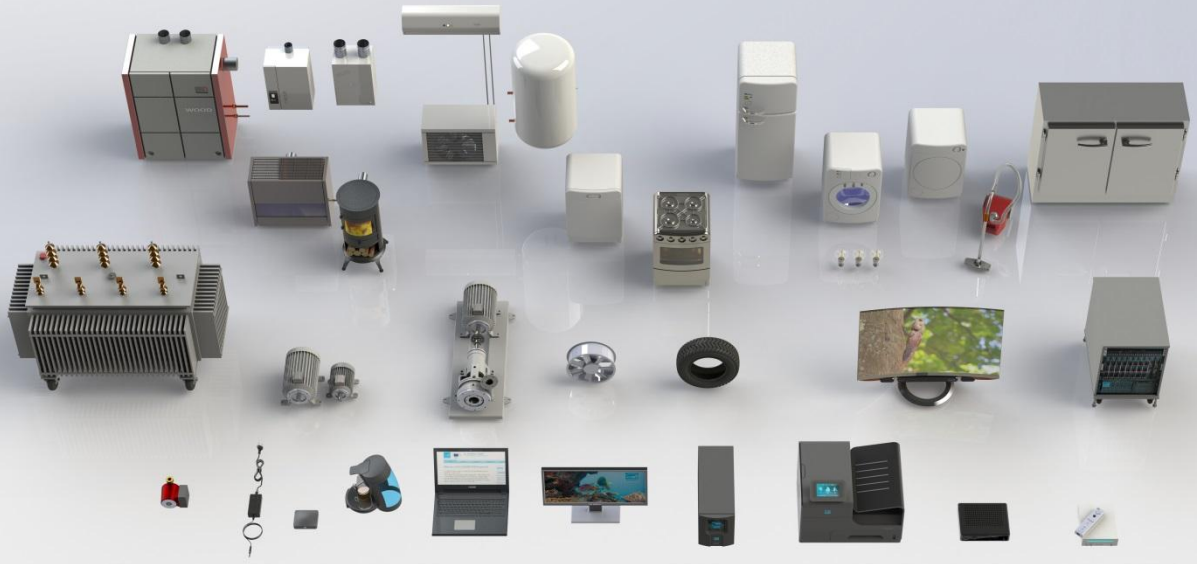
European Commission

Ecodesign Impact Accounting

Special Report
Material Inputs for Production
2016



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Energy

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Executive Summary

In the context of the recent discussions on 'Circular Economy' and the important role of Ecodesign and Energy Labelling in the most recent Commission's proposal, there is a need for a more extensive impact analysis of the consumption of (non-energy) material resources in Ecodesign in order to set priorities and determine the best approach per product group.

This report is an addition to the main Ecodesign Impact Accounting (EIA) of March 2016. It calculates the material consumption for the production of the 2010 sales and the 'installed stock'. The material inputs are a compilation of over 200 Bills of Materials (BOMs) generated in 40 Ecodesign preparatory studies that took place in the period 2006-2016. These BOMs were mostly presented in a general EcoReport format which allows to compute totals across products for over 60 materials. This makes it possible to generate probably the most comprehensive overview of material's use in regulated Energy-related Products (ErP) to date.

After introductory chapters 1 and 2, explaining background and methodology, the material inputs for annual sales of the regulated ErP are calculated in Chapter 3. The material volume of sales depends not only on the unitary product weight but also on the average product life, with 'fast-moving' products requiring a higher annual materials input. For comparison Chapter 4 calculates the total material volume of the ErPs installed ('stock').

Chapter 5 gives a more detailed view of the specific materials involved and discusses specific use. Finally, Chapter 6 makes a comparison between the identified material's input in ErP and the total EU-28 consumption of plastics, metals, glass, cardboard and rubber.

The main conclusions are:

- The total weight of the ErP sold is 14.6 Mt (EU 2010). This is 4.6% of the EU-28 total consumption of plastics, metals, glass, cardboard and rubber (318 Mt).
- The main consumers are 'Tyres' (3075kt; 21%), 'Household Refrigeration' (1204kt; 8%) and 'Washing Machines' (952kt; 7%).
- Most consumed materials, in terms of weight, are part of the Ferro-metals group, which covers 46% of all materials. The Miscellaneous group has a high share (25%) in the total weight due to the inclusion of natural & synthetic rubber for tyres.
- The most consumed specific material is by far steel sheet with an annual consumption of 3450kt, which is 24% of the total weight of all products. The top three is completed with *cast iron (1411kt; 10%)* and *natural rubber (1349kt; 9%)*.
- The total weight of all installed products is 161Mt. The 'fast-moving' tyres (3-4 product life) are no longer number one. Most heavy product group is 'utility transformers' (17.8Mt; 11%). Still second largest is 'household refrigeration' (15.7Mt; 10%), again followed by 'washing machines' (14.3Mt; 9%).

Note that the ranking of products is only illustrative; it is **not** to be used as a priority listing for circular economy policy measures. This analysis is an important part of the puzzle, but for proper decision support a comprehensive assessment is needed. For instance, there can be negative trade-offs between longevity and safety (e.g. for tyres). Longevity of products slows down the introduction of more energy efficient new products, which is important for products where there is still a large energy saving

potential (refrigerators, electronic displays). Also recycling plays a role, e.g. cooking appliances have a relatively high materials input, but most of these materials are metals and easy to recycle. Furthermore, this special report uses 'weight' as a parameter, but in a more comprehensive assessment all environmental impact categories of the EcoReport (energy, carbon emissions, acidifying emissions, etc.) have to be considered in all phases of the product life cycle. Last but not least, the current analysis makes an inventory of the materials that end up in the final product. It does not take into account production waste, which may add some 10-15% (after primary scrap recycling). The resources consumption during use and the End-of-Life stage –part of the main EIA analysis—is not integrated here at product level.

Also note that this a preliminary analysis, based on a harmonised compilation of Bills of Materials (BoMs) over a 10-year time period (2005-2015) performed by different contractors with varying levels of detail and quality. The authors have taken great care to use the best available data, but can assume no liability for the reliability of the data and its use.

Contents

1 Introduction

Following the recent discussions on 'Circular Economy'[1] and the important role of Ecodesign and Energy Labelling in the most recent Commission's proposal[2], there is a need for a more extensive impact analysis of the consumption of (non-energy) material resources in Ecodesign in order to set priorities and determine the best approach per product group. This is confirmed by recent meetings of the Competitiveness Council of 29 February 2016[3] and the Environmental Council of 4 March 2016[4]. An aggregation of the available data in the various Ecodesign studies of the last 10 years can make a valuable contribution and that is why this extension is now included in the EIA study.

Analysis of the consumption of (non-energy) material resources is a mandatory part of every preparatory Ecodesign study for Energy-related Products (ErPs) since 2005. Over 40 preparatory Ecodesign studies have resulted in over 200 Bills of Materials for 'base case' product groups. The format and tools for these analyses are included in the methodologies for preparatory studies, MEEuP 2005[5] and MEErP 2011[6], and constitute a valuable data source for the policy decisions regarding the individual product groups. The 'Ecoreport' Excel tool, part of the MEErP 2011, prescribes a strict format for quantitative data that has been followed in almost all studies. This tool has been used by most of the contractors and enables to produce aggregate data of over 60 materials, clustered in 8 material groups (bulk- and technical plastics, ferro and non-ferro metals, coatings and electronics, packaging and miscellaneous).

In this first preliminary assessment the focus is on material inputs per product and, by using sales and stock data from the EIA study, the total of materials used in new ErP and the ErP that are in use (the stock). An inventory of the End-of-Life (EoL) streams, such as recycling, re-use and disposal, is not yet available but, in as much as the data exist in the underlying Ecodesign studies, may be included in later versions of the EIA study.

This analysis is a harmonised compilation of Bills of Materials (BoMs) over a 10-year time period (2005-2015) performed by different contractors and with varying level of quality. VHK has tried to use the most reliable and recent BoMs especially for dynamic sectors, such as electronics, but can assume no liability for the information in this report or the use thereof. Nonetheless, the strong point of this analysis is an unprecedented level of detail across a very large part of the whole range of energy-related products and, with all its possible flaws, constitutes the most comprehensive inventory of material inputs in ErP in the EU.

[1] 7th Environmental Action Plan (EAP), Decision No 1386/2013/EU of the European Parliament and of the Council of 20 November 2013 on a General Union Environment Action Programme to 2020 'Living well, within the limits of our planet',OJ L 354, 28.12.2013, p. 171–200

[2] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, Closing the loop - An EU action plan for the Circular Economy, COM/2015/0614 final, Brussels 2.12.2015.

[3] Flynn, V., Circular economy needs impact analysis – ministers, ENDS Daily, 1 Mar 2016.

[4] Flynn, V., Strong support for circular economy ecodesign at Council, ENDS Daily, 7 Mar 2016. See also http://www.consilium.europa.eu/en/meetings/env/2016/03/04/#

[5] Kemna, R., Methodology for Ecodesign of Energy-using Products (MEEuP), VHK for the Commission, Nov. 2015.

[6] Kemna, R., Methodology for Ecodesign of Energy-related Products (MEErP), VHK fort he Commission, 2011.

2 Methodology

In this analysis all the materials which have been inventoried for the Ecoreports in previous preparatory studies are linked to the sales of the current version of EIA (March 2016). In general, there were two major steps: 1) Retrieval and analysis of all Bills of Materials and 2) linking those BoM's to the sales of the current EIA. In this chapter, the sub-steps will be described, including the main problems which were faced during the inventory.

The file reflects the status of one year. Reference year for the sales is 2010. The original data for the Bills of Materials stem from the period from 2001 to 2016, with most studies being conducted in between 2007 – 2009. For those products, the 2010 data are likely to match the material input in weight.

For some products particularly in the electronics sector, there is a continuous development aimed at weight reduction. For instance, over the last 10-15 years the weight of televisions of the same screen size has decreased by over 80% (e.g. from 60 to 9 kg for a 32" screen). Other products have grown heavier because of increase in size (+10% over the last year for refrigerators and washing machines) and/or energy efficiency (e.g. more insulation of refrigerators, more copper in motors, etc.). This study has taken great care to use the most recent BoMs especially for the above mentioned products where changes are expected. Nonetheless, the data presented here will have an uncertainty—at aggregate level—of roughly ±10%.

2.1 Bills of Materials

To get the desired information on the overall material consumption, an Excel file was built according to the following steps:

- For all Lot numbers in EIA, the Bills of Materials were derived from the original preparatory studies. Most of these BoM's are available in the Task 4 reports. In some cases, original Ecoreport data were available.
- The materials which are used for this study are directly related to the list of input materials for the Ecoreports. The materials in this list are all numbered, as can be seen in Annex B. The list in Annex B is the list as used in this study and is based on the numbering of the original list of materials. This list of materials was recently updated and some materials have been added (PET and Refrigerant). However, this updated version has only been used for a few (of the newer) preparatory studies. During the collection of all Bills of Materials for this study, mostly the older formats were found, which explains why this older format is used as the base of the study. In case a preparatory study made use of the new Ecoreport inputs, the numbering of the materials was corrected to the numbering of the list of Annex B.
- Some product groups included very specific materials, which were not included in the original format. Examples are rubber in tyres and mercury in lamps. Since these materials do have a specific impact, it was chosen to add them to the material list. The full, final list including the numbering can be found in Annex B.
- The Excel file consist of an Info sheet, 5 result sheets and a number of input sheets, where all BoM info is collected. The following information can be expected on the Info and Result sheets:
    a. *Info:* an overview of the status of the information inventory on sales and materials per product group. Also, notes were made if special

calculations were done or if the reader should be aware of certain information.

b. *Totals per unit:* Collects all material inputs per unit. It calculates the product weight based on this input.
c. *Total_Sales:* The input from the '*Totals per unit*' sheet is multiplied by the sales numbers of 2010 (see 2.2 for more details on the collection of these data).
d. *Total_Stock:* The results from the *Total_Sales* sheet are multiplied by the lifespan (copied from EIA) for all materials.
e. *Summary_Data:* The total consumption of every material is collected for every product group. It calculates the total weight of all product groups. Furthermore it presents graphs on the relative share of the weight per material category and presents the absolute weight of each material. This is all done for both sales and stock data.
f. *Result_graphs:* Shows pie-charts for all materials to show the relative influence of the different product groups and materials.

2.2 Link to EIA sales

As mentioned, the results are dependent on the sales data from EIA. In most cases, the link between the BoM and EIA sales was not that clear. Different situations could occur when trying to find the right data:

- The original preparatory study would include a BoM which would match the current EIA base case. Sales from EIA could be directly copied into the sheet without any adaptions.
- For some EIA product groups, more BoM's were available for one specific EIA base case. This could lead to two situations:
    a. It may be that a sub-base case for which the BoM was constructed was eventually excluded from the scope of the regulation. This means the base case is not included in EIA and so the BoM should not be used any more. As a general rule, a BoM is not included in the calculations of this study if the base case was excluded from EIA. [7].
    b. Another option is that an EIA base case represents a (weighted) average of more than one of the original base cases (and thus BoM's). In that situation, the studies were reviewed again, to see if there was any information available on sales data. If so, all relevant BoM's were included and matched to a share (in %) of the sales from the EIA base case.
- For some EIA base cases, no detailed BoM was available. In such situations a representative BoM was recreated. This was done by finding a product with similar properties and a detailed BoM available. If no relevant information was available (and sales numbers in EIA were low) it may be that no BoM was made. In Annex A more detailed information about the construction of these new Bills of Materials can be found.
- If a BoM was available in a certain product group, but no EIA base case could be related to it, it was not used. Also, if the BoM could be related to a product in the study or impact assessment, but was eventually excluded from Ecodesign regulation (and thus EIA), it was (currently) excluded from the materials inventory as well.

[7] It may be optional to include *all* bills of materials for which sales data are available for a more accurate overview. The question is whether the closest approximation is more desirable or the clear link with EIA.

2.3 Accuracy of the data

There are several factors that can influence the accuracy of the results. In this paragraph, three of these issues will be addressed.

2.3.1 New BoM's

As explained in the previous chapter, some of the BoM's used for calculations are not derived from a preparatory study or Ecoreport, but were created –derived from BoMs for similar products—because original data was not available. Of all used BoM's, 22% was newly created (see Figure 1). These new BoMs account for 12% of the total weight of all products (see Figure 2). Furthermore, these BoMs are linked to 2% of the sales of all base cases which are included in this study. In Annex A an overview can be seen of the resources of all BoM's. If a BoM is not original, a short explanation is given about the assumptions which were made for the new BoM. Also, if any calculations were conducted to match the BoM's to the available sales data from EIA an explanation is given.

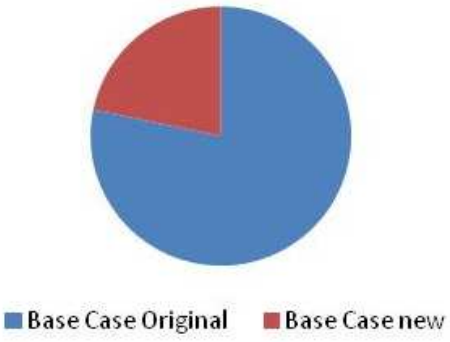

Figure 1. Original vs new BoM's

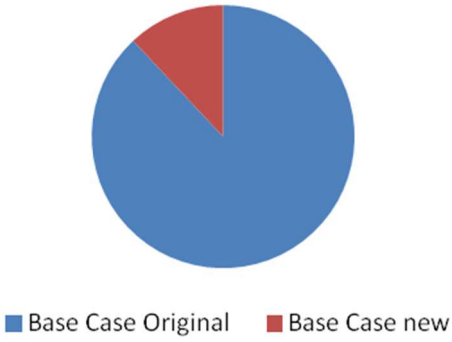

Figure 2. kton of original and new BoM's

2.3.2 Year of origin of the BoM's.

Another aspect which should be taken into account is the relevance of the data in the present. As stated earlier, the BoM's are derived from preparatory studies, which often have been conducted years ago. Figure 3 shows that more than 1/4th of all studies was conducted in 2007 and that over half (58%) was conducted in 2010 or before.

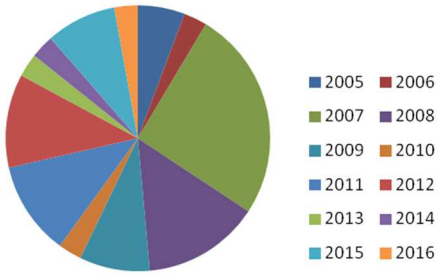

Figure 3. Year of origin BoM's

Having said that, for the most dynamic products like televisions (2014) and refrigerators (2016), the BOMs are recent and probably valid for today's situation. More details can be found in Annex A.

2.3.3 Double counting

Some products groups in EIA are not only sold and used as an independent product, but can also be integrated as a component in other regulated products. This implies that, similar to the double counting of energy in EIA, there could be an issue of double counting of material inputs. E.g. the material inputs for Condensing Units could be double counted in other refrigeration products and the material inputs for motors could be double counted in compressors or fans.

Currently, a double counting correction has only been applied for the central heating combis where the same product can be used both for space and water heating. To avoid double counting, the material inputs for combi appliances were partitioned according to their energy output, i.e. 15% was counted in Lot 2 (water heating) and 85% in Lot 1 (space heating).

For other product groups double counting has not been assessed yet, because this involves studying more in detail the original BoM's to verify which components are included/excluded.

3 Sales based results

The first results were retrieved by multiplying the sales data from EIA (2010) with the unit product weights from the Bills of Materials. This provided information on the total weight of all product groups, the materials with the largest annual impact in terms of weight, and insights in *which* products consume *what* materials. In this chapter the most important and interesting findings are presented.

In the graphs in this and following chapters, the abbreviations of Table 1 will be used for the product groups.

Table 1. Product groups and abbreviations

WH	WH dedicated Water Heater	**UPS**	UPS Uninterruptable Power Supply
CHC	CHC Central Heating Combi	**RF**	RF Household Refrigeration
CH	CH Central Heating Boiler	**CF**	CF Commercial Refrigeration
SFB	SFB Solid Fuel Boilers	**PF**	PF Professional Refrigeration
AHC	AHC total Heating & Cooling	**CA**	CA Cooking Appliances
LH	LH Local Heaters	**CM**	CM household Coffee Makers
RAC	RAC Room Air Conditioner	**WM**	WM household Washing Machine
CIRC	CIRC Circulator pumps <2.5 kW	**DW**	DW Household Dishwashers
E6/VU	E6/10 VU Ventilation Units (res & nonres)	**LD**	LD household Laundry Drier
LS_ECO	LS Light Sources, mln units ECO	**VC**	VC Vacuum Cleaners
DP	DP electronic DisPlays	**FAN**	FAN Industrial Fans >125W
STB	STB Set Top Boxes	**MT**	MT Motors 0.75-375 kW
VIDEO	VIDEO	**WP**	WP Water pumps
ES	ES Enterprise Servers	**CP**	CP Standard Air Compressors
PC	PC Personal Computers	**TRAFO**	TRAFO Utility Transformers
EP	EP & IJ imaging equipment	**TYRE**	TYRE
BC	BC Battery Charged devices		

3.1 Total weight of products sold in 2010

The total sales weight has been calculated as the sum of the materials included in the categories of the Ecoreports, being:

- Bulk plastics (including PET [100] where applicable),
- TEC plastics,
- Ferro,
- Non-ferro metals (including mercury [95]),
- Coatings,
- Electronics (including controller boards [98]) and
- Miscellaneous (including refrigerant [92], natural rubber [93], synthetic rubber [94] and other [99]).

For all included materials included in each category see ANNEX B.

In the graph of Figure 4, the group 'Packaging' has been added. Packaging consists of the materials LDPE [1], EPS [6], cardboard [56] and office paper [57]. Those materials have been split from their original material groups [8].

Figure 4 shows that some product groups have a more significant impact in terms of total weight than others. The total weight of all product groups was calculated as 14.6 Mton. The most heavy product group is 'Tyres' with a total weight of 3.1 Mton (equal to

[8] These materials are rarely used inside the products, so their entire mass has been assumed to represent packaging.

21% of the overall weight), followed by 'Domestic Refrigerators' (RF, Lot 13) with 1.2 Mton (8%) and the 'Washing Machines' (WM, Lot 14) with 0.9 Mton (7%).

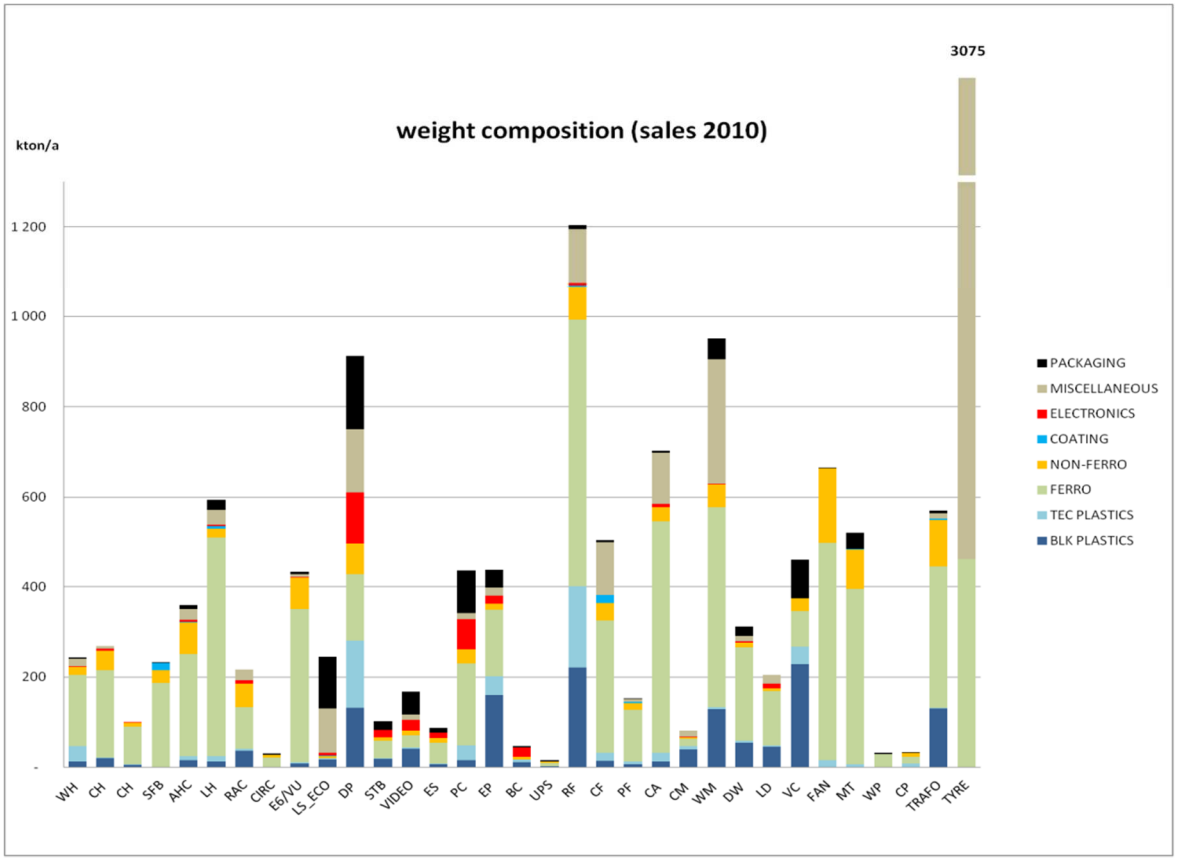

Figure 4. Total weight of the products sold in 2010

Figure 4 also shows the division of the weight over the material categories. For most product groups the highest weight-share is for ferrous materials. However, in the case 'Tyres', the weight depends mainly on the amount of rubber included in the product. Although the tyres do not have an extreme high weight per unit - varying from 9 to 60 kg - the high sales quantities cause a major annual impact (see Table 2).

Table 2. Material Inputs for products sold in the reference year 2010, in kton/a (data underlying Figure 4).

	BULK PLASTIC	TEC PLASTIC	FERRO	NON-FERRO	COATING	ELEC.	MISC.	PACK>	TOTAL
WH dedicated Water Heater	12	34	159	17	0	2	16	3	**243**
CHC Central Heating boiler	6	1	69	12	0	1	1	0	**89**
CH Central Heating	25	6	357	41	0	4	0	0	**434**
SFB Solid Fuel Boilers	0	0	187	28	16	1	0	0	**232**
AHC total Heating & Cooling	16	9	226	70	1	4	25	8	**359**
LH Local Heaters	12	12	486	19	6	4	32	23	**594**
RAC Room Air Conditioner	36	4	93	51	0	7	24	0	**216**
CIRC Circulator pumps <2.5 kW	1	0	21	5	0	0	0	2	**30**
VU Ventilation Units (res & nonres)	8	2	340	71	0	1	6	7	**435**
LS Light Sources, mln units ECO	17	2	0	5	0	7	98	114	**244**
DP electronic DisPlays	131	150	147	70	0	113	140	163	**913**
STB Set Top Boxes	18	2	39	6	0	16	1	19	**102**
VIDEO	41	2	27	11	0	24	12	50	**167**
ES Enterprise Servers	7	1	47	9	0	12	0	10	**86**
PC Personal Computers	15	33	181	32	0	67	13	97	**438**
EP & IJ imaging equipment	160	42	146	14	0	16	19	41	**440**
BC Battery Charged devices	11	6	0	6	0	20	0	4	**47**
UPS Total	2	0	7	3	0	1	0	2	**15**
RF Household Refrigeration	221	180	592	74	3	6	119	9	**1204**
CF Commercial Refrigeration	13	19	293	39	17	1	118	5	**505**
PF Professional Refrigeration	6	6	114	15	3	0	6	1	**152**
CA Cooking Appliances	12	19	516	30	0	8	114	4	**703**
CM household Coffee Makers	40	7	17	3	0	2	13	0	**81**
WM household Wash Machine	129	4	446	50	0	2	275	46	**952**
DW Household Dishwashers	55	4	207	10	0	4	11	22	**312**
LD household Laundry Drier	45	3	121	6	0	10	20	0	**205**
VC Vacuum Cleaners	228	39	79	28	0	0	0	88	**461**
FAN Industrial Fans >125W	0	15	484	165	0	0	0	2	**666**
MT Motors 0.75-375 kW	0	7	389	88	2	0	0	37	**522**
WP Water pumps	0	0	29	0	0	0	0	4	**33**
CP Standard Air Compressors	0	8	16	8	0	0	0	1	**32**
TRAFO Utility Transformers	131	1	315	104	2	0	13	5	**570**
TYRE	0	0	463	0	0	0	2612	0	**3075**
TOTAL	**1399**	**619**	**6610**	**1090**	**52**	**334**	**3689**	**765**	**14557**

3.2 Most consumed materials in products sold in 2010

The material inputs of the BoM's are divided into 8 main categories. Figure 5 provides the weight-share per material category. Ferrous materials represent the majority of the material consumption (45%), followed by the Miscellaneous group with a share of 26%, mostly due to the rubber consumed in the 'Tyres'. Bulk Plastics cover 10% of the material inputs, Non-Ferrous metals (8%), TEC Plastics (4%), Electronics (2%) and Coatings (0.3%). The Packaging (5%) was treated separately, since this could be a specific target for improvements.

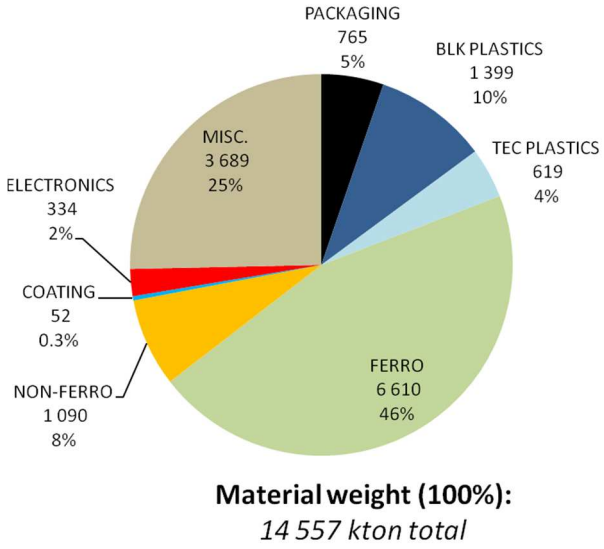

Figure 5. Material consumption per category in products sold in 2010

The weight of the material categories can be narrowed down to the specific materials causing the impact. The high share of the Ferro group is due to three of the top five most consumed materials belong to this group (Table 3). Just *steel sheet galvanised* alone covers more than half of the material consumption of the total Ferro group. With the addition of the weights of *cast iron* and *steel tube/profile* almost the whole Ferro group (86%) is covered. The top 5 consumed materials is completed by *natural* and *synthetic rubber*, which are only used in 'Tyres'.

Table 3. Top 5 most consumed materials in products sold in 2010

Rank	TOP 5 Material	kton/a
1	Steel sheet galvanized	3401
2	Natural Rubber	1349
3	Cast iron	1312
4	Synthetic Rubber	854
5	Steel tube/profile	843

4 Stock based results

The previous chapter described the impacts of the newly introduced materials (contained in products sold) in one particular year, in this case 2010. This chapter addresses the quantity of material installed (contained in products in stock) and its division over the EIA product groups. This quantity was computed multiplying the data on sales by the lifetime of the products. Even though this is not the exact quantity of material in the stock, it gives a good impression of the effect of the different lifetimes of the products [9].

4.1 Total weight of products in stock

The total stock weight is 161 Mton. Figure 6 provides the distribution over the product groups. The group with the highest total weight in the stock are the 'Utility Transformers' (TRAFO) with 17.8 Mton, followed by 'Domestic Refrigeration' (15.7 Mton), 'Washing Machines' (14.3 Mton) and 'Cooking Appliances'(12.1). Materials in 'Tyres', that were dominant in the sales weight, now rank 5th with 12.0 Mton.

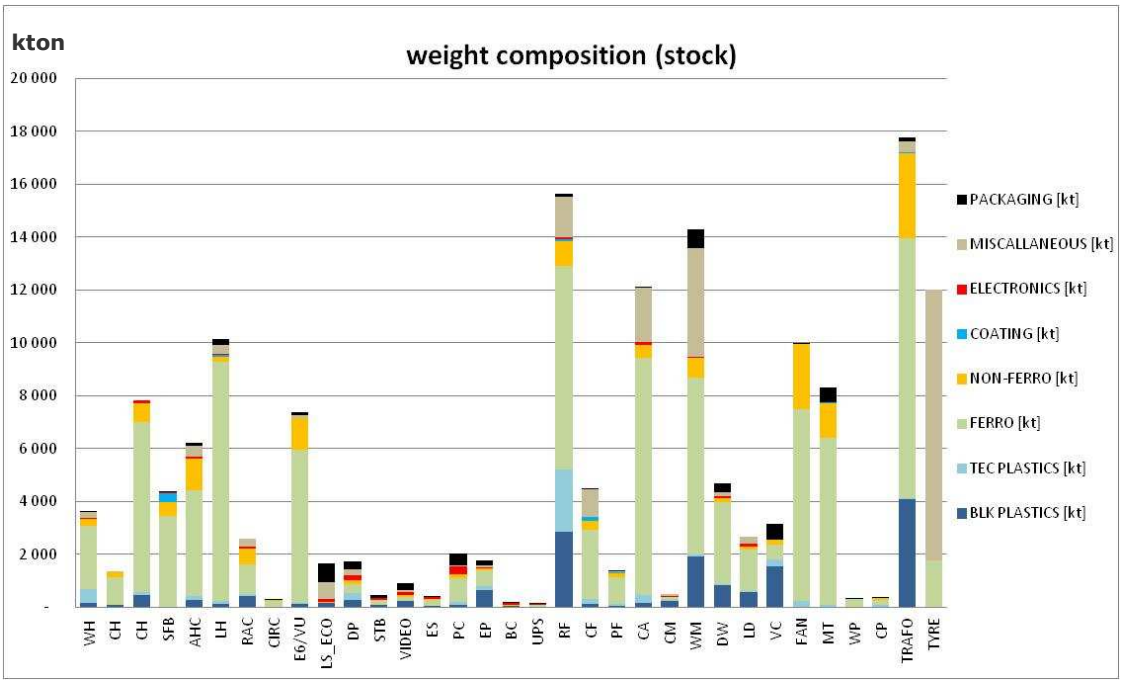

Figure 6. Total weight of products in the stock (sales 2010 x lifetime), in kton

The difference in relative impacts of the product groups when looking at the sales weight (Figure 4) or at the stock weight (Figure 6) is caused by the differences in lifetime. 'Tyres' have the 3rd lowest lifetime (sales weighted average) and their stock weight is 'only' around 4 times their sales weight. On the other hand, 'Utility Transformers' have an average lifetime of 32.2 years, by far the longest lifetime of all product groups.

[9] This assumes that sales are constant over lifetime years and that the material inputs for the sold products are the same in all years. In reality sales vary over the years, and for many product groups there is also a significant evolution in material inputs, some increasing the product weight, others reducing it.

Table 4. Average lifetime of products, top and bottom 5

Rank	TOP 5	Life		Rank	Bottom 5	Life
1	TRAFO Utility Transformers	32.3		1	BC Battery Charged devices	3.5
2	SFB Solid Fuel Boilers	18.4		2	EP & IJ imaging equipment	4.0
3	CH Central Heating	18.0		3	TYRE	4.0
4	AHC total Heating & Cooling	17.3		4	PC Personal Computers	4.3
5	VU Ventilation Units (res & nonres)	17.0		5	STB Set Top Boxes	4.5

4.2 Most consumed materials for products in stock

At stock level, the relative weight of ferrous materials in products is higher than at sales level. This is again linked to the lifetime: The products with a relatively high share of ferrous materials often also have a long life. The increase of the share of the Ferro group is counterbalanced by a decrease in the impact of the Miscellaneous group. This is related to the decreasing impact of the rubber in the 'Tyres'.

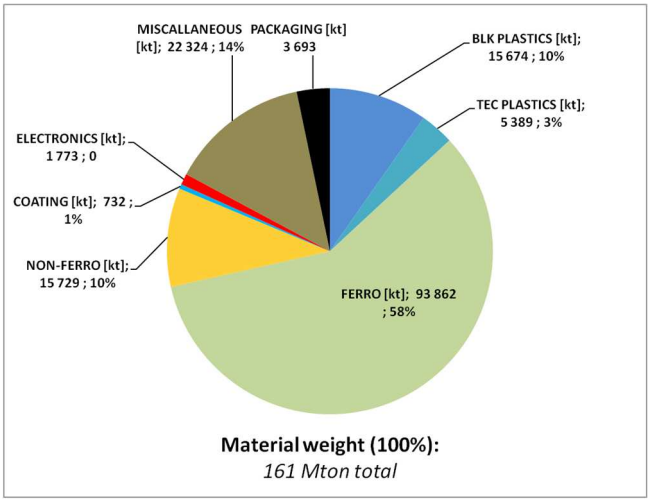

Figure 7. Consumption for the main categories

The large share of ferrous materials in the stock is also clear in the top 5 of most consumed materials, of which 4 belong to the Ferro group (Table 5): *steel sheet galvanised*, *cast iron, stainless 18/8 coil* and *steel tube/profiles.*

Also interesting is to see that one plastic, *polypropylene*, is more apparent at stock level than at sales level. As can be seen in Figure 6, this is related to the high stock of the 'Utility Transformers', 'Household Refrigeration' and 'Washing Machines'.

Table 5. Top 5 most used materials (stock 2010)

Rank	TOP 5 Material	Gton
1	Steel sheet galvanized	47
2	Cast iron	23
3	Stainless 18/8 coil	13
4	Steel tube/profile	13
5	Poly-Propylene (PP)	10

5 Detailed material consumption

For each of the 8 material categories, this chapter provides the weight shares for the individual materials in that category. In addition it is shown in which product groups the materials of the category are mainly applied. These data are presented for the materials contained in the products sold in the reference year 2010 (i.e. sales based data).

5.1 Bulk Plastics

The total quantity of Bulk Plastics in products sold in 2010 is 1399 kt/a.

More than half of the Bulk Plastics (62%) is consumed by only five product groups (Figure 8). The highest shares can be found in 'vacuum cleaners' (VC) and 'household refrigeration' (RF), both with a share of 16%. Other large consumers are 'printers and copiers' (EP), 'displays' (DP) and 'utility transformers' (TRAFO). Bulk plastics are mainly used for the housings of these products (except for TRAFO [10]).

The most used material types are *polypropylene (PP: 43%), ABS (17%)* and *polystyrene (PS: 16%).* The plastics LDPE and EPS (combined covering 8% of the Bulk Plastics) are mostly used for packaging purposes only (see Figure 15 in paragraph 5.8).

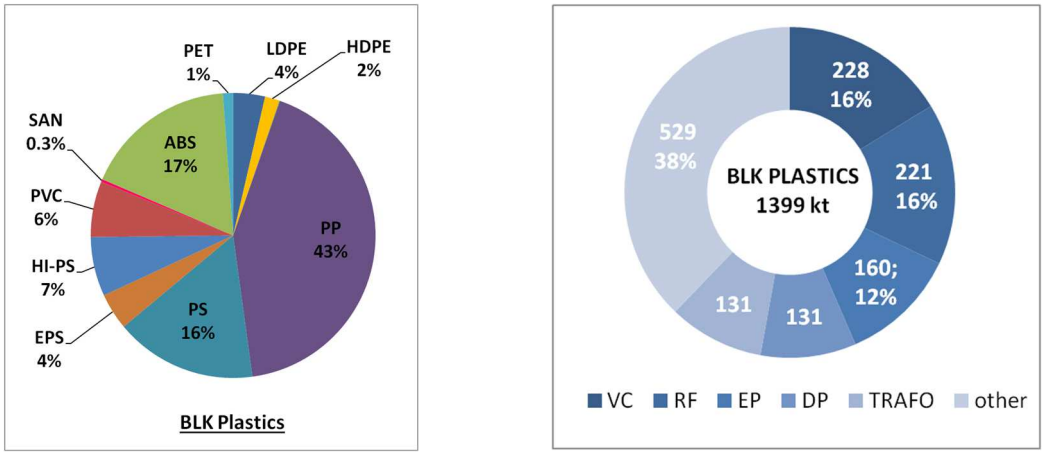

Figure 8. Consumption of Bulk Plastics in products sold in 2010

5.2 TEC Plastics

The main consumers of TEC plastics (total 619 kt/a) are 'household refrigeration' (180 kt; 29%) and 'displays' (150 kt; 24%) (Figure 9), that together account for more than half of the amount of TEC plastics. Other product groups with high consumption levels are similar to those of the bulk plastics: 'printers & copiers' (42 kt) and 'vacuum cleaners' (39 kt).

R*igid PUR (39%)* is the most widely used TEC plastic (thermal insulation in refrigerators). Other common TEC Plastics are *polycarbonate (PC, 28%)*, *PMMA (e.g. Plexiglas, 14%)* and *PA6 (e.g. Nylon, 12%)*.

[10] The high share of transformers in the Bulk Plastics is the introduction of 'mineral oil' and not actually a plastic. It is assumed that 'mineral oil' was modelled as PP since it was the best available equivalent in the Ecoreports

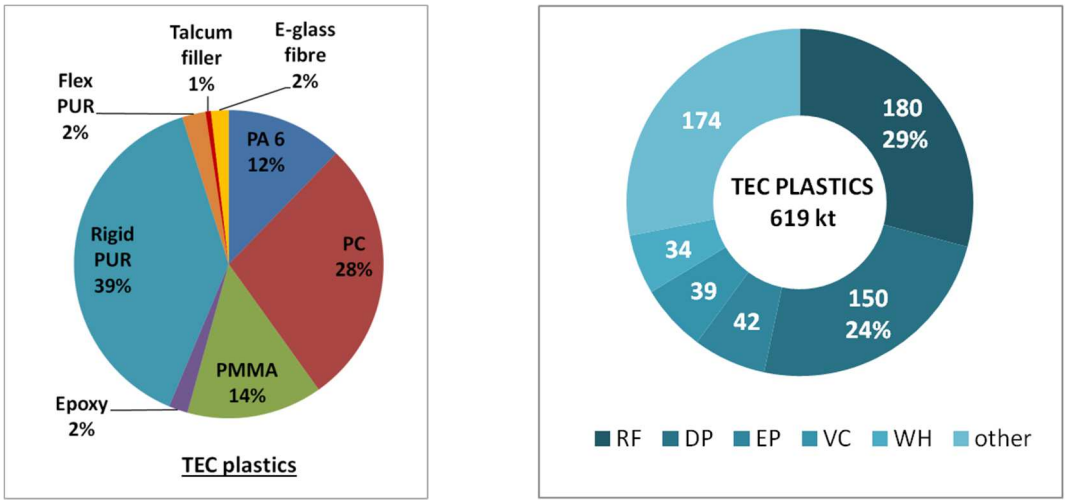

Figure 9. Consumption of TEC Plastics in products sold in 2010

5.3 Ferro

The Ferro group – 6610 kt in total (Figure 10) - does not have a dominant consuming product group, but multiple consumers of similar size. Again 'household refrigeration' (592 kt; 9%) has the highest share. In addition there is a high consumption by 'cooking appliances', 'local heaters', 'industrial fans' and 'tyres'; groups which are in general heavy. Main conclusion here is that the ferrous materials are more equally spread over the product groups than other material categories.

More than half of the Ferro material use consists of *steel sheet galvanised (52%),* followed by *cast iron (21%)*, *steel tubes and profiles (12%), stainless 18/8 coil (12%)* and a small amount of *ferrite (1%).*

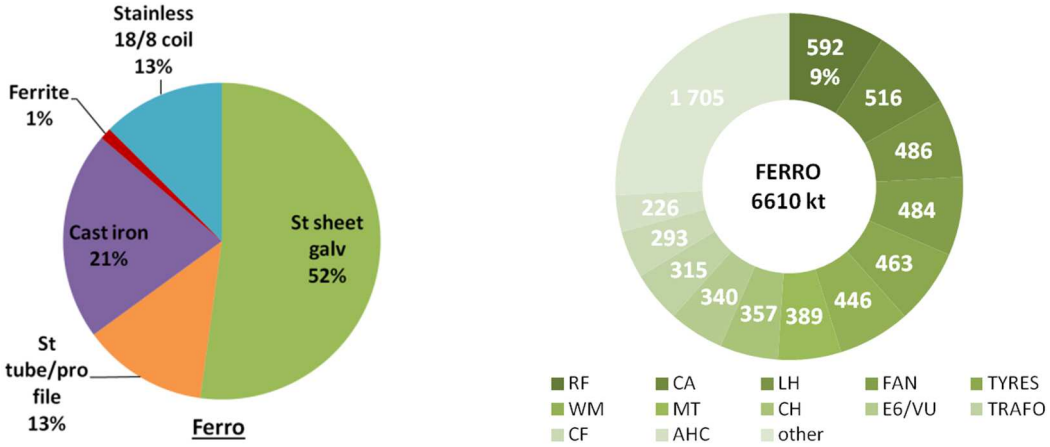

Figure 10 Consumption of Ferro materials in products sold in 2010

5.4 Non-Ferro

In the Non-Ferro group (Figure 11), copper is the main consumer, though in different forms. Copper in total covers 55% of the Non-Ferro materials and can be split up in *Cu tube/sheet, Cu wire* and *Cu winding wire*. Another 41% of the group consists of aluminium: *aluminium die cast* and *aluminium sheet/extrusion.*

Non-Ferro materials (1090 kt) can mainly be found in industrial products such as 'industrial fans' (165 kt; 15%), 'utility transformers' (104 kt; 10%) and motors (88 kt;

8%). Analogous to the share of product groups of the Ferro category, the weight of the Non-Ferro groups is more equally divided over multiple product groups.

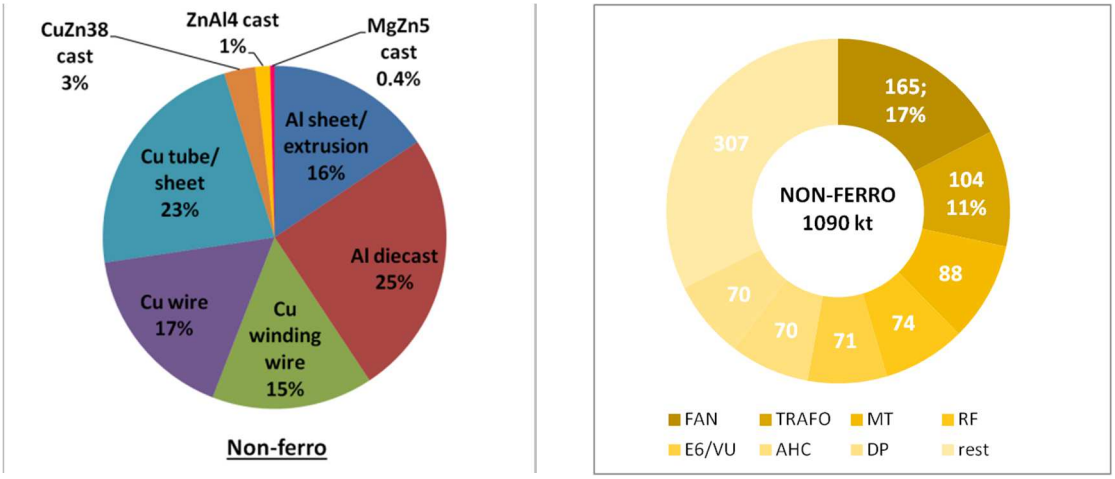

Figure 11. Consumption of Non-Ferro materials in products sold in 2010

5.5 Coating

Coatings (Figure 12) represent a (small) total of 52 kt/a in products sold in 2010. The main share in this group (65%) is defined as *powder coating* without further specifications.

Coating and/or plating (52 kt) is applied in few product groups. The main shares can be found in 'commercial refrigeration' (17 kt; 33%) and solid fuel boilers (16 kt; 31%).

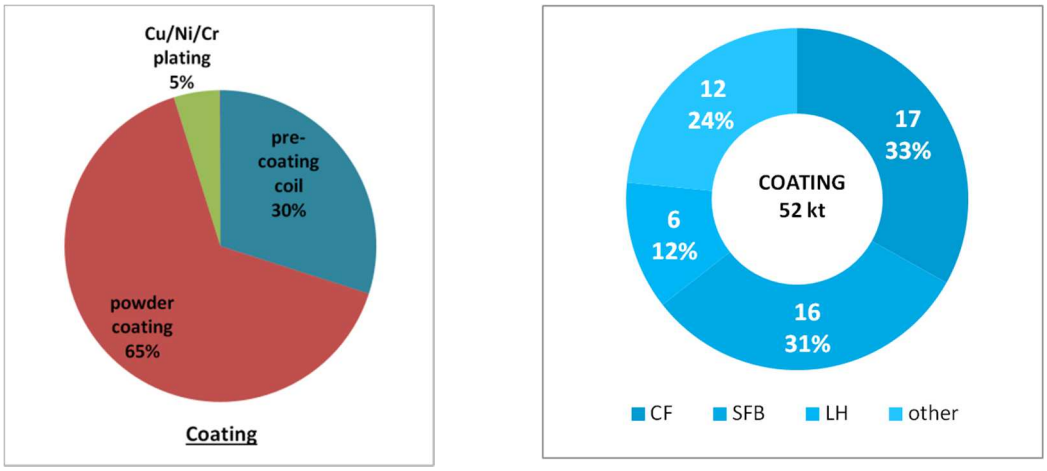

Figure 12. Consumption of Coatings in products sold in 2010

5.6 Electronics

The major share in Electronics (total 334 kt/a) can be traced back to 'displays' (113 kt) (Figure 13), which is related to the large sales numbers in this group. Together with 'computers' (67kt) they cover more than half of the weight of electronics.

In the Electronics group, the most apparent components are the *controller boards (30%), LCD electronics (25%)* and *big caps & coils (16%).* Note that 80-90 weight % of certain components are not semiconductor materials (ICs, diodes, resistors, etc.) but

support-materials such as resin-boards (for PWBs, controller boards), glass (for LCD screens), conductor material (copper/aluminium) and plastics (e.g. for slots, ports, enclosures).

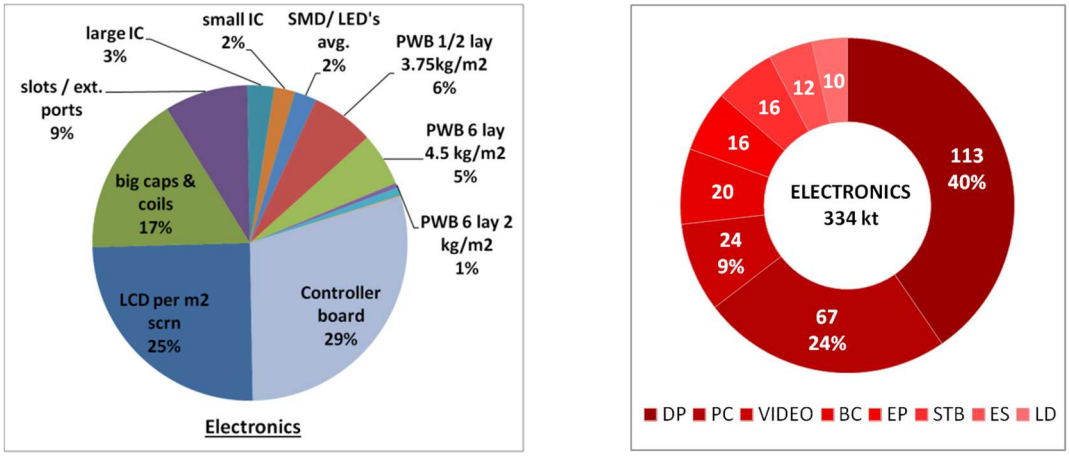

Figure 13. Consumption of Electronics in products sold in 2010

5.7 Miscellaneous

The category Miscellaneous (Figure 14) groups materials that are found in only a few specific products, e.g. *rubbers*, both *natural (46%)* and *synthetic (29%)*. As explained earlier, these are not original materials used in Ecoreports. However, since rubber became so significant due to the large sales numbers of the 'Tyres', it was decided to treat them as a separate material instead of placing them in the 'other' group. In the graphs can also be seen that the 'tyres' account for 71% of the weight of the category.

Another material in this category is *'glass for lamps' (15%)*, with the notion that most likely this represents *all* sorts of glass and not only inputs for light sources (Lot 8/9/19) [11]. Glass is also found in 'displays' (140 kt in total), 'refrigeration' (shelves, Lot 12/13/E1), ovens (doors, Lot 22/23), copiers (glass plate for scanning, Lot 4).

The share of the 'washing machines' derives from the concrete included in the base.

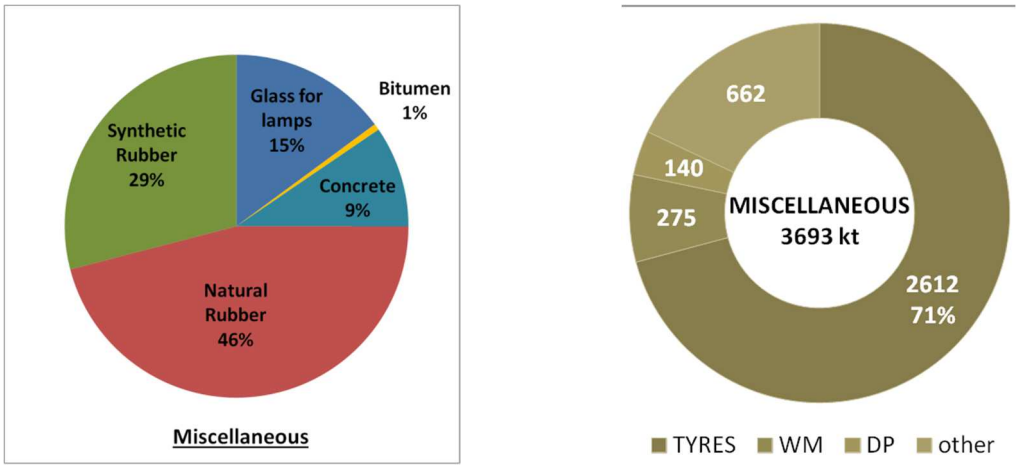

Figure 14. Consumption of Miscellaneous materials in products sold in 2010

[11] In the EcoReports the material 'glass' is not available, only 'glass for lamps' is defined. Consequently, many preparatory studies used the characteristics of the latter material to approximate the impacts of the glass material in their products.

5.8 Packaging

Product packaging and manuals are included in the 'Packaging' category, of which the main consumer is *cardboard (67%)*, followed by *office paper (18%, in the manuals)* and smaller shares of *EPS (8%)* and *LDPE (7%).*

Most of the packaging (and manuals) is linked to 'displays' (163 kt; 37%), while 'light sources' (19%), 'computers' (16%) and 'vacuum cleaners' (15%) also have significant shares.

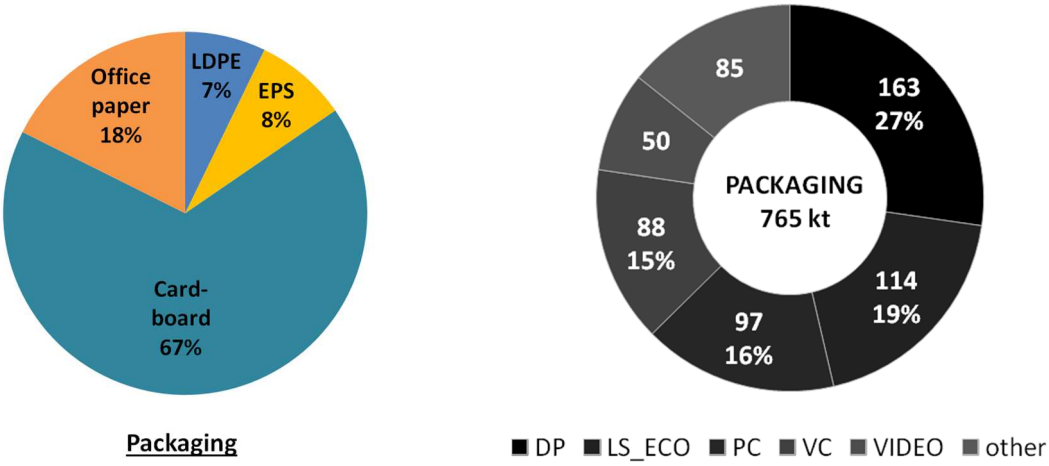

Figure 15. Consumption of packaging in products sold in 2010

6 Comparison ErP with total EU material consumption

6.1 EU Materials Consumption

From miscellaneous sources the EU-28 material consumption (2013-2014) for the relevant material groups was retrieved. A comprehensive overview is given in Annex D. In total 318 Mt of plastics, metal, glass, rubber, paper & cardboard was consumed in the EU-28. For electronic components and coatings no EU data could be retrieved, but in terms of volume they are relatively insignificant. Hereafter the results for the other materials are given.

6.1.1 Plastics

The manufacturing association Plastics Europe reports an EU-2014 plastics consumption of 47.7 Mt. The graph below also includes 1 Mt of E-glass fibre that is used for reinforcement. Around 73% of plastics are bulk-plastics, whereas the technical plastics make up 27% of the total. The most popular plastic is PP (polypropylene, 19% of total) and the most popular plastics application is packaging (40% of total). Plastics in Electrical and Electronic Equipment (EEE) is 6% of consumption, according to this source.

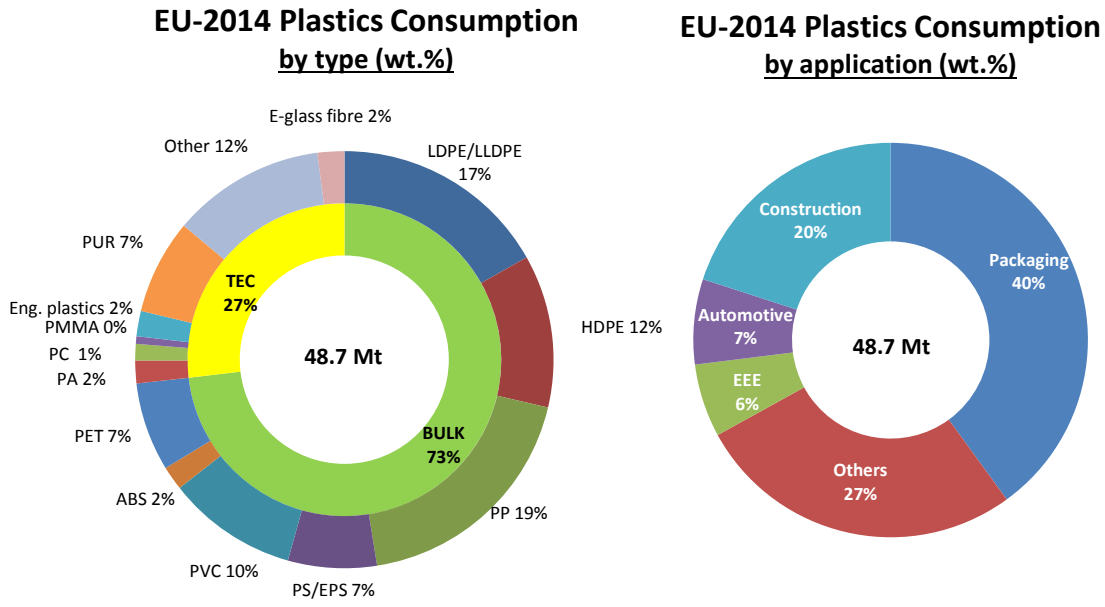

Figure 16. EU consumption of plastics (source: Plastics Europe 2015 [for plastics]; Glass Alliance Europe (GAE) [for E-glass fibre])

6.1.2 Ferro metals

Figure 17 is mainly based on data from Eurofer (for steel) and CAEF (iron castings). The end-use data from Eurofer 2013 were slightly adapted for increased use of castings in automotive and mechanical engineering applications. End-uses of **stainless** steel (not shown in the figure) include 38% appliances, 19% process industry, 17% construction, 11% in telecom (Customer Premise Equipment CPE) and 3% in others.[12]

[12] Source: SMR, all stainless steel finished products. January 2012.

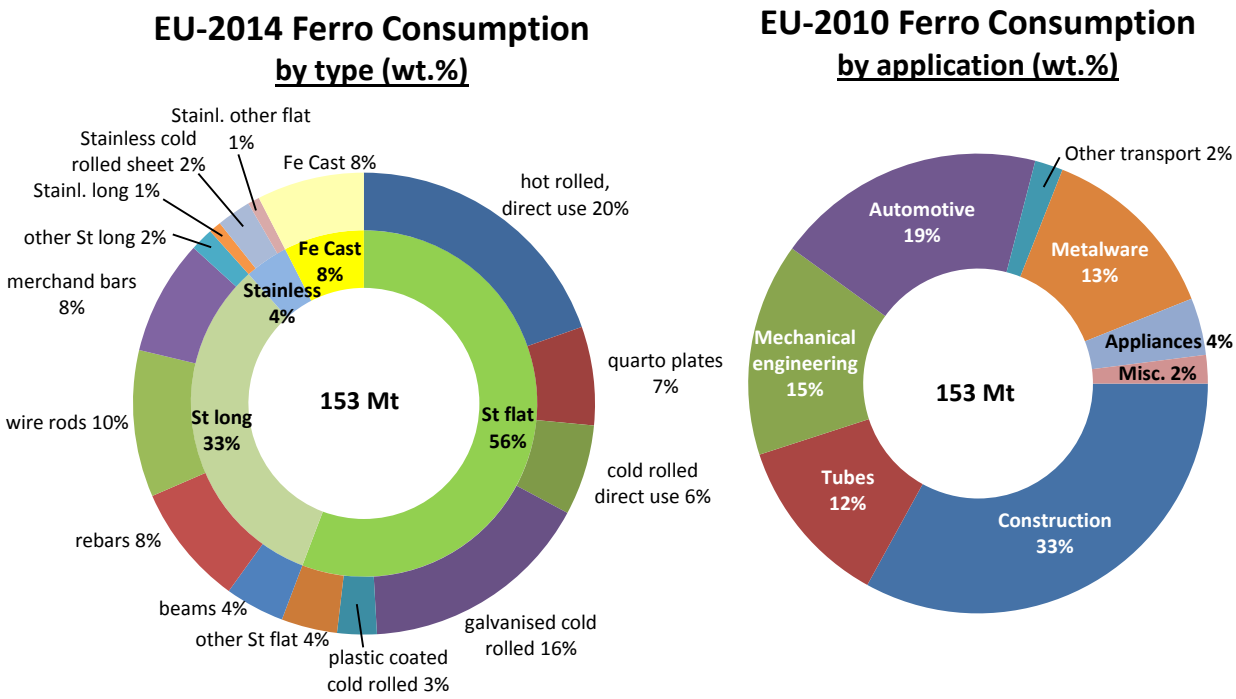

Figure 17. EU consumption of Ferro-metals (source: Eurofer [for steel]; CAEF [for Fe-castings)

Note that the production values relate to semi-finished products ('semis'), i.e. excluding losses in production of semis from crude steel.

6.1.3 Non-ferro metals

The figures below give the typology and end-uses of the main non-ferro metals, aluminium and copper. Note that the split-up of copper types is based on an older, but more detailed source. Especially for the EU some of these values may have changed.

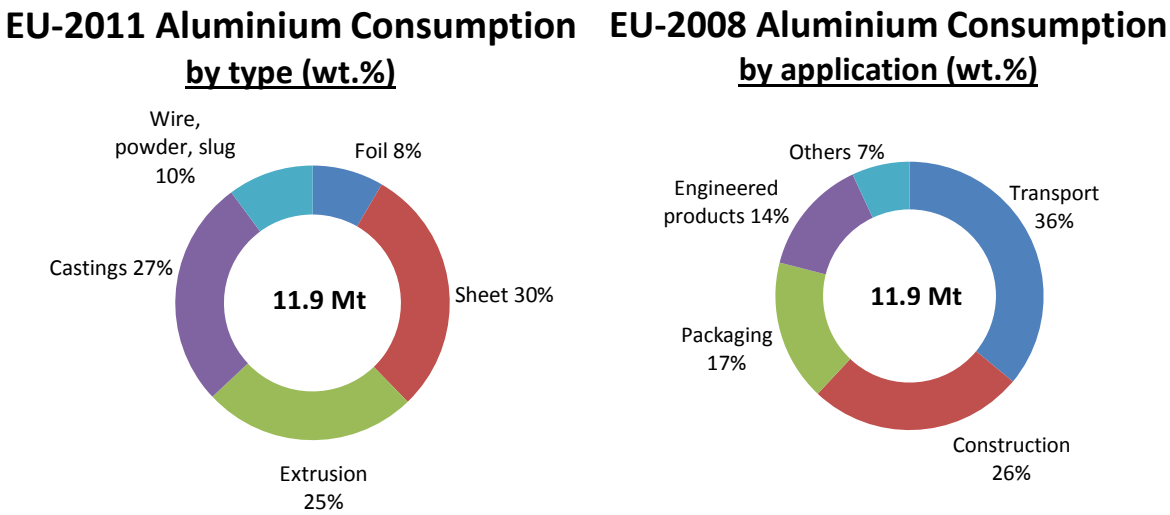

Figure 18. EU consumption of aluminium (source: European Aluminium Association, 2015)

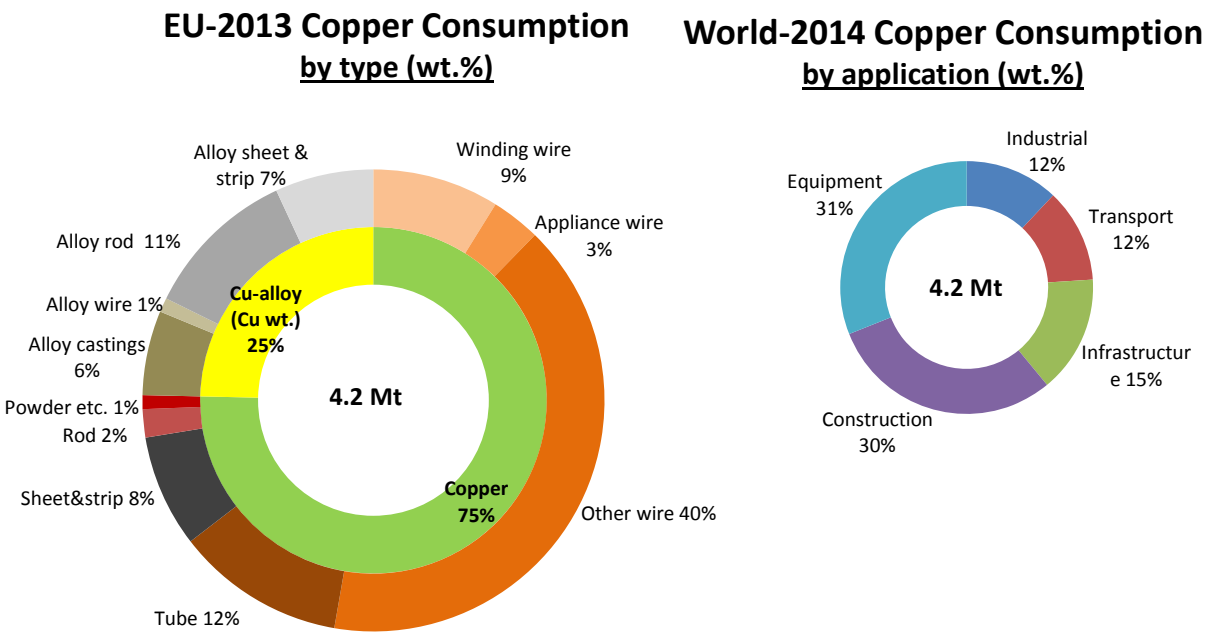

Figure 19. EU consumption of copper (source: ICSG, The World Copper Factbook 2015; Joseph, G. 1999)

6.2 Comparison EU with ErP material groups

Table 6 gives a comparison of total EU-28 material consumption versus the material consumption for regulated ErP found in the preceding chapters. The total ErP consumption of 14.5 Mt is 4.6% of the EU-28 total. For plastics and ferro metals the share is comparable; for non-ferro metals it is 6.6%. The share for glass, paper and cardboard is significantly smaller and only 1.4 and 0.6%.

The only materials input where ErP are very significant at EU-level is rubber, where the tyres take up over 60% of the total.

Table 6. Materials consumption EU-28 versus regulated ErP

Materials groups	**EU-28** ***kt***	**ErP** ***kt***	**ErP/EU** **%**
Bulk Plastics	35 707	1 518	4.3%
Tec Plastics	13 097	607	4.6%
Ferro Metals	141 548	6 626	4.7%
Non-Ferro Metals	16 470	1 090	6.6%
Coatings	*na*	*52*	*na*
Electronics	*na*	*334*	*na*
Miscellaneous, of which		4 330	
--Glass	31 358	437	1.4%
--Paper & cardboard	76 339	647	0.8%
--Rubber	3 500	2 203	62.9%
Total	**318 019**	**14 557**	**4.6%**

6.3 Comparison EU with ErP specific materials

To find peak material's users, Table 7 gives a comparison at the most detailed level and for those materials where data are available. ErP-materials that make up more than 10% of EU-total consumption are marked with a box.

For bulk-plastics relative peak users are PS (e.g. for fridge innerliner, 12.2% of EU total) and ABS (typically used for housing of consumer products, 29% of EU total). PP use is relatively high at 7%.

The technical plastics PC (for housing) and PMMA (for optical functionality) are popular for ErP with around 30% of total EU-consumption. PUR (insulation fridge) is also relatively high at 7%.

Galvanised steel sheet is popular in the ferro-metals group. Stainless steel sheet is used e.g. in washing machines (drum) and dishwashers (innerliner).

For non-ferro metals it is somewhat surprising that none of the specific materials makes up more than 10% of the total.

In the miscellaneous group, apart from rubber, the use of technical glass e.g. for light sources, washing machines and displays is significant with two-thirds of ErP share in the EU-total. Nonetheless, technical glass is a relatively small segment of the total glass market (see Table 6).

Table 7. Selected materials consumption EU-28 versus regulated ErP

Materials	EU-28 *kt*	ErP *kt*	ErP/EU %
PLASTICS			
LDPE (1,3)	8222	56	0.7%
HDPE (2)	5784	25	0.4%
PP (4)	9178	645	7.0%
PS, EPS (5,6,7)	3346	409	12.2%
PVC (8)	4923	96	1.9%
ABS (9,10)	908	269	29.6%
PET	3346	17	0.5%
BULK Plastics	**35707**	**1518**	**4.3%**
PA (11)	860	76	8.8%
PC (12)	621	173	27.8%
PMMA (13)	287	88	30.7%
Tec-pl (14+)	956	12	1.3%
PUR (15,16)	3585	255	7.1%
Other	5784	3	0.1%
E-glass fibre	1004	11	1.1%
TEC plastics	**13097**	**607**	**4.6%**
FERRO			
St sheet galvanised (21)	24867	3450	13.9%
Plastic coated (38)	4231	15	0.4%
Other flat products (incl. 24, ferrite)	5978	78	1.3%
St tube/profile (22)	12341	843	6.8%
Fe castings (23)	11511	1411	12.3%
Stainless coil/sheet (25)	3670	828	22.5%
FERRO TOTAL	**62598**	**6625**	**10.6%**
NON-FERRO			
Al sheet/extrusions (26)	7500	170	2.3%
Al-Castings (27, 32)	3200	288	9.0%
Cu-Winding wire (28)	375	166	7.4%
Cu-wire (29)	1854	183	9.9%
Cu-tube/sheet(30)	833	246	9.2%
Cu-alloy castings (31)	*403*	32	8.0%
MgZn5 cast (33)	62	5	7.3%
NON-FERRO total	**14227**	**1090**	**7.7%**
MISCELLANEOUS			
Special glass (54)	662	437	66.0%
Other graphic papers (57)	22402	135	0.6%
Cardboard box material (56)	24077	512	2.1%
Natural rubber (93)	1150	854	74.2%
Synthetic rubber (94)	2350	1349	57.4%

6.4 Concluding remarks

Note that this study is **not** to be used as a priority listing for circular economy policy measures. This analysis is an important part of the puzzle, but for proper decision support a comprehensive assessment is needed. For instance, there can be negative trade-offs between longevity and safety (e.g. for tyres). Longevity of products slows down the introduction of more energy efficient new products, which is important for products where there is still a large energy saving potential (refrigerators, electronic displays). Also recycling plays a role, e.g. cooking appliances have a relatively high materials input, but most of these materials are metals and easy to recycle. Furthermore, this special report uses 'weight' as a parameter, but in a more comprehensive assessment all environmental impact categories of the EcoReport (energy, carbon emissions, acidifying emissions, etc.) have to be considered in all phases of the product life cycle. Last but not least, the current analysis makes an inventory of the materials that end up in the final product. It does not take into account production waste, which may add some 10-15% (after primary scrap recycling). The resources consumption during use and the End-of-Life stage –part of the main EIA analysis—is not integrated here at product level.

Also note that this a preliminary analysis, based on a harmonised compilation of Bills of Materials (BoMs) over a 10-year time period (2005-2015) performed by different contractors with varying levels of detail and quality. The authors have taken great care to use the best available data, but can assume no liability for the reliability of the data and its use.

Annex A. Bills of Materials resources

LOT #	NAME	RESOURCES BOM/SALES	YEAR
2	WH dedicated Water Heater	_Sales available for 22 sub-base cases (7 subgroups, with each another subdivision in sizes). _BoM's available for total subgroups EIWH and GIWH (covering 8 base cases) _BoM's available for 'generic storage', 'combi storage parts', 'solar storage parts' and 'gas storage parts'. (all in sizes M – XXL) _GSWH (M – XXL) BoM's = BoM generic storage + BoM GSWH parts (4 base cases) _ESWH (XXS – XXL) BoM's = BoM EIWH + BoM Generic Storage (8 base cases) *To do this 'generic storage was' rescaled for XXS, XS and S, based on weight per volume ratio of M sized storage. Also, EIWS L-XXL was rescaled based on the M sized EIWH.* _SOLAR DEVOCES = BoM generic + BoM 'solar storage parts' (2 base cases)	2007
1	CHC Central Heating boiler	_CHC divided into 2 subgroups (CIWH and CSWH) and a total of 5 base cases _BoM available of CIWH (size M) in Lot 2 _BoM CSWH = BoM generic storage (Lot 2) + BoM combi-boiler parts (Lot 2)(4 base cases) _sales data were derived from prep study and for avery base case a share of sales was calculated	2007
1	CH Central Heating	_Original prep study (9 base cases) _Sales data were derived from prep study and used to calculate the share of the total sales for every base case	2007
15	SFB Solid Fuel Boilers	_5/12 original Lot 15 study base cases are used as input for the SFB (BC 8-12) _EIA sales match base cases exactly, no further info needed	2009
21/E6	AHC total Heating & Cooling	_In E6 one BoM for a AC chiller (400kW) and one for a WC chiller (900kW) was available _From the prep study, the weight/kW capacity was derived and used to calculate the masses of the other chillers. BoM's were created by applying the same relative configuration in materials of the total weight. _In E6 BoM's were available for AC rooftop, AC VRF and AC splits _In Lot 21 two BoM's were available for AHF (residential and non residential). Together with Lot 20 'warm air unit heaters' they for 21/E6 AHF base case. _No BoM's were available for HTPCH. Same method and data as for chillers was used; weight/kW ratio to calculate total weight and apply same relative material share. _In Lot 21, the AC Split (reversible) and AC VRF (reversible) BoM's were available. _In the end 13/15 AC cooling applications were covered. No BoM's available for Cheng and ACF. No BoM was created since there was no good reference available. _In AC heating, 3/6 base cases were covered. For the reversible's, no AC Rooftop BoM was available; so all sales are linked to the cooling BoM. For the Split and VRF the sales can be split over cooling only and reversible, just as in EIA. - No BoM's available for ACF (reversible) and AHE. No BoM was created since there was no good reference available. _EIA sales match base cases exactly, except for the AHF. For the AHF base case, sales for every of the 3 base cases was derived from the matching prep study and the share of the total was calculated and used as an input. All other base cases match EIA sales.	21: 2012 E6 AIRCO: 2012
20	LH Local Heaters	_7/12 original Lot 15 study base cases are used as input for the LH (BC 1-7) _also 9/11 original Lot 20 study base case were used as an input for the LH _'air curtains' are excluded from EIA and therefore not used _EIA sales match base cases exactly, no further info needed	2012
10	RAC Room Air Conditioner	_Three BoM's were available, two were used (cooling only 3.5kW split and 3.5kW split reversible) _EIA sales match base cases exactly, no further info needed	2012
11	CIRC Circulator pumps <2.5 kW	_Three base cases available, only one in EIA _New BoM was created by taking the weigthed average of the three base cases. Sales derived from the prep study. *NB. All three base case are included in the scope, yet only the sales of 1 base case (integrated circulator boiler) seems to be used in EIA. Remains unclear what happened to the data.*	2008
E6/10	VU Ventilation Units (res & nonres)	_In E6 the BoM's of the non residential base cases (5 in total) are available. _NRVU Central Balanced consist of 4 base cases, all BoM's are available _Sales for E6 were derived from a calculation sheet used for EIA. The share of the total sales for the NRVU central balanced base cases was calculated with these data. _In Lot 10 there are 8 BoM's available. None of them seem to apply to the EIA base cases.	E6VENT: 2012 10VENT: 2009

LOT #	NAME	RESOURCES BOM/SALES	YEAR
		_From the prep study, more summarized data were found. Assumptions are: RVU central undirected = exhaust central, RVU central balanced = HR central and RVU Local Balanced = HR Local. _New BoM's were created based on the total mass (from prep study) and the relative share of the materials (percentages derived from both the prep study as the other BoM's on ventilation units)	
8/9/19	LS Light Sources, mln units ECO	_BoM's for all EIA base cases derived from new Ecoreports, 2015 study _Sales for every subtype were derived from Ecoreport, share of total sales was calculated	2015
5	DP electronic Displays	_BoM available for 32" standard average TV (flatscreen data from >2010) _Assumed that TV LoNa and TV MeNa are equal to TV standard _New BoM created for PC monitor, 22", scaled (partly) from average TV BoM	2015 [draft IA]
18	STB Set Top Boxes	_Simple: 2 BoM's available and one line in EIA _Share of the sales derivd from prep study _Complex: 5 BoM's available, 2 relevant for EIA base cases _Sales share derived from prep study	Simple: 2007 Complex: 2008
E3	VIDEO	_Three BoM's available, matching the EIA base cases	2010
E9	ES Enterprise Servers	_Three BoM's available, matching the EIA base cases	2015
3	PC Personal Computers	_Six BoM's available, 2 relevant for EIA _Assumptions: BoM Tablet = 1/10th of BoM laptop, BoM Thin Client = 1/10th of BoM Desktop and BoM workstation = 1.5x BoM Desktop _EIA sales match base cases exactly (after the adoptions), no further info needed	2005
4	EP & IJ imaging equipment	_Five BoM's available, with six base cases. _Prep study informs that BoM for IJ printer can be used for both Mono and Colour _EIA sales match base cases exactly, no further info needed	2007
6/26	SB (networked) Stand-By (rest)	_No BoM's available and no resources to create them	
7	BC Battery Charged devices	_12 BoM's available _3/12 are excluded from scope regulation and thus not included _Share on sales is derived from the prep study and CLASP report	2007
27	UPS Total	_Four BoM's available, matching the EIA base cases	2013
13	RF Household Refrigeration	_Five base cases available, one line in EIA _share on sales derived from review prep study	2016
12	CF Commercial Refrigeration	_Five base cases available, matching the original Lot 12 base cases _In EIA3 (march 2016) a new base case is added 'supermarket segment non-bases cases'. Two new BoM's were created for this base case, a remote and plug-in variant. _Remote non-base case is the average of BoM of RCV2 and RHF4 _Plugin non base case is a the remote non-base case + BoM for compressor/condenser module. _Sales for the original base cases match EIA base cases. Share of sales for remote and plugin non base cases derived from 'EIA note on Double Counting Condensing Units' (VHK, 2016).	2007
E1	PF Professional Refrigeration	_BoM available for service cabinets and piston compressor and fan & motor _From prep study, summarized data were available from process chillers and condensing units, so the total weight could be estimated. _BoM of the RCU was created by assuming the RCU consist mainly of a compressor and fans; the relative material share of those BoM's were applied to the calculated total weight of the RCU. _BoM of the HT Process chillers was calculated by the same method as the LT and MT Process chillers (see Lot 21/E6)	2011
22/23	CA Cooking Appliances	_10 BoM's available for Lot 22 Domestic Ovens, 2/10 relevant for Lot 22/23 _6 BoM's available for Lot 22 Domestic Ovens, 2/6 relevant for Lot 22/23 _BoM for Range Hoods was based on information from Lot 10 Ventilation Units. Total weight was calculated using the weight/W ratio. Share of the materials of the total weight was equal to assumptions for other Lot 10 ventilation units.	22:2011 23:2011 10VENT: 2009
25	CM household Coffee Makers	_5 BoM's available for 7 base cases in EIA. _Assumption is that the original BoM for drip filter machine is for a drip filter with a glass pot. In EIA there are the variations glass, thermos and automatics. _BoM for 'thermos' is equal to the BoM of the 'drip glass' however the E-glass fibre (#18) is replaced by 800g stainless steel (#21) which is assumed to equal the jug (based on internet research)	2011

LOT #	NAME	RESOURCES BOM/SALES	YEAR
		_BoM for the automatic drip machine the BoM of the full automatic espresso machine was used and the E-glass fibre jug was added	
14	WM household Washing Machine	_One BoM available for the washing machine, matching the EIA base case	2007
14	DW Household Dishwashers	_Two BoM's available for one EIA base case. _Share of the sales derived from prep study	2007
16	LD household Laundry Drier	_Two BoM's available for 3 EIA base cases _Air vented tumble and air condenser BoM match EIA base case _No BoM for Gas Dryer, also, no good basis available for creating a new BoM.	2009
17	VC Vacuum Cleaners	_ One BoM available of a Upright vacuum cleaner (being some sort of average) _In EIA there are 2 base cases, being domestic and commercial vacuum cleaner _From prep study can be derived that most vacuum cleaners are canister types (for both domestic and commercial 85%) _In the prep study, the total weights per material category for domestic and commercial vacuum cleaners are available (both canister and upright types) _To create a new domestic and commercial VC BoM, the share of materials of the original (upright) BoM was applied to the summarized material weights of the prep study. _The 2 newly created BoM's match the EIA base cases and sales.	2006
11	FAN Industrial Fans >125W	_8 BoM's available for 6 EIA base cases. Two are not included in product scope and neglected. _BoM's match EIA base cases in terms of sales, no issues	2008
11	MT Motors 0.75-375 kW	_6 BoM's available for 1 line in EIA _share of the sales for the base cases can be derived from the prep study	2008
11	WP Water pumps	_8 BoM's available for 1 line in EIA _share of the sales can be found in prep study	2008
31	CP Standard Air Compressors	_New BoM's from IA study could be used directly from Ecoreports _BoM's match EIA base cases	2014
E2	TRAFO Utility Transformers	_7 BoM's available, matching EIA base cases	2011
TYRE	TYRE	_Material composition derived from: Scenario calculations and data_Tyre review study _share of natural and synthetic rubber derived from: European Tyre & Rubber Industry, Statistics, 2015	ETRI: 2015 Excel: ?

LOT #	BC total		BC original		BC new		BC no BoM	
	#	kton	#	kton	#	kton	#	Sales (000's)
2 WH	22	243	8	38	14	205	-	-
1 CHC	5	291	1	237	4	64	-	-
1 CH	9	499	9	499	-	-	-	-
15 SFB	5	232	5	232	-	-	-	-
21/E6 AHC	22	359	7	209	10	150	5	6.3
20 LH	16	594	16	594	-	-	-	-
10 RAC	2	216	2	216	-	-	-	-
11 CIRC		30	-	-	1	30		
E6/10 VU	8	435	5	424	3	11	-	-

8/9/19 LS	18	245	18	245	-	-	-	-
5 DP	4	913	1	662	3	251	-	-
18 STB	4	102	4	102	-	-	-	-
E3 VIDEO	3	167	3	167	-	-	-	-
E9 ES	3	86	3	86	-	-	-	-
3 PC	5	438	2	420	3	18	-	-
4 EP&IJ	6	440	6	440	-	-	-	-
6/26	-	-	-	-	-	-	4	67927
7	9	47	9	47	-	-	-	-
27	4	15	4	15	-	-	-	-
13	5	1188	5	1188	-	-	-	-
12	6	505	5	240	1	265	-	-
E1	3[13]	152	3	35	1	117	-	-
22/23 CA	5	703	4	580	1	123	-	-
25 CM	7	81	5	54	2	27		
14WM	2	700	1	700	-	-	-	-
14DW	3	300	2	300	-	-	-	-
16LD	3	205	2	205	-	-	1	19
17VC	2	461	-	-	2	461	-	-
11FAN	6	666	6	666	-	-	-	-
11MT	7	522	6	522	-	-	1	?
11WP	8	33	8	33	-	-	-	-
31CP	3	32	3	32	-	-	-	-
E2TRAFO	6	556	6	556	-	-	-	-
TYRE	3	3075	3	3075				
TOTAL	**212**	**15167**	**162**	**13013**	**45**	**1764**	**11**	**67952**

[13] Originally 5, but since EIA II the 'blast cabinets' and the 'walk in cold rooms' are excluded.

Annex B. Material list and numbering

1	LDPE	**Bulk Plastics**		54	Glass for lamps	**Miscellaneous**
2	HDPE			55	Bitumen	
3	LLDPE			56	Cardboard	
4	PP			57	Office paper	
5	PS			58	Concrete	
6	EPS			59	per m3 CE&ICT	**Final assembly** ***[not used for material calculation]***
7	HI-PS			60	per m3 appliances	
8	PVC			61	per product	
9	SAN			62	per m3 retail product	**Distribution and retail** ***[not used for material calculation]***
10	ABS			63	per m3 installed product	
11	PA 6	**TEC Plastics**		64	per retail product	
12	PC			65	Electricity per MWh	**Use: Energy per MWh Electric** ***[not used for material calculation]***
13	PMMA			66	Electric, η 96%, per GJ	
14	Epoxy			67	Elec. GSHP, η 288%, GJ	
15	Rigid PUR			68	Gas, η 86%, atmospheric	
16	Flex PUR			69	Gas, η 90%, atmosph.	
17	Talcum filler			70	Gas, η 101%, condens.	
18	E-glass fibre			71	Gas, η 103%, condens.	
19	Aramid fibre			72	Oil, η 85%, atmosph.	
20				73	Oil, η 95%, condens.	
21	St sheet galv	**Ferro**		74	Wood pellets, η 85%.	
22	St tube/profile			75	Wood pellets, η 88%.	
23	Cast iron			76	Wood logs, η 67%.	
24	Ferrite			77	Wood logs, η 74%.	
25	Stainless 18/8 coil			78	Extra for fossil fuel extraction	
26	Al sheet/extrusion	**Non-ferro**		79	Toner	**Use Consumables per Mton** ***[not used for material calculation]***
27	Al diecast			80	Detergent dishw.	
28	Cu winding wire			81	Rinsing agent dish	
29	Cu wire			82	Regeneration Salt dishw	
30	Cu tube/sheet			83	Water per m3	
31	CuZn38 cast			84	Vacuum cl. bags	
32	ZnAl4 cast			85	Mini-van diesel	**Use: Maintenance** ***[not used for material calculation]***
33	MgZn5 cast			86	repair parts	
34	foundries Fe/Cu/Zn	***OEM Manufacturing [not used for material calculation]***		87	Landfill	**Disposal: Env. Costs per kg final product** ***[not used for material calculation]***
35	foundries Al			88	Dumped Hg	
36	sheetmetal plant			89	Refrigerant	
37	sheetmetal scrap			90	Incinerated	

38	pre-coating coil	**Coatings**		91	Plastics, re-use, recyc.	
39	powder coating			92	Refrigerant	**Miscellaneous**
40	Cu/Ni/Cr plating			93	Natural Rubber	
41	Au/Pt/Pd per g			92	Synthetic Rubber	
42	LCD per m2 scrn	**Electronics**		93	Mercury (Hg)	**Non-ferro**
43	CRT per m2 scrn			94		
44	big caps & coils			95		
45	slots / ext. ports			96		
46	large IC			97		
47	small IC			98	Controller board	**Electronics**
48	SMD/ LED's avg.			99	Other	**Miscellaneous**
49	PWB 1/2 lay 3.75kg/m2			100	PET	**Bulk Plastics**
50	PWB 6 lay 4.5 kg/m2					
51	PWB 6 lay 2 kg/m2					
52	Solder SnAg4Cu0.5					
53	PWB assembly					

Annex C. Materials Input Sales and Stock

The following tables give the detailed materials input for sales (Table 1 to 5) and installed stock (Table 6 to 10).

Table 1. weight of **SALES**					BLK Plastics [ton]											BULK Plastics
product	**PRODUCTS** product group	**SALES 000 units**	**Product Weight kton**	**% of total wt.**	**LDPE 1**	**HDPE 2**	**LLDPE 3**	**PP 4**	**PS 5**	**EPS 6**	**HI-PS 7**	**PVC 8**	**SAN 9**	**ABS 10**	**PET 10b**	**subtot**
WH	WH dedicated Water Heater	10918	243	2%	123		10	1 732	4 926	476		300		4 924		**12**
CHC	CHC Central Heating boiler	6065	89	1%				2 832	240					2 850		**6**
CH	CH Central Heating	6987	434	3%				23 188	1 947							**25**
SFB	SFB Solid Fuel Boilers	438	232	2%	129											**0**
AHC	AHC total Heating & Cooling	710	359	2%								6 740	276	8 990		**16**
LH	LH Local Heaters	24464	594	4%										12 339		**12**
RAC	RAC Room Air Conditioner	4705	216	1%				36 085								**36**
CIRC	CIRC Circulator pumps <2.5 kW	8065	30	0%	464			1 387								**2**
VU	U Ventilation Units	3212	435	3%	7 358	3 609						3 883		459		**15**
LS	LS Light Sources, mln units	2365491	244	2%											17 436	**17**
DP	DP electronic DisPlays	93465	913	6%					294	13 516	34 347	35 049		61 335		**145**
STB	STB Set Top Boxes	57238	102	1%	113	128		7	592		639	2 057		15 026		**19**
VIDEO	VIDEO	55248	167	1%	242	22		307	2 538			9 312	708	28 416		**42**
ES	ES Enterprise Servers	2590	86	1%		1 043		3	3 400			607		1 471	5	**7**
PC	PC Personal Computers	64225	438	3%	7 365			146	110	1 828		841		14 163		**24**
EP	EP & IJ imaging equipment	31674	440	3%	4 648	3 378	146	4 108	40 392	2 989	62 470	2 023	742	46 807		**168**
BC	BC Battery Charged devices	333333	47	0%	72		725	25				6 006		3 851		**11**
UPS	UPS Total	1441	15	0%	286	54		20		125		283		1 523		**2**
RF	RF Household Refrigeration	19196	1204	8%	3 199	2 376		28 846	159 370	516		12 140	1 985	15 901		**224**
CF	CF Commercial Refrigeration	2097	505	3%	80	216	156	460	912	3 880	960	6 242		4 515		**17**
PF	PF Professional Refrigeration	1035	152	1%	158	292		668		726	3 562	1 283	28	371		**7**
CA	CA Cooking Appliances	36324	703	5%	2 147	9 565		199		2 147		1 924		586		**17**
CM	CM household Coffee Makers	26262	81	1%				28 258	535			639	833	9 383		**40**
WM	WM househ. Washing Machine	13164	952	7%	23 067	702		109 278				3 049		15 763		**152**
DW	DW Household Dishwashers	7034	312	2%	4 008	3 216		39 017	3 857	359		2 960		5 835		**59**
LD	LD household Laundry Drier	5268	205	1%				9 873	25 143			573		9 419		**45**
VC	VC Vacuum Cleaners	54138	461	3%				227 794								**228**
FAN	FAN Industrial Fans >125W	14928	666	5%												-
MT	MT Motors 0.75-375 kW	9949	522	4%						36 551						**37**
WP	WP Water pumps	1675	33	0%	1 335											**1**
CP	CP Standard Air Compressors	106	32	0%				235				50				**0**
TRAFO	TRAFO Utility Transformers	177	570	4%		516		130 292								**131**
TYRES	Replacement TYREs	287 531	3 075	0												-
	% per material group	*millionunits*	*kton*		3.6%	1.7%	0.1%	42.5%	16.1%	4.2%	6.7%	6.3%	0.3%	17.4%	1.1%	100.0%
	TOTAL	**3549**	**14557**		**55**	**25**	**1**	**645**	**244**	**63**	**102**	**96**	**5**	**264**	**17**	**1 517**
	% of total				0.38%	0.17%	0.01%	4.43%	1.68%	0.43%	0.70%	0.66%	0.03%	1.81%	0.12%	10.42%

Table 2.	TEC plastics [ton]									[kt]	Ferro [ton]					
weight of **SALES**	PA 6	PC	PMMA	Epoxy	Rigid PUR	Flex PUR	Talcum filler	E-glass fibre	Aramid fibre	TEC Plastics	St sheet galv	St tube/profile	Cast iron	Ferrite	Stainless 18/8 coil	FERRO (kton)
product	11	12	13	14	15	16	17	18	19	subtot	21	22	23	24	25	subtot
WH	7 037	2			27 386				2	**34**	154 954	41	775	529	2 444	**159**
CHC					733					**1**	49 120		15 265		4 132	**69**
CH					6 368					**6**	209 025		133 189		15 047	**357**
SFB										**-**	37 362		149 448			**187**
AHC		8 871								**9**	186 182	25 700	7 558		6 267	**226**
LH		12 339								**12**	156 143	58 575	271 030			**486**
RAC	4 383									**4**			93 262			**93**
CIRC										**-**			20 557			**21**
VU		1 602				829				**2**	338 752		926			**340**
LS		87		1 374	700					**2**			3		217	**0**
DP	8 587	49 612	85 867					5 724		**150**	146 752	525				**147**
STB	443	405				944				**2**	9 124	517		1 309	27 924	**39**
VIDEO	236	1 138		36		216		460		**2**		24 983	11	12	1 854	**27**
ES	9	833			83	5				**1**	46 621	40	160		415	**47**
PC	13 523	15 978	1 316	2 417		47				**33**	166 508	2 520	11 373		235	**181**
EP	9 763	25 316	596	325	1 364	3 660		1 024	2	**42**	136 583	3 152	235	1 648	4 659	**146**
BC	140	6 100								**6**	71			87	165	**0**
UPS	10	31	0	20			0	6	22	**0**	4 132	391	2 065	487	25	**7**
RF	668	282			179 452					**180**	246 426	36 921	296 910		11 540	**592**
CF	248	777	4	17	17 933	1				**19**	257 846	13 306	6 831	10 600	3 949	**293**
PF	1 175	24		92	4 901	169				**6**	47 491	6 068	20 920	39 386	94	**114**
CA	6 894	7 218		166		4 786				**19**	109 788	5 478		11 083	389 400	**516**
CM	2 113	203						4 193		**7**	7 939	169			8 751	**17**
WM	1 297	2 620								**4**	92 380		154 109		199 117	**446**
DW	2 891		49	1 019		19				**4**	57 987		17 850		130 990	**207**
LD	831	414	151		1 500					**3**	47 016	60 963			13 216	**121**
VC		38 793								**39**	7 066	5 408	66 857			**79**
FAN	14 836									**15**	7 597	458 444	9 314	9 006		**484**
MT				5 614		1 034				**7**	233 728	47 876	106 949			**389**
WP						41				**0**			21 617		7 109	**29**
CP	696	12				3 482	3 482			**8**		8 002	3 621	4 004		**16**
TRAFO				1 245					21	**1**	230 291	84 337				**315**
TYRES										**-**	463 063					**463**
% group	12.2%	27.9%	14.2%	2.0%	38.8%	2.5%	0.6%	1.8%	0.0%	100.0%	52.2%	12.8%	21.3%	1.2%	12.5%	100.0%
Total	**76**	**173**	**88**	**12**	**240**	**15**	**3**	**11**	**0**	**619**	**3 450**	**843**	**1 411**	**78**	**828**	**6 610**
% total	0.52%	1.19%	0.60%	0.08%	1.65%	0.10%	0.02%	0.08%	0.00%	4.25%	23.70%	5.79%	9.69%	0.54%	5.68%	45.41%

Table 3.	Non-ferro [ton]								kt	Coating/plating [ton]				kt
weight of **SALES**	Al sheet/extrusion	Al diecast	Cu winding wire	Cu wire	Cu tube/sheet	CuZn38 cast	ZnAl4 cast	MgZn5 cast	NON-FERRO	pre-coating coil	powder coating	Cu/Ni/Cr plating	Au/Pt/Pd per g	COATING
product	26	27	28	29	30	31	32	33	subtot	38	39	40	41	subtot
WH		1 304		945	5 560	8 833			**16.64**					-
CHC		2 855			6 318	2 424			**12**					-
CH		9 617			21 743	9 293			**41**					-
SFB					27 838				**28**		16 118			**16**
AHC	21 868	5 833			27 926	594	14 208		**70**		788			**1**
LH		9 470			9 748				**19**		6 261			**6**
RAC	15 550				35 675				**51.22**					-
CIRC		2 196	3 025						**5**		134			**0**
VU		36 412			32 804	1 349			**71**					-
LS	1 673	870		736	91	1 782			**5**		6	320	27	**0**
DP	12 403			56 993		660			**70**					-
STB	2 044	1 518	439	1 865		426			**6**	450			0	**0**
VIDEO	1 712	2 811	61		6 317	235	92		**11**			4		**0**
ES	6 207	593		235	1 600	674	130	42	**9**				1	**0**
PC	8 807	353	6 052	10 058	2 126			4 460	**32**		47			**0**
EP	3 930	212	2 226	5 460	2 429	60	119		**14**			4	6	**0**
BC	433	177	3	4 211	97	811	8		**6**					-
UPS	711	963		758	264	85			**3**		29			**0**
RF	31 016			5 692	37 159				**74**		3 255			**3**
CF	17 213	2 547	2 405	2 565	14 074	181			**39**	12 144	4 924			**17**
PF	4 987	162	8 007	131	1 529	60	46		**15**	2 832				**3**
CA	2 284	6 220	1 869	12 808	4 014	2 985			**30**					-
CM	306	306	130	1 933		60	608		**3**					-
WM	20 711	10 035		17 964	7	1 364			**50**					-
DW	2 005			7 767		195			**10**					-
LD	2 548			3 520					**6**					-
VC	4 557		23 134						**28**					-
FAN		132 444	32 449						**165**					-
MT		42 675		45 593					**88**			2 036		**2**
WP									-		23			**0**
CP		3 482	725	3 673		22	21		**8**			94	0	**0**
TRAFO	9 357		85 355		8 841				**104**		2 025			**2**
TYRES									-					-
% group	15.6%	25.0%	15.2%	16.8%	22.6%	2.9%	1.4%	0.4%	100.0%	29.9%	65.2%	4.8%	0.0%	101.8%
Total	**170**	**273**	**166**	**183**	**246**	**32**	**15**	**5**	**1 090**	**15**	**34**	**2**	**0**	**52**
% total	1.17%	1.88%	1.14%	1.26%	1.69%	0.22%	0.10%	0.03%	7.49%	0.11%	0.23%	0.02%	0.00%	0.35%

Table 4.	Electronics [ton]													kt
weight of **SALES**	LCD per m2 scrn	CRT per m2 scrn	big caps & coils	slots / ext. ports	large IC	small IC	SMD/ LED's avg.	PWB 1/2 lay 3.75kg/m2	PWB 6 lay 4.5 kg/m2	PWB 6 lay 2 kg/m2	Solder SnAg4Cu0.5	PWB assembly	Controller board	ELECTRONICS
product	42	43	44	45	46	47	48	49	50	51	52	53	98	subtot
WH	164		782	82		5	11	169			17		932	**2**
CHC													1 093	**1**
CH													4 464	**4**
SFB													1 206	**1**
AHC													4 451	**4**
LH													3 606	**4**
RAC													6 876	**7**
CIRC														**-**
VU													501	**1**
LS							20	6 695			492	81	11	**7**
DP	78 394												34 188	**113**
STB			4 290	3 496	465	175	693	4 754	2 349		246			**16**
VIDEO				10 050	3 953	834	550	2 126	4 784	1 367		301		**24**
ES					118				2 646	50	89		8 987	**12**
PC	2 303		29 691	12 162	4 477	4 089	4 568	2 019	6 653		1 386			**67**
EP	1 989		3 922	1 256	123	205	797	4 030	1 421	187	191		2 369	**16**
BC			16 097	1 168		807	758	1 116			310			**20**
UPS	5		374	266	4	21	155	384	35		137			**1**
RF			295										6 022	**6**
CF	9		7	63	36	77	34	36					324	**1**
PF	12			12									64	**0**
CA													7 633	**8**
CM	92			42		952		197	330	11				**2**
WM													2 271	**2**
DW													3 834	**4**
LD													9 531	**10**
VC														**-**
FAN														**-**
MT														**-**
WP														**-**
CP													0	**0**
TRAFO														**-**
TYRES														**-**
% group	24.8%	0.0%	16.6%	8.6%	2.7%	2.1%	2.3%	6.4%	5.5%	0.5%	0.9%	0.1%	29.5%	22.0%
Total	**83**	**-**	**55**	**29**	**9**	**7**	**8**	**22**	**18**	**2**	**3**	**0**	**98**	**334**
% total	0.57%	0.00%	0.38%	0.20%	0.06%	0.05%	0.05%	0.15%	0.13%	0.01%	0.02%	0.00%	0.68%	2.29%

Table 5.	Miscellaneous [ton]								kt
weight of **SALES** product	Glass 54	Bitumen 55	Cardboard 56	Paper (manual) 57	Concrete 58	Natural Rubber 93	Synthetic Rubber 94	Other 99	MISCELLANEOUS subtot
WH			1 598	395				16 216	**18**
CHC								926	**1**
CH									**-**
SFB									**-**
AHC			8 217	0				24 708	**33**
LH	1 154		22 352	726				30 708	**55**
RAC								23 992	**24**
CIRC			983	936					**2**
VU								6 426	**6**
LS	94 749		84 422	29 280				3 244	**212**
DP	79 507		125 223	23 834				60 218	**289**
STB	781		15 675	2 903					**19**
VIDEO		2 058		49 602	9 621				**61**
ES			10 180	119					**10**
PC	37		87 525					13 235	**101**
EP	18 877		29 580	4 252					**53**
BC			3 134	463					**4**
UPS			1 124	137					**1**
RF	111 608			4 824				7 528	**124**
CF	37 613		733	502				80 640	**119**
PF				26				6 422	**6**
CA	80 216							33 595	**114**
CM								13 342	**13**
WM	24 409		21 660	1 460	250 673				**298**
DW			15 811	1 532	10 775				**28**
LD								20 193	**20**
VC			78 790	9 086					**88**
FAN			2 226						**2**
MT									**-**
WP			2 326	79					**2**
CP				532	7			12	**1**
TRAFO		3 499	624	3 987	9 332				**17**
TYRES						1 349 265	853 559	409 459	**2 612**
% group	10.5%	0.0%	11.8%	3.1%	6.5%	31.1%	19.7%	17.3%	100%
Total	**459**	**6**	**512**	**135**	**280**	**1 349**	**854**	**751**	**4 330**
% total	3.13%	0.0%	3.52%	0.93%	1.93%	9.27%	5.86%	5.16%	29.78%

STOCK

Table 6. weight STOCK product	PRODUCTS product group	STOCK mln. units	Product Weight Mt	Life (years)	BLK Plastics [kton] LDPE 1	HDPE 2	LLDPE 3	PP 4	PS 5	EPS 6	HI-PS 7	PVC 8	SAN 9	ABS 10	PET 10b	BULK Plastics subtot
WH	WH dedicated Water Heater	164	3.6	15.0	2		0	26	74	7		4		74		**187**
CHC	CHC Central Heating boiler	91	1.3	15.0				42	4					43		**89**
CH	CH Central Heating	109	7.8	18.0				417	35							**452**
SFB	SFB Solid Fuel Boilers	8	4.3	18.4	2											**2**
AHC	AHC total Heating & Cooling	11	6.2	17.3								130	5	136		**271**
LH	LH Local Heaters	297	10.1	12.2										116		**116**
RAC	RAC Room Air Conditioner	56	2.6	12.0				433								**433**
CIRC	CIRC Circulator pumps <2.5 kW	81	0.3	10.0	5			14								**19**
VU	U Ventilation Units	55	7.4	17.0	125	61						66		8		**260**
LS	LS Light Sources, mln units	13883	1.7	5.8											152	**152**
DP	DP electronic DisPlays	620	1.7	6.6					0	22	57	86		128		**293**
STB	STB Set Top Boxes	256	0.4	4.5	1	1		0	2		3	9		70		**85**
VIDEO	VIDEO	294	0.9	5.3	1	0		2	13			48	4	165		**232**
ES	ES Enterprise Servers	13	0.4	4.9		5		0	17			3		7	0	**32**
PC	PC Personal Computers	279	2.0	4.3	35			1	0	7		3		65		**112**
EP	EP & IJ imaging equipment	127	1.8	4.0	19	14	1	16	162	12	250	8	3	187		**671**
BC	BC Battery Charged devices	1158	0.2	3.5	0		2	0				21		16		**40**
UPS	UPS Total	8	0.1	5.3	2	0		0		1		2		8		**14**
RF	RF Household Refrigeration	250	15.7	13.0	42	31		375	2 072	7		158	26	207		**2 916**
CF	CF Commercial Refrigeration	19	4.5	12.8	1	2	1	4	8	35	9	56		41		**157**
PF	PF Professional Refrigeration	9	1.4	8.4	1	2		6		7	32	16	0	3		**68**
CA	CA Cooking Appliances	588	12.1	16.2	30	134		3		41		29		8		**245**
CM	CM household Coffee Makers	158	0.5	6.0				170	3			4	5	56		**238**
WM	WM househ. Washing Machine	197	14.3	15.0	346	11		1 639				46		236		**2 278**
DW	DW Household Dishwashers	99	4.7	14.1	60	48		585	58	5		44		88		**889**
LD	LD household Laundry Drier	68	2.7	13.0				128	327			7		122		**585**
VC	VC Vacuum Cleaners	370	3.1	6.8				1 549								**1 549**
FAN	FAN Industrial Fans >125W	224	10.0	15.0												**-**
MT	MT Motors 0.75-375 kW	126	8.3	12.7						576						**576**
WP	WP Water pumps	18	0.4	11.0	15											**15**
CP	CP Standard Air Compressors	1	0.4	10.5				2				0				**3**
TRAFO	TRAFO Utility Transformers	6	17.8	32.3		16		4 086								**4 102**
TYRES	Replacement TYREs	1158	12.0	4.0												**-**
	% per material group	*millionunits*	*Mt*		4.0%	1.9%	0.0%	55.6%	16.2%	4.2%	2.1%	4.3%	0.3%	10.4%	0.9%	100.0%
	TOTAL	**20 801**	**161**		**687**	**325**	**4**	**9 499**	**2 775**	**720**	**351**	**742**	**43**	**1 783**	**152**	**17 080**
	% of total		1		0.43%	0.20%	0.00%	5.91%	1.73%	0.45%	0.22%	0.46%	0.03%	1.11%	0.09%	10.63%

Table 7.	TEC plastics [ton]									[kt]	Ferro [ton]					
weight STOCK product	PA 6 11	PC 12	PMMA 13	Epoxy 14	Rigid PUR 15	Flex PUR 16	Talcum filler 17	E-glass fibre 18	Aramid fibre 19	TEC Plastics subtot	St sheet galv 21	St tube/profile 22	Cast iron 23	Ferrite 24	Stainless 18/8 coil 25	FERRO (kton) subtot
WH	106	0			411				0	**516**	2 324	1	12	8	37	**2 381**
CHC					11					**11**	737		229		62	**1 028**
CH					115					**115**	3 762		2 397		271	**6 431**
SFB										**-**	687		2 749			**3 437**
AHC		134								**134**	3 430	393	113		94	**4 030**
LH		116								**116**	2 526	591	5 950			**9 068**
RAC	53									**53**			1 119			**1 119**
CIRC										**-**			206			**206**
VU		27				14				**41**	5 759		16			**5 775**
LS		2		14	3					**19**			0		1	**1**
DP	14	82	142					9		**248**	347	1				**348**
STB	2	2				4				**8**	46	2		5	112	**165**
VIDEO	1	6		0		1		2		**11**		132	0	0	9	**141**
ES	0	4			0	0				**5**	229	0	1		2	**232**
PC	57	70	5	12		0				**144**	806	12	56		1	**876**
EP	39	101	2	1	5	15		4	0	**168**	546	13	1	7	19	**585**
BC	0	23								**23**	0			0	1	**1**
UPS	0	0	0	0			0	0	0	**1**	41	4	14	5	0	**64**
RF	9	4			2 333					**2 345**	3 204	480	3 860		150	**7 693**
CF	2	7	0	0	161	0				**171**	2 320	120	61	93	36	**2 629**
PF	9	0		1	44	2				**56**	488	55	169	319	1	**1 032**
CA	128	101		2		68				**300**	1 551	82		166	7 170	**8 970**
CM	13	1						25		**39**	48	1			53	**101**
WM	19	39								**59**	1 386		2 312		2 987	**6 684**
DW	43		1	15		0				**60**	870		268		1 965	**3 102**
LD	11	5	2		19					**38**	611	793			172	**1 576**
VC		264								**264**	48	37	455			**539**
FAN	223									**223**	114	6 877	140	135		**7 265**
MT				82		15				**97**	3 688	752	1 866			**6 307**
WP						0				**0**			238		78	**316**
CP	8	0				42	42			**92**		82	43	46		**172**
TRAFO				35					1	**36**	7 130	2 683				**9 813**
TYRES										**-**	1 776					**1 776**
	13.7%	18.3%	2.8%	3.0%	57.6%	3.0%	0.8%	0.8%	0.0%	100.0%	47.4%	14.0%	23.7%	0.8%	14.1%	100.0%
	738	**988**	**152**	**163**	**3 103**	**162**	**42**	**41**	**1**	**5 389**	**44 476**	**13 109**	**22 273**	**785**	**13 218**	**93 862**
	0.46%	0.61%	0.09%	0.10%	1.93%	0.10%	0.03%	0.03%	0.00%	3.35%	27.67%	8.15%	13.86%	0.49%	8.22%	58.39%

Table 8.	Non-ferro [ton]								kt	Coating/plating [ton]				kt
weight STOCK	Al sheet/extrusion	Al diecast	Cu winding wire	Cu wire	Cu tube/sheet	CuZn38 cast	ZnAl4 cast	MgZn5 cast	NON-FERRO	pre-coating coil	powder coating	Cu/Ni/Cr plating	Au/Pt/Pd per g	COATING
product	26	27	28	29	30	31	32	33	subtot	38	39	40	41	subtot
WH		20		14	83	132			**250**					-
CHC		43			95	36			**174**					-
CH		173			391	167			**732**					-
SFB					554				**554**		322			**322**
AHC	396	88			482	11	213		**1 190**		12			**12**
LH		89			93				**182**		74			**74**
RAC	187				428				**614.70**					-
CIRC		22	30						**52**		1			**1**
VU		619			558	23			**1 200**					-
LS	9	9		4	1	14			**38**		0	3	0	**3**
DP	21			122		1			**144**					-
STB	8	6	2	8		2			**26**	2			0	**2**
VIDEO	10	17	0		36	1	0		**64**			0		**0**
ES	30	3		1	8	3	1	0	**46**				0	**0**
PC	42	2	30	48	10			18	**149**		0			**0**
EP	16	1	9	22	10	0	0		**58**			0	0	**0**
BC	2	1	0	16	0	3	0		**22**					-
UPS	6	7		6	3	1			**24**		0			**0**
RF	403			74	483				**960**		42			**42**
CF	155	23	21	23	127	2			**350**	109	44			**154**
PF	52	1	65	1	23	1	0		**143**	25				**25**
CA	34	93	28	227	58	45			**485**					-
CM	2	2	1	12		0	4		**20**					-
WM	311	151		269	0	20			**751**					-
DW	30			117		3			**150**					-
LD	33			46					**79**					-
VC	31		157						**188**					-
FAN		1 987	487						**2 473**					-
MT		603		700					**1 303**			29		**29**
WP									-		0			**0**
CP		42	7	44		0	0		**92**			1	0	**1**
TRAFO	275		2 629		310				**3 214**		65			**65**
TYRES									-					-
	13.0%	25.4%	22.0%	11.1%	23.9%	3.0%	1.4%	0.1%	100.0%	18.7%	76.8%	4.5%	0.0%	100.0%
	2 051	**4 001**	**3 466**	**1 754**	**3 752**	**468**	**219**	**18**	**15 729**	**137**	**562**	**33**	**0**	**732**
	1.28%	2.49%	2.16%	1.09%	2.33%	0.29%	0.14%	0.01%	9.78%	0.08%	0.35%	0.02%	0.00%	0.46%

Table 9.	Electronics [ton]													kt
weight STOCK	LCD per m2 scrn	CRT per m2 scrn	big caps & coils	slots / ext. ports	large IC	small IC	SMD/ LED's avg.	PWB 1/2 lay 3.75kg/m2	PWB 6 lay 4.5 kg/m2	PWB 6 lay 2 kg/m2	Solder SnAg4Cu0.5	PWB assembly	Controller board	ELECTRONICS
product	42	43	44	45	46	47	48	49	50	51	52	53	98	subtot
WH			12	1		0	0	3			0		14	**30**
CHC													16	**16**
CH													80	**80**
SFB													23	**23**
AHC													68	**68**
LH													36	**36**
RAC													83	**83**
CIRC														-
VU													9	**9**
LS							0	82			3	0	0	**85**
DP	130												57	**186**
STB			19	15	2	1	3	19	12		1			**72**
VIDEO				59	22	5	3	12	24	8		2		**135**
ES					1				13	0	0		44	**58**
PC	9		129	56	19	18	23	10	30		7			**301**
EP			16	5	0	1	3	16	6	1	1		9	**58**
BC			72	5		3	3	4			1			**89**
UPS			4	1	0	0	1	3	0		1			**10**
RF			4										78	**82**
CF			0	1	0	1	0	0					3	**5**
PF	0			0									1	**1**
CA													119	**119**
CM				0		6		1	2	0				**9**
WM													34	**34**
DW													58	**58**
LD													124	**124**
VC														-
FAN														-
MT														-
WP														-
CP													0	**0**
TRAFO														-
TYRES														-
	7.8%	0.0%	14.4%	8.1%	2.5%	2.0%	2.1%	8.5%	4.9%	0.5%	0.8%	0.1%	48.2%	100.0%
	139	**-**	**256**	**143**	**45**	**35**	**38**	**150**	**87**	**9**	**14**	**2**	**854**	**1 771**
	0.09%	0.00%	0.16%	0.09%	0.03%	0.02%	0.02%	0.09%	0.05%	0.01%	0.01%	0.00%	0.53%	1.10%

Table 10.	Miscellaneous [ton]								kt
weight STOCK	Glass for lamps	Bitumen	Cardboard	Office paper	Concrete	Natural Rubber	Synthetic Rubber	Other	MISCELLANEOUS
product	54	55	56	57	58	93	94	99	subtot
WH			24	6				243	**273**
CHC								14	**14**
CH									-
SFB									-
AHC			124	0				384	**508**
LH	14		224	8				308	**554**
RAC								288	**288**
CIRC			10	9					**19**
VU								109	**109**
LS	609		616	115				26	**1 366**
DP	131		207	58				100	**497**
STB	3		67	12					**83**
VIDEO		10		278	52				**341**
ES			50	1					**51**
PC	0		401					53	**454**
EP	76		118	17					**211**
BC			11	3					**13**
UPS			7	1					**8**
RF	1 451			63				98	**1 611**
CF	339		7	5				678	**1 028**
PF				0				57	**57**
CA	1 523							504	**2 027**
CM								80	**80**
WM	366		325	22	3 760				**4 473**
DW			237	23	162				**422**
LD								263	**263**
VC			536	62					**598**
FAN			33						**33**
MT									-
WP			26	1					**26**
CP				5	0			0	**5**
TRAFO		106	21	131	284				**542**
TYRES						5 281	3 343	1 610	**10 233**
	17.2%	0.4%	11.6%	3.1%	16.3%	20.2%	12.8%	18.4%	100.0%
	4 512	**116**	**3 045**	**819**	**4 258**	**5 281**	**3 343**	**4 814**	**26 188**
	2.81%	0.1%	1.89%	0.51%	2.65%	3.29%	2.08%	2.99%	16.29%

Annex D. EU-28 and ErP materials input compared

PLASTICS	EU (kt)	ErP(kt)	ErP/EU
source: Plastics Europe, Plastics – the Facts 2015, An analysis of European plastics production, demand and waste data, 2015 (sales data relate to 2014)			
LDPE (1,3)	8222	56	0.7%
HDPE (2)	5784	25	0.4%
PP (4)	9178	645	7.0%
PS, EPS (5,6,7)	3346	409	12.2%
PVC (8)	4923	96	1.9%
ABS (9,10)	908	269	29.6%
PET	3346	17	0.5%
BULK Plastics	**35707**	**1518**	**4.3%**
PA (11)	860	76	8.8%
PC (12)	621	173	27.8%
PMMA (13)	287	88	30.7%
Tec-pl (14+)	956	12	1.3%
PUR (15,16)	3585	255	7.1%
Other	5784	3	0.1%
E-glass fibre	1004	11	1.1%
TEC plastics	13097	**607**	**4.6%**
Total plastics & fibre	**48804**	**2125**	**4.4%**
FERRO			
sources: Eurofer, European Steel in Figures, (2015 edition, covering 2010-2014), 2015 (www.eurofer.org)			
http://www.caef.org/downloads/kategorie.asp?kat=9			
End-products steel			
hot rolled, direct use	30032		
quarto plates (thick plates for bridges, etc.)	10558		
cold rolled direct use	9701		
coated sheets, of which	29098		
--St sheet galvanised (21)	*24867*	3450	13.9%
--plastic coated (38)	*4231*	15	0.4%
other flat (incl. 24, ferrite)	5978	78	1.3%
Total flat steel products	**85367**	**3544**	**4.2%**
beams	6385		
rebars (betonstaal)	13000		
wire rods (staaldraad)	15727		
St tube/profile (22)	12341	843	6.8%
Total long steel products	**49948**	**843**	**1.7%**
Total steel products	**135315**	**4387**	**3.2%**
Crude (136 Mt non-alloy, 25.4 Mt alloy)	*161885*		
Fe castings (23)	**11511**	**1411**	**12.3%**
Stainless			
hot roll	458		
bright bars	334		
wire rod	323		
drawn rod	197		
Total stainless long	**1313**		
hot roll strip, direct use	973		
quarto plate	277		
Stainless coil/sheet (25)	3670	828	22.5%

Total stainless flat	**4920**	**828**	16.8%
Total stainless	**6233**	**828**	13.3%
FERRO TOTAL	**141548**	**6626**	**4.7%**

NON-FERRO

sources:
http://www.european-aluminium.eu/aluminium-sector-in-europe-2010/
Joseph, G., Copper --its trade, manufacture, use and environmental status, International Copper Association Ltd., 1999
ICSG, The World Copper Factbook 2015, International Copper Study Group, 2015
http://www.mmta.co.uk/magnesium-market-overview

Aluminium (2011)			
Foil	1000		
Sheet (26)	3500	170	2.3%
Extrusion (26)	3000		
Castings (27, 32)	3200	288	9.0%
Wire, powder, slug	1200		
	11900	**458**	**3.9%**
Copper			
Winding wire (28)	375	166	7.4%
Appliance wire (29)	146		
Other wire (29)	1708	183	9.9%
Tube (30)	500	246	11.1%
sheet&strip (30)	333		
rod	83		
Cu-alloy castings (31)	*403*	32	6.6%
Alloy wire (brass, bronze)	42		
Alloy rod	458		
Alloy sheet & strip	292		
Powder etc.	42		
Copper total (incl. 118 Zn, 25 Ni, 10 Sn)	**4381**	**627**	**14.2%**
Magnesium diecasts	62	5	7.3%
Other Mg end-uses	127		
Total magnesium	**189**	**5**	1.6%
NON-FERRO total	**16470**	**1090**	**6.6%**
powder coating (39)	na	34	
Cu/Ni/Cr plating (40)	na	2	
Au/Pt/Pd per g (41)	na	0	
COATINGS		**52**	
LCD per m2 scrn (42)	na	83	
CRT per m2 scrn (43)	na	0	
big caps & coils (44)	na	55	
slots / ext. ports (45)	na	29	
large IC (46)	na	9	
small IC (47)	na	7	
SMD/ LED's avg. (48)	na	8	
PWB 1/2 lay 3.75kg/m2 (49)	na	22	
PWB 6 lay 4.5 kg/m2 (50)	na	18	
PWB 6 lay 2 kg/m2 (51)	na	2	
Solder SnAg4Cu0.5 (52)	na	3	
PWB assembly (53)	na	0	
Controller board (98)	na	98	
ELECTRONICS		**334**	

Glass

source: Members of Glass Alliance Europe (GAE), Panorama of the EU glass industries 2014, 2015

container glass	20401	kt		
flat glass(unworked)	7753			
domestic glassware	1126			
reinforcement fibres (18)	1004			
special glass (54)	662		437	26.2%
other	412			
Total Glass	**31358**		**437**	1.4%

Paper & Board

source: CEPI, Key statistics of the Paper and Pulp Industry 2013, Confederation of European Paper Industries, June 2014.

Newsprint	7283		
Uncoated Mechanical	4807		
Coated Mechanical	5162		
Uncoated Woodfree	7212		
Coated Woodfree	5221		
Other Graphic Papers	22402	135	0.5%
TOTAL GRAPHIC PAPERS	**29686**		
SANITARY AND HOUSEHOLD	**6796**		
Case Materials	24077	512	1.7%
Carton Board	5661		
Wrappings	2883		
Other Paper & Board for Packaging	3350		
TOTAL PACKAGING PAPERS	**35971**		
OTHER PAPER & BOARD	**3885**		
Total paper & board	**76339**	**647**	**0.8%**

Rubber

source: ETRMA, Statistics booklet, European Tyre & Rubber Industry, 2015.

Natural rubber (93)	1150	854	74.2%
Synthetic rubber (94)	2350	1349	57.4%
Total rubber	**3500**	**2203**	**62.9%**

Bitumen (55)	na	18
Concrete (58)	na	280
Other (99)	na	751
MISCELLANEOUS		**4330**