0,00E+00	0,00E+00
EPDM rubber ETH U	5,91E+00	1,94E-05	4,96E-02	3,72E-03	1,60E-04	6,23E-07	4,10E-02	2,85E-02	0,00E+00	1,91E+02	0,00E+00	2,99E-05	5,08E-09	1,19E-04	2,37E-12	0,00E+00
PA 6 I	5,23E-02	0,00E+00	1,12E-04	1,65E-05	7,17E-08	2,57E-10	3,31E-05	4,17E-05	0,00E+00	1,05E+00	8,44E-05	4,53E-08	1,20E-11	0,00E+00	0,00E+00	0,00E+00
PA 66 GF30 I	5,45E-03	5,00E-10	3,64E-05	3,99E-06	3,62E-09	1,11E-12	1,45E-05	5,98E-07	0,00E+00	5,85E-02	2,26E-04	0,00E+00	2,30E-12	1,82E-08	0,00E+00	0,00E+00
PA 66 I	1,17E+00	9,67E-08	7,30E-03	9,11E-04	5,89E-07	4,04E-10	2,81E-03	1,44E-04	0,00E+00	1,26E+01	2,95E-02	0,00E+00	8,13E-10	1,08E-06	0,00E+00	0,00E+00
PC I	1,13E+00	4,14E-07	5,76E-03	6,65E-04	2,40E-07	9,22E-10	2,69E-03	4,64E-04	0,00E+00	2,17E+01	4,28E-02	0,00E+00	1,49E-09	0,00E+00	0,00E+00	0,00E+00
PC 30% glass fibre I	1,09E-02	3,83E-09	5,69E-05	6,47E-06	5,18E-09	1,12E-11	2,72E-05	4,30E-06	0,00E+00	2,08E-01	4,22E-04	3,85E-10	1,39E-11	9,71E-10	1,55E-18	0,00E+00
PE (HDPE) I	1,06E-02	0,00E+00	1,47E-04	1,49E-05	7,93E-09	2,01E-12	8,99E-05	9,39E-05	0,00E+00	8,51E-01	3,60E-04	0,00E+00	1,35E-11	0,00E+00	0,00E+00	0,00E+00
HDPE B250	9,63E-02	4,82E-08	5,88E-04	6,04E-05	1,56E-07	4,52E-10	2,70E-04	3,25E-04	0,00E+00	3,33E+00	1,44E-03	4,28E-08	5,40E-11	1,44E-07	0,00E+00	0,00E+00
PP granulate average B250	1,12E+01	8,76E-06	1,08E-01	8,21E-03	2,65E-05	8,27E-08	6,55E-02	2,40E-02	0,00E+00	4,36E+02	1,86E-01	7,06E-06	8,33E-09	2,41E-05	0,00E+00	0,00E+00
PP granulate average B250	5,23E+00	4,11E-06	5,04E-02	3,85E-03	1,24E-05	3,88E-08	3,07E-02	1,12E-02	0,00E+00	2,04E+02	8,71E-02	3,31E-06	3,91E-09	1,13E-05	0,00E+00	0,00E+00
PP granulate average B250	3,94E-03	3,09E-09	3,79E-05	2,90E-06	9,36E-09	2,92E-11	2,31E-05	8,45E-06	0,00E+00	1,54E-01	6,55E-05	2,49E-09	2,94E-12	8,50E-09	0,00E+00	0,00E+00
PP GF30 I	7,74E-02	1,87E-10	1,17E-03	8,99E-05	1,41E-07	1,35E-10	8,33E-04	3,04E-04	0,00E+00	4,85E+00	2,63E-03	1,18E-08	8,72E-11	2,98E-08	4,76E-17	0,00E+00
PVC B250	5,04E-01	1,44E-07	5,96E-03	5,58E-04	2,49E-06	3,48E-09	3,17E-03	1,47E-03	0,00E+00	1,51E+01	3,16E-02	2,70E-07	1,32E-09	4,58E-06	0,00E+00	0,00E+00
PB B250 (1998)	3,17E-02	1,14E-08	2,49E-04	1,89E-05	2,72E-08	1,09E-10	1,50E-04	5,23E-05	0,00E+00	7,60E-01	8,35E-04	8,90E-09	2,11E-11	2,11E-08	0,00E+00	0,00E+00
Bitumen refinery Europe U	2,05E-02	2,57E-07	1,55E-04	1,36E-05	2,02E-07	3,64E-10	1,08E-04	1,36E-04	0,00E+00	1,91E+00	0,00E+00	5,72E-08	4,90E-11	7,78E-08	7,75E-16	0,00E+00
Concrete I	1,24E+00	2,30E-08	6,48E-03	8,21E-04	1,89E-06	1,01E-08	2,13E-01	2,55E-04	0,00E+00	1,54E+01	3,20E-02	2,18E-07	1,48E-09	3,64E-06	5,85E-15	0,00E+00
Electronics for control units/RER U	1,57E+00	8,49E-08	1,29E-02	2,31E-03	2,17E-04	1,03E-06	1,13E-02	5,96E-04	0,00E+00	3,67E+01	0,00E+00	6,05E-05	0,00E+00	3,54E-04	1,45E-12	0,00E+00

PP granulate average B250	5,35E-02	4,20E-08	5,16E-04	3,94E-05	1,27E-07	3,97E-10	3,14E-04	1,15E-04	0,00E+00	2,09E+00	8,90E-04	3,38E-08	4,00E-11	1,16E-07	0,00E+00	0,00E+00
Glass (white) B250	1,38E+00	1,26E-06	8,07E-03	6,04E-04	8,34E-05	8,98E-09	4,86E-03	1,25E-03	0,00E+00	2,18E+01	1,23E-01	4,09E-06	2,84E-09	1,42E-06	0,00E+00	0,00E+00
Gravel I	2,18E-04	8,05E-12	2,39E-06	3,36E-07	6,62E-10	3,54E-12	6,09E-07	1,33E-07	0,00E+00	2,85E-03	1,20E-05	7,63E-11	8,53E-13	1,27E-09	2,05E-18	0,00E+00
Lubricating oil, at plant/RER U	2,78E-02	2,40E-08	2,49E-04	1,35E-04	3,90E-07	2,33E-09	2,01E-04	1,44E-04	0,00E+00	2,28E+00	0,00E+00	9,00E-08	0,00E+00	7,44E-07	6,81E-15	0,00E+00
Kraft paper, bleached, at plant/RER U	-5,08E-02	1,82E-08	1,05E-03	5,26E-04	2,45E-06	1,82E-08	6,22E-04	6,23E-05	0,00E+00	8,76E+00	0,00E+00	3,38E-07	0,00E+00	8,02E-06	5,60E-13	0,00E+00
Copper I	6,69E-01	4,15E-11	6,15E-02	2,84E-04	1,01E-08	4,62E-11	5,99E-02	2,47E-05	0,00E+00	8,45E+00	1,19E+01	3,02E-09	5,76E-10	6,57E-09	1,06E-17	0,00E+00
Poplar I	2,52E-01	5,14E-09	3,24E-03	5,26E-04	4,41E-07	2,92E-09	7,21E-04	3,78E-04	0,00E+00	5,17E+01	2,13E-01	8,92E-07	1,66E-09	8,14E-07	1,31E-15	0,00E+00
Water demineralized ETH U	3,32E-01	4,37E-07	2,52E-03	9,91E-05	3,39E-06	8,35E-09	2,01E-03	1,05E-04	0,00E+00	7,55E+00	0,00E+00	1,66E-06	2,66E-10	7,23E-06	2,18E-14	0,00E+00
Lubricating oil, at plant/RER U	4,38E-02	3,78E-08	3,93E-04	2,12E-04	6,15E-07	3,68E-09	3,17E-04	2,28E-04	0,00E+00	3,60E+00	0,00E+00	1,42E-07	0,00E+00	1,17E-06	1,07E-14	0,00E+00
Electricity MV use in UCPTE U	1,54E+01	7,60E-06	1,10E-01	3,74E-03	1,04E-04	3,44E-07	9,20E-02	3,36E-03	0,00E+00	3,64E+02	0,00E+00	2,63E-05	7,50E-09	1,54E-04	9,55E-13	0,00E+00
Heat gas B250	3,22E+00	3,69E-08	3,96E-03	5,05E-04	1,20E-06	2,39E-07	1,71E-03	3,68E-04	0,00E+00	5,45E+01	0,00E+00	6,26E-07	2,57E-09	1,50E-06	0,00E+00	0,00E+00
Truck 28t B250	5,38E+00	6,00E-06	7,30E-02	1,23E-02	8,20E-06	4,20E-08	7,78E-03	1,35E-02	0,00E+00	7,05E+01	0,00E+00	2,84E-06	5,67E-08	2,25E-06	0,00E+00	0,00E+00
Sea ship B250	1,20E-01	1,33E-07	1,82E-03	4,08E-05	2,53E-06	5,54E-09	1,61E-03	1,17E-04	0,00E+00	1,65E+00	0,00E+00	1,10E-06	8,01E-11	9,60E-08	0,00E+00	0,00E+00
Hot rolling, steel/RER U	2,49E+00	2,05E-07	8,44E-03	3,73E-03	2,63E-04	2,88E-07	8,28E-03	1,81E-03	0,00E+00	5,27E+01	0,00E+00	7,33E-06	0,00E+00	2,69E-04	3,65E-12	0,00E+00
Sheet rolling, steel/RER U	1,07E+00	7,67E-08	4,96E-03	1,94E-03	1,45E-04	1,33E-07	4,75E-03	2,92E-04	0,00E+00	2,29E+01	0,00E+00	1,53E-06	0,00E+00	1,09E-03	2,37E-12	0,00E+00
Extruding alum I	4,69E+02	5,06E-05	3,66E+00	1,48E-01	1,47E-03	2,66E-06	2,69E+00	1,56E-01	0,00E+00	8,57E+03	2,87E+01	3,51E-04	1,47E-07	2,36E-03	4,20E-12	0,00E+00
Wire drawing, copper/RER U	4,29E-01	2,31E-08	3,12E-03	2,39E-04	3,69E-05	1,10E-07	2,69E-03	1,28E-04	0,00E+00	1,01E+01	0,00E+00	1,40E-05	0,00E+00	2,05E-05	1,91E-13	0,00E+00
Foaming, expanding/RER U	3,54E-01	4,68E-08	1,91E-03	1,37E-04	1,69E-06	1,94E-08	1,52E-03	3,46E-03	0,00E+00	7,17E+00	0,00E+00	1,16E-06	0,00E+00	1,61E-06	2,17E-14	0,00E+00
Injection moulding/RER U	10,01081	6,25E-06	0,046411	0,006722	7,91E-05	7,18E-07	0,033831	0,002601	0	250,801	0	1,49E-05	0	0,000143	1,3E-12	0
Extrusion PVC I	0,067083	0	0,001029	7,58E-05	6,61E-09	3,05E-11	0,000833	0,000197	0	0,947131	0,00289	7,33E-13	6,5E-11	0	0	0

Table 5.67: WM 5 – EoL phase – Output of SimaPro with "Ecoindicator 95 rev EuP method"

Impact category	Unit	Total	Recycling only B250 avoided	Incineration B250 (98) avoided	Landfill B250 (98)
greenhouse	kg CO2	-6,58E+01	-6,75E+01	8,93E-01	7,90E-01
ozone layer	kg CFC11	-2,33E-05	-2,33E-05	-4,93E-08	4,31E-08
acidification	kg SO2	-2,71E-01	-2,70E-01	-8,92E-04	5,12E-04
eutrophication	kg PO4	-1,92E-02	-1,94E-02	2,96E-06	1,53E-04
heavy metals	kg Pb	-4,39E-04	-4,38E-04	-1,24E-06	3,15E-07
carcinogens	kg B(a)P	-3,67E-05	-3,67E-05	-6,30E-09	2,96E-10
winter smog - P.M.	kg SPM	-1,85E-01	-1,84E-01	-1,08E-03	1,26E-04
summer smog - VOCs	kg C2H4	-5,61E-02	-5,64E-02	6,88E-06	2,82E-04
pesticides	kg act.subst	0,00E+00	0,00E+00	0,00E+00	0,00E+00
energy resources	MJ LHV	-9,62E+02	-9,70E+02	7,77E+00	5,39E-01
solid waste	kg	-4,92E+01	-4,92E+01	0,00E+00	0,00E+00
Heavy metals (air)	kg Ni eq	-3,81E-05	-3,83E-05	3,76E-08	1,56E-07
PAHs (air)	kg PAH/20 eq	-9,06E-07	-9,08E-07	1,58E-09	4,24E-10
Heavy metals (water)	kg Hg/20 eq	-1,08E-03	-1,08E-03	-2,38E-06	1,77E-06
POP (air)	kg TE eq	2,98E-11	0,00E+00	2,97E-11	5,52E-14
POP (water)	kg TE eq	0,00E+00	0,00E+00	0,00E+00	0,00E+00

Table 5.68: WM 5 – Life Cycle – Output of SimaPro with "Ecoindicator 95 rev EuP method"

Impact category	Unit	Total	WM 5kg assembling	Electricity LV use UCPTE U	Delivery van (<3.5t) B250	WM 5kg EoL	WM 5kg use materials (per LC)
greenhouse	kg CO2	3,42E+03	6,44E+02	1,93E+03	6,86E+00	-5,66E+01	8,95E+02
ozone layer	kg CFC11	1,44E-03	1,29E-04	1,25E-03	7,29E-06	-2,13E-05	7,73E-05
acidification	kg SO2	2,46E+01	6,13E+00	1,41E+01	2,55E-02	-2,49E-01	4,59E+00
eutrophication	kg PO4	1,75E+00	2,50E-01	4,74E-01	2,93E-03	-1,66E-02	1,04E+00
heavy metals	kg Pb	3,70E-02	3,83E-03	1,52E-02	2,11E-05	-3,75E-04	1,83E-02
carcinogens	kg B(a)P	1,27E-04	2,88E-05	4,64E-05	8,63E-08	-3,67E-05	8,81E-05
winter smog - P.M.	kg SPM	2,04E+01	5,02E+00	1,18E+01	1,03E-02	-1,74E-01	3,81E+00
summer smog - VOCs	kg C2H4	1,02E+00	2,91E-01	4,34E-01	1,91E-02	-4,62E-02	3,23E-01
pesticides	kg act.subst	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
energy resources	MJ LHV	7,80E+04	1,23E+04	4,57E+04	8,77E+01	-8,43E+02	2,07E+04
solid waste	kg	1,69E+02	2,09E+02	0,00E+00	0,00E+00	-4,01E+01	0,00E+00
Heavy metals (air)	kg Ni eq	8,02E-03	8,36E-04	3,67E-03	6,30E-06	-3,35E-05	3,55E-03
PAHs (air)	kg PAH/20 eq	2,96E-06	2,26E-06	1,23E-06	2,41E-07	-7,77E-07	1,00E-10
Heavy metals (water)	kg Hg/20 eq	7,05E-02	5,19E-03	1,95E-02	3,31E-06	-8,89E-04	4,66E-02
POP (air)	kg TE eq	2,84E-09	2,15E-09	4,08E-10	0,00E+00	2,59E-11	2,52E-10
POP (water)	kg TE eq	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00