Annex A - Interview programme

	Surname	Type	Organisation	Status
EU	Kazakevicius Eduardas	Commission officials	DG CLIMA	Arranged
EU	TRUSZCZYNSKI Jacek	Commission officials	DG ENER	Completed
EU	Hodson Paul	Commission officials	DG ENER	Completed
EU	Lichtenvort Kirstin	Commission officials	DG ENTR	Completed
EU	Parenti Alberto	Commission officials	DG ENV	Completed
EU	Pennignton David	Commission officials	JRC - IES	Completed
EU	Wolf Oliver	Commission officials	JRC- IPTS	Completed
EU	Mr. GASC Emilien	Consumer group	ANEC/BEUC	completed
EU	BORG Nils	Environmental group	ECEEE	completed
EU	TOULOUSE Edouard	Environmental group	ECOS	Completed
EU	ARDITI Stéphane	Environmental group	EEB	completed
EU	BOYE OLESEN Gunnar	Environmental group	INFORSE	completed
EU	RIVIERE Philippe	Expert/consultant	ARMINES	contacted
EU	SHAILENDRA Mudgal	Expert/consultant	BIO IS	Completed
EU	PEDERSEN Per Henri	Expert/consultant	DTI	Completed
EU	SCHISCHKE Karsten	Expert/consultant	Fraunhofer IZM	completed
EU	Mr. Reintjes Norbert	Expert/consultant	Ökopol	Completed
EU	KEMNA Rene	Expert/consultant	VHK	Completed
EU	VAN TICHELEN Paul	Expert/consultant	VITO	contacted
EU	Cassells Sheila	Industry association	Digital Interoperability Forum	Completed
EU	Mr. Kunze Peter	Industry association	ACEA	Completed
UK	Mr. Martin Alex	Industry association	AMDEA	Completed
EU	RAMBALDI Matteo	Industry association	CECED	Completed
EU	Garczynska Magdalena	Industry association	CECIMO	completed
EU	MITTELHAM Stéphanie	Industry association	CELMA	Completed
EU		Industry association	CEPMC	Completed
EU	Ms. Baton Marie	Industry association	CLASP	Completed
DE	Sattler	Industry association	ZVEI	completed
EU	Corridori	Industry association	COCIR	completed
EU	Tove Larsson	Industry association	Food Industry Europe	completed
EU	Wolfgang Hahn	Industry association	Digital Europe	completed
EU	LEROY Christian	Industry association	EAA	Completed
EU	NOWAK Thomas	Industry association	EHPA	completed
EU	STURM Juergen	Industry association	ELC	completed
EU	BAERTEL Els	Industry association	EPEE	completed
EU		Industry association	EURATEX	completed
EU	Hidalgo Antoni	Industry association	EURIMA	contacted
EU	DAVIDSON Christel	Industry association	Eurocommerce	
EU	MARLET Christine	Industry association	EUROGYPSUM	Completed
EU	CARPENTIER Annick	Industry association	EUROMETAUX	Completed
EU	Mr. Tollit Charles	Industry association	European Power Tool Association	Completed
EU	Courtey Sylvain	Industry association	EUROVENT	completed
EU	Mr. Schubert Florian	Industry association	European Ventilation Industry Association	completed
AT	Ms. Hesse Sabine	Industry association	Association of the Austrian Machinery and Metalware Ind.	contacted
FI	Mr. Härkönen Heikki	Industry association	Illuminating Engineering Society of Finland	completed
EU	VANDOORSLAER Guy	Industry association	ORGALIME	completed

Interview programme A

	Surname	Type	Organisation	Status
EU	Hammans Chris	Industry association		completed
BE	Mr. Kaemmer Norbert	Manufacturer/importer	Emerson Climate Technology	completed
NL	Dr. Beekwilder Jos	Manufacturer/importer	Océ Technologies BV	Completed
EU	Mr. Loebel Oliver	Manufacturer/importer	PU Europe	completed
UK	Rimmer	Member states authorities	DEFRA	completed
BE	CREVECOEUR	Member states authorities	BELGIUM	completed
DK	NIELSEN	Member states authorities	DENMARK	completed
FR	LEFEBVRE	Member states authorities	FRANCE	completed
DE	AKKERMAN	Member states authorities	GERMANY	Contacted
IT	PRESUTTO	Member states authorities	ITALY	completed
NL	SIDERIUS	Member states authorities	NEDERLANDS	Completed
NO	FAGERLUND	Member states authorities	NORWAY	completed
SE	LOPES	Member states authorities	SWEDEN	completed
UK	Rimmer Mike	Member states authorities	UNITED KINGDOM	Completed
NO	Bekkhus Niels	National industry association	Confederation of Norwegian Enterprise (NHO)	completed
DE	Völker Kathrin	National industry association	HKI - Industrial Association for House,Heating+Kitchen Technology	completed
DE	Bernhard Sattler	National industry association	ZVEI	completed
DE	SCHOELER Claudia	Industry association	VDMA	completed
DE	Hagemann	Industry association	VDW	completed
SE	Sandqvist Maria	National industry association	Teknikföretagen	completed
EU	MROTZEK	Standard body	CEN CENELEC	completed
DE	Steinmueller	Standard body	VDE	completed
Extension				
C1	Sausages and processed meat	Industry association	CLITRAVI	completed
C2	Clothing	Industry association	COTANCE	completed
C2	Clothing	Industry association	International Tanneries Association	completed
C2	Clothing	Industry association	European Association of Fashion Retailers	completed
C1	Sausages and processed meat	Industry association	Food Industry Europe	completed
C3	Cleaners and detergents	Industry association	AISE	completed
C4	Floor coverings	Industry association	Cerame-Unie	completed
C4	Floor coverings	Industry association	European Resilients Flooring Manufacturers' Institute	completed
C5	Passenger cars	Industry association	ACEA	completed

List of non-energy related considered for case studies B

Annex B - List of products considered for case studies

	Product group/category	Relevant PRODCOM codes	Data on volume of sales and imports	Main environmental impact areas (and severity)	LCA relevant information available	Comments for/against selection
Agricultural products						
1	Sausages and other prepared meat products	10131460 10131430 22212130	5million tonnes sold production (2010,PRODCOM) Net exports: 71 thousand tonnes	High environmental impacts per Euro of consumption (EIPRO) (Acidification, eutrophication, photochemical oxidation, ecotoxicity, human toxicity, ozone layer depletion, global warming, abiotic depletion) Main phases : farming, production	JRC – IPTS studies on environmental impact and improvement potential	Meet products have the highest environmental impact level according to EIPRO - Sausages subcategory is among the highest in the broader group Preferable as it includes certain level of processing activity
2	Ice cream and frozen desserts	10521000	3 million m^3 sold (2010, PRODCOM) Net exports: 40,000 tonnes	High environmental impacts per Euro of consumption (EIPRO) according to EIPRO (Acidification, eutrophication, photochemical oxidation, ecotoxicity, human toxicity, ozone layer depletion, global warming, abiotic depletion) Main impact phases : farming, production	EIPRO study on environmental impact	Subcategory of dairy products - preferable as it includes higher level of processing
3	Bottled and canned soft drinks	11071930 11071950	66billion litres sold (2010, PRODCOM)	Moderate level of impacts per Euro of consumption (EIPRO). High in relation to Global warming, Acidification, photochemical oxidation Main impact phases: farming, production	No study identified	No study available
Consumer products						

List of non-energy related considered for case studies B

	Product group/category	Relevant PRODCOM codes	Data on volume of sales and imports	Main environmental impact areas (and severity)	LCA relevant information available	Comments for/against selection
4	Clothing (apparel consisting at least 90% by weight of textile fibres)	1411000-14391090(122 8 digit codes)	4.6 billion tonnes fibres consumption in EU25 (Euratex,2010) – Around 50% for apparel.	High environmental impact according to EIPRO study (Global warming, Photochemical oxidation, Abiotic Main issue/impact areas: raw material (fibres) production, use of chemicals and energy for processing and production, use phase (washing), disposal	EIPRO study and eco-label study	Important product category in terms of share in environmental impacts Diverse range of products but less so in terms of typical materials
5	Footwear	15201100-15204080	Eco-label study: 1.6 billion pairs apparent consumption (EU15 -1999) PRODCOM: 0.6 billion pairs produced (2010) Net imports: 1.9 billion pairs	Relatively high environmental impacts according to EIPRO study (main aspects: ozone layer, photochemical oxidation) Main issue/impact areas: use of chemicals and energy for production, disposal	European and Dutch Eco-label	Second most important product sub-group after clothing Rather diverse in terms of materials used
6	Furniture (for bedroom or living room, shops, office)	31001155-31091450 (excluding mattresses codes, see below)	Total Market: €100 billion (2010, EU25) – 10% imports Wood: 1/3rd of market Wooden: 2.6 billion units produced (PRODCOM, 2011)	Relatively high levels of impact per Euro to: (photochemical oxidation, ozone layer depletion, eutrophication, abiotic resources use) Main issues identified: Raw materials and use of chemicals in production phase, Disposal at end of life	LCA analysis for Eco-label and other labels	Product category varies (depending on material, type)

List of non-energy related considered for case studies B

	Product group/category	Relevant PRODCOM codes	Data on volume of sales and imports	Main environmental impact areas (and severity)	LCA relevant information available	Comments for/against selection
7	Mattresses (and mattress bases)	31031230-90	35 million units sold in EU27 (Eco-label study) 50 million units produced (PRODCOM,2010) €3.8 billion value Net imports: 7.6 thousand tonnes	Average level of impact per Euro consumed concerning most categories Main issues/impact phases: use of material during production, durability of product, disposal	LCA analysis for Eco-label	Well defined durable consumer product sub-category under furniture category with a number of eco-labels available.
8	Cleaners (all purpose cleaners - and hand dishwashing detergents)	20411000 20412020/30/50/90 20413240/50/60/70	Market value of €2.3 billion for all purpose, 2,2 for sanitary and 1 for hand dishwashing detergents in 2007 14 million tonnes produced (2010, PRODCOM) Net exports: 1.2 million tonnes	EIPRO: Average level of impact per Euro spent Eco-label analysis: (Eco)toxicity, Global warming, Ozone layer depletion, Photochemical oxidation, Eutrophication Main issues/impact phases: use and disposal	LCA analysis for Eco-label	Also relevant for industrial products group
9	Soaps, shampoos and hair conditioners	20413120/50/80 20421630/50 20421915 20421930	Eco-label study: approx. 1 million tonnes in EU 6.7 billion Euro in 2003 >1.5 million tonnes produced (2010, PRDCOM) Net exports: 150 million tonnes	High environmental impact according to Eco-label study Ecotoxicity (Impact on water quality during use/disposal), waste (packaging), eutrophication and acidification, abiotic resources Main impact phases: use/disposal	LCA analysis for Eco-label (data from multiple studies)	
Housing						

List of non-energy related considered for case studies B

	Product group/category	Relevant PRODCOM codes	Data on volume of sales and imports	Main environmental impact areas (and severity)	LCA relevant information available	Comments for/against selection
10	Paints and varnishes (indoor and outdoor)	20301150/70 20301225/29/30/50/70 20302213 (not including powders used in paints)	7 million tonnes produced (2010, PRODCOM) Net exports: 0.7 million tonnes	EIPRO: Moderate-high level of environmental impact per Euro consumed (Photochemical oxidation, Ozone layer depletion) Eco-label study: VOC emissions, (eco)toxicity, Global warming potential, acidification, Toxicity Main issues/impact phases: raw material/solvent used in production, emissions/waste in use	Full LCA analysis for Eco-label	Also relevant for industrial product group
11	Hard floor Coverings (tiles)	23311010/20	Data from Eco-label study: 60 million tonnes produced in EU	Eco-label study: Main issues/impact areas : Raw material extraction, particle emissions, use of chemicals, energy, water during production Toxic substances during use (cleaning)	Eco-label study	Covered by eco-label schemes
12	Soft coverings (wood, plastic, textile floor coverings)	13016155 13931100/200/300/930/990 160101077 16012110/50 16221030/60 22197200 22192085 22231155/59/90 22231500	Carpets :Produced volume : 1,125 million m2. Net imports: 61 million m2 Wood: 143 million m2 produced. Net imports: 11 million PVC: 377 million m2 Laminates: 25 million m2 produced Net exports: 48 million m2 (PRODCOM, 2010)	Eco-label study Multiple impacts depending on category Raw material, energy used for production, chemicals for installation, energy and chemicals during use, Waste (Disposal)	Eco-label study	Covered by eco-label scheme and LCA data Great variation in products

List of non-energy related considered for case studies B

	Product group/category	Relevant PRODCOM codes	Data on volume of sales and imports	Main environmental impact areas (and severity)	LCA relevant information available	Comments for/against selection
13	Adhesive and sealants	20521020/40/60/80	4 million tonnes produced (2010,PRDCOM) Net exports: 84 thousand tonnes	EIPRO: Relatively high environmental impacts per Euro consumed (Environmental aspects: Abiotic resources depletion, Ozone layer depletion, Photochemical oxidation)	Covered by Nordic Swan eco-label	Covered by eco-label scheme
Industrial products						
15	Lubricants and greases (additives not included)	20594155/57/75/79	1 million tonnes produced (2010, PRODCOM) Net exports: 0.36 million tonnes	EIPRO: High level of abiotic depletion per Euro of consumption Eco-label study: (Eco) Toxicity during use and disposal,	EU Eco-label scheme study	Information from eco-label study
16	Industrial cleaning and degreasing agents	20411000 20412020/30/50/90 20413240/50/60/70	€3.2 million (2007, Eco-label study)	EIPRO: Average level of impact per Euro spent Eco-label analysis: (Eco)toxicity, Global warming, Ozone layer depletion, Photochemical oxidation, Eutrophication	Eco-label study	
Means of transport						
17	Passenger cars	29102100 29102230 29102310/30/40 29102400	>200 million passenger cars fleet, Annual sales of 15million (2006, IMPRO study) Net exports: 1.5 million units	EIPRO: High level of impact per Euro spent for all environmental impact categories Main issues: Raw materials use during production, energy and emissions during use phase	JRC – IPTS studies on environmental impact and improvement potential	IMPRO study provides data on improvement potential that can support the analysis
18	Agricultural tractors	28302100/200/330/350/370/390	240 thousand units sold (2008, AEA)[1]		No data	No data

[1] Source: http://www.aea.uk.com/downloads/The%20agricultural%20machinery%20industry.doc). PRODCOM data indicate a smaller number of sales below 200,000 units.

List of non-energy related considered for case studies B

	Product group/category	Relevant PRODCOM codes	Data on volume of sales and imports	Main environmental impact areas (and severity)	LCA relevant information available	Comments for/against selection
			28 billion production value (2008,CEMA) Net imports: 33,000 units			

Note: highlighted with blue the products selected

Case studies – Sausages and other processed meat products C1

CASE STUDY 1: SAUSAGES AND OTHER PROCESSED MEAT PRODUCTS[2]

Product category overview

The case study examines the feasibility of developing eco-design requirements within the context of the Ecodesign Directive for the product category of sausages and other meet products. This product category has been selected as representative of the broader food and beverages product group. According to EIPRO study[3], food and drink products represent around 20-30% of the total impact for most environmental impacts categories. Within the product group, sausages and processed meat products represent the third most important category with a share of around 10% in almost all environmental impact categories.

There was no standard definition of sausages and standard meat products identified. According to Regulation (EC) No 853/2004 regulation, 'Meat products' means processed products resulting from the processing of meat or from the further processing of such processed products, so that the cut surface shows that the product no longer has the characteristics of fresh meat.

On the basis of information from the Food and Agriculture Organisation[4] the sausages and processed meat products fall under the following categories that reflect the different types of processes:

- Fresh processed meat products (e.g. hamburgers, fried sausages, kebab);
- Cured meat pieces (raw cured beef, raw ham, cooked beef, cooked ham, bacon);
- Raw cooked meat products (Frankfurter type sausages, mortadella, lyoner);
- Pre-cooked cooked meat products (liver sausage, corned beef, pate, corned beef);
- Raw-fermented sausages (salami);
- Dried meat products (meat flosses, dried meat strips).

Inside these subgroups one can find important variations on the basis of the type (pork, beef, other) and percentage of meat and other ingredients. According to the industry association there are over 2000 recipes for sausages.

Market analysis

Market data

According to the data provided by CLITRAVI and Food Industry Europe, the total size of the processed meat EU market in 2010 was around 13 million tones with a total volume of € 66.3 billion. The EU is a net importer of processed meat, the lion share of which is processed poultry that is further processed before reaching the final consumer. In contrast, the EU is a net exporter of sausages.

[2] The case study of the specific product group has been based on desk research and an interview with the relevant industry associations, the Food Industry Europe – representing the whole food industry – and CLITRAVI – representing the meat processing industry.
[3] ec.europa.eu/environment/ipp/pdf/eipro_report.pdf
[4] http://www.fao.org/docrep/010/ai407e/AI407E09.htm

Case studies – Sausages and other processed meat products C1

Table 1 - Main data on sausages and processed meat market

Indicator	Data	Source
Total size of EU market (volume)	13 million tonnes (2010)	CLITRAVI
Total size of EU market (value)	€ 66.3 billion (2010)	CLITRAVI
Imports into the EU (volume) [5]	516.000 tonnes (2010)	Eurostat
Imports into the EU (value)	€ 1.482 million (2010)	Eurostat
Exports from the EU (volume)	234.000 Tonnes (2010)	Eurostat
Exports from the EU (value)	€ 676 million (2010)	Eurostat
Total number of firms in EU	14.000	CLITRAVI
Total number of employees	560.000	CLITRAVI

On the basis of Eurostat household budget survey data 2005)[6], the average annual consumption per household for food and non- alcoholic beverages was € 3,594 (17% of the total budget). Meat products represent 3.8% of the total (€747/year) and dried, salted and edible meat (e.g. sausages, salami, ham, and pate) represented 1.2% of the total consumption. Other preserved or processed meat and meat-based preparations (e.g. canned meat, meat extracts, meat juices, meat pies.) represented an additional 0.4% of the total consumption.

Market structure

According to CLITRAVI, he processed meat market is characterised by very low levels of concentration, typical of most of the food industry sector. In total, there are around 14,000 firms active in the sector – excluding butchers that also produce in some cases processed meat products. While there are four large manufacturers that control around 16% of the market in the 9 larger EU countries, most meat processing companies are small or medium sized and often family-owned focusing on the local or national markets.[7] While certain operators are getting larger shares as the industry restructuring slowly progresses, overall it remains quite fragmented.

A key feature of the sausages market is the strong link of processed meat products with territory, tradition and industry structures that vary considerably among countries as a result of history. Artisanal production represents around 21% of total German production but close to zero in the UK. The average in other countries is around 10%. Furthermore, in Germany and France retailers also own processing plants producing products under their own private label. In general though, private label is not as strong in this sector as in other categories of food products.

Life Cycle Analysis – main environmental aspects and key stages of the life cycle of the product

Analysis of life cycle stages of processed meat products

According to the Food and Agriculture Organisation the typical sausage and other processed meat product life cycle includes the following stages:

1. Livestock breading and the associated crop production.
2. Livestock slaughtering that produces bovine, poultry or pork meat.

[5] Poultry meat preparations (falling under CN code 1602) are making the lion's share of imports. They are finished meat products (i.e. ready to eat) but are further processed and largely destined to composite foods.
[6] http://epp.eurostat.ec.europa.eu/portal/page/portal/household_budget_surveys/introduction
[7] In the food industry in general 86% of the firms have less than 20 employees. (Competitiveness report)

3. Processing of meat (deboning of meat, grinding, chopping and mixing with other ingredients, extruding), fermentation, smoking or drying (depending on the type of sausage) and casing for the development of the final product.
4. Packaging (typically plastic or can).
5. Transportation to the point of sale.
6. Storage in the stores (including refrigeration for most products).
7. Consumption (storage, preparation of food and food and package waste).
8. End of life for the packaging and any food waste.

The above stages of the life cycle are associated with different possible environmental impacts of greater or lesser importance in terms of potential environmental impacts.

Livestock farming requires substantial amounts of water for crop production and creates water pollution through the use of fertilisers and greenhouse gas emissions primarily due to the enteric methane production and manure management processes. It is also linked with substantial impact on the land (soil erosion) and has direct impact on land use affecting biodiversity.

The **processing of meat** for the production of sausages and other meat products include substantial amounts of water for processing (thawing process) and cleaning and energy for smoking of certain processed meat products, ventilation, drying and freezing of products. It also creates a certain amount of wastewater that can include certain cleaning agents but also organic material and other product remnants. Furthermore, around 70% of the total food produced is packaged there can be important packaging waste created.[8]

The **distribution** and sale of products is primarily linked with the fuel consumption for the transport but primarily with energy use for chilling during distribution and in-store refrigeration (temperatures vary between -1C and 8C depending on the type of the product).[9] At the **use phase**, the main impacts concern the energy used for refrigeration and preparation (cooking) but also the packaging and food waste that may be recycled or composted or thrown for general waste in the **end-of-life**.

LCA analysis - Important environmental aspects related to the life cycle of processed meat

During the course of the study we were not able to identify studies that examine the environmental impact of sausages and processed meat on the basis of a life cycle approach and, in general, there are rather few studies examining the impact of food products across the entire life cycle. The existing research work focuses on primary production with a strong focus on energy consumption, climate change implications and eutrophication.[10] As a result, our analysis has been based on the combination of various sources in order to develop as complete as possible a picture concerning the life cycle of processed meat products.[11]

The first source of information is the EIPRO study. The study does distinguish between impacts in the different life cycle stages of the product but indicates that food and drink consumption contribute between 20-30% of the total environmental impacts results from consumption in the EU. Sausages and other processed meat product represent the 3rd most important product group with around 10% share in most categories examined (see Table 2 below). Furthermore, sausages and processed meat products are in the

[8] Data provided by CLITRAVI.
[9] ftp://ftp.jrc.es/pub/eippcb/doc/fdm_bref_0806.pdf
[10] Manchester Business School on different life-cycle assessments.
[11] Following communication with the relevant stakeholders we intend to ask for additional feedback from both the industry association and environmental NGOs on the basis of this case study.

list of the 35 products with the highest impact per Euro of consumption on all eight impact categories analysed in this study.

Table 2 – Contribution of sausages and processed meat products in various environmental aspects

	Food/beverages	Sausage and processed meat			Rank
	Share in total	Share in total	Share in group	Impact/Euro spent	
Climate change	29.3%	2.5%	8%	1.21E-12	3
Resources depletion	20.6%	1.4%	12%	6.76E-13	8
Acidification	29.7%	2.8%	9%	1.34E-12	2
Photochemical smog	25.5%	1.9%	7%	9.43E-13	5
Human toxicity	23.6%	1.8%	11%	8.48E-13	6
Ecotoxicity	31.6%	2.2%	%	1.05E-12	4
Eutrophication	58.1%	4.8%	9%	2.30E-12	1
Ozone depletion	23.6%	1.7%	11%	7.92 E-13	7

Source: EIPRO study

Based on the Impact/Euro indicator, global warming, eutrophication and acidification appear as the most important impacts, while resource and ozone depletion have the lowest scores. EIPRO does not access impact categories related to agricultural products like water and land use. However, in the LCA studies for other agricultural products these appear to be very relevant as there is a lot of land and water needed to grow crops used from the feeding of animals (e.g. maize and soy).

Additional information on the overall impact of sausages is derived from the study of Blonk Milieu Advies.[12] This research applied the ReCiPe impact assessment method to compare 23 types of smoked sausages in terms of environmental impact focusing on climate change, energy and land use**.** The functional unit and system boundary were not explicitly stated in the report. The results indicate that the type of meat used in sausages is particularly important for greenhouse gases as beef is associated with a very high methane emission, coming from the digestive system of the cow. In comparison, vegetarian alternatives have a much lower impact.

Table 3: Environmental performance of different smoked sausages

Smoked Sausages (type and % of meat included)	Greenhouse Gases (kg CO2eq/kg)	Land Use (m2*year/kg)	Energy Use (MJ/kg)	LCA score (ReCiPe)
No meat	1,4	3,1	8,5	216
No meat	2,8	5	19,7	384
17% pork, 61% chicken	3,1	31,7	16,7	1444
7% pork, 70% chicken	3	30,1	16,3	1515
68% pork	3	34,1	16,9	1613
75% pork	3,2	37,5	17,9	1768
77% pork, 3%beef	4,1	39,7	19,1	1902
84% pork	3,6	42,7	19,8	2010
92% pork	3,9	46	21,6	2167
70% pork, 18%beef	7,6	42,1	21,6	2170
94% pork	4	47	20	2214
75% pork	3,6	48	17,6	2226
100% pork	4,1	47,5	22,2	2238

[12] http://www.blonkmilieuadvies.nl/nl/publicaties/publicaties.php

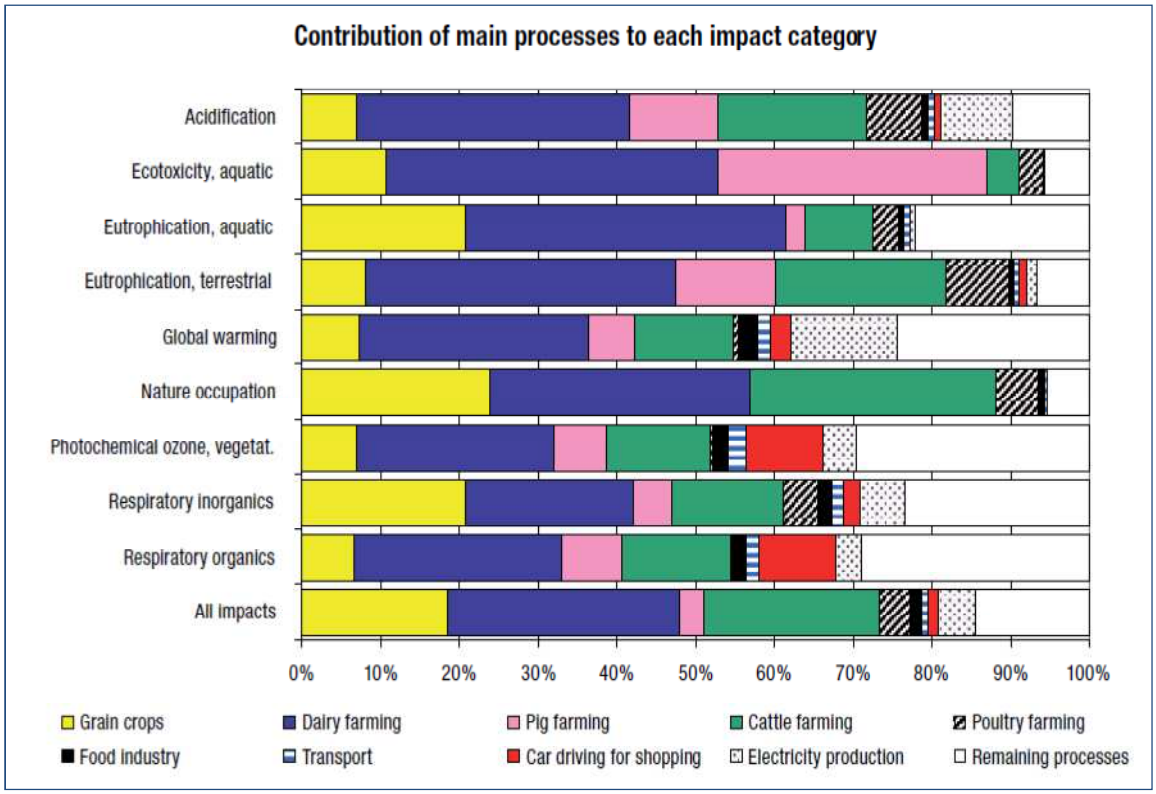
Case studies – Sausages and other processed meat products C1

Smoked Sausages (type and % of meat included)	Greenhouse Gases (kg CO2eq/kg)	Land Use (m2*year/kg)	Energy Use (MJ/kg)	LCA score (ReCiPe)
84% beef	20,7	31,8	23,3	2345
97% beef, 3% pork	24,8	38,1	27,6	2806

Adapted from Natuur en Milieu (2011). Note: Not all results shown

Certain conclusions on the role of the different life cycle stages can also be derived from the combination of various sources, even though one needs to be cautious due to differences in methodologies and definitions of functional units. The review of a number of LCA studies on meat products on behalf of DEFRA[13] suggests that primary production (livestock breeding) has the lion share (over 60%) in terms of energy use and greenhouse gas emissions for beef, pork while rather less for chicken. The same applies to most other environmental impact categories according to the IMPRO study.[14] The food processing part appears to have only a minor contribution in almost all categories. In the case of energy use, the use phase (storage and cooking) in households or restaurants is also important (45% of total). The data from IMPRO study on meat and dairy products indicates that the storage of food in the households accounts for approximately 20% of the total electricity consumption in the life cycle of meat and dairy products.

Chart 1 - Contribution of main meat and dairy processes to each impact category.



Source: IMPRO study

However, as these studies examine general meat products where the production/processing phase is limited to slaughtering and packaging, it misses the additional processing stage that applies in the case of sausages and processed meat. Based on information from the Reference Document on the best available

[13] Manchester Business School on different life-cycle assessments

[14] IPTS (2008), Environmental Improvement Potentials of Meat and Dairy Products, http://ipts.jrc.ec.europa.eu/publications/pub.cfm?id=1721

technologies[15] (BREF) for salami, cured ham and sausage, an average production unit in a Nordic country (NO,SE,DK) consumes 2000kwh (7MJ) of energy for one tonne of finished sausages and other processed meat products. In combination with the data from Natuur en Milieu study this indicates that around 30% of the total energy required is consumed in the production phase.[16] Data from Italian units indicate even higher amounts of energy varying between 9 and14MJ per tonne. Besides the applied technology, parameters such as climate and temperature can also play an important role on the amount of energy required as well as the specific type of processed meat concerned.

The BREF document offers no data on the relative impact of packaging materials, but indicates that the energy used in canning meat is around 0.5 MJ, thus rather less significant. The distribution phase (cooling of products during transportation and the refrigerators in retail stores) has a rather minor share (5%) according to IMPRO study but again this may vary depending on the type of product and the temperature required for preservation.

On the basis of the above, we can rather safely conclude that energy use is distributed across the different stages of the life cycle. This does not apply to greenhouse gas emissions where the enteric methane and manure management processes in the initial breeding stage represent the main source. The industry association (CLITRAVI) suggested that the primary production phase represents more than 85% of the total CO_2 emissions.

CLITRAVI representatives also referred to the importance of water use during the production phase related to the various meat processing methods applied (including cooling with water after cooking) and the hygiene requirements that apply in the food processing sector. The data from the BREF document suggest a total of 5-10m^3 of water for units in the Nordic countries and 10-20m^3 for Italian units.

According to CLITRAVI another important environmental issue that is not related to the livestock breeding phase is the issue of packaging and food waste. Around 70% of the food consumed is packaged and the mass of the packaging material is usually around 1% of the food mass[17]. Typical packaging of sausages and other processed meat products is based on multiple-layers of different plastics (mainly Polyamide and poluethylene) to operate as barriers to oxygen and water vapor[18]. Such blends are more difficult to recycle than single plastic packaging materials.[19]

Waste is also related to the amount of food that is not consumed and thrown away. According to a 2010 study of BIO IS[20], around 90 million tonnes of food waste was generated in 2006 of which food manufacturing was responsible for around 39% and households 42%. Other sectors, including the retail sector, represent 16% of the total waste. Consumer behavior has a key role in that respect. According to data from the UK[21], consumers throw up to 25% of food, half of which is edible. Cooking excessive portion sizes, inappropriate storage or not consumption by the expiry date are the main reasons. In the case of the manufacturing sector, food waste is no more than 5% of the total volume of food production– although according to industry representatives less than 1% - and in most cases it is considered rather unavoidable.

[15] IPTS (2006), Integrater Pollution Prevention and control, Reference Document on Best Available Techniques in the Food, Milk and Drink industries, January 2006

[16] The combination of data from two different studies is not ideal but it is used in the absence of other relevant information. Additional feedback from stakeholders is necessary at this stage.

[17] http://www.incpen.org/pages/pv.asp?p=ipen8

[18] http://www.fao.org/docrep/010/ai407e/AI407E21.htm

[19] http://www.incpen.org/pages/pv.asp?p=ipen8

[20] BIO IS (2010), Preparatory study on food waste across EU27, Final Report , October 2010

[21] WRAP(2009), Household Food and Drink Waste
in the UK, http://www.wrap.org.uk/downloads/Household_food_and_drink_waste_in_the_UK_-_report.6a981a01.8048.pdf

Case studies – Sausages and other processed meat products C1

Information from CLITRAVI indicated that in the case of processed meat the percentage of waste in the total production volume is 0.4-0.5% although it may vary depending on the type of meat product being produced.

Information on the end-of-life of food products has not been identified. Greenhouse emissions from the disposal of organic waste can be one issue but there is also a large amount of recycling of the packaging material that has a positive contribution. According to Eurostat data for 2009, around 42% of municipal waste is distributed to composting, 38% to landfill and 20% to incineration.[22] According to the BIO IS study the environmental impacts of end-of-life impacts for meat products are rather limited.[23]

On the basis of the analysis provided, a number of conclusions on the key issues and the main contributing phases can be derived:

- The raw materials production phase (feedstuff and livestock breeding) represents the stage with the most important impacts in the product life cycle of sausages and processed meat products. It represents the main source of greenhouse gas emissions especially in the case of beef based processed meat products. This stage is also the prime contributor to resources depletion, acidification and eutrophication related to ammonia from manure and the use of fertilizers.
- Energy use is distributed across different stages of the life cycle including the production phase, distribution/retail and the use phase. Consumer habits in terms of efficient cooking (e.g. the use of a lid when heating water) and the use of the energy efficient freezers and ovens can critically affect the overall amount of energy used.
- Solid waste from packaging and food waste resulting from the use phase represent also a rather important environmental aspect.

In relation to the possible use of organic meat for the production of processed meat products, there is no clear view as to the extent that this would bring reduced environmental impacts for the whole life cycle. A number of studies on different types of meats indicate important trade-offs between the reduction of impact related to the limited used of fertilizers with other issues such as land use. According to a 2006 report from the Manchester Business School "…there is insufficient evidence to state that organic agriculture overall would have less of an environmental impact than conventional agriculture".[24]

Implications of MEEuP as an impact assessment method for this product category

The next step of the case study was to examine the possible issues resulting from the use of the MEEuP and the EcoReport in the case of sausages. On the basis of a review of the MEEuP guidelines the following key conclusions can be reached:

- The MEEuP approach does not consider the **allocation** of the different impacts from different products. As shown above, the quality and type of meat used in these products vary and this will have to be considered in order to assess the environmental impacts. On the basis of the use of the current MEEuP approach this difference does not become evident in the assessment.
- **Climate change:** It is not clear in the MEEuP manual how to deal with biogenic carbon uptake when plants are growing, and how to deal with the biogenic methane produced in the digestive system of cows.

[22] http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Waste_statistics

[23] BIO IS (2010), Technical support to identify product categories with significant environmental impact and with potential for improvement by making use of Ecodesign measures- Final Report - April 2010

[24] Manchester Business School (2006), Environmental impacts of food production and consumption, Research report completed for the Department for Environment, Food and Rural Affairs (DEFRA) by Manchester Business school

Case studies – Sausages and other processed meat products C1

- **Land use:** MEEuP does not address the issue of land use. However, land used for keeping cattle but also the long supply chain of food, including soy contribute significantly to habitat destruction and this is another element lost in the case of the MEEuP.
- In the case of the **acidification and eutrophication,** the current MEEuP methodology would probably miss the fate step.

Table 4 – Summary of the analysis of issues/aspects potentially missed from the use of the MEEuP EcoReport

Relevant impact categories	Most important phases	Issues/aspects missed
Land-use	Livestock breeding	X
Energy use	Livestock breeding, Production and Use	X
Water use	Livestock breeding, Production and Use	
Climate change	Livestock breeding	X
Eutrophication	Livestock breeding	X
Acidification	Livestock breeding	X
Waste	Use and manufacturing	

As it is clear the main issues come from the inability of the MEEuP to assess a number of aspects related to the initial crop production and livestock breeding phase of the life cycle. There is no indication that this is an issue that applies only to sausages and processed meat products. It appears to be relevant for almost all categories of food and other products for which, according to all LCA studies, the initial stages in the life cycle are the main source of environmental impacts.

Current Policy framework

As part of the case study we also examined the current policy framework related to the environmental impact areas identified in the previous section. We considered existing regulations that directly or indirectly address the environmental impacts of processed meat or food products more generally. We also looked into existing standards and industry initiatives that address one or more aspects

Regulatory instruments

- The Common Agricultural Policy and the relevant regulation 1782/2003 set requirements linking the payment to producers of agricultural products – including livestock used for meat products – to compliance with certain environmental and other standards.

- A number of EU Directives and Regulations are in force to protect the environment from the pollution caused in agricultural processes. **These include the Nitrates Directive (**91/676/EEC) concerning the use of fertilisers and the land application of livestock manure and establishing good agricultural practices to be implemented on a voluntary basis. It also includes the **regulation on the use of Sewage sludge** (86/768/EEC) and the **Regulation 2003/2003** setting standards for certain categories of mineral fertilisers.

- Council Regulation (EC) No 834/2007 on **organic production and labelling of organic products** sets principles and general rules for organic production and providing that foods (including meat products) may only be marked as "organic" if at least 95% of their agricultural ingredients are organic. The key issue is the restriction in the use of external inputs such as fertilisers and certain types of food additives in the products. It also makes provisions for the use of the EU organic logo.

- Industrial Emissions Directive (2010/75/EC) - The IED (successor of the IPPC Directive) aims to minimise pollution from industrial sources and covering emissions to air, water and land. THE IPPC Directive applies to meat processing plants with production capacity of more than 75 tonnes. Plants are required to apply for permits to the national authorities that are provided on the basis that all necessary measures are taken

against pollution and no significant pollution is caused, that waste production is avoided, energy is used efficiently and that measures for accidents are avoided. The emission limits are set in terms on the best available techniques (BAT) identified. BAT reference documents (BREFs) have been developed and are periodically revised to assist authorities to assist authorities and companies. IED and the former IPPC Directive are plant specific rather than product specific regulations that addresses most of the environmental aspects related to slaughtering and processing of meat for the production of sausages.

- **Water framework Directive 2000/60/EC** – Aims to ensure that all water basins meet good status by 2015 and required the reduction and control of pollution from agriculture, industry and urban areas setting water pricing mechanisms on the basis of the polluter pays principle. For the sausages and processed meat production, the Directive has a direct relevance in relation to the initial stages of their production.

- **Ecodesign of EuP Directive (2005/32/EC) (for freezers, fridges, grills, hobs, ovens, etc.)** – The Ecodesign Directive applies – or is expected to apply - to a number of products that are related to the preservation of sausages and meet products (domestic refrigerators and freezers already covered, commercial refrigerators and freezers and refrigerating and freezing equipment that are currently in the consultation forum phase) and for their preparation (domestic and commercial ovens, hobs and grills).

- **Council Directive 2000/13/EC on labelling, presentation and advertising of foodstuffs** concerns the labelling of foodstuffs delivered to the consumer and certain aspects relating to the presentation and advertising. In the case of the specific products it requires the provision of information in relation to the appropriate storage conditions and "use by" indications that can affect the durability of the product and the amount of food waste produced.

- **European Regulation (EC) 1935/2004 on materials and articles intended to come into contact with food** that requires, among other issues, that recycled material used for the packaging of sausages and other meat products meet minimum food safety and consumer requirements.

- **Packaging and packaging waste Directive (94/62/EC):** This Directive refers to all packaging placed on the market and all packaging waste. It sets requirement in relation to the weight and volume of packaging taking also into consideration hygiene, safety and acceptability, to reduce the hazardous content of packaging and to design reusable and recoverable packaging. Member States are expected to take measures at the national level to reduce packaging waste and increase recovery with certain targets set. The Directive addresses some key aspects related to the sausages and processed meat – as well to most other food products – as the food and drink industry is a major user of packaging and its use has implication on the amount of waste (packaging and food waste) is produced at the end of life stage. The Packaging Directive is complemented and extended by the **Waste Framework Directive t**hat requires Member States to develop waste management policies on the basis of a policy that gives priority to waste prevention and reuse before recycling, recovery and disposal. The producers of waste are expected to assume the costs of waste management thus providing an incentive to reduce waste created in the production process.

- Landfill Directive (1999/31/EC) – The Landfill Directive aims to prevent or reduce the adverse effects of the landfill of waste on the environment, in particular on surface water, groundwater, soil, air and human health. It defines the different categories of waste (municipal waste, hazardous waste, non-hazardous waste and inert waste) and applies to all landfills, defined as waste disposal sites for the deposit of waste onto or into land. The Directive declares that some waste types may not be accepted in landfills. Products made from biomass (e.g. food) are to be avoided as they are flammable/biodegradable.

- **The EU Directives setting standards on light and heavy duty commercial vehicles** (98/69/EC, 2005/55/EC and 2005/78/EC) address the greenhouse gas and other emissions related to the transportation of raw meat and the distribution of final products to the points of sale.

Case studies – Sausages and other processed meat products C1

- **General food law (178/2002)** and the subsequent regulation does not directly address environmental aspects but it sets certain requirements concerning the hygiene and quality of products – thus issues such as water and chemicals use during meat processing - and affects the whole supply chain.

Table 3 - Summary of main relevant regulation and main issues addressed

No	Name of regulation	Main aspect regulated/addressed
Crop production and livestock breeding phase		
1	Common Agricultural Policy	Agriculture and livestock breeding processes and relevant impact
2	Nitrates Directive (91/676/EEC), Regulation on the use of Sewage sludge (86/768/EEC), Regulation 2003/2003 on mineral fertilisers	Use of fertilisers and sludge in the crop production and livestock breeding
3	Council Regulation (EC) No 834/2007 on organic production and labelling of organic products	Agriculture and livestock breeding process and relevant impacts
Production phase		
4	Industrial Emissions Directive (2010/75/EC)	Air, water and soil emissions and energy use in meat slaughtering and processing processes
5	Water framework Directive	Emissions to water during the crop, livestock breeding, meat slaughtering and processing phases
6	European Regulation (EC) 1935/2004 on materials and articles intended to come into contact with food	Requirements concerning the packaging material used for sausages and processed meat products
Distribution		
7	Euro 4 standard for light-duty road vehicles (98/69/EC) - Euro V standard for high-duty vehicles (2005/55/EC and 2005/78/EC)	Greenhouse gas emissions during production and distribution phase
Use phase		
8	Ecodesign of EuP Directive (2005/32/EC) (for freezers, fridges, grills, hobs, ovens, etc.)[25]	Energy used during refrigeration and cooking during the use phase
9	Council Directive 2000/13/EC on labelling, presentation and advertising of foodstuffs	Information on the ingredients in foodstuff and guidance of the best way to preserve and consume products
End of life		
10	Directive on Packaging and Packaging Waste (94/62/EC)	Package creation and processing
11	Landfill Directive 1999/31/EC	Set limits on the amount of biomass to be disposed in landfills.

Voluntary standards and labels - industry initiatives

The discussions with industry did not indicate the presence of any voluntary industry wide initiative setting minimum standards related to the sustainable production of sausages and other processed meat products. There are however labelling schemes used that aim to provide environmental information to consumers.

[25] May also be related to the distribution/retail phase once implementing measures for commercial refrigeration units are adopted

Case studies – Sausages and other processed meat products C1

The French retail chain CASINO has initiated the use of the carbon footprint and packaging recyclability rate label that, among a total of 300 products, also covers processed meat products.

Looking more generally in the food sector, the recent EU Eco-label study identified a number of government or private sector labelling schemes for food and drink products.[26] The review suggests that most of them do not follow a life cycle approach and many of them focus on a single issue (e.g. MSC chain of custody scheme for sustainable fishing). The Milieukeur Eco-label in the Netherlands is an example of more extended – although not complete – life cycle approach beyond agricultural production. The same applies to the European organic label although it is based on principles of organic agriculture and does not cover non-organic products. Another important issue is that most existing labelling schemes employ input or practice-based criteria focusing on the prescription of or banning of certain practices in agriculture rather than the measurement of the outputs of the process. The Carbon trust carbon footprint is one example of this approach that is used by a number of retailers in the UK and elsewhere. It provides information on the greenhouse gas emissions (eq. g CO_2) per 100g of product and indicates the recyclability rate of packaging.

Even more relevant is the Grenelle initiative in France, an extension of the Grenelle law.[27] The objective of the initiative – still in the experimental stage - is to introduce labels covering multiple issues on the basis of standard methodology for the measurement of environmental outputs. The methodology developed is informed by existing LCA methodologies such as the BP-X30-323 standard[28] and it expected to be supported by a database including environmental data related to a range of food products to support life cycle impact analysis with rather limited need for primary data collection. 60 firms from the food sector – including 3 from the meat processing industry – aiming to test the feasibility of displaying environmental information on products covering greenhouse gas emissions (carbon footprint) but also issues such as water use, impact on biodiversity (land use) and natural resources. Multiple possible ways of providing this information (pictogram on product, in store information, via mobile applications or online) are to be used and evaluated in terms of effectiveness.

A study of practices in the retail sector has also shown that food retailers –mainly the large ones - use a number of green practices for food products.[29] A few of them apply certain eco-design principles for their own brand products in relation to food packaging while some conduct basic LCAs using various methodologies to identify "hot spots" and develop relevant product specifications while some ban certain products with high environmental impacts (bluefin tuna). Another approach followed by food retailers is the introduction of codes of conduct to their supplier setting minimum requirements referring to good agricultural practices. For example, ASDA in the UK (subsidiary of Wal-Mart) and Mercadona in Italy require all suppliers of fruits and vegetables - for fresh consumption and for frozen and canned food- to meet certain requirements and the suppliers are audited and certified annually by an external company. In some cases retailers use their own codes of conduct while others rely on certification of existing schemes and labels, such as the Marine Stewardship Council for fish products[30], the Global Good Agriculture Practice scheme (GlobalG.A.P.)[31] or the Milieukeur standard. The GlobalG.A.P. focuses on the business-to-business aspect providing information on the practice used and is not used as a label on the product. From the retailers' side, the adoption of such practices is driven both by corporate social responsibility principles but

[26] Oakdene Hollins (2011), EU Eco-label for food and feed products - feasibility study, http://ec.europa.eu/environment/Eco-label/about_Eco-label/pdf/Eco-label%20for%20food%20final%20report.pdf
[27] Presentation on Grenelle provided by Food Industry Europe.
[28] AFNOR, General principles for an environmental communication on mass market products.
[29] BIO IS (2009), Towards a greener retail sector – A report to the European Commission DG Environment.
[30] http://www.msc.org/
[31] http://www.globalgap.org/cms/front_content.php?idcat=9

also a way for differentiation. Consumer demand is still not seen as the main driver although there it has an increasing role.

Overall, there are a large number of public or private initiatives. Motivated by the need to streamline the different approaches, a European Food Sustainable Consumption and Production Round Table have been initiated by the European Commission with the participation of actors across the supply chain. The objective of the roundtable is "to promote a science-based, coherent approach to sustainable consumption and production in the food sector across Europe, while taking into account environmental interactions at all stages of the food chain".[32] The conclusion of the initial work is that, at this stage, there are no reliable, practical and harmonised methodologies that can be used, to assess and communicate the environmental impact of food products.[33]

The same conclusion on the current methodologies comes from the study on the possible development of an EU Eco-label for food, drinks and feed mentioned. Furthermore, one of the findings is that the development of environmental output criteria and the verification of compliance can be quite complex. The study concludes that the process of multi-criteria assessment and verification for an EU Eco-label is expected to be resource intensive and that the costs of application may be particularly burdensome for SMEs.

The objective of the Round Table of Sustainable Food Production and Consumption is to promote a streamline and simplification of existing approaches. In this direction, very relevant is also the work conducted by JRC IES towards the development of a harmonised methodology for the calculation of the environmental footprint of products on the basis of product footprint category rules.[34] Building on existing methodological standards (ISO 14040-44, PAS 2050, BP X30, WRI/WBCSD GHG protocol, Sustainability Consortium, ISO 14025, and Ecological Footprint), the objectives is to form guidelines for the development of so called Type III environmental declarations that are quantitative, LCA-based claims of the environmental aspects of certain goods. Among the sectors considered for an initial trial period is the food sector. Such a scheme – if generally recognised - can potentially support firms in ensuring conformity with generic requirements under the Ecodesign. Both initiatives described expect to produce results within 2012.

Overall, we conclude that policy existing tools cover only parts the relevant environmental impacts along the life cycle. The manufacturing processes and related impacts are more or less under the scope of existing regulations while the use phase is mainly addressed indirectly through information provision and there certain gaps. In relation to the key agricultural production stage, the existing tools (CAP, nitrates directive, organic farming) provide only a partial coverage of the relevant issues. There is also a plethora of voluntary schemes and labels that complement certain aspects including the key initial stages. Unfortunately, we have no information as to what share of the total is covered by such approaches and what is the overall impact in terms of environmental improvements.

The existing policy framework appears less comprehensive in the key life cycle stage, crop and livestock production. However, this stage is the least likely to be affected by product specific requirements.

[32] http://www.food-scp.eu/node/20
[33] http://www.food-scp.eu/files/Guiding_Principles.pdf
[34] http://ec.europa.eu/environment/eussd/product_footprint.htm

Case studies – Sausages and other processed meat products C1

Policy Analysis

Description of possible Ecodesign requirement regulatory measure

On the basis of the previous analysis the following eco-design requirements for processed meat were considered:

- Generic requirements requiring to conduct a life cycle analysis, develop the ecological profile of the specific product, identify alternative options against benchmarks and also provide information to consumers on the key aspects related to these products;
- Specific requirement for the use of meat produced on the basis of agriculture practice scheme (e.g. Global G.A.P.) or minimum requirement in relation to the use of organically produced meat;
- Minimum requirements on the amount (e.g. weight of packaging/product) and recyclability of packaging material used while taking into consideration the issue of product safety requirements.

Alternative policy options

Against the possible coverage under the above Ecodesign Directive Implementing Measure the following alternative options were considered.

Business as usual - The business as usual scenario includes a combination of existing market forces, regulations related to environmental impact of production processes and certain developments on a voluntary basis towards the provision of additional information on environmental impacts to consumers.

Mandatory labelling or other mandatory information scheme could possibly include the labelling of sausages and processed meat products classifying them – on a standard basis - in terms of certain key environmental impacts such as energy use or greenhouse emissions, informing consumers on the appropriate temperature for conservation and methods of disposal. Mandatory labelling may also inform consumers on the impact of the products throughout the life cycle, providing guidance on the most appropriate preservation and disposal method. Labels may be displayed on the product, on the shelve at the point of sale or on the web.

Voluntary agreement - A possible alternative is the promotion by industry of a voluntary scheme – inside or outside the context of the Ecodesign – aiming to address certain key issues such as packaging waste or, to the extent possible, issues like energy and water use throughout the product lifecycle. A voluntary agreement can also develop within the context of the Ecodesign Directive.

Financial tools –taxes on food products with higher levels of CO_2 emissions (VAT or other tax) could also be used. This could focus on those products that are more CO_2-intensive or those that are based exclusively on organic meat. Other possible financial instruments include the provision of grants or a Reform of CAP promoting investments in technologies and processes used in agricultural production and meat processing and grants for R&D activity for the development of more environmental products and processes (Eco-innovation scheme under the Competitiveness and Innovation Programme).

Assessment of Ecodesign against alternative options

The criteria used for comparing the possible Ecodesign requirements against the alternative options described were:

- The expected effectiveness of the measures in bringing improvements
- The costs involved
- Ease of implementation (including the use of the MEEuP methodology)

- Impact of any necessary changes to existing Ecodesign requirements

There is so far limited experience as to how generic requirements can work within the context of the Ecodesign and how effective they can be. Still, in the case of sausages and processed meat – as in the case of most other food products – establish requirements for some form of simplified LCA, the development of an ecological profile and consideration of alternative certain aspects of the life cycle appears feasible – it is already done by a number of retailers for many products. Such an analysis will lead to identification of the important role of raw materials and may push producers to introduce changes in the requirements to suppliers to improve certain aspects.

As indicated earlier, the basis for such a universal life cycle impact assessment approach is missing. According to a recent study on behalf of DEFRA[35] "*for the majority of impact categories, measurement and assessment techniques suffer from a range of problems including subjectivity, lack of transparency, uncertainty, unjustified assumptions, data deficiencies and lack of validation. A considerable amount of scientific development and debate towards achieving standardised techniques for measuring and assessing environmental impacts is required*". However, there is significant work in progress and the experiment of the Grenelle initiative in France. On the other hand, while compliance with such requirements may not be difficult for large producers of processed meat, it may be rather expensive for the SMEs that dominate the sector unless it is much simplified.

Finally, a point that remains unclear to us is the extent that the Directive does allow for the setting of generic requirements only. Article 15 states that *"implementing measures shall lay down eco-design requirements in* ***accordance with Annex I and/or Annex II*****".** It goes on: "Specific *eco-design requirements shall be introduced for selected environmental aspects which have a significant environmental impact".* Our understanding is that specific requirement also have to be introduced and that Annex I based generic requirements cannot stand on their own.

In relation to the possible use of a specific requirement for the meat produced on the basis of certain agricultural practice or standards, the current practice indicates that this is feasible but there are, in our view, a few important considerations. In contrast to other requirements that can be tested on the product, such requirement will only be possible to monitor and verify on the basis of some type of certification or declaration. While such an approach is not uncommon in other sectors, it may be particularly challenging in a sector where suppliers are based around the globe and may affect farmers and animal producers with limited resources. It will also introduce certain administrative costs for a processed meat industry with a large number of SMEs that may be difficult to meet unless there is a general increase in the price of the products.

As far as the introduction of requirements for a minimum level of organic meat is concerned, again this is feasible on the basis of certification/declaration scheme but it may lead to higher prices of food products (10-40%)[36]. Even though economies of scale can be expected, there could still be important cost implications for the production of sausages that would pass to consumers In addition, as indicated earlier, it is far from clear that organic based products provide products with an overall improved environmental profile. According to the food industry representatives, the certification requirements for organic farming do not contribute to scientifically reliable conclusions of the overall environmental performance of a food or drink product as it does not cover all relevant stages in the environmental life-cycle of food products and does cover all pertinent environmental impacts.

Concerning the issue of packaging of food products, while recyclability or weight requirements could be set by the Ecodesign, the existing legislation already covers most parts of these aspects. Still, within the context

[35] http://randd.defra.gov.uk/Document.aspx?Document=FO0419_9996_FRP.pdf
[36] Winter, CK and SF Davis, 2006 "Organic Foods" Journal of Food Science 71(9):R117–R124.

of generic requirements, producers may be required to consider the type and weight of packaging against other aspects such as durability of the product that can have an impact on food waste. In relation to the minimum standards on energy and water used in the production stage, a number of considerations make such a measure inappropriate. First of all, these aspects are already addressed at the plant/process level by the Industrial Emissions Directive. Secondly, it is expected to be very difficult and rather costly to monitor and enforce them in practice as there will be important allocation issues. Thirdly, the production stage represents only a part of the total energy and water consumption with limited capacity of manufacturers to directly affect the livestock production or consumption phase. Finally, energy and water use are also linked with the recipe and quality of the specific products but also with the geographical location of certain production units and the climate that lead to different requirements for similar categories of products. An eco-design measure that would set minimum standards would probably lead to uneven treatment of production units in different locations.

On the basis of our initial analysis, there are certain important practical and economic limitations for the implementation of Ecodesign requirements, at least in the short term. There is significant additional preparatory work required before such requirements become operational. It is also not possible to tell whether such an approach can be more effective in comparison to an approach focusing on improving the agricultural production and livestock breeding stages in the EU through tools like the CAP, further promoting and streamlining organic farming and also strengthening the requirements of existing regulations on industrial emissions and packaging waste. On the one hand, the introduction of supply chain requirements on behalf of producers can be particularly effective in terms of pushing for changes and adoption of environmental practices at a global scale. However, there are also WTO issues that need to be considered. While product specific requirements (so called PR-PPMs) – such as the use of fertilizers for corps - are generally accepted, non-product specific requirements are generally not considered acceptable[37] with a danger of going against WTO requirements (equal treatment for both EU and non-EU manufacturers). On the other hand, a **business as usual scenario** that includes existing voluntary schemes and labelling will be much easier to implement. The increasing number of voluntary initiatives in terms of the development of green supply chains and labelling schemes by producers or retailers should also be expected to bring certain improvements.

The alternative case of **mandatory labels** or other information tools could by themselves also be effective in reducing some of the impacts, create demand for more products with a greener environmental profile and push producers towards the adoption of green supply chain practices. However, the effectiveness of labelling in relation to food products has certain limits as price is key and, in contrast to EuPs, there are no other cost benefits during the life cycle. Still, as in the case of standards, there are more or less the same issues concerning the methodology and measurement of the relevant indicators. In addition, there is a danger of confusion in relation to the use of other labelling schemes that concern only certain products in the market – e.g. organic label.

A **voluntary initiative on the basis of certain minimum eco-design requirements** could provide an alternative with certain advantages given the greater flexibility provided. Still, issues related to methodology and measurement will have to be clearly defined. Besides, the implementation within the context of the Ecodesign framework may be rather difficult. The meat processing sector may not be the most appropriate given the large share of small producers with focus on the local market, the fragmented structure of the supply chain but also the different market structure among the EU countries. It would be

[37] Designing greener electronic products: building synergies between EU product policy instruments or simply passing the buck?, International institute for industrial environmental economics at Lund University, Report for European Environment Bureau (EEB), Analysis of the EuP, RoHS and WEEE Directives

very difficult to achieve the minimum market share required under the Ecodesign. Outside the Ecodesign, the promotion of some voluntary initiative bringing along the main actors could be possible.

In relation to financial instruments, the use of taxes to promote environmentally friendly sausages may be difficult to implement. It would still require transparent and consistent measurement methods that are not present at this stage. It could be particularly contentious and maybe not politically feasible. However, the provision of tax breaks or support for the adoption of green supply chain approaches for sausage producers – especially SMES - or for adoption of good agricultural practices in the primary phase, could be relatively effective although costly and, most probably, with less impact than a mandatory measure. Such scheme already applies in the Netherlands where the Milieukeur label is also linked with access to financial support.

Summarizing, the use of eco-design specific requirements for sausages and processed meat products appear as a potentially effective to address their environmental impacts given the potential to influence agricultural production through the supply chain. But it can be quite complex, demanding and costly – especially for SMEs. Furthermore, while there is work in this direction, the necessary basis for establishing specific requirements on the basis of an LCA is still far from being a reality. Generic requirements based on simplified assessments of the impacts and the development of an ecological profile is more feasible but probably not as effective. Process oriented approach focusing on the relevant life cycle stages – primarily the livestock production phase – through financial tools or regulation could be more promising.

Table 3- Summary table of assessment of Ecodesign-based requirements against alternative options

Option	Effectiveness	Costs	Ease of implementation	Impact on Ecodesign
Ecodesign based requirements	- Potentially high environmental improvements in relevant areas if properly implemented	- Possibly high costs for implementation through the use of supply chain certifications – especially for SMEs - Costs for development of compliance/ certification structures and standards	- Possibly complex to establish - Important additional work needed to develop measurements standards, methodology and data	- Need for change of the MEEuP or new methodology to cover other issues - No apparent changes for Directive document
Mandatory labelling	- Effective but not as in the case of minimum requirements Danger of consumer confusion	- Possibly high costs for implementation through the use of supply chain certifications – especially for SMEs - Costs for development of compliance/ certification structures and standards	- Possibly complex to establish Important additional work needed to develop measurements standards, methodology and data	No expected impact
Business as usual scenario	- Effectiveness depends on level of development of industry initiatives for green supply chains	- Some additional costs for enforcement of legislation Moderate costs for industry for monitoring VAs and development of new	Easy to implement as already in place	No expected impact

Case studies – Sausages and other processed meat products C1

Option	Effectiveness	Costs	Ease of implementation	Impact on Ecodesign
	- Potential for significant impacts from strengthening of existing legislation (e.g. CAP)	labels		
Voluntary agreement	- Effectiveness depends on the level of participation. Possibly difficult in the case of the processed meat sector	- Costs for implementation through the use of supply chain certifications possibly significant but most probably less than mandatory standards Reduced costs for authorities for enforcement	- Possibly complex to establish Important work needed to develop measurements standards, methodology and data	No expected impact
Financial instruments (taxes or financial support instruments)	- Effectiveness of taxes potentially high if targeted - Limited effectiveness of grants and R&D unless on a very broad scale	High costs for financial instruments	- Tax on specific types of products may be very difficult to implement (politically and practically) - Grants/tax breaks on the basis of practice or standards easier Will still need measurement methods or the use of certain standards	No expected impact

Initial conclusion from the case study in relation to the broader product group

The overall conclusion of the study is that the use of Ecodesign based requirements can bring substantial improvements for the category of sausages and processed meat products provided that it does target the initial stages of their life cycle which is the key aspect. Other stages (production) and issues (energy and water use, recyclability of packaging) could also be considered although the improvement potential may be rather limited. Despite the relative processing required for this category of food products, the initial stages are still dominant.

There are certain practical, as well as economic, considerations for the development of such an approach at this stage. They include the absence at this stage of a widely accepted methodology ad standards to support a life cycle analysis. The current MEEuP methodology and the EcoReport do not seem to provide the answer but there are already efforts and projects working in this direction with the participation of multiple stakeholders. The Food Sustainable Consumption and Production Roundtable, co-chaired by the European Commission, aims at establishing a framework methodology widely agreed upon within the food supply chain. They also include the substantial costs that may arise for the implementation of an approach that will be based on declarations or certificates to ensure conformity. Focusing only on generic

requirements and the development of an ecological profile may be an alternative option but it is not clear whether this is acceptable under Article 15 of the current ErP directive.

In that respect, at least in the short to medium term, the promotion of voluntary initiatives towards minimum eco-design requirements – within or outside the scope of the Ecodesign –could provide a more flexible and viable approach to cover important parts of the market and bring substantial results.

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CASE STUDY 2: CLOTHING[38]

Introduction and methodology

This case study examines the feasibility of developing eco-design requirements in the context of the Ecodesign Directives for products that fall under the category of clothing and textiles. In contrast to energy using products, these products have greater impact on the environment in the production phase compared to the using phase. The case study represented in this chapter will concern consumer durable products.

According to the relevant Commission Decisions[39] the relevant textile product sub-groups are defined as follows:

- Textile clothing and accessories: clothing and accessories (such as handkerchiefs, scarves, bags, shopping bags, rucksacks, belts etc.) consisting of at least 90 % by weight of textile fibres;
- Fibres, yarn and fabric (including durable non-woven) intended for use in textile clothing and accessories or interior textiles.

There is no standard definition for leather clothing. For the purposes of the study, the product scope covers the following products:

- Leather jacket;
- Cotton jeans.

The product group includes products that are generally purchased by consumers for personal use. However, it should be noted that there are several stages along the supply chain between the early stages of the lifecycle and the ultimate consumption by the consumer. The lifecycle that links the source of the materials- agriculture in the case of cotton and the meat and dairy industry for leather- is complex and highly globalised at most steps along the supply chain, with several intermediary steps before ultimately reaching consumers

Market analysis

Market data

The European textiles and leather sector, which also includes clothing and leather production, employs over two million people in 177,000 enterprises, mainly small and medium-sized enterprises (SMEs), and has a turnover of more than €200 billion.[40] Industry representatives from the apparel industry, the fashion industry, and the leather tannery sectors have been consulted; however, due to the diverse nature of the clothing industry, the range of producers, and the high volume of imports from outside of the EU, reliable estimates for cotton jeans and leather jackets do not exist.[41]

Industry stakeholders estimate that at a global level, shoes constitute the most significant users of leather in the apparel industry. The Confederation of National Associations of Tanners and Dressers of the European Community (COTANCE) estimates that clothing represents 10-15% of the entire leather sector's

[38] This case study was based on a combination of desk research and interviews with relevant stakeholders. See section 1.7.

[39] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:197:0070:0086:EN:PDF

[40] EuroFound. 2004 Trends and drivers of change in the EU textiles and leather sector: Mapping report. http://www.eurofound.europa.eu/emcc/publications/2004/ef0485en.pdf

[41] Industry representatives will continue to request information from manufacturers and retailers. However, it is likely that accurate estimates are unlikely.

turn-over (approximately € 7 billion). Most leather is exported for manufacturing and is then re-imported. This is due to the high costs of labour in Europe. High-end production (approximately 5%) remains in Europe.

Sector structure

Over the past 15 years, the sector has undergone large-scale restructuring. Modernisation of the industry has progressed considerably, productivity has increased, and European production has been reoriented towards high-quality articles with a greater focus on innovation. However, this restructuring has also entailed a reduction of approximately one third of the workforce as much of the industry has moved off-shore...[42] The situation is now a complex series of interlocking industries: "The textile industry is one of the industries with the longest and most complicated industrial chains of the manufacturing industry. It involves actors from the agricultural, chemical fibre, textile, and apparel industries, retail and services sector, and waste treatment. The industry is fragmented and heterogeneous, dominated by small and medium enterprises (SMEs) which account for more than 80% of the market."[43]

For many decades, the textiles and clothing sectors were a notable exception to the progressive liberalization of trade in manufactured goods. However, since the beginning of 2009, trade in textiles and clothing is fully liberalized and there are no longer any quantitative restrictions in the EU on textile and clothing exports including imports originating. As a result of this liberalisation, China has become the EU's largest provider of textiles and clothing, and continues to capture market share in Europe.[44]

The textiles and clothing sector in Europe was severely affected by the economic crisis of 2008 and 2009. Production as well as consumption levels experienced a sharp decrease from June 2008 to June 2009. Since July 2009 a slow stabilisation of consumption levels could be observed, though figures show that a general decrease of -11% of imports took place from 2008 to 2009. These downward trends were also reflected in EU textiles and clothing (T/C) export figures, where exports in T/C products have decreased by -17% with a decline of textile exports by -18% and by -16% of clothing exports. Since January 2010 a recovery was observed.[45]

The sector is dominated by large retailers that import products from overseas. In terms of production the industry consists of a sizable number of small and medium sized businesses in the high-end or luxury category.

The volume of production in the leather jacket industry at EU level is low since the market is dominated by imports. Stakeholders estimate that imports correspond to more than 80% of all products sold in the EU. Main exporters are to the EU are China, India, Pakistan, Bangladesh, Vietnam and South Korea. In terms of leather, high end product continues to be produced in Europe; a rough estimate is that up to a maximum of 5% of what is sold in Europe is high end product. European tanners are considered to be the best in the world, but high costs limit production at the highest end. The market of leather jackets is estimated by stakeholders to be dominated by small and micro enterprises, 40% and 58.5% respectively. Similar data on production for cotton jeans is not available.

Trends in the market

Each product has a distinct set of dynamics that underpin the trends in the market. Leather jackets are a highly cyclical product with significant year-to-year variations depending on the dominant fashion trends each season. In spite of this cyclical demand, supply is essentially inelastic due to it being a by-product of the meat industry. Cotton jeans are cyclical but with a significantly less varied annual demand. However,

[42] EuroFound: http://www.eurofound.europa.eu/emcc/publications/2004/ef0485en.pdf
[43] Cited in: http://center.sustainability.duke.edu/sites/default/files/documents/clothing_actionplan.pdf
[44] http://ec.europa.eu/trade/creating-opportunities/economic-sectors/industrial-goods/textiles-and-footwear/
[45] http://ec.europa.eu/trade/creating-opportunities/economic-sectors/industrial-goods/textiles-and-footwear/

particular styles of cotton jeans are more popular than others in any given year. This is significant due to the treatment processes used in creating particular styles or colours.

Shift to Sustainability

The term "Eco-fashion" or sustainable fashion refers to clothing that uses environmentally sensitive fabrics and responsible production techniques. Both the cotton jeans industry and the leather industry have developed a wide range of techniques, processes and products to reduce environmental impact, and the area is subject to continued scientific research and development.

Within the industry and manufacturing of **cotton jeans,** "green" and ethical fashion has been among the trends in the recent years. Producers and designers have started to market cotton jeans made of 100 % organic cotton or products made of materials produced under consideration of human rights and ethical and environmental impact. Examples of this are jeans that have not undergone stonewashing, jeans that are all-natural dyed or jeans made by techniques that save water in the finishing process.[46] Moreover, the industry has voluntarily begun to ban the use of sandblasting in denim products, a process that is driven by recent attention[47] to and understanding of the impact that some treatment processes have on human health.

Leather jacket production has the potential to have a high environmental impact in terms of effluent, solid waste and emissions to air, but modern tanneries – especially those in Europe – have addressed most of these issues. A study of progress and recent trends in biotechnological methods for leather processing identifies that the growth of biotechnology in the past two decades has resulted in significant improvements in the production and application of bio products in various leather-processing steps.[48] Moreover, the compilation of best available practices has helped to diffuse cleaner production methods. The commercial exploitation of many new advances depends on cost-effective production and a secured, industrial-scale method of application.[49]

Globalisation and fragmented supply chain

During the past 20 years, trade liberalisation and communication innovations have increased the opportunities for retailers and brands to buy their products from producers worldwide. The result is a new business model for major retailers, such as supermarkets, department stores, and brand owners, such as leading clothing companies. These retailers and brands have become 'global sourcing companies', outsourcing the production of the goods they sell to tiers of competing suppliers and producers through complex international networks, or global supply chains. These supply chains are:

- *driven by the big brands and retailers* – as the link from producers to consumers, retailers and brands have tremendous power in determining price and environmental standards
- *segmented into high and low profit steps* – high-profit steps in the process, such as innovation, marketing, and retailing, are tightly guarded by retailers and brands located in Europe. In contrast, the low-profit steps, such as sourcing raw materials, production and assembly, finishing and packaging, are outsourced to mid-chain suppliers and low-cost producers worldwide;

[46] http://www.levistrauss.com/news/press-releases/levis-brand-introduces-waterless-jeans
[47] See, for example: http://www.cleanclothes.org/news/killer-jeans
[48] Thanikaivelan et al. 2004, "Progress and recent trends in biotechnological methods for leather processing," in *Trends Biotechnol*. 2004 Apr; 22(4):181-8.
[49] European Commission 2003, "Reference document on Best Available Techniques for the Tanning of Hides and skin"

- widely dispersed but tightly integrated – spanning continents, a supply chain can draw dozens of firms into the process of making and delivering a single product. Quality, technical standards, and logistics are closely controlled and coordinated.[50]

Increasing incidence of counterfeit trade

Of the total value of counterfeit merchandise seized around the world, 63% is related to the textile sector. For example, EU Customs seized 26,000 counterfeit apparel shipments in 2006. In 2007, they seized 37,000 - an increase of almost 30%. The total value of apprehended goods, however, increased only 13%. In spite of some efforts to improve surveillance, the adoption of new anti-counterfeiting mechanisms would remain ineffective if companies were not control their labelling supply and monitor application stringently.[51] This is especially relevant in terms of the subcontracting arrangements used in the manufacture of clothing.

Life Cycle Analysis – main environmental aspects and key stages of the life cycle of the product

In this section we identify the possible environmental aspects related to the life cycle of leather jackets and cotton jeans. In the section that follows, we provide an assessment of the importance on the basis of the life cycle information available.

The analysis is divided into two components. The first component outlines the lifecycle of each product, based on reviews of the best available evidence. This evidence is generally derived from studies undertaken by environmental agencies, academic researchers, and the relevant industries themselves. The LCA analysis identifies 'hotspots' in each of the products, outlining the stages along the product lifecycle that generate the highest environmental impact for each product.

The second component outlines possible approaches that could be used to reduce the total lifecycle impact in the areas with the highest value as measures by the concept of **improvement potential**. This second section addresses both products. This analysis is important as it will assist in identifying key factors that could be linked to a set of regulations part of an Ecodesign regulatory measure.

Characteristics of a typical product

Jeans are made from cotton, though in some cases other materials are blended with the cotton to improve the texture, durability, or form. As the case specifies both the material (cotton) and the product (jeans), the assumption will be that these two identifiers will be used throughout the analysis. The particular cotton used in jeans is a woven textile (textile), which creates a more rugged type of material than other cotton products. This type of cotton is known as denim. Denim has been traditionally dyed using blue indigo dye, though colours now vary and treatment methods have proliferated over the past two decades.

Leather jackets are composed mainly of leather, but other components include buttons, stitching, and the lining (wool, cotton, among others). There are various types of leather, including buckskin, sheepskin, and cowhide, though leather from cowhides most commonly used to make leather jackets. No livestock are raised for the specific purpose of making leather; it is almost always a bi-product of another industry. Raw hides are processed by tanneries and undergo treatment and dyeing before being sold to wholesalers, who in turn supply the various producers of leather jackets.

Identification of impacts in the different life cycle phases

Jeans

Textile mills prepare raw cotton for the production of apparel and textile products by transforming them into fibre, yarn, and thread. During this production process a number of processes, called finishing, are

[50] http://www.eurofound.europa.eu/emcc/publications/2004/ef0485en.pdf

[51] Just-style. Global market review of counterfeit apparel - forecasts to 2014: http://www.just-style.com/analysis/counterfeit-clothing-a-growing-problem_id101100.aspx

performed either within the textile mill or at a separate finishing mill. Among others, these processes include dyeing, bleaching and stonewashing. Some manufacturers continue to use sandblasting methods, despite the known health risks. Finishing encompasses chemical or mechanical treatments performed on fibre or fabric to improve appearance, texture, or performance.

Textile product mills convert raw textiles into finished products other than apparel. Examples of items made in this sector are household items, such as carpets and rugs, towels, curtains, sheets and furniture.

The apparel manufacturing industry transforms fabrics by textile manufacturers into clothing and accessories. The main processes within this industry is cutting and sewing the fabrics and complete the finished product. This finish may include stone washing and acid washing. Stone washing is used to give newly manufactured cotton garments, such as cotton pair of jeans, a faded worn-out look appearance while acid washing is also a kind of stone washing using chlorine to bleaching the jeans.[52]

Leather jackets

The preparation of hide or skin to apparel such as leather jackets is divided into three sub-processes; preparatory stages, tanning and crusting. All true leather undergoes these sub-processes. Surface coating may be added as sub-process into this sequence.

At the preparatory stage, the hide or skin is prepared for tanning. During this stage, many of the unwanted raw skin components are removed. Preparatory stages may include soaking to remove dirt and salt, de-fleshing to remove flesh and fat remnants and liming where hair is removed from the skin.[53]

Tanning is the process that converts the protein of the raw hide or skin into a stable material which will not putrefy and is suitable for a wide variety of end applications. Tanning is mainly a chemical treatment and the hides undergo one or more of a range of different types of tanning, of which the main ones are mineral tanning, synthetic tanning, vegetable tanning and oil tanning.

Surface coating is then applied for some leathers and this process is also referred to as finishing. Finishing operations may include oiling, brushing, polishing and ironing. Some types of leather undergo treatments to waterproof the material, while others, such as suede, are characterized by less treatment and as a result are much more fragile.

After the preparation of the skin or hide, apparel such as leather jackets is manufactured. The manufacturing process includes cutting, assembling, moulding and pressing. This commonly takes place on a mass production basis in a factory, but may also be carried out on a smaller scale and specialist basis. The small-scale production of high quality, high value added leather jackets increasingly characterize the European industry, with lower valued leather jackets manufactured outside of Europe.

Life Cycle analysis

Jeans

The analysis of a pair of cotton jeans was based on a study for the French Environment Agency ADEME by Bio Intelligence Service in 2006. The purpose of the study was to create an environmental product declaration (EPD).

The functional unit is jeans worn once a week for four years. The product considered is trousers of blue denim material which have been slightly washed out. It weighs 666 grams (g), including 600g of denim material, 37.5g of lining fabric, 10.4g of double yarn, 3.6g of rivets (for a total of 6 rivets) et 14g of buttons (for a total of 4 buttons).

[52] http://www.bls.gov/oco/cg/cgs015.htm
[53] http://www.euroleather.com/process.htm

The jeans are worn 1 day per week during 4 years, and are washed in a washing machine of class C at 40°C after they have been worn 3 times. When they are worn out, jeans are thrown away with household waste half the time, or in some cases are given or sold to a second user who will use them for another 4 years. The environmental impacts of jeans are presented in Table 1.

Table 1: The environmental impacts of a pair of jeans (most important phases highlighted)

	Cultivation of cotton	Spinning mill	Weaving	Improvement	Manufacturing	Trouser treatment	Use	End of life
Energy consumption	1	1	2				4	
Climate change	2	1	2	1			3	
Ozone layer depletion	2	2	2	2			2	
Human toxicity	1		1		2		4	
Aquatic eco-toxicity	4						1	
Euthrophication	2		1	2			3	
Water consumption	4						2	
Household waste							4	3

Note: 1 - Contributes between 5 and 9% to the total life cycle; 2- Contributes between 10 and 34%; 3: Contributes between 35 and 59%; 4: Contributes more than 60%

Source: Adapted from ADEME, 2006.

Based on the data in Table 2, the most relevant impacts of the life cycle of jeans can be divided into two main phases:

- The jeans manufacturing stage, that goes from the cultivation of cotton to the possible treatments of trousers (washing out)
- The use of jeans (cleaning, ironing) and their end of life (disposal)

The second study was conducted by Levi's and was based on a pair of Levi's 501 jeans, medium stonewash, produced for the U.S market during the 2006 production year.[54] Three indicators were considered; climate change, energy use and water consumption. Table 2 indicates the contribution of different life cycle stages to the environmental indicator.

[54] Levi Strauss & Co. "A Product Life Cycle Approach to Sustainability". 2009. http://www.levistrauss.com/sites/default/files/librarydocument/2010/4/Product_Lifecyle_Assessment.pdf (accessed July 19 2011).

Table 2 - Contribution of different life cycle stages to three environmental indicators,

	Cotton	Fabric	Cut/Sew/Finish	Logistics (retail)	Use	End-of-life
Climate change (g CO2 eq)	1.7	6.6	3	2.1	18.6	0.5
Energy use (MJ)	17.7	84.9	40.8	29.8	226.6	0.4
Water consumption (m3)	1704	72.1	110.8	18.1	1575.2	0.4

Source: Levi Strauss

The Levi's 501 jeans study found that the climate change impact was highest at the consumer-use phase (58%), as was the energy-use impact (58%). Water consumption was highest at the cotton-production and consumer-use phases (49% and 45% respectively).

Hotspots in the Lifecycle

Jeans

It should be noted that in the cases of missing data or information, estimations were made to provide a full account of the range of environmental impacts. These assumptions relate mainly to the use phase and are the result of washing. For example, according to ADEME, human toxicity of a pair of jeans is mainly due to the use of washing powder; the exposure to pesticides and fertilizer in the production of cotton are apparently less relevant. We assumed that the impact on climate change is due to the type of energy used by the washing machine. The second reference of Levi's Strauss does not make it explicit.

Based on the available information, the **life cycle stages which contribute most to the environmental impact of a pair of jeans are cultivation of cotton and use**. The most important impact categories for cotton cultivation are water consumption and aquatic eco-toxicity, whereas for the use phase it is energy consumption, human toxicity and household waste associated with disposal. The table below provides an overview of the main impacts and life cycle stages.

Table 3 - Contribution of different life cycle stages to the main environmental impacts of jeans

	Life cycle phase			
Key Impacts	**Production**	**Use phase**	**End of life**	**Main contributors to the most relevant life cycle phase**
Climate change		X		The type of energy used by the wash machine.
Energy use		X		Primarily energy consumption required to wash and dry the jeans. Energy use varies depending on the water temperature and washing/drying machines.
Water use	X			The production of cotton demands significant amounts of water.
Eutrophication	X			Use of fertilizers, pesticides and defoliants in the production of cotton.
Human toxicity		X		Use of washing powder.
Waste			X	Cotton jeans mostly disposed in landfills.

Source: ADAME

Leather jacket

The analysis of a leather jacket is based on a study by Milà i Canals et al. (2001).[55] The goal of the study is to set environmental criteria for the Catalan eco-label for leather. Data quality requirements included are those defined in ISO 14040.

The material assessed is chrome-tanned bovine leather. The functional unit is 1000 kg of salted hide. The study is limited to the production phase only i.e. cradle to gate. It therefore does not take into account the subsequent life cycle stages in the production of a leather jacket or the use phase. In other words, **the environmental impact of the material is being assessed rather than the product itself.** This unfortunately represents a limitation in the evaluation of leather jackets and is a key aspect identified in section.

The production chain studied starts with the agricultural products (fertiliser and pesticide production is also included) needed for cattle raising; it is followed by the slaughterhouse, and ends at the tanning industry gate. As most industrial processes yield more than one product, it is necessary to allocate the burdens caused by these processes (resource consumption and emission) to all the products. In this study, allocation was based on economic criteria. The relative contribution of the different life cycle stages to the impact categories are shown in Table 4.

Table 4: Environmental impacts in the life cycle of chrome-tanned leather

	Unit	Agriculture	Cattle Raising	Slaughter-house	Storage	Tannery	TOTAL
Electricity	kWh	6.59E+02	1.50E+01	3.92E+00	1.78E+01	3.30E+02	1.03E+03
Global warming	eq kg CO 2	5.54E+03	6.99E+03	5.87E+02	7.32E+01	6.59E+03	1.98E+04
Human toxicity	eq kg Pb	5.49E-01	3.11E-02	1.44E-02	2.16E-02	1.95+00	2.56E+00
Aquatic eco-toxicity	eq kg Zn	2.38E-01	9.56E-03	1.60E-03	2.31E-03	7.00E-03	2.59E-01
Terrestrial eco-toxicity	eq kg Zn	1.35E-01	2.01E-06	1.56E-03	5.73E-04	1.61 E+00	1.75E+00
Photochemical ozone formation	eq kg ethane	1.72E+00	1.28E+00	1.33E-01	1.20E-01	1.30E+00	4.55E+00
Acidification	eq kg SO2	7.34E+01	8.15E+01	5.47E+00	9.00E-01	6.68E+01	2.28E+02
Nitrification	eq kg PO4	4.22E+01	1.43E+01	1.04E+00	1.65E§	1.29E+01	7.21E+01

Source: Adapted from Milà i Canals. 2001

One of the main conclusions is that the tannery is a key stage in most of the impact categories, mainly due to the land-filling of the tannery wastes. Agriculture and cattle raising also play a very important role in most of the impact categories; the former, due to the related energy consumption and use of fertilisers, and the latter due to the emissions associated with animal care. Table 5 below shows the processes contributing to the impact categories.

Table 5 - Leather jacket – Life cycle stages contribution to environmental impact categories

Impact	Phase (% of contribution)	Substance	Origin
Energy Consumption	Agriculture (60-65)	--	field operations
		--	mineral fertilisers production

[55] Milà i Canals, L., X. Domènèch, J. Rieradevall, R. Puig and P. Fullana. "Use of Life Cycle assessment in the procedure for the establishment of environmental criteria in the catalan ECO-label of leather". The International Journal of Life Cycle Assessment, Volume 7, Number 1, 39-46 (2001).

Impact	Phase (% of contribution)	Substance	Origin
Global Warming	Cattle Raising (36)	CH,	rumen
	Tannery (33)	CH,	landfill biogas
	Agriculture (28)	N20	De-nitrification
Human Toxicity	Tannery (76)	Cr	wastes in landfill
	Agriculture (21)	NO 3	leaching from fertilisers
Aquatic Ecotoxicity	Agriculture (92)	Hg, Cd	mineral fertilisers production
		NO3	leaching from fertilisers
Terrestrial Ecotoxicity	Tannery (92)	Cr	wastes in landfill
Photochemical Ozone	Agriculture (40)	NMVOC	energy consumption
	Cattle Raising	CH4	rumen
Formation	Tannery (23)	CH4	landfill biogas
Acidification	Cattle Raising (37)	NH 3	volatilisation from animal wastes
	Agriculture (32)	NH 3	volatilisation from organic fertilisers
	Tannery (29)	NH 3	anaerobic degradation in landfill
Nutrification	Agriculture (59)	NH 3	volatilisation from organic fertilisers
		NO 3	leaching from fertilisers
	Cattle Raising (20)	NH 3	volatilisation from animal wastes
	Tannery (18)	NH 3	anaerobic degradation in landfill

Source: Adapted from Mila i Canals, 2001

The second study used in the analysis of leather jackets is a study by the Cleaner Production Institute (CPI), 2009.[56] The goal of the study was to identify hot spots for the leather manufacturing industries using production that occurs in Pakistan. It is an environmental and social assessment. Only the former is considered in this evaluation. The geographic location of the study is important as a majority of the products on the European market are imported from lower-cost countries. Moreover, the purpose of this report is to identify hotspots, which is consistent with the purpose of the report based in Pakistan.

The functional unit is not explicit in the report, although the product under analysis is a leather jacket. The system boundary is production to end-of life, and production only begins at the slaughtering phase, which is appropriate based on the particularities of leather products as by-products of another industries. The study applied its own impact assessment method where the impacts categories are first attributed with scores from 1 to 3 based on different sources of data and subsequently weighted based on the significance given to the impact categories by stakeholders. The stakeholder groups are named (e.g. slaughter house people, tannery owners and workers, customers, and government). However, the details of the stakeholder consultation process are not presented.

The scores of the impacts over the life cycle are presented in Table 6. There are data gaps and the attribution of scores is rather subjective, although the data sources are mentioned in the report. Nevertheless, the scores are indicative of relative impacts across the lifecycle of a typical product.

Table 6: The environmental impacts of the leather jacket - Perceived Impact, as indicated by stakeholders (1: Low significance, 2: Medium significance, 3: Most significance)

Environmental Aspects	Slaughtering	Collection	Tanning Process	Tannery Solid Waste	Stitching	Distribution	Use and End of Life

[56] Cleaner Production Institute (CPI). "Simplified Life Cycle Assessment. Hot Spot Identification in the Leather Production Chain". 2009. http://www.sci-pak.org/LinkClick.aspx?fileticket=Sdiz2ni%2BWvQ%3D&tabid=72 (accessed July 19, 2011).

Raw material	2	1	3	2	1	1	-
Water consumption	2	-	2	1	-	-	-
Energy consumption	1	1	2	1	1	1	1
Land use	1	1	1	3	-	-	-
Waste generation	1	1	2	3	1	1	-
Air emissions	1	2	2	1	-	-	-
Wastewater generation	3	-	3	2	-	-	1

Source: Adapted from CPI (2009).

The most significant phases of leather jacket product chain life cycle assessment are slaughtering, tanning process and tannery solid waste use and disposal. Collection, storage and transportation of hides and stitching of leather jackets are moderate and distribution and use/end of life are of low significance.

After weighting according to stakeholders' value judgements, tanning appears to be the phase responsible for the most environmental impact sand wastewater generation the impact category most relevant (Table 7). Tannery consumes about 40-100 m^3 water per ton of raw hides. Wastewater generation from a typical tannery is in the range of 300-900m^3/day. An aspect having a score within the range of 6 to 9 is considered as Hot Spot, according to the stakeholders consulted.

Table 7: Environmental hot spots of the leather jacket (weighted scores >= 6)

Environmental Aspects	Slaughtering	Collection	Tanning Process	Tannery Solid Waste	Stitching	Distribution	Use and End of Life
Raw material			9	6			
Water consumption	6		9				
Energy consumption			6				
Land use				9			
Waste generation			6	9			
Air emissions			6				
Wastewater generation	6		9	6			
Score of between 6 and 9 is considered to be a hotspot by stakeholders. Only score within this range are reported							

Source: adapted from CPI (2009)

The study by Mila I Canals et al. (2001) and the CPI (2009) combine to provide a good overview the product life cycle of a leather jacket. The first study focuses on the production stage while the second study takes into account the subsequent life cycle stages. The highest environmental burdens in the production phase are due to agriculture, tannery and cattle raising, particularly energy consumption and fertilizer use in agriculture. According to CPI the most significant environmental burdens occur in slaughtering, tanning process and solid waste use and disposal.

It should be noted that in the cases of missing information, estimations were made based on reasonable assumptions. For example, the study of Milà i Canals et al. is a cradle to gate study and does not identify the relevance of the impact categories if compared to a total score. We completed this part of the assessment considering that energy consumption and fertiliser uses are the main sources of impact in agriculture. The CPI excludes the stages before slaughtering; this is in line with the view that since leather is a bi-product, the pre-slaughter stages should not be included in the analysis of a leather product. Moreover, it does not follow ISO 14040 and the attribution of scores in the impact assessment is rather subjective. Finally, the production chain considered is in Pakistan, which can deviate from a system in

Europe. More research and robust analysis are therefore needed to cover the complete life cycle and allow the identification of the key impacts of the leather jacket.[57]

In terms of post-slaughter stages of the lifecycle, the tanning process is the most significant phase overall. Energy consumption and air emissions are the hot spots in the tanning phase whereas land use is a hotspot in the solid waste use and disposal phase. Wastewater generation and its contamination is an issue for all of these phases.

Table 8- Contribution of different life cycle stages to the main impacts

Key Impacts	Life cycle phase			Main contributors in the most relevant life cycle phase
	Production	Use phase	End of life	
Energy use	x			Due to energy-intensive agricultural methods.
Abiotic depletion	X			Tanning is a raw material intensive process.
Acidification & Eutrophication	X			Volatilization from animal wastes and the use of fertilizers in agriculture are the main contributors.
Water consumption	X			Water is mostly used during slaughtering and tanning.
Waste	X			Tanning produces most volume of the total waste generated.

While energy use of leather is found in the pre-tannery stages of the lifecycle, the remaining environmental impacts occur in later stages of the production chain.

Because leather is a by-product of the meat industry, it is fundamentally important to note that the design of the system boundaries in any lifecycle analysis is important. Industry representatives stress that the main issue with LCAs in the leather industry is the one concerning the system boundaries. In the industry's view, it is of utmost importance from a systemic point of view that any LCA in this industry starts with the raw hide or skin as obtained through flaying of the animal. The industry points out that it is extremely rare that an animal is raised for the hide or skin and no animal would be spared from slaughter because of a reduced demand for hides or skins. Supply is inelastic to demand. The industry states that energy use associated with agriculture dwarfs any impact in later stages. This limited post-slaughter impact has served to discourage improvement because it appears to have very little relative impact on the total carbon footprint of a leather jacket if the system boundaries cover earlier stages of the life cycle.

Industry representatives argue that a tighter system boundary is required, which would ideally only cover the post-slaughter phases. Stakeholders within the leather industry state that a wide system boundary that includes the pre-slaughter phase prevents concerted initiatives toward environmental sustainability since any improvement would have virtually no impact on the total footprint, as pre-slaughter phases account for the vast majority of environmental impacts. The system parameters should ideally be aligned with the phases of production over which producers have control.

Implications of applying the MEEuP method instead of the more traditional LCA methods used

Comparing the LCIA presented earlier with the MEEuP based approach indicates a number of key issues and missed opportunities resulting from a possible use of the MEEuP methodology in the case of consumer goods, with specific reference to the test cases of jeans and leather jackets. They are presented here by

[57] Industry representatives have been consulted to assist in identifying a more robust study. They are not aware of any additional studies.

topic and summarised in table 9. The table below summarises the most important impact categories and relevant life cycle stages as well as the most relevant shortcomings for each product type.

Table 9 – Issues from the use of MEEuP for clothing products - Summary table

	Most relevant impact categories	Most relevant Life cycle stage(s)	Implications of using the MEEuP
Jeans	Water consumption Aquatic eco-toxicity Energy use Human toxicity Solid waste	Agriculture - Cultivation cotton Use - Washing - Disposal	➢ Land use not considered ➢ Water use not well accounted i.e. irrigation water in scarce areas and heated water during use phase ➢ Toxicity does not include pesticides ➢ Allocation is not addressed
Leather jacket	Energy use Waste Land use	Production - Tanning process - Fertilizer	➢ Land use is not considered ➢ Allocation is not addressed ➢ Toxicity does not address pesticides

Overall, the MEEuP as currently established has **shortcomings** when dealing with natural fibres. However, it should work reasonably well with synthetic fibres, which were not considered in this case study. The main concerns related to the MEEuP include:

- **Abiotic depletion**: MEEuP has a very limited scope, only energy use is taken into account.
- **Acidification and Eutrophication**: in MEEuP a fate step is missing.
- **Water**: Irrigation is common in cultivation of cotton. MEEuP does not fully address water. Also the importance of regionalized characterization factors for water use should be considered. The result of the assessment is also sensitive to the scope and data used in the assessment: cotton is good if data is taken from a non-irrigated farm, whereas it is bad if considering an irrigated farm and including all types of water.
- **Land use**: Since cotton and cattle demand land use in the beginning of the production chain, and MEEuP does not address land use, it is a potential issue.
- **Toxicity**: With regarding to the use of pesticides, toxicity in MEEuP only includes metals. Impacts related to the use of pesticides would not be accounted for since toxicity in the MEEuP method focuses primarily on metals.

A major shortcoming of the MEEuP method is how it deals with allocation issues. This is especially relevant for the leather jacket case, as leather is a by-product of the meat and dairy industries. Currently in MEEuP there is no clear guidance on how to allocate the environmental impacts amongst different products. For this reason, the leather industry argues that the pre-tannery phases of the lifecycle should be removed from the analysis, and that any assessment of the impact of the leather goods industry should start at the point where the raw hide is converted into leather.

Improvement potential

On the basis of the analysis provided, a number of areas for improvement potential for leather jackets and cotton jeans can be identified.

Jeans

- The use of organic cotton to reduce the environmental impact since it forbids the utilisation of chemicals (fertilizers, pesticides, defoliants), and therefore prevent toxic substances from being spread in waters and soils.
- Encourage a reduction in the frequency of washing, which reduces the environmental impact since it allows for a decrease in washing powder consumption and the utilisation of washing machines and irons, which consumes much energy.
- Encouraging washing at low temperatures to reduce energy use.
- Improve the quality of fibres so that clothes last longer.
- Extending the life cycle of jeans through reuse - i.e. to give away or sell one's jeans increases the number of days which they will be used – or recycle clothes.

Jackets

- Reduce/minimise the amount of chromium used in tanning or maximise recovery. Requirements for chromium free leather is not considered appropriate as the resulting leathers have different properties and different market position. Furthermore, other different tanning agents also have environmental impacts, but different ones.[58]
- Reduce the maximum amount of mineral fertilisers used in agriculture (e.g. criteria for 'organic agriculture'). The management of organic fertilisers should be controlled, as ammonia emissions coming from this source are a main impact generator. This last recommendation applies also for cattle raising.

As it becomes clear, an important part of improvements are related to consumer behaviour and not as much the product design. This is particularly evident in the case of leather products. Much of the reduction in the energy and other impacts related to the use phase are associated with washing and maintenance, while the decision about supply chain is largely the purview of importers.

Maintenance is tied directly to the type of cleaning performed, and energy and water improvement is dependent on improving washing machines. In some cases, such as with suede leather, specialized drycleaners are involved in maintenance. There are some potential improvements to the dry-cleaning process, but because this is a highly limited segment of the industry, no estimate is possible.

Moreover, there are a range of industry initiatives that are highly specific to particular brands and styles of both leather jackets and cotton jeans. For the latter, end-of-life opportunities exist in resale of fabric as lower-value textile reuse for purposes other than as clothing.[59]

Finally, transport costs associated with clothing can also be an important environmental impact. This is a reflection of where the raw material is sourced or the product produced. We do not consider appropriate to set requirements on the mode of transport or the distance covered as it would operate as a clear barrier to trade.

Current Policy framework - Review of existing policy tools

The products examined in this case study are covered by a number of mandatory and voluntary policy initiatives/tools at the European level. These have been analysed from the perspective of the key environmental impact and the respective life cycles stages addressed.

Regulatory instruments

Registration, Evaluation, Authorization, and restriction of Chemical substances (REACH): The REACH is the regulatory framework for the management of chemicals. The aim is to improve the protection of human

[58] http://www.leatherworkinggroup.com/images/documents/faq%20oct%2007.pdf
[59] http://www.uniformreuse.co.uk/uk-clothing-waste.html

health and the environment through the better and earlier identification of the intrinsic properties of chemical substances. At the same time, REACH aims to enhance innovation and competitiveness of the EU chemicals industry. The benefits of the REACH system will come gradually, as more and more substances are phased into REACH. REACH requires firms which manufacture and import chemicals to evaluate the risks resulting from the use of those chemicals and to take the necessary steps to manage any identified risk. Industry has the burden of proving that chemicals produced and placed on the market are safe.[60]

Water Framework Directive (2000/60/EC): As the textile production industry is one of the biggest wastewater generating sectors, regulations such as the Water Framework Policy have an influence on the environmental impacts of the sector. The Water Framework Directive deals with the management of:

- Inland surface waters;
- Groundwater;
- Transitional water;
- Coastal waters.

The Water Framework Directive aims at preventing and reducing pollution, promoting sustainable water use, protecting the aquatic environment, improving the status of aquatic ecosystems and mitigating the effects of floods and droughts. Its ultimate objective is to achieve "good ecological and chemical status" for all Community waters by 2015. From 2010, Member States will have to ensure that water pricing policies provide adequate incentives for users to use water resources efficiently, and that the various economic sectors contribute to the recovery of the costs of water services, including those relating to the environment and resources.[61]

Directive on Packaging and Packaging Waste (94/62/EC amended by Directive 2004/12/EC): This Directive covers all packaging placed on the market in the Community and all packaging waste, whether it is used or released at industrial, commercial, office, shop, service, household or any other level, regardless of the material used. Member States should take measures to prevent the formation of packaging waste, and to develop packaging reuse systems reducing their impact on the environment.

Landfill Directive (99/31/EC): The objective of the Directive is to prevent or reduce as far as possible negative effects on the environment from the land filling of waste, by introducing stringent technical requirements for waste and landfills. It defines the different categories of waste (municipal waste, hazardous waste, non-hazardous waste and inert waste) and applies to all landfills, defined as waste disposal sites for the deposit of waste onto or into land. Landfills are divided into three classes:

- landfills for hazardous waste;
- landfills for non-hazardous waste;
- landfills for inert waste.[62]

Directive on Biocides (98/8/EC) and The New Biocides Regulation (COM (2009) 267): The basic principles for the Directive on Biocides (98/8/EC) are that he producers and formulators responsible for the placing of the market of the biocidal products and their active substances must apply for authorisation and submit all necessary studies and other information needed for the assessments and the decision making. The scope has been extended to cover articles and materials treated with biocidal products, including furniture and textiles.[63]

[60] http://ec.europa.eu/environment/chemicals/reach/reach_intro.htm
[61] http://ec.europa.eu/environment/water/water-framework/index_en.html
[62] http://ec.europa.eu/environment/waste/landfill_index.htm
[63] http://ec.europa.eu/environment/biocides/revision.htm#_Background_information

Ecodesign of EuPs Directive (2005/32/EC) and Energy Labelling - (washing machines and dryers) – The Ecodesign Directive applies to washing machines, which are a key determinant of the use-phase impacts of clothing that is washed by consumers. In this case, it affects the use-phase impacts of cotton jeans.

Integrated pollution prevention and control (IPPC Directive) (2008/1/EC), now replaced by the **Industrial Emissions Directive (IED):** This Directive ("the IPPC Directive") requires industrial and agricultural activities with a high pollution potential to have a permit. This permit can only be issued if certain environmental conditions are met:

- Use all appropriate pollution-prevention measures, namely the best available techniques (which produce the least waste, use less hazardous substances, enable the substances generated to be recovered and recycled, etc.);
- Prevent all large-scale pollution;
- Prevent, recycle or dispose of waste in the least polluting way possible;
- Use energy efficiently;
- Ensure accident prevention and damage limitation;
- Return sites to their original state when the activity is over.

This Directive is supported in the case of leather jackets by a report on Best Available Techniques for the tanning of Hides and Skin[64] and includes a set of guidelines for improving the tanning process, as well as a support document for the textiles industry.[65]

- Substitution of substances;
- Process-integrated measures;
- Water management and treatment;
- Waste management and treatment;
- Air abatement.

New EU Regulation on Textile Names and labelling of Textile of Textile Products

This new regulation was adopted by the Council of the European Union on 19th of July 2011. The regulation will revise current rules on the use of textile fibre names, labelling, marking and determination of the fibre composition of textile products, with a view to improving the functioning of the internal market and to providing accurate information to consumers. The current and revised Directive applies to:

- Textile products exclusively composed of textile fibres,
- Products containing at least 80% by weight of textile fibres,
- Furniture, umbrella and sunshade coverings, floor coverings, mattresses and camping goods, and warm Linings of footwear, gloves, mittens and mitts, provided that the textile parts of such products constitute at least 80% by weight of the complete article,
- Textiles incorporated into other products.[66]

Animal By-products Regulation 1069/2009: Regulation (EC) No 178/2002 constitutes the cornerstone of the new European legislation on food safety. Adopting the "from farm to table" approach, it aims, by drawing on the latest scientific opinions, to guarantee a high standard of health and safety throughout the food chain. Animal by-products are defined as the entire bodies or parts of bodies of animals or products of animal origin not intended for human consumption. They represent more than 15 million tonnes of meat,

[64] European Commission 2003, "Reference document on Best Available Techniques for the Tanning of Hides and skin"
[65] http://www.epa.ie/downloads/advice/brefs/Textiles.pdf
[66] http://www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/en/intm/123939.pdf

dairy products and other products, including manure. This Regulation lays down the health and surveillance rules applicable to:

- The collection, transport, storage, handling, processing and use or disposal of animal by-products;
- The placing on the market and, in certain specific cases, the export and transit of animal by-products and products derived there from.[67]

Voluntary standards

In addition to the mandatory standards set by the above regulation, the European Eco-label scheme sets voluntary requirements aiming to cover, typically, the top 10-20% of the market.

The European Eco-label: The European Eco-label is an environmental label instituted by Council Regulation (EC) 880/92 of 23 March 1992 to encourage business to market products and services that are kinder to the environment. The criteria are agreed on European level. Since November 2007 textiles are the most important product group under the European Eco-label Scheme, with more than 70 companies adhering to the scheme. The current Eco-label on clothing, bed linen and indoor textiles ensures that:

- Substances with harmful effects on the aquatic environment and air have been limited during fibre production;
- The risk of allergic reaction has been reduced;
- The product does not shrink more than conventional products;
- The product is colour resistant against washing, drying frictions and light exposure as conventional products.[68]

Oeko-Tex® Standard 100/1000/100plus: The Oeko-Tex® Standard 100 is a globally uniform testing and certification system for textile raw materials, intermediate and end products at all stages of production. The Oeko-Tex® Standard 100 was developed in the 1990s and was the first label to practically assess potential harmful substances in textile productions. There have been annual re-evaluations and by now there is 73,000 certificates issued. 46.6% of all Oeko-Tex® Standard products are found in countries within the European Market.

ToxProof/EcoProof – This label, developed by TÜV in Germany, is exclusively for textiles, especially the ones made from cotton. The products have to meet certain criteria throughout their entire life cycle, including environmental performance and reduction of negative effects on human health. Its influence seems to be limited today.[69]

Member State initiatives

The Nordic Swan: The Nordic Eco-label is the official Eco-label of the Nordic Countries and was established in 1989 by the Nordic Council of Ministers with the purpose of providing an environmental labelling scheme that would contribute to a sustainable consumption. The label is voluntary and includes "textiles, skins and leather", with requirements based on the European Eco-label criteria. It takes into account clothing textiles and accessories, interior textiles, fibres, yarn and fabric intended for use these textiles, skins and leather from goats, sheep, cattle and pigs from agricultural production. Supplementary requirements to the EU Eco-label deal with performance requirements, suitable tanning and chemical treatment of skins and

[67] http://europa.eu/legislation_summaries/food_safety/animal_nutrition/f81001_en.htm
[68] http://ec.europa.eu/environment/Eco-label/

[69] BIO IS

leather, energy and water consumption during manufacturing, recyclability and ethical production (such as child labour, health and safety).[70]

UK Clothing Roadmap: The Sustainable Clothing Roadmap launched in 2007, with the aim of improving the sustainability of clothing across its lifecycle, from the crops that are grown to make the fabrics, to the design and manufacture of the garment, retail, use and end of life.[71]

France - Grenelle initiative – In the context of the Grenelle initiative that is currently in the experimental phase different types of clothing articles (trousers, shirts) are labeled in relation to certain key environmental aspects. The labels provide information on environmental outputs calculated on the basis of LCA methodology and covers a range of environmental aspects depending on the product.

Financial instruments

Textiles represent important part of the total environmental taxes (18.8 %) applied in Europe. These taxes, which are collected during the life cycles of products and services consumed, are estimated between €1500 and €4800 annually per European. They are mainly related to energy use and ecotoxicity (lead and mercury use) during the production stage.[72]

France- Taxe Emmaüs"- Since November 2006, an eco-levy on textiles called "Taxe Emmaus" has been implemented in France. It sets the principle of manufacturer responsibility about the end-of-life phase of textile clothing, leather, shoes and household linen. Manufacturers contribute to the recycling of their products by paying this contribution to the organisations in charge of second-hand clothes recovery and recycling. This contribution is estimated to less than 1€ per piece of clothing.[73]

Industry-led initiatives

GLOBAL ORGANIC TEXTILE STANDARD (GOTS): The GOTS has been in place since spring 2010. This label has been adopted more than 2,000 textile facilities that are currently participating in the GOTS inspection and certification system. Participating groups cover processors, manufacturers, importers and exporters. The objective of the standard is to unify the more than 50 existing standards and draft standards regarding organic textiles under one harmonized label, as the multiplicity of labels has contributed to confusion among market participants and consumers, and has potentially served to hamper free international trade in organic textiles.

The standard was developed by the International Working Group on Global Organic Textile Standards, which was formed in 2002 as a joint initiative of leading organic textile standards organizations. It is a comprehensive fibre certification, containing provisions to reduce environmental impact across the various stages of fabric production–from raw materials harvesting to dyeing, bleaching, and processing. Two levels of certification are offered: (1) "organic" or "organic in conversion" for those products containing at least 95% certified organic fibres or fibres from fields transitioning to organic; and (2) "made with X% organic materials" for those products containing 70%–95% certified organic or organic in conversion fibres. GOTS also forbids the use of dangerous substances, including heavy metals, formaldehyde, toxic dyes, and chlorine bleach.

Better Cotton Initiative: BCI aims to promote measurable improvements in the key environmental and social impacts of cotton cultivation worldwide to make it more economically, environmentally, and socially sustainable. Since 2005, the BCI has been working with organisations from across the cotton supply chain and interested stakeholders to facilitate a solution for the mainstream cotton sector.[74]

[70] http://www.nordic-Eco-label.org/
[71] http://www.defra.gov.uk/publications/files/pb13461-clothing-actionplan-110518.pdf
[72] BIO IS study
[73] BIO IS study
[74] http://www.bettercotton.org/index/140/better_cotton_system.html

Finally, the review of large retailers practices have identified eco-design approaches followed by certain retailers– e.g. Inditex and H&M.[75] These include the conduct of simplified life cycle analysis on certain products to identify the key environmental aspects and the development of codes of conducts with their suppliers, in some cases mandatory if it is to maintain the business relationship. However, the study indicates that this is much more difficult to implement for smaller size retailers that focus on national markets.

Leather Working Group (LWG)[76] – LWG was formed in April 2005 to promote sustainable and appropriate environmental stewardship practices within the leather industry. The LWG has created a protocol to accurately assess the compliance and environmental stewardship practices of leather manufacturers and is already used by a large number of international brands that are members of the LWG. Tanneries are rated on the basis of fulfilment of the protocol requirements that address the tanning process as well as traceability back to the slaughterhouse. The LWG is a global scheme. So far the focus has been mainly on the footwear supply chain with audits of around 20% of the total production.

Eco-Management and Audit Scheme (EMAS): The EU Eco-Management and Audit Scheme (EMAS) is a management tool for companies and other organisations to evaluate, report on and improve their environmental performance. The scheme has been available for participation by companies since 1995 and was originally restricted to companies in industrial sectors. Since 2001, EMAS has been open to all economic sectors including public and private services. Companies must:

- Adopt an **environmental policy;**
- Conduct an **environmental review**;
- Establish an effective **environmental management system**;
- Carry out an **environmental audit**;
- Provide a **statement** of its environmental performance;

Conclusion- Summary of existing tools

Table 10 summarizes the range of tools to address the various stages of the lifecycle. It is important to note that several of these initiatives are horizontal and cover several stages of the lifecycle.

Table 10: Summary of policy tools- textiles and leather

No	Name of legislation/policy/standard	Environmental issue/aspect addressed
Raw Materials		
	Water Framework Directive (2000/60/EC	Standards on water use
	IPPC Directive (IED)	Environmental performance of individual processes in the textiles and leather sector, including chemicals and energy use.
	Regulation on organic production and labelling of organic products (834/2007)	Sustainable sourcing of products
	Global Organic Textiles Standards	Chemical substances, use of pesticides
	Better Cotton Initiative	Chemical substances, use of pesticides
	Biodiversity Action Plan for agriculture	Use of pesticides
	Common Agricultural Policy	Use of pesticides
	Thematic strategy on the Sustainable use of pesticides (COM(2006) 372)	Use of pesticides

[75] BIO IS (2009), Towards a greener retail sector- Report to the European Commission DG Environment

[76] http://www.leatherworkinggroup.com/about/background.htm

No	Name of legislation/policy/standard	Environmental issue/aspect addressed
Production phase		
	New Biocides Regulation (COM (2009) 267):	Restricts the use of biocidal additives in the treatment process of textiles.
	Registration, Evaluation, Authorization, and restriction of Chemical substances (REACH):	Chemical substances
	IPPC Directive (IED)	Environmental performance of individual processes in the textiles and leather sector, including chemicals and energy use.
	Directive on labelling of textiles (2008/121/EC)	Sustainability of inputs
	Environmental Technologies Action Plan (COM(2004)	Development and commercialization of new technologies
	Water Framework Directive (2000/60/EC)	Water use in the production process
Distribution		
	Directive on Packaging and Packaging Waste (94/62/EC and 2004/12/EC)	Materials waste in the packaging, recyclability
Use phase		
	Ecodesign of EuP Directive (2005/32/EC) Energy Labelling	Washing and Drying
	Directive on biodegradability and labelling of detergents(2004/648/EC)	Detergents used in cleaning (cotton jeans)
End-of life		
	Landfill Directive (99/31/EC):	
	Directive on Packaging and Packaging Waste (94/62/EC and 2004/12/EC)	Materials waste in the packaging, recyclability

Policy Analysis

Description of possible eco-design requirements

On the basis of the previous analysis certain eco-design requirements were identified. In the case of jeans these included:

- Set minimum levels of organic cotton used in the production of jeans;
- Set maximum standards on the levels of chemicals in fibres;
- Provision of information on labels concerning appropriate washing and drying temperature (already provided in most products).

In addition to that, generic requirements concerning the development of the ecological profile of products, provision of information to consumers were considered.

In the case of leather jackets we consider that relevant specific requirements could include**:**

- Maximum amount of chromium and other chemicals in the leather;
- Requirements on the production processes used for the production of the leather (e.g. certification on the basis of a protocol/standard).

In addition to the above, generic requirements concerning the development of the ecological profile of products through a simplified LCA and product declarations, as well as provision of information to consumers could be considered. This could also include the development of care protocols based on influencing use-phase and end-of-life phase impacts.

Definition of alternative options

Against the possible coverage under an Ecodesign Directive, the industry discussions point to a number of alternative options.

- **Business as usual** - The business as usual scenario on the basis of existing market forces and voluntary initiatives as well as toxicity related regulations;
- **Mandatory labelling** or other mandatory information scheme could include the labelling of products;
- **Voluntary agreements of industry in relation to environmental practices or use of standards**;
- **Financial tools –**use of a tax to shift consumer demand toward sustainable products.

Assessment of alternative options

The criteria used for comparing the Ecodesign based requirements against the alternative options were:

- The expected effectiveness of the measures in bringing improvements;
- The costs involved;
- Ease of implementation (including the use of the MEEuP methodology);
- Impact of any necessary changes to existing Ecodesign requirements.

The implementation of some of the above eco-design requirements could help address issues such as minimum performance, material use, human toxicity, and durability. We should note though that certain aspects important aspects – as far as jeans are concerned – can only be addressed indirectly as they are very much related to consumer behaviour. As explained in section 3, the main use phase improvements are related to care and maintenance of the products, and care instructions could be revised with a view to reduce use-phase impacts.

Any approach to clothing would require focusing on influencing the global supply chain. Certain mechanisms and tools for tracking and identifying source materials or assessing the environmental impact of the products already exist but we consider that there are important implementation issues. The UK Leather Federation points out that the processes of producing and manufacturing leather is very complex and consists of a chain of sub-sequences of which many of the processes are carried out outside Europe. After the production of leather from raw hides and skin, the materials are then sold to other sectors such as the footwear, the furniture or the garnet sector. Cotton jeans are largely produced in lower cost countries and distributed by large retailers who have increasingly globalised the supply chain to generate efficiencies.

As a result, there are important costs involved for compliance with such requirements that will have to be based on declarations from suppliers or some form of certification. Representatives from the leather industry have also pointed to feasibility issues related to both to labelling as well as mandatory eco-design requirement. The main point is that there are difficulties in setting basic requirements for composition labelling in other leather products, apart from footwear. On the other hand, the industry is supportive of initiatives that would set requirements applying to all products, since a significant issue continues to be counterfeiting.[77] However, counterfeit can also present a significant market surveillance and enforcement problem for both Member States and industry.

In relation to the business as usual scenario, there are already certain aspects that are addressed. There is already a shift in consumer preferences with increasing in demand for sustainable textiles. This is reflected

[77] Global market review of counterfeit apparel - forecasts to 2014. Just-style. Taken from: http://www.reuters.com/article/2008/04/11/idUS170785+11-Apr-2008+BW20080411

in the substantial increase – more than three times in period 2006-2008.[78] Meanwhile, tanneries are implementing recognized 'best available techniques' to various degrees as part of the IPPC[79] - as well as the Leather Working Group stated earlier. The textiles industry is similarly supported by a reference document, though the extent to which the guidance is being implemented is unclear.[80] Clearly, certain level of improvements should be expected at a reduced cost as measures are being implemented to address specific environmental impacts of clothing products.

Voluntary agreements could possibly be used as an alternative on the basis of agreement on certain environmental standards. However, to date, there has yet to be significant development of industry-wide voluntary agreements that includes a very large number of small producers. Most initiatives occur at the product-material level (cotton) or within large companies themselves. Due to the highly fragmented and global supply chain, we consider that such an option cannot be as effective and would be probably impossible to achieve the minimum requirements of market share required from even an inclusion of a larger number of brands can achieve significant results.

As far as labelling is concerned, several aspects are already covered and initiatives already exist. Mandatory labelling could bring together the fragmented system of voluntary agreements that are currently developing. From a practical side, the same issues would apply to labelling if it is to be based on the measurement of certain environmental outputs (supply chain difficulties, use of certificates) although it is clearly something that is already done by a number of producers. In terms of effectiveness, it is difficult to see an important impact – at least as great as in the case of minimum requirements – since environmental considerations are still not a key issue for the majority of consumers, at least at this stage. Issues of enforcement would also apply, especially given the high incidence of counterfeiting. Furthermore, there are possible dangers of confusion given the presence of a number of labels, although it could possibly be integrated in the current labels that consumers are familiar with. In combination with minimum requirements – or as part of the generic requirements – it can bring additional results.

Financial tools, on the basis of environmental aspects would have to be applied at the Member State level. They would entail a number of practical difficulties in their implementation unless based on some kind of generally recognised standard. Support to tanneries or agricultural producer for adoption of certain practices or certification could play a role but, unless in a great scale, it cannot bring sizeable impacts. Furthermore, in the context of the 2005 WTO agreements to liberalize the textile industry, any attempt to distort the textile markets would most likely face challenges in international courts.

[78] http://cogent.controlunion.com/cusi_production_files/SISI_files/FL_011210114219_Market_Report_08-_Executive_Summary.pdf

[79] Now the IEP

[80] http://www.epa.ie/downloads/advice/brefs/Textiles.pdf

Table 11- Summary table of assessment of Ecodesign-based requirements against alternative options

Option	Effectiveness	Costs (for industry and authorities)	Ease of implementation	Impact on Ecodesign
Ecodesign requirements	- High for certain aspects if properly implemented and enforced in global supply chain - Energy and water use not possible to address - Limited value for toxicity aspects	- High administrative and certification costs for industry - Significant costs for authorities	- Difficult due to complicated and global supply chain - Problem due to size of counterfeit - Measurement and test methods generally exist	Need to change MEEuP methodology
Voluntary Agreement	- Potentially high impacts if high level of participation (but difficult)	- High costs of planning passed onto the industry	- Impossible within the context of Ecodesign due to very large number of producers Difficult outside	No expected impact
Mandatory labelling	- Low in relation to Ecodesign requirements	- High administrative and certification costs for industry - Significant costs for authorities	- Difficult due to complicated and global supply chain - Problem due to size of counterfeit - Measurement and test methods generally exist	No expected impact
Business as usual	- Limited in relation to minimum requirements applying across the board – still certain aspects already addressed	Low - several initiatives currently in place	Easy, as existing schemes would be expanded	No expected impact
Financial Instrument	Grants : Probably low added value unless on a wide scale	Grants: High costs if on a wide scale	Tax: WTO regulations could act as a barrier Possibly difficult to implement	No expected impact

Conclusion from the case study – lessons in relation to the broader product group of clothing

The overall conclusion of the study is that any approach taken to address the design of clothing would clearly require a mechanism to influence the initial stages of textiles production through the supply chain. This can be a particularly problematic aspect since the clothing supply chain is global. Certification or declaration schemes can possibly be used to ensure compliance with certain requirements. There are a number of such initiatives that have been implemented by individual brands or particular groups of retailers, though there would be significant administrative and compliance costs, especially for small firms.

It is also clear from the two types of clothing considered that there are very different processes during production and therefore the environmental impacts that come at different stages of production. To advance a set of eco-design requirements for the clothing/apparel product group, it may be necessary to develop a 'material by material' eco-design requirements rather than product-by-product ones. Developing generic requirements for all natural fibres may be problematic. However, a generic component of requiring some form of simplified LCA, the development of an ecological profile, and consideration of alternative certain aspects of the life cycle appears feasible – and is already done by a number of brands and retailers for many products.

We should also note the allocation problems inherent in current LCA guidance documents. An eco-design approach would need to address some of the difficulties associated with isolating the production of clothing from production of materials to other sectors, especially inputs in the pre-production phases (i.e., the impacts of agriculture and the meat industry). Further preparatory work would need to be carried out to strengthen the guidance found in LCA documents, specifically with reference to system boundaries and allocation issues.

Due to the heterogeneity of the industry, the diverse range of actors, the high incidence of counterfeiting, and the unique properties of each type of apparel, any regulation concerning the processes causing greatest environmental impact will need to be flexible. Due to the high number of manufacturers and producers along the supply chain, aggregate compliance costs of adjusting production processes or input could be high for producers, especially at the lower end of the market where margins tend to be low.

At the same time, the high incidence of counterfeiting and the globalised supply chain pose questions in relation to market surveillance and enforcement. In this respect, a generic requirement combined with a mandatory label could assist in addressing issues of counterfeit.

While the most significant potential improvements can be achieved through eco-design requirements that can influence the supply chain, use-phase impacts are tied mainly to consumer behaviour as well as complementary products. According to the BIO IS study, products that require frequent cleaning are those that contribute most to environmental impact.[81] Thus, cotton jeans and leather jackets will have different impact profiles, as leather jackets are rarely cleaned, and when they are, only using a specialized process. Moreover, leather has a significantly longer duration than most other products in this category. Addressing washing frequency could be tied to a mandatory labelling scheme with a set of product-specific protocols that include consumer guidance on care that encourage less frequent washing, washing at lower temperatures, and limiting the amount of detergent used in the washing process. For leather jackets, this could also include care instructions related to cleaning or treatment. In this respect, the generic requirements of an Ecodesign approach could include a requirement to develop care instructions. Several brands and retailers have implemented care tags based on sustainability issues. A mandatory requirement could broaden this practice.

In conclusion, there is scope for improvement based on the introduction of Ecodesign requirements to address the supply chain of clothing, especially generic requirements that require mandatory information provision in the form of declarations and a simplified LCA. There is also scope for improvements for each type of material, though these requirements would need to be set for each material rather than for entire product groups. With reference to an LCA, preparatory work to refine LCA guidance would need to be completed, with specific reference to allocation issues. Generic requirements could be reinforced by protocols to influence consumer behaviour, which is the most significant determinant of use-phase impact. These implementation issues would result in high aggregate costs to the industry and would include short-term duplication of efforts that are already underway for some products and materials. However, long-term impacts of Ecodesign requirements could include the reduction of the currently fragmented system of measures.

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Case studies – All purpose cleaners and hand dish washing detergents C3

CASE STUDY 3: ALL PURPOSE CLEANERS AND HAND DISH WASHING DETERGENTS[82]

Introduction and methodology

This case study examines the feasibility of developing eco-design requirements in the context of the Ecodesign Directive for products that fall under the category of all-purpose cleaners and hand dish wash detergents. All-purpose and general hard surface cleaners are widely used in domestic and industrial settings every day for the routine cleaning of floors, walls, ceilings, countertops, toilets, mirrors, and other fixed surfaces. These products usually come in the form of sprays, wipes and liquid cleaners. Hand and dish wash detergents are used in households and in relevant professional sectors (e.g. restaurants, offices) instead or in parallel to dish washing machines.

For the purposes of the study, the product scope covers the following products:

- All-purpose cleaners (hard surface cleaners);
- Sanitary cleaners;
- Window cleaners;
- Hand dishwashing detergents.

The product scope follows two existing eco-labels. According to the relevant Commission Decisions[83] the product sub-groups are defined as follows:

- All-purpose cleaners comprise detergent products intended for the routine cleaning of floors, walls, ceilings, windows and other fixed surfaces, and which are either diluted in water prior to use or used without dilution. All-purpose cleaners mean products intended for indoor use in buildings which include domestic, commercial and industrial facilities.
- Window cleaners comprise specific cleaners intended for the routine cleaning of windows which are being used without dilution.
- Sanitary cleaners comprise detergent products intended for the routine removal/scouring, of dirt and/or deposits in sanitary facilities, such as: laundry rooms, toilets, bathrooms, showers and kitchens. Hand dishwashing detergents' comprise all detergents intended to be used for hand washing such as: dishes, crockery, cutlery, pots, pans, kitchen utensils etc.

The product group includes products for private/household or for professional (institutional and industrial) use.

Market analysis

Market data

On the basis of data provided by AISE, the total value for the household market for all-purpose cleaners in 2009 was close to € 5.2 billion. The data provided by AISE did not provide information on the number of units. The professional sector (kitchen, catering and building maintenance) represented an additional 2.4

[82] The case study has been based on a combination of desk research and an interviews with the key stakeholders. On the basis of the above definition of the product scope the most relevant industry association in Europe is the International Association for Soaps, Detergents and Maintenance Products (A.I.S.E).

[83] COMMISSION DECISION of 28 June 2011 on establishing the ecological criteria for the award of the EU Eco-label to all-purpose cleaners and sanitary cleaners, and COMMISSION DECISION of 24 June 2011 on establishing the ecological criteria for the award of the EU Eco-label to hand dishwashing detergents

billion, although this number includes both hand and dish wash detergents. According to the PRODCOM database, a total of 14million tones of all-purpose cleaners and detergents were produced in Europe in 2010 with a total of 1.2 million tons of net exports (1.5 million tonnes of exports and 0.3 million tonnes imports). However, the PRODCOM data includes all types of detergents and does not make a distinction between household and industrial/professional uses. On the basis of the share of the sales value of these products to the total market of detergents and cleaners, we can estimate a total volume of 3.5-4.5 billion kilograms

Table 1 - Market data

	Market Sales value (million € 2009)	Volume
Household	5186	2.5 bln kgs (estimate)
All-purpose cleaners	1688	
Window cleaners	256	
Sanitary cleaners	1351	
Hand dishwashing detergents	1941	1.2 billion lts (AISE data)
Industrial and institutional	2423	1.3 bln kgs (estimate)
Total	**7609**	**3.7 bln kgs (estimate)**

Source: AISE and Eurostat and own elaboration

The data from the period 2003-2007 indicated a steady growth of sales for most of the products in the category (between 2-5% depending on the product). However, this growth was halted during the 2009-2010 period as a result of the economic crisis.

In the case of detergents, the market is affected by an increasing trend in households having a dishwasher (30% in 1995, 42% in 2005 according to CECED), which has led to an increase in the share of detergents for dish washing machines. Still, hand dishwashing detergents are used in households and in the industrial sector for a number of items (e.g. fine glasses) but also as all-purpose kitchen cleaners.

In terms of the dominant product form of cleaners, data from the UK retail market (2009) indicates that liquid cleaners represented more than 40% of the total sales, followed by sprays (around 35%).[84] Wipes share was less than 10%.

Furthermore, information from the UK market suggests that consumer's choice of products (for both cleaners and detergents) is primarily driven by performance, brand name and price.[85] Additions of aromas/scents are also increasingly considered. Environmental parameters – such as reduction of waste or energy conservation – are also considered by a certain group of consumers but are not the priority criteria.

Sector structure

According to information provided by AISE, the detergents sector is characterised by a rather significant level of concentration with 4 large multinational companies controlling no more than 50% of the total EU market and around 130-140 manufacturers represent around 80-90% of it. An important share of the market is covered by retailers' own brands (e.g. around 25% in the UK market). AISE has a total number of 900 members across Europe with an important share (around 60%) of SMEs, that are mainly active in their respective national markets. In the professional/industrial sector there is even greater share of small firms

[84] Marketing magazine (2011),Sector Insight: Household cleaners, http://www.marketingmagazine.co.uk/news/1049667/Sector-Insight-Household-cleaners/?DCMP=ILC-SEARCH

[85] Marketing magazine (2011),Sector Insight: Dishwashing-detergents http://www.marketingmagazine.co.uk/news/1062328/Sector-Insight-Dishwashing-detergents/?DCMP=ILC-SEARCH

that provide specialised cleaning solutions. Still, according to AISE, two large multinational companies control rather significant shares in this market.[86]

Trends in the market

In terms of the current market trends, the discussions with AISE indicate that the general tendency in the industry sector is s the development of products with increased level of concentration of active agents, that results in a reduced level of materials used. In the case of household products, there is a general trend towards the use of dosage measures to guide consumers in using the appropriate dosage. These are trends that have been supported by certain voluntary initiatives in the sector.

Life Cycle Analysis – main environmental aspects and key stages of the life cycle of the product

Characteristics of a typical product

Detergents contain various chemical ingredients such as surfactants (surface active agents) that perform the main cleaning function, but also colorants, preservatives, oxidizing, alkaline and other Volatile Organic Compounds (VOCs). Surfactants are the main type of raw material across the product groups (with the exception of glass cleaners; see Table 2 below). Different raw materials that are used in the final products have specific intrinsic properties, which largely determine their potential environmental impact and adverse effects to human health. Most of the surfactants are relatively toxic to aquatic organisms. Their toxicity is caused by the surface-active properties of surfactants which disturb the transportation of substances (for example oxygen) through biological membranes (for example fish gills). The biodegradability of surfactants varies, depending on the form of the carbon chain. Straight chains are more readily degradable than branched chains while toxicity increases in line with the length of the carbon chain.

Fragrances and dyes are added to products to improve the user experience by masking the potentially harsh smell of the cleaning product, to distinguish them from other products and to improve the user experience. Although preservatives and fragrances have adverse effects on aquatic organisms, the main concern of these ingredients is related to the risk of sensitisation and allergy.

Table 2 - Average composition of detergents and all purpose cleaners (% of chemical by weight)

	Hand dishwashing detergent – regular /concentrated	All purpose cleaners	Floor cleaners	Glass cleaners
Surfactants	Anionic: 10-20/10-30 Non-ionic: 0-10/10-20 Amphoteric: 0-3/0-5	Anionic: 1-10 Nonionic:1-10 Soaps: 1-5	Anionic: 1-10 Nonionic:1-10 Soaps: 1-5	Anionic: 0-1 Nonionic:0-1
Builders	Citric acid: 0-2	Citric acid: 1-10 Polycarboxylates:0-2	Citric acid: 1-10 Polycarboxylates: 0-2	-
Colourants	<0.1	0-0.1	0-0.1	0-0.2
Fragrances	<0.5	<1	<1	<1
Hydrotopes	0-0.5/0-1	0-0.5	0-0.5	-
Preservatives	0-1	<0.5	<0.5	<1

[86] No specific data made available

Case studies – All purpose cleaners and hand dish washing detergents C3

	Hand dishwashing detergent – regular /concentrated	All purpose cleaners	Floor cleaners	Glass cleaners
Solvents				Ethanol: 5-20 Isopropyl alcohol: 5-20
Other	Viscosity controlling agents: 0-0.5	Alkalinity sources 0-10	Alkalinity sources 0-10	Alkalinity sources 0-10 Ph adjusters: 0-2
Water	Balance to 100	Balance to 100	Balance to 100	Balance to 100

Source: www.cleanright.eu

Identification of impacts in the different life cycle phases

Chemical cleaning products have environmental impacts throughout their lifecycle stages, including raw materials extraction, manufacturing and packaging of the final product, distribution, use and end of life. However, the most significant impacts occur during the manufacturing, use, and disposal stages.

In relation to resources used, cleaners and hand dish wash detergents are formulated from basic chemicals produced by the organic and inorganic chemical industry. The key issues are the extraction and use of the raw material (including fossil fuels), the energy and water used in the relevant industrial processes and the relevant air and water emissions. We should note that, while surfactants are mainly produced from fossil fuels, there are also a number of cleaners that also use surfactants derived from plant oils (e.g. palm or coconut oil). In this case the reduction in terms of CO_2 emissions and energy is replaced by greater amount of solid waste but also issues of land use in agriculture.[87] Human exposure to detergents, in particular workers – e.g. skin and eye irritation - are also important aspects to look at, as well as packaging of the detergents.

The distribution of the products is related primarily to the relevant fuel (energy consumption) points of sale and the relevant, albeit very limited, contribution to ozone depletion.

The use phase of the products life cycle is linked to a number of environmental impacts. Most of the cleaning products are applied by hand or require some other form of direct application, which can put a person at **a risk of exposure to hazardous chemicals**. Persons involved in frequent cleaning, especially those who clean occupationally, may experience excessive exposure to certain chemicals. Exposure to other chemical ingredients, used in cleaning products, may also pose other risks to human health, e.g. carcinogenic and otherwise toxic ingredients at high concentrations.

The cleaning efficacy of products is often enhanced through **the use of high temperature water which causes additional energy consumption**. Certain types of floor cleaners and hand dishwash liquids are dissolved in hot water to adequately perform their cleaning functions. In contrast, warm water is not a necessary in the case of wipes or sprays used in hard surfaces. Water – usually cold - is also used for the rinsing of the surfaces.

There are certain trends in the industry towards cleaners performing effectively with room temperature water, thereby saving the energy that would otherwise be required to heat the water. These products are mainly prevalent in the institutional and industrial marketplace but, at least so far, less so in the consumer sector.

[87] http://www.scienceinthebox.com/en_UK/programs/natural_synthetic_en.html

Case studies – All purpose cleaners and hand dish washing detergents C3

The discharge of cleaners and detergents and/or their prepared solution following their use can have an impact on the environment in terms of the **toxicity of the aquatic environment, wastewater loading, air pollution** and subsequent treatment, **resource consumption and disposal of packaging materials**. Cleaning products are released into the environment during normal use through evaporation of the volatile components and the rinsing down the drain of residual product from cleaned surfaces, sponges, etc. phosphorus or nitrogen in the ingredients may also contribute to **nutrient loading of water in bodies**, leading to adverse effects on water quality (Vashon, 1992). In most cases, the waste water is treated in municipal waste water treatment plants. Many of those remove phosphates by chemical precipitation or biological processes and the same applies to a large proportion of the nitrates present in the waste water. Treated wastewater effluent containing low concentrations of substances originating from detergents is released into lakes, rivers and the marine waters where aerobic degradation contributes to the removal of the substances and this depends on the bio-degrability of the chemicals used.

Cleaning chemicals are also often wiped away with paper towels or cloths that subsequently are disposed to a landfill. In the US, 176,000 tons of household waste from cleaning products was generated annually making up about 11.5% of the 1.6 million tons of **household waste** disposed yearly.[88] The overall impact of the end of life of the detergents (resource consumption, energy use) depends significantly on the type of municipal waste handling processes, the use of landfills or incineration of paper waste for energy recovery and the level of recycling of the plastic bottles and sprays.

The LCA study analysis

The analysis of the product has been primarily based on an ISO compatible, peer reviewed study commissioned by AFISE- French association of detergent producers (2004)[89]. The study was performed by Procter and Gamble.

The life-cycle-assessment (LCA) study was performed on three market relevant kitchen cleaning products: kitchen cleaning wipes, kitchen cleaning spray and liquid household cleaner (LHC) product in a bottle. The functional unit of the study was defined as 'product used for 1 year of surface cleaning for one household' (floors excluded). A sensitivity analysis was also applied to allow possible different uses of the product. This study does not explicitly cover hand dish wash detergents although these products share quite similar characteristics in terms of key ingredients. Where available, the information from the study was complemented by other sources such as the discussion document for the revision of the Canadian ecologic standard (CCD-146) for hard surface cleaners.

The studies do not explicitly cover hand dish wash detergents. However, as shown in Table 2 they are rather similar to all-purpose cleaners in terms of overall composition (with the exception of viscosity agents and the higher level). Concentrated hand dish detergents have rather higher levels of concentrations of the some categories of substances but we do not expect that this to cause significant changes to conclusions, regarding the use of the key environmental impacts or, even more, the MEEuP method.

The LCA study compared the three types of products, examining the total impact as a result of 1 year of cleaning in a single household, on the household and total sold waste, water and energy consumption and 7 indicators based on traditional LCIA methodologies. The analysis distributed the result over different stages. Table 3 provides the calculated values for the three standard types of products examined.

[88] http://www.ecologo.org/common/assets//Revision%20of%20CCD-146-%20Discussion%20Document-%20Dec%207%202009.pdf

[89] AFISE (2004), Comparative life cycle assessment study 3 cleaning products for kitchen surfaces. French study. An iso-compliant life cycle assessment study of hard surface cleaning products used in the kitchen

Case studies – All purpose cleaners and hand dish washing detergents C3

Table 3 - LCIA comparison of all-purpose cleaners - Adapted from Afise (2004).

Impact category	Unit	Wipe form	Spray form	Liquid form
Household waste	kg	2.07	0.74	0.34
Total solid waste	Kg	1.35	0.94	1.02
Water usage	lts	312	237	829
Energy usage	MJ	186	148	220
Climate change	G eq. CO2	7399	6462	6912
Acidification	g. eq H+	1.02	0.85	0.96
Ozone depletion	g.eq. CFC-11	0.000545	0.000565	0.000514
Photochemical smog	g. eq. C2H4	122.33	122.98	8.00
Human toxicity	Kg body weight	42.73	37.73	39.83
Aquatic toxicity	m3 polluted water	0.58	0.86	0.86
Eutrophication	g. eq. PO_4^{3-}	1.23	4.59	8.31

Source: AFISE

Examining the individual phases, the study indicates deviations among the three types of products. The results are summarised in Table 4. In the case of wipes there are important contributions for the ingredients manufacturing and packaging with the exception photochemical smog (use) and waste (disposal). Results in the disposal phase can be negative due to the energy reclaimed through waste incineration. In the case of spray based products, the use phase is more important for most impact categories. Manufacturing is related primarily to human toxicity[90] (contact with chemicals in the production), energy use and climate change and air acidification. For the liquid based (LHC) products there is a higher share of the use phase including the high levels of water and energy use (hot water usage).

Table 4 – Main contributing life cycle stages per environmental impact for all purpose cleaners in different forms

Impact category	Wipe form	Spray form	Liquid form
Total waste	Disposal (64%)	Disposal (41%)/Use (34%)	Use (69%)
Water usage	Production/packaging (92%)	Use (85%)	Use (98%)
Energy usage	Production/packaging (85%)	Production/packaging (85%)	Use (59%)
Climate change	Production/packaging (75%)	Production/packaging (72%)	Use (52%)
Acidification	Production/packaging (73%)	Production/packaging (70%)	Production/packaging (57%) Use (31%)
Ozone depletion	Distribution (48%)	Distribution (61%)	Distribution (57%)
Photochemical smog	Use (96%)	Use (97%)	Production/packaging (70%)
Human toxicity	Production/packaging (73%)	Production/packaging (75%)	Production/packaging (58%) Use (34%)
Aquatic toxicity	Production/packaging (73%)	Use (54%)	Use (82%)
Eutrophication	Production/packaging (43%)/Use (39%)	Use (75%)	Use (93%)

Source: AFISE study

The study provided also a sensitivity analysis in terms of some key assumptions aspects of the products. One of the key findings is the importance of consumer habit in terms of the use of hot or cold water for cleaning with liquid products. A change of water temperature from 41.5C to 12C can lead to a reduction in energy consumption of up to 50% and has an impact on climate, air acidification, photochemical smog and

[90] AISE suggests that the use of LCA for aspects related to human toxicity are not appropriate.

even human toxicity. Furthermore, increased refill of the spray products can also reduce a range of environmental impacts associated while in the case of wipes with chemicals with high levels of evaporation there is a reduction in the total waste levels.

The above analysis of the life cycle impacts refer to the consumer/domestic use of all purpose cleaners. We have not been able to identify studies providing specific information related on the use of all purpose cleaners for industrial and institutional uses. However, the discussions with the relevant industry association (AISE) and the review of a number of sources (e.g. US Greenseal standard on cleaners used for industrial purposes) and other sources[91] helped us identify the key areas of possible differentiation and specific aspects/issues that may apply. These include:

- There is in general higher priority given by the industrial users of cleaners and hand detergents on the effectiveness, energy and water savings of products. At the same time though, there is also a need to balance energy and water savings with hygiene requirements in some sectors that use cleaning products (e.g. food, sanitary facilities).
- According to AISE, the materials used in cleaners and detergents sold to the industrial and institutional sector are around 90% the same as in the domestic sector, with identical toxicity characteristics. However, the products supplied to the professional sector can normally be in highly concentrated form for maximum efficiency because users often have sophisticated dose control systems to ensure correct dilution during use. There is an increasing tendency for the use of closed dilution control systems – especially by large volume users - that allow for accurate dilution of cleaners and detergents leading to increased efficiency and reduced waste of water and chemicals, as well as reduced exposure of workers.
- Given the focus on greater efficacy from industrial and institutional users, manufacturers often use more alkaline products (e.g. NaOH). This increases the acute contact hazards of a product, but is better in relation to the impact in the disposal phase. Furthermore, the better degradable NTA is often favoured in relation to the most recalcitrant EDTA salts, even though NTA has a poorer human toxicity profile. This is because industrial users have greater capacity to handle hazardous substances and workers are trained to handle products with hazardous chemicals correctly. Producers of cleaners and detergents for institutional/industrial uses are generally obliged to provide information and/or training for the appropriate handling and use (e.g. level of dilution, disposal, and protection measures).
- In industrial use, there is generally a higher volume of hazardous waste produced in comparison to household waste, which may pose higher load for wastewater treatment. However, most industrial units are obliged to have their own independent waste water treatment facilities, which help decrease the impact of any waste emitted to the environment. Thus, the high volume waste produced in the case of industrial uses can be a more important aspect in a context of an LCA for professional uses.
- Stricter legal requirements to ensure the safe use, transportation and disposal including the provisions resulting from of the Seveso Directive, are to be enforced by the industrial sector.
- Important part of industrial and institutional cleaners and hand dishwash detergents are sold in bulk (high volumes) with reduced packaging and with greater reuse/refill options that reduce resource use and solid waste load.

[91] http://www.cleanlink.com/sm/article/Dilution-Control-Closed-Loop-Chemical-Dispensing-Systems--13131
http://www.greenseal.org/Portals/0/Documents/Standards/GS-52%20Stn%20Dev/GS-52_GS-53_Draft_Final_Comparison_Table.pdf
http://www.greenseal.org/Portals/0/Documents/Standards/GS-37%20std%20dev/gs37_background_doc_11-16-07.pdf
http://www.greenseal.org/Portals/0/Documents/Standards/GS-37%20std%20dev/gs37_discussiondocument.pdf

The above observations suggest that in the case of industrial and institutional uses there are possibly increased concerns in terms of the toxicity and biodegrability of the chemicals used for industrial uses. At the same time, given current practice there may be fewer opportunities for minimising further energy, water or resources consumption.

Improvement potential

On the basis of the LCA analysis provided, a number of areas for improvement for cleaners and detergents produces were identified.

At the product design level possible areas of product improvement include:

- Minimise the weight of the wipe in wipe-based products;
- Reduce packaging by the use of refill bottles without trigger (spray based products);
- Reduce the use of chemicals that contribute to photochemical smog (wipes and spray);
- Use chemicals with low level of Chemical Oxygen Demand (liquid cleaners and hand dish wash detergents);
- Develop products that operate at low water temperatures (liquid cleaners and hand dish wash detergents).

We should also note that important part of any impacts is determined by consumer habits. Rinsing and cleaning habits - amount and temperature of the water used – can have a direct impact on the level of water and energy consumption. This is particularly the case for liquid cleaners. In the case of wipes, their use in the full extent can reduce the environmental impact related to waste and emissions. In that respect, beyond design features, information provision or awareness raising campaigns can have an important contribution. As far as industrial cleaners and detergents are concerned the main focus can be on the toxicity and biodegrability of chemicals.

Implications of applying the MEEuP method instead of the more traditional LCA methods used

The next step of the case study was to examine what would be the result of using the current MEEuP in the case of cleaners and detergents and what would the possible missed opportunities. On the basis of a review of the MEEuP guidelines the following key conclusions and issues from the possible use of can be reached:

Water consumption: In the MEEuP report water use is only defined as processing water, and not household water use. On the basis of this definition the MEEuP approach would most probably miss the important aspect of water used in the use phase, unless the intake by water companies would be interpreted as processing water. This appears to be a rather artificial definition. Another limitation of MEEuP is that it only considers total water use, without reflecting relative scarcity.

Human toxicity: Nitrogen and sulphur oxides during production of ingredients and packaging materials are the main drivers. In the MEEuP report these substances are not taken into account as a toxic substance; only metals and a few other substances are covered, so unless the list of substances is excluded this would probably lead to different conclusions. Unlike state of the art LCA methods, direct exposure of chemicals to the user is not addressed in MEEuP, and this can also create serious limitations.

Aquatic eco-toxicity: Environmental impacts are linked to the use and disposal phase. Again the MEEuP report only specifies the toxicity of metals, which is irrelevant for this product group. Modern detergents contain an extensive range of organic chemicals, and many stakeholders would probably want to understand the toxicity differences. This is another area that would have to be addressed in the EcoReport tools of an extended MEEuP.

Case studies – All purpose cleaners and hand dish washing detergents C3

Eutrophication: The level of COD in waste water is the decisive factor of the eutrophication parameter. Unlike many other impact assessment methods, MEEuP does cover the COD parameter effectively.

As far as the remaining aspects are concerned (energy consumption, climate change, air acidification and photochemical smog), the initial analysis of the MEEuP methodology is not expected to lead to significant deviations from the LCA study examined.

Overall we conclude that if the same assessment would have been made with the MEEuP method a few problems would occur:

- Issues related to human and aquatic toxicity could not be reflected in a proper way. This is probably the most serious shortcoming of the existing methodology with respect to cleaning products but also in relation to chemicals;
- The water use in the use phase would, mot probably, not have been accounted for.

Table 5 summarises areas where the use of the current MEEuP approach would most probably lead to underreporting of certain issues.

Table 5 – Comparison of MEEuP and AFISE Life Cycle Analysis - Areas with expected difference in bold

	Wipes		Spray		Liquid	
	AFISE	**MEEuP**	**AFISE**	**MEEuP**	**AFISE**	**MEEuP**
Solid waste	H	H	L	L	L	L
Residual solid waste	M	M	M	M	M	M
Water use	L	L	L	L	**H**	**L**
Energy use	M	M	M	M	M	M
Climate change	M	M	M	M	M	M
Air acidification	M	M	M	M	M	M
Photochemical smog	H	H	H	H	L	L
Human toxicity	**M**	**L**	**M**	**L**	**M**	**L**
Aquatic toxicity	**M**	**L**	**M**	**L**	**M**	**L**
Eutrophication	L	L	M	M	H	H

Note: H: high; M: medium; L: Low.

Current Policy framework - Review of existing policy tools

The products examined in this case study are covered by a number of mandatory and voluntary policy initiatives/tools at the European level. These have been analysed from the perspective of the key environmental impact and the respective life cycles stages addressed.

Regulatory instruments

From the regulatory side, the relevant pieces of legislation are:

- **Regulation (EC) No 648/2004 on Detergents and surfactants**: The Regulation sets requirements in relation to the primary and ultimate biodegradability of surfactants contained in the detergents in order to protect the aquatic environment. It also sets requirements concerning allergenic fragrances. Derogations can be granted in the case of detergents used in industrial processes if the impact on the environment is small compared to the socio-economic benefits but so far this has been used in only a very few cases (according to AISE). The Regulation sets also labelling requirements for cleaners and

detergents sold to general public. The Regulation is currently under the legislative process to be amended to limit the total phosphorous content of consumer laundry detergents as well as of Consumer Automatic dishwasher's detergents, allowing to reduce discharge of phosphate into waste water and consequently reduced costs for removing them while reducing 'contribution to eutrophication of EU surface waters. Thus, from the life cycle perspective, the Regulation addresses the environmental impacts related to the use and end-of-life of the products as well as human health exposure (e.g. allergenic fragrances).

- **Regulation (EC) No 1907/2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH): REACH** regulation covers all chemicals and mixtures and sets requirements for the registration of all chemicals used by industry. The regulation requires industry to conduct a risk assessment of the chemicals used and imposes restriction or authorisation requirements to a number of substances of very high concern with the aim to promote their replacement by less hazardous ones. The regulation is currently at the early stages of its implementation. From the environmental impact perspective the focus of REACH is developing the necessary information on the toxicity of chemicals substances contained in cleaners and detergent to humans and the environment. REACH covers almost all phases of the life cycle of chemicals substances used from the production to the end of life stage.
- **Regulation (EC) No 1272/2008 on classification, labelling and packaging of substances and mixtures (CLP):** The Regulation requires the classification of dangerous substances and the adequate labelling with the provisions of the relevant information and necessary symbols (mandatory labelling). The information provided concerns the toxicity of the substances included but also the contribution to ozone depletion and photochemical smog, ionizing radiation and on hazardous waste. It also requires the use of adequate packaging to prevent any loss of contents or the attack by the contents (mandatory standards). In relation to detergents and all-purpose cleaners, the regulation covers the distribution, use and disposal stages of the life cycle.
- **Packaging and packaging waste Directive (94/62/EC):** This Directive refers to all packaging placed on the market and all packaging waste. It sets requirement in relation to the weight and volume of packaging taking into consideration hygiene, safety and acceptability, to reduce the hazardous content of packaging and to design reusable and recoverable packaging. Member States are expected to take such measures to reduce packaging waste and increase recovery with certain targets set. From the point of view of the environmental impact, the Directive addresses the aspects of resource depletion, ecotoxicity and waste related to the end of life of products, including cleaners and detergents. According to AISE, the Directive has not been particularly affective so far. There is lack of harmonisation among the Member States in respect to recovery which leads to significant costs for industry.
- **The Biocides Directive**[92] sets standards in relation to the presence of biocides in a number of products including cleaners and detergents. Biocides are increasingly used in certain categories of products, particularly in the professional sector. The Directive focuses, from a different angle, on the toxicity of the products and is linked primarily with the use phase. At this stage the Directive is under revision with a proposal to be transformed to a regulation that will aim to address issues related to the costs of registration of substances but also, according to AISE, the non-harmonised implementation across Member States.[93]

[92] It is currently revised with the possible result of being transformed into a regulation.
[93] http://ec.europa.eu/environment/biocides/revision.htm

Case studies – All purpose cleaners and hand dish washing detergents C3

Voluntary approaches

Besides the mandatory requirements, the European Eco-label scheme sets voluntary requirements aiming to cover top 10-20% of the market. The general requirements are[94]:

- The product has a reduced impact on the aquatic environment;
- Does not contain hazardous substances (volatile organic compounds and other substances of high concern);
- Has a limited effect on the growth of algae in water;
- It is largely biodegradable;
- It uses less packaging;
- It includes information for correct environmental use;
- It is guaranteed to perform at least as effectively as conventional products.

According to the 2008 data, there were 51 Eco-label license holders for hand dishwashing detergents and 88 for all purpose cleaners. According to AISE the market share of labelled products remains limited. Furthermore, AISE claims that the requirements concerning the presence of certain chemical substances on the basis of the hazard levels - rather than the level of risk posed – may inhibit the development of new products with higher level of concentration of cleaners and detergents and not serve the aim for an overall higher level of sustainability. However, supporting data in this direction were not made available.

Besides the EU Eco-label, there are also national voluntary Eco-label standards (Nordic Swan, Blue Angel) that set specific (operational requirements) for cleaners and detergents with rather similar approach followed to the EU Eco-label.

Furthermore, besides the product specific standards, the existing EMAS and ISO voluntary standards – not industry specific - apply to the production/manufacturing process of the relevant units.

Self regulation instruments

In parallel to the existing regulations, industry - led by AISE- has initiated a number of voluntary agreements. The most relevant/important is the **Charter for Sustainable Cleaning**[95] that was initiated in 2005 and was further updated in 2010. According to AISE, the aim is to encourage the whole industry to undertake continual improvement in terms of sustainability and also to encourage consumers to adopt more sustainable ways of doing their washing, cleaning and household maintenance. The Charter is a lifecycle analysis (LCA) based framework. It covers a number of aspects including the human and environmental safety of chemicals and products, to eco-efficiency, occupational health and safety, resource use and consumer information.

The Charter stipulates a process-focused set of Charter Sustainability Procedures (CSPs) for companies to implement in their management systems, and that are subject to external verification. It also defines a set of 11 Key Performance Indicators (KPIs) for companies to report on. This allows A.I.S.E. to generate an annual sustainability report for the sector. It is expected that as the overall sector improves its performance the charter requirements and the Key Performance Indicators will be revised.

By October 2011 more than 155 companies had joined the initial 2005 Charter, representing around 80% of the total production output in Europe of the total products covered by AISE members and 55 have already

[94] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32009D0888:EN:NOT
[95] www.sustainable-cleaning.com

signed up for the 2010 agreement, including also retailers' firms. AISE reports that in the period 2006-2010 the Charter led to a reduction of energy use by 13%, of waste by 7.5% and of packaging by 3%.

More relevant from the product policy perspective is that the 2010 update that introduces a product dimension, enabling companies to provide a sustainability assurance for individual products. These can be obtained by companies committed to the Charter update 2010 through voluntary compliance with the new Advanced Sustainability Profiles (ASPs) for product categories. The requirements are set on the basis of an LCA analysis and will focus on the more relevant aspects. According to AISE, the aim of the scheme is to cover most of the market and as a result of the voluntary standards would become more ambitious and feasible. Compliance with the scheme is indicated by a special label and monitored by an independent body that collects the relevant information and helps assess the overall sector performance. The ASP standards do not set long term targets but are expected to be revised after certain period.

The ASP profiles are developed on the basis of a life cycle analysis and are tailored to each detergent category targeting the most important aspects for enhancing sustainability. At this stage ASPs have only been defined for household laundry detergents that were considered as having priority given their greater share of the market. There is still no assessment of the impact of the scheme.

Table 6 - Example of Advanced Sustainability Profiles – Detergents for washing machines

Product formulation	Dosage/job <85g and 135ml Passing of environmental safety check
Packaging weight per job	Total packaging <7g/job
Packaging recycled content	>60% board
End user information provided	Temperature : Ability to wash at <30C indication Washright panel[96]

Source: AISE

AISE also indicated that in the context of the Charter 2010 aquatic toxicity is also controlled by a screening system to ensure that for the correct use-phase dose, products do not contain any individual ingredient which exceeds predicted no-effect concentration. This screening system will be subject to revision on the basis of information created in the context of REACH regulation.

In the case of all-purpose cleaners and hand dish wash detergents the process has been initiated and the criteria are expected to be developed in the second half of 2012. There are still issues concerning the definition of standard dose/job on the basis of which the requirements will be set. According to AISE besides the toxicity issues that are already rather extensively covered by existing regulation, the focus is expected to be on the use phase with aim for higher level of concentration in order to reduce the use of resources but also on the packaging and the possible re-use/refill of the products.

In addition to the charter, two more relevant voluntary initiatives are Cleanright[97] and Safe use. The first focuses on the provision of information to consumers to ensure the sustainable use of products and the second on the safe use of chemicals. Joint CEFIC and A.I.S.E. website provides consumers across Europe with information and advice on the safe and sustainable use of soaps, detergents and maintenance products.

Other tools

Another product specific tool is the Green Public Procurement Product Sheet for detergent products setting criteria for the purchase of products by authorities The GPP for detergent-type products are currently

[96] Washright panel provides tips for saving water and energy and save packaging, recycle or refill.
[97] WWW.CLEANRIGHT.EU

primarily based on the existing EU Eco-label criteria but are currently under review and might contain more comprehensive set of criteria. At this stage there is no information on the level of use (share in total number of authorities or in total public sector purchase of detergents) to assess the impact of the green public procurement. In a few countries (UK, BE, PT) it has been adopted as a mandatory requirement for local authorities but in most other countries there seems to be rather low penetration.

Finally, a sectoral agreement was signed between government, industry and retailers in Belgium in 2011. The aim is to increase the share of products that comply with the Eco-label and/or the AISE sustainability charter requirements over time.

Conclusions

On the basis of the analysis and the discussions with stakeholders, we can identify the impact areas where relevant regulation or other policy tools are already in place. Since the information on the effectiveness of these instruments is limited it is not possible for CSES to make an assessment of whether they represent the appropriate policy mix. What is rather clear though is that the issues of toxicity to human and the environment are extensively covered by existing legislation in relation to the production phase as well as the use phase (information provision) and there are also initiatives by the industry to strengthen their effectiveness. Regulation (CLP and Packaging Directive) also addresses the issues of waste resulting from cleaners and detergents. In comparison, in the areas related to resource depletion (materials, water, energy) and climate change are currently addressed by industry voluntary mechanisms that focus either on the products design (Eco-label and the expected charter) or information provision to improve consumer habits during the use phase, during which most of the environmental impacts take place.

Table 7 – Existing policy tools and main environmental impacts - Highlighted cells indicate the most important impact areas for each life cycle stage

	Raw Materials production	Production /Packaging	Distribution	Use	End of life
Resource depletion	Packaging Directive	EU Eco-label Sustainable charter		EU Eco-label Sustainable charter Cleanright	Packaging Directive
Human toxicity	REACH	REACH, Detergents Regulation Biocides Directive Seveso Directive Sustainable charter	CLP,REACH	CLP, Detergents Regulation EU Eco-label Cleanright	
Ecotoxicity	REACH	REACH, Detergents Regulation Biocides Directive Sustainable charter	CLP, REACH	CLP, Detergents EU Eco-label	
Climate change		Sustainable charter		Sustainable charter, Cleanright	
Ozone depletion					
Acidification					

Case studies – All purpose cleaners and hand dish washing detergents C3

	Raw Materials production	Production /Packaging	Distribution	Use	End of life
Photochemical smog					
Particulate matter					
Eutrophication		Detergents Regulation Eco-label		EU Eco-label Cleanright	
Land use					
Ionizing radiation					
Hazardous waste		Packaging Directive Sustainable charter	CLP	CLP	CLP, Packaging Directive
Non-hazardous waste		Packaging Directive Sustainable charter	CLP	CLP, Packaging Directive Sustainable charter Cleanright	CLP, Packaging Directive

Blue fonts: Mandatory requirements/labelling, Red fonts: Self regulation standards/labels, Green: Voluntary standards

Policy Analysis

Description of a possible Ecodesign based regulatory measure

On the basis of the life cycle analysis conducted, the key/priority areas that an Ecodesign based regulation could focus would be related to the following aspects:

- Human toxicity and eco-toxicity of detergents related to the production, distribution and use phase;
- The energy use related to the production, distribution (transport) and the use phase (hot water use);
- Resources depletion in relation to the production of detergents (fossil fuels) and the use phase (water use);
- The level of waste related to the use and end of life (packaging).

At a more operation level, specific eco-design requirements could include:

- Performance levels for normal/cold water temperature (25 C) for hand dish wash detergents or floor surface cleaners that are diluted in water;
- Decrease/manage the dosage used for a standardised job by the design of the product for a set water temperature and inform consumer on a uniform way;
- Reduce the inactive agents in the cleaners to make them more compact without affecting efficiency;

- Ban/control the presence of certain chemicals of high concern (on the basis of the information provided through REACH regulation);
- Requirements on the packaging weight;
- Increased level of recyclability of the product (e.g. refill bottles).

In addition to the specific requirements, generic requirements concerning the development of the ecological profile of all purpose cleaners and detergents on the basis of a simplified life cycle analysis, information provision and action on the basis of certain benchmarks could also be used.

We need to note that there are possible trade-offs or interdependencies among some of the above provisions. For example, a requirement to make cleaners and detergents more compact may mean the presence of higher concentration of substances in cleaners and detergents or, more often, a more stringent classification of products with increased requirements for their transport and sale. The same applies to possible requirements for lowering the water temperature for hand dish wash detergents. In relation to the packaging there are also certain trade-offs with the safety provisions for chemical products.

Furthermore, important part of the requirements stated above is already within the scope of other legislation. The level of toxicity of the chemicals included is addressed in the detergents and biocides Regulations as well as in REACH regulation. In that respect additional eco-design requirements would mostly duplicate current available mandatory requirements, going against the principle of avoidance of duplication of regulatory requirements foreseen in the Ecodesign Directive.

The packaging regulation and CLP regulation also set certain requirements in relation to the amount of waste produced but also set certain minimum standards for the type of packaging that needs to be used for both industrial and professional uses of detergents. In contrast, the existing regulation does not address the issues related to the performance per dosage unit or the water temperature. According to AISE these are key performance parameters that drive competition in the market and help differentiate products.

Definition of alternative policy options

Against the possible coverage under an Ecodesign Directive Implementing Measure, a number of alternative scenarios were also examined. These included:

Business as usual - The business as usual scenario includes a combination of existing market forces, toxicity related regulations, EU Eco-label voluntary scheme and the voluntary sectoral approaches under the Sustainable Charter.

Mandatory labelling or other mandatory information scheme would include the labelling of products on the basis of their performance for a standard job and/or under cold water. Mandatory labelling could also be considered in parallel to minimum eco-design requirements in the same way that it is currently used in the case of EuPs.

Voluntary agreement in the context of Ecodesign - A possible alternative self-regulation approach includes the use of the voluntary scheme (such as the Sustainable charter) inside the context of the Ecodesign.

Financial tools – the use of a tax for detergents with a low level of performance could theoretically be used. However, such a financial scheme would have to be applied at the Member State level and would entail a number of practical difficulties in its implementation. It is thus not further considered. Another alternative at the European levels would be the use of Green public procurement for the purchase of detergents of certain minimum level of quality by public authorities.

A fifth option was proposed by AISE based on **the promotion of multi-stakeholder agreements** between government, industry and retailers as in the case of Belgium described earlier. These agreements will set

targets for increasing the proportion of products on shelf which meet certain higher standards of sustainability but with no legal requirements.

Assessment of alternative options

The criteria used for comparing the Ecodesign requirements against the alternative options were:

- The expected effectiveness of the measures in bringing improvements;
- The costs involved;
- Ease of implementation (including the use of the MEEuP methodology);
- Impact of any necessary changes to existing Ecodesign requirements.

From the implementation point of view, the establishment of all or some of the above Ecodesign requirements could help address issues such as minimum performance, dosage or water temperature that are currently not addressed by legislation and concern primarily to the use phase. From a feasibility point of view, developing requirements related to the performance or water temperature should not be problematic, as there are already efforts being made towards the definition of a standard job/work as a unit of reference. The same applies to the issue of toxicity and the presence of certain chemical substances although there is the risk of overlapping with the existing chemicals regulation.

We should note though that the effectiveness of such requirement needs to be further analysed, with focus on consumer behavior. It is not clear to what extent the design of these products could lead to important savings as the main driver of water or energy use relies on consumer habits. In contrast to energy using products like washing machines the level of control of the designer on consumer behavior is rather limited. Furthermore, as already pointed, there are possible trade-offs between achieving high levels of effectiveness and the requirement for minimising the use of certain types of chemicals. According to both the Commission and AISE, the hazard based approach adopted in the case of EU Eco-label is not appropriate and has led a number of manufacturers to withdraw their products. Data supporting this claim were not made available.

Clearly, the development of requirements would require guidance and addressing of possible trade-offs taking into consideration all relevant regulations on chemical substances. The input from the current implementation of the Directive and our own analysis indicates that the current MEEuP and the EcoReport tool are not particularly helpful in assessing environmental toxicity and supporting the assessment of trade-offs.

It is very difficult to assess the possible impact of such requirements on industry at this stage. AISE suggests that strict requirements could affect innovation and introduce additional compliance costs related to the necessary testing and changes to the product lines. However, more in depth analysis of the possible costs would be necessary on the basis of specific provisions. In addition, there are administration costs for the development of a new Implementing Measure for the Commission and stakeholders. Finally, there are important monitoring and enforcement costs for the Member States. On the basis of the information from the CLASP study an effective enforcement of the requirements would require costs in the range of for each Member State (average) although this is far from what is currently spent by most Member States.

As far as the adoption of generic requirements for the development of an ecological profile is concerned, the existing life cycle tools for eco-labels and for the sustainable charter suggest that such requirements should be feasible and rather easy to implement. Given the presence of significant information requirements and the labels in the context of the sustainable charter, the possible requirements may simply adopt existing practices.

Case studies – All purpose cleaners and hand dish washing detergents C3

In comparison to the minimum standards on the basis of the Ecodesign, the **use of a mandatory label** providing information or ranking cleaning products on the basis of their effectiveness (e.g. on issues of water or dosage needed for a given type of job, performance with cold water) could bring results, at least as far as household products are concerned. The result would be to integrate environmental considerations on consumer choice and creating stronger incentives for competition on the basis of performance. The study on energy using products[17] indicates that the introduction of energy labelling could influence the purchase by up to 50% although the industry representatives (AISE) suggested that the experience from Eco-label is not particularly supportive on the role of the labels in driving consumer response in the sector. Furthermore, we should note that the introduction of a mandatory label will have to replace or to adopt existing labels used by industry on a voluntary basis with some possible confusion of consumers – at least in the initial period. Furthermore, in the case of industrial products such information is already provided and more generally labels are not considered as having a similarly important role. From the practical side, the development of a label would, as in the case of specific minimum standards, require the development/adoption of the relevant standard for assessing performance and developing the relevant product classification. Clearly, as generally promoted in the context of the SCP/SIP, a combination of minimum standards and labelling could bring greater results as far as consumer products are concerned.

On the other hand, AISE notes that the addition of more labels on top of those related to the CLP and detergents regulation could be problematic and there is a danger that this could lead to consumer confusion and eventually disinterest in reading labelling information.

From the costs side, mandatory labelling could also entail compliance costs include administrative costs for the changes in the labelling of products and testing. They should not be expected to very different to those related to minimum requirements. In comparison to the case of Ecodesign requirements, mandatory labelling would most probably incur rather lower costs to authorities for market surveillance and enforcement.

In the case of no action (**business as usual scenario**), important part of the key environmental impacts identified in the analysis are already addressed by existing regulation, especially as far as environmental toxicity aspects are concerned (REACH). In addition, the voluntary initiative promoted by AISE – the Sustainable Charter and the advanced sustainability profile - can be expected to achieve a good level of results in relation to the issues of energy, water use and recycled material. The 2005 Charter covered more than 80% of the industry and the update that includes the product related Advanced Sustainability profile has already attracted a large number of manufacturers. The Charter has been upgraded in 2010. The necessary independent monitoring tools are also already in place. It would be necessary to ensure that the high level of participation applies also to the Advanced Sustainability Profile and that the criteria set are ambitious enough. From the point of view of the implementation and efficiency such an option would incur the least costs and would be the easier and faster to implement.

However, a possible **integration of the existing VA in the context of an extended Ecodesign** could have additional advantages. It would require changes to the existing structure of the scheme to bring it in line with the Annex 8 requirements of the Directive, including the establishment of long term targets in the form set under the Ecodesign. It could strengthen the effectiveness of the existing VA and increase the level of participation to more than 80% without requiring substantial additional effort from both the EU detergency industry and the Commission side. In addition, the threat of the development of an Implementing Measure provides a further incentive for participation in the scheme. Industry highlighted that already significant progress has been made and the nature of the existing VA does follows most of the requirements set in Annex VIII of the Ecodesign (minimum level of market coverage, monitoring of performance by independent body), while long term commitment and targets for improvement need to be added. AISE is continuously upgrading the Charter which continues to spread further.

Case studies – All purpose cleaners and hand dish washing detergents C3

Concerning the potential use of financial instruments on the basis of GPP the key disadvantage is that the impact of such a measure would be limited to professional products. However, the consumer market represents the main market for detergents. Furthermore, the capacity to reach a wide range of public authorities – many of which are expected to base such decision on budget considerations – would be difficult according to the hitherto experience.

Finally, in relation to the option of multi-stakeholder agreements, AISE suggests that the experience from Belgium is positive and such an option can be effective while still easy to implement and with limited costs at Member States' level. However, the effectiveness of such an option will very much depend on the targets set and there may be some monitoring costs to ensure that the agreement can be enforced. Following the SCP/SIP approach we consider that such approaches should be seen as complementary to legal instruments setting minimum requirements operating as market based tools towards higher levels of sustainability.

Table 8 - Summary table of assessment of Ecodesign based requirements against alternative options

Option	Effectiveness	Costs (for industry and authorities)	Ease of implementation	Impact on Ecodesign
Development of Implementing Measures focusing on product effectiveness	- Achieve targeted level of material, energy and water use savings at a predicted horizon (assuming effective surveillance and enforcement)	- Administrative costs for implementation and enforcement. - Compliance costs for production changes and testing – possibly high costs to SMEs	- Possible to develop standards. - Time consuming	- Need for change of MEEuP to cover other issues could also benefit in the revision of existing IMs - Possible additional complications/delays for the overall management of the Directive
VA in the context of the Ecodesign	- Similar level of savings as in the case of Ecodesign IMs	Low - Low costs for authorities - Moderate costs for industry for monitoring VA	- Relatively easy and fast to implement on the basis of existing charter AISE	No expected impact
Mandatory labelling (without VA product based approach)	- Lower level of effectiveness in relation to IMs depending on consumer awareness - Unclear horizon of achieving targets - Danger of consumer confusion	- Administrative costs for industry and authorities for development and implementation - Compliance costs for testing of products low	- Possible to develop standards labelling but time consuming - Issue of multiple labels in products	No expected impact
Business as usual (including VA with product based approach)	- Effectiveness depends on industry participation in VA and incentives – possibly not as effective as Ecodesign	No additional costs to authorities Moderate costs for industry for monitoring VA	Easy to implement as almost in place	No expected impact
Financial	- Low effectiveness	- Low additional costs	- Easy to implement	No expected impact

Case studies – All purpose cleaners and hand dish washing detergents C3

Option	Effectiveness	Costs (for industry and authorities)	Ease of implementation	Impact on Ecodesign
instrument	as public sector represent a small share	(extra costs for more expensive products)	but difficult to reach all public sector	
Multi-stakeholder agreements	- High (according to AISE) if done at EU level. - No guaranteed results ; depends on level of ambition set	- Limited administrative costs Costs for change	Flexible - Achievable if adequate stakeholder engagement. - No need for new standards	No expected impact

Conclusion from the case study – lessons for the broader chemicals' product group

The conclusion of the study is that it should be possible, under certain circumstances, to cover chemical products such as cleaners and hand dish wash detergents for household and industrial use in an extension of the Directive. However, the important aspect of toxicity of chemicals is already covered by EU legislation (REACH, CLP and Detergents Regulation) and there is probably limited scope for additional action within the context of the Ecodesign without leading to issues of duplication with the relevant EU legislation. However, beyond the key aspect of toxicity of the substances, there is scope for introducing requirements to improve the resources use (material, energy, water). This is also a consideration that applies to almost all categories of chemicals used for consumer or industrial purposes.

The presence of EU Eco-label requirements and the Sustainable Charter developed by the detergency industry suggest that the development of Ecodesign requirements may still be a realistic option. In particular, it could be expected that compliance with requirements should allow better and easier enforcement and monitoring through application of test standards.

Nevertheless, in comparison to EuPs, it is less clear to what extent Ecodesign requirements can have a particular role in the consumer behavior, which is a key point for the aspects of water and energy use in the case of consumer cleaners and detergents. This case study did not examine in depth the ways that product design may affect consumer habits but, on the basis of the market data from the UK presented earlier[98], it seems reasonable to expect that environmental considerations are, in general, of less priority to consumer than the efficacy of the product (cleaning or hygiene) and the final retail price. Furthermore, cost savings are less evident for products with a life cycle of a few months than those that apply in the case of EuPs. Consequently, it is rather clear that in order to achieve expected results, any minimum requirement would also need to operate in conjunction with information tools (e.g. labels) and consumer awareness raising schemes.

Such issues do not seem to apply in the case of industrial cleaners and detergents since their users are, in general, much more aware of efficacy and energy and water use issues. Consequently, for those products the improvement potential seems quite limited.

Finally, the review of the MEEuP methodology indicates that certain changes would be necessary before such products –and other products with similar characteristics – be covered. This would include the EcoReport where, according to the initial analysis, the current methodology (MEEuP) appears to have significant weaknesses in terms of identifying certain aspects and addressing the possible relation between

[98] Marketing magazine (2011),Sector Insight: Dishwashing-detergents
http://www.marketingmagazine.co.uk/news/1062328/Sector-Insight-Dishwashing-detergents/?DCMP=ILC-SEARCH

the chemical content and concentration on the one hand and the and level of energy and water use on the other.

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Interview

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CASE STUDY 4: FLOOR COVERINGS[99]

Introduction and methodology

This case study examines the feasibility of developing Ecodesign requirement in the context of the Ecodesign Directives for products that fall under the category of floor coverings. The product has been chosen to represent the broader category of housing products. Some products are covered by eco-labels while others are not. The product scope follows that of two existing eco-labels:

- According to a Commission Decision of 26 November 2009: The product group "**wooden floor coverings**" shall comprise wood- and plant-based coverings: including wood and timber coverings, laminate floorings, cork coverings and bamboo floorings which are made, for more than 90 % in mass (in the final product), from wood, wood powder and/or wood/plant-based material. It does not apply to wall coverings, where properly indicated, or coverings for external use or for coverings with a structural function. With some exceptions, this product group will not include any covering treated with biocidal products at any stage of the production process.
- According to Commission Decision of 9 July 2009: The product group "**hard coverings**" shall comprise — for internal/external use, without any relevant structural function — natural stones, agglomerated stones, concrete paving units, terrazzo tiles, ceramic tiles and clay tiles. For hard coverings, the criteria can be applied both to floor and wall coverings, if the production process is identical and uses the same materials and manufacturing methods.
- According to Commission Decision of 30 November 2009: **Textile floor coverings** shall be defined as floor coverings, usually of woven, knitted, or needle-tufted fabric; commonly installed with tacks or staples, or by adhesives. Loose mats and rugs are excluded. It does not apply to wall coverings or that for external use.

It should be noted that the industry generally divides itself into hard coverings (HFC) and soft coverings (SFC). For the purposes of the study, the scope of the analysis covers the following products; ceramic tiles are an example of HFC while the others are SFC coverings:

- Ceramic Tiles
- Linoleum
- Wood
- Vinyl
- Carpet (Nylon and Wool)

Market analysis

Market data

Global demand for flooring and carpets is forecast to grow 5.0 percent annually through 2014 to 15.3 billion square meters, a noticeable improvement over market performance during the period from 2004-2009. Product sales at a global level are expand at a faster pace, rising 6.5 percent per year until 2014, due to an expected rise in average floor covering prices and demand from a recovering housing market, supported by increased purchasing power in a number of developing nations.[100]

[99] This case study has been based on a combination of desk research and interviews with key stakeholders. Please refer to list in the last section.

[100] World Flooring & Carpets Market Published on March 2011

Case studies – Floor coverings C4

Many various types of flooring exist all produced in different ways, with different characteristics. Carpets are the most widely produced flooring in the world and serves the demand for 835, 000, 000 m^2 of carpet a year.[101]

Ceramic tiles are the only floor covering in the present study to be part of the category of hard floor covering (HFCs) category. This sector of the ceramics industry continues to be highly competitive internationally, with strong production concentrations in Italy and Spain. Other sizeable activities are located in Portugal, Germany and France but with significant growth in imports, especially from China. The European ceramics industry records total sales of around € 26 billion and employs 222, 000 people. Wall and floor ceramic tiles constitute the biggest sector in turnover among European ceramic industries with total sales in 2009 estimated around € 9 billion. Although Italy and Spain are by far the two biggest producers in the EU, significant production also exists in Poland, Portugal, Germany, France, Bulgaria, the UK, Romania, the Netherlands, Czech Republic and Hungary**.**[102]

In terms of soft floor coverings (SFC), the four product groups in the present study account for roughly 90 percent of the total SFC market. **Carpet** total production amount nearly € 5.541 billion, corresponding to 1,125 Mm^2. Belgium accounts for the most significant share of the industry, with Germany, the Netherlands, and the UK also generating significant shares of European production. The production of **wood flooring** is distributed more equally across Europe, with several centres of production accounting for € 2.748 billion and 143 million square meters of flooring. **Vinyl flooring** is a set of a wider category of PVC flooring, EU 25 total production amount nearly € 1.7 billion, corresponding to 337 million square meters. Linoleum constitutes a small yet growing share of the market, with a value of € 394 million. In this resilient floor market, there is a medium concentration with a few large firms dominating European and indeed global production.

Table 1: Value of floor covering (2006 data)

Product Family	*Value of European Industry*		*Production Volume*
	Million €	*% on floor covering total (EU 25)*	
Hard Floor Coverings			
Ceramic tiles	11, 700	--	1.6 Bm2
Soft Floor Coverings			
Carpets	5, 541	36	1, 125 Mm^2
Wood floorings	2, 748	17	143 Mm^2
PVC coverings	1, 700	9	337 Mm^2
Linoleum coverings	394	2	43 Mm^2
Laminates[103]	5, 375	34	25 Mm^3

Sources: LCE Lifecycle Engineering. 2007[104]

Sector structure

Each product has a distinct set of market dynamics that underpin trends the in the market. The major driver of trends is the set of retailers that control the market, which in turn distribute products to professional

[101] European Carpet and Rug Association. http://www.pro-dis.info/ecra.html?&L=%B01

[102] Cérame Unie. Sector Overview- Wall and Floors Tiles. http://www.cerameunie.eu/en/ceramic-sectors/wall-and-floor-tiles

[103] Data referred to the entire EU production of laminates, not only for floor coverings.

[104] LCE Lifecycle Engineering. 2007. Study for the HFC Criteria Revision and SFC Criteria Development: http://www.apat.gov.it/certificazioni/site/_files/Eco-label/1st%20Background%20Document.pdf

contractors before the products reach consumers. Indeed, consumer demand is generally funneled through at least two points, the retailers and the professional contractors, before it affects the market. The supply chain that links the producers is dominated by intermediaries that include building designers (interior designers, architects, and engineering firms) affect the selection of building materials through building design decisions. Thus, the product group includes products that are generally purchased at several stages along the supply chain between the early stages of the lifecycle and the ultimate consumption by the consumer.

The concentration of companies within the flooring industry varies widely depending on the product. Within some product categories, such as carpets, the industry composition is characterised by a few large industrial producers complemented by many small producers within the fashion industry. Other product categories such as resilient flooring-- which is composed of several sub-categories-- is characterised by a relatively low number of producers.

Trends in the market

The industries that comprise the floor coverings market are increasing characterised by large-scale **internationalisation**. This is especially true in the case of imports, which have now gained significant market share. Production tends to be localised, except in the case of materials sourced from a global supply chain, such as natural fibres, linseed, and wood.

Another major trend is a shift toward **sustainability**. Changes in production technology due to environmental and energy resource have started to make some options more desirable than others, such as the more durable resilient floor coverings. In parallel to this, replacement of materials is drawing on new types of materials, such as bamboo and cork flooring instead of traditional types of wood. Within carpets, nylon, as a raw material, costs 30-40% more than polyester because nylon's largest ingredients are petroleum based, causing polyester to increase its market share. Post-consumer content from recycled bottles is now a major source of the polyester used in carpets.[105] [106] In higher-end developments, there is an increased demand for recycled or reuse of flooring, which also has an aesthetic or design benefit.

This focus on sustainability has driven a **profusion of labelling and external certification systems** to inform consumers and retailers about the environmental performance of products. Some of these systems are tied to building directives and construction laws, which in turn increasingly influences green public procurement patterns. As consumers are increasingly conscious of sustainability issues, more types of materials are developed to address those concerns, and new building certification systems are beginning to embed sustainability into the mainstream design and construction sector. Certification and standards thus exist for source materials, stages of the supply chain, as well as system-focused approaches such as those that determine building standards, either building codes or certification systems.

Life Cycle Analysis – main environmental aspects and key stages of the life cycle of the product

In this section we identify the possible environmental aspects related to the lifecycle of floor coverings. The analysis is divided into two components. The first component outlines the lifecycle of each product, based on reviews of the best available evidence and using a simplified lifecycle analysis (LCA). This evidence is generally derived from studies undertaken by the environmental agencies, academic researchers, and the relevant industries themselves. The LCA analysis identifies 'hotspots' in each of the products, outlining the stages along the product lifecycle that generate the highest environmental impact for each product.

[105] Data refers to American market: http://blog.floorcoveringinstitute.com/

[106] Data refers to American market: http://www.fcnews.net/2011/06/energy-economy-affecting-fiber-usage-nylon-still-king-but-lead-is-shrinking-fast/#comments

Case studies – Floor coverings C4

The second component outlines possible approaches that could be used to reduce the total lifecycle impact in the areas with the highest potential improvement. This second section addresses both products. This analysis is important as it will assist in identifying key factors that could be linked to a set of regulations part of an Ecodesign regulatory measure.

Characteristics of a typical product

Floor coverings are divided into several subcategories. Table 2 below outlines the major production steps of each of the five sub-products in the analysis, and highlights major environmental issues linked to them. Following that, section 1.3.2 specifies key characteristics of each product and outlines the major impact categories linked to the lifecycle of each of the products.

Table 2: Characteristics of a typical production process

Product	Main Production Steps	Major Issues
Ceramic Tiles	Ceramic tiles are produced using a kiln and involves batching, mixing and grinding, spray-drying, forming, drying, glazing, and firing.	➢ potential volatile pollutants contained in the mix of raw materials ➢ energy use in production
Linoleum	Linoleum floorings consist of a hard layer of linoleum compound on a backing cloth of jute. The compound is a mixture of linseed oil, colophonium (a resin from coniferous trees), limestone, ground wood, ground cork, and pigment. Linseed oil and colophonium are oxidised and then mixed with the other ingredients. Titanium dioxide is used as the main pigment. The mixture is pressed with a roller onto a woven backing of jute and dried. It is then finished with an acrylate dispersion layer. The cutting waste is recycled back into the process of the next batch of linoleum.	➢ Fertilizer in the production process ➢ Pigments and dyes could contain harmful substances
Wood	The manufacture of wooden flooring is relatively simple. After felling the trees, the trees are transported to sawmills where barking, sawing to the desired dimensions and drying take place. However some types of wooden flooring would require an intermediate processing/treatment stage. This may include the application of oil or lacquer.	➢ Environmental implications of logging. ➢ Processing could include use of toxic substances ➢ International transport
Vinyl	Vinyl is made from mixtures of polyvinyl chloride, plasticiser, limestone, stabilisers, pigments and other additives. Polyvinyl chloride is made from sodium chloride, ethylene and using electrical power. Some products have a final surface layer of polyurethane. The cutting waste is recycled into other products.	➢ Potentially harmful substances in the materials ➢ Glue or other fasteners used to install vinyl flooring could contain toxins
Carpets	The manufacture of tufted carpet can be split into three processes: 1. Tufting: in this phase of process a multi needled tufting machine is used to form the pile in the backing cloth. 2. Dyeing: the product is coloured unless the yarn was dyed beforehand. 3. Backing: the backing is then coated in adhesive and a foam or secondary backing applied.	➢ Crude oil use in polyester ➢ Dyeing process potentially harmful to employees, and residual dyeing compounds remain in carpet during use ➢ Volatile organic compounds and formaldehyde

Source: Study for the HFC Criteria Revision and SFC Criteria Development, 2007.

The LCA study analysis

Ceramic tiles

The analysis of ceramic tiles is based on a comparative life cycle assessment of flooring materials: ceramic versus marble tiles by Nicoletti et al. (2002).[107] The functional unit chosen was 1 m^2 of flooring tile over a period of 40 years. The study covers the entire life cycle of the two systems, from cradle to grave.

There are three kinds of flooring ceramic tiles: unglazed, double-fired glazed, and single fired glazed. Consequently there are three productive processes which differ in the use of glaze and in the number of firing cycles. In this study the single-fired flooring tiles are assessed.

The impact assessment method is used is CML 2000. Eight impact categories are considered; depletion of abiotic resources (ADP); global warming (GWP); ozone layer depletion (ODP); human toxicity (HT); aquatic toxicity (ECA); acidification (AP); nitrification (NP); photochemical oxidant creation (POCP). Table 3 identifies the contributions of the impact categories to the eco-indicator.

Table 3 - The environmental impact of ceramic tiles

Impact categories	Eco-indicator	Percentage of impact
Abiotic resources	2.53 E-16	0
Global warming	1.93 E-12	46
Ozone layer depletion	8.33 E-15	0
Human toxicity	1.24E-13	29
Aquatic toxicity	1.36 E-13	3
Acidification	6.70 E-13	16
Photochemical oxidant creation	1.46 E-14	4
Nitrification	8.14 E-14	2
Total	**4.21E-12**	**100**

Source: Adapted from Nicoletti et al. (2001)

Global warming potential, human toxicity and acidification are the main impact categories for ceramic tiles. The production phase has the largest contribution to the environmental impact followed by pre-production. The contribution of the production phase to the eco-indicator is due to body forming (40%), glaze production (43%) and production of the glazed tile (43%). The operations of fritting, preparation of the mix body and frit fusion appear as most relevant. The impact categories which are involved in these operations are:

- **Global warming** in the operations of preparation of the body mix (35%) and of firing (36%), due to the relevant thermal energy consumption.
- **Human toxicity** in the operations of frit fusion (37%) and firing (30%), due to the emissions of arsenic and lead in the atmosphere.
- **Acidification** in the operations of firing (41%), preparation of the body mix (22%).

The study excludes the materials used to fix the tiles, because of lack of good quality data and of the equivalency of the two systems (mortar and adhesives), and all the products used for cleaning and hygiene. Nevertheless, the study provides an indicative set of key impact categories.

Environmental impact categories - ceramic tiles: The most important impact categories for ceramic tiles are climate change, human toxicity and acidification, and much of this is related to energy consumption. The life cycle phase with the highest burden is production, particularly the following processes: preparation

[107] Nicoletti, G.,Notarnicola,B.,Tassiell,G, (2002), iComparative Life Cycle Assessment of flooring materials: ceramic versus marble tiles, Journal of Cleaner Production, 10, 283–296

of the body, the fusion of the frit and the firing of the glazed body in the ceramic system. The source of these emissions is found during the thermal processes and in the high quantity of potential volatile pollutants contained in the mix of raw materials.[108]

In terms of potential improvements, the most crucial interventions are among atmosphere emissions (lead emissions and arsenic emissions). Improvements can be achieved in the purification treatments of flue gases. Additional improvements could be achieved with a further reduction of thermal energy consumption.[109]

Linoleum

The analysis of linoleum is based on a study by Gorree et al. (2000).[110] The study was chosen because it provides the most appropriate data that could be identified. While the study is the most complete that could be identified and is useful in identifying impact categories, it lacks sufficient data estimate the relative importance. Nevertheless, the study points to main impact categories.

The functional unit chosen was 2000 m^2 linoleum used in an office or public building over a period of 20 years. For the baseline scenario a 2.5 mm Marmoleum flooring system was considered. Two different systems were considered in the scenario analysis: 2.0 mm Marmoleum, 4.5 mm Corklinoleum.

The CML 2000 impact assessment method was used. Nine impact categories were included in the study: extraction of abiotic resources, climate change, ozone layer depletion, human toxicity, ecotoxicity, photo oxidant formation, acidification, eutrophication and odour. Table 3 shows the contributions of the impact categories to the eco-indicator.

Table 4 - The environmental impact of Linoleum

Impact categories	Eco-indicator	Contribution in total (%)
Ecotoxicity	3.13E-08	85
Photochemical oxidant formation	1.69E-09	5
Acidification	1.32E-09	4
Global warming	7.58E-10	2
Human toxicity	5.71E-10	2
Resource depletion	5.09E-10	1
Odour	3.20E-10	1
Ozone layer depletion	5.69E-11	0
Euthrophication	1.19E-10	0
Total	**3.66E-08**	**100**

Source: Adapted from Gorree et al. (2000)

Ecotoxicity, acidification and oxidant formation are the main impact categories. The production of raw materials is the main contributor for most impact categories. Exceptions to this are ozone layer depletion, where linoleum production is the main contributing stage (64%) and human toxicity, where the contribution of the disposal stage is largest (41%). For abiotic depletion, the contribution of raw material, linoleum production, laying and use is almost equal while for odour the contribution of the laying and use stages almost equals that of the raw materials stage.

[108] Nicoletti et al. 2002
[109] Nicoletti et al. 2002
[110] Gorree, M., Guinee,J.,Huppes,G.,Van Oers,L.,(2000), Environmental Life Cycle Assessment of Linoleum, The international journal of life cycle assessment, volume 7, number 3,

The processes or groups of processes that contribute largely to more than one impact category are:

- The growing of linseed (emissions of NH3, N20, pesticides)
- Gas and electricity used at Forbo-Krommenie B.V
- Oil used for the production of maintenance products
- The transport of raw materials
- The incineration of linoleum
- Coal used for the production of detergents and acrylic dispersions/emulsions

Environmental impact categories – linoleum. Data on the production of maintenance products is not complete. Better data on maintenance products is needed before more conclusions can be drawn on the influence of maintenance. Ecotoxicity, acidification and oxidant formation are the main impact categories of linoleum. The production of raw materials is the main contributor to these categories. Gorree et al. (2000) identified a number of product improvements: using linseed which is cultivated with less fertilizers and pesticides; reducing energy consumption during the production phase; using the most environmentally friendly pigments; linoleum with tall oil has a better environmental performance than linoleum with linseed.

Wood

The analysis of wood floor coverings is based on a study by Nebel et al. (2004).[111] The floor coverings analysed include solid parquet (8 mm, 10 mm and 22 mm thickness), multilayer parquet, solid floor boards and wood blocks (year rings upside). The functional unit is defined as 1 m² of laid wood floor covering assuming average wear and tear in a home that is completely refurbished after 50 years.

The following categories were considered in the impact assessment: global warming (GWP), acidification (AP), eutrophication (EP), ozone depletion (ODP) and photo oxidant formation (POCP), following the CML baseline 2000 method. The use of primary energy is also presented.

Table 5 - Overview of environmental impact of wood floorings

	Solid parquet 8 mm	Solid parquet 10 mm	Solid parquet 22mm	Multilayer parquet	Solid floor boards	Wood blocks
GWP [kg CO2-equivalent]	7.1	5.9	4.4	12.7	0.2	-2.8
AP [kg SO2-equivalent]	0.103	0.113	0.106	0.223	0.064	0.121
EP [kg PO4 3— equivalent]	0.0149	0.0161	0.0149	0.0339	0.0098	0.0189
POCP [kg C2H4-equivalent]	0.2821	0.3576	0.2103	0.4904	0.0808	0.2605
ODP [kg R11-equivalent]	0.0000041	0.0000043	0.0000039	0.0000062	0.0000022	0.0000042
Primary energy [MJ]	534	553	529	917	213	494

Source: Adapted from Nebel at al. (2004)

[111] B. Nebel, B. Zimmer,2 and G. Wegener, (2004), Life cycle assessment of wood floor coverings, Proceedings from IUFRO Division 5, http://www.srs4702.forprod.vt.edu/PUBSUBJ/pdf/04t3.pdf#page=45

It should be noted that this study uses normalised values to represent the entire wood flooring sector in Germany rather than normalized values for each type of wood flooring. Based on the analysis, the following impact categories can be identified:

- **Climate change**: The greatest contribution comes for the stages where the wood is burned (sawmilling, production and thermal utilisation).
- **Ozone depletion**: Laying, surface finishing and refurbishment contribute 44% of the total result for ozone depletion. About one third of the results are from the production of the floorings. All transport processes amount to an average of 13%.
- **Photo oxidant formation**: The POCP of the system under analysis is mainly caused by VOCs emitted from the solvents in the used glues and surface finishes.
- **Acidification**: The NOx emissions are mainly from the provision of energy in the unit processes production and thermal utilisation, where SO2 is mainly from the combustion of fossil fuels for the provision of energy but also from transport.
- **Euthrophication**: In the system under analysis over 90% of the Eutrophication is caused by nitrogen oxides. Since these are also the main contributors to the acidification potential, the relative contributions of the life cycle stages are similar for both impact categories.
- **Primary energy**: Kiln drying and the actual production are the most energy consuming processes.

The energy consumption for cleaning and other related environmental impacts is not included in these figures. No data for the production of an oil and wax finish was available, though the impact of these complementary products would yield important conclusions.

Environmental impact categories – wood. Mainly energy consumption and the use of solvents influence the environmental impacts of wood floorings. The most relevant life cycle stages for the issue of energy consumption are 'production' and for photo-oxidant formation 'laying', 'surface finishing' and 'refurbishment'.

The most important opportunities for improvements are located in the unit processes laying, surface finishing and refurbishment. The POCP result can be reduced significantly depending on the choice of glue and varnish at each of these stages. Results for the energy consumption of kiln drying varied significantly. In particular, the humidity at the starting point has a major influence. Companies that make more use of open air drying achieve lower humidity at the start of the kiln drying and can thus save energy (Nebel et al. 2004).

Vinyl

The analysis of vinyl was based on a study of environmental life cycle analyses (LCAs of PVC) and competing materials commissioned by the European commission, 2004.[112] The study is based on an assessment of existing literature. One of the applications of PVC investigated is floorings. Table 5 shows the energy consumption and emissions for an average PVC floor.

Table 5: Energy consumption and emissions for an average PVC floor

Energy use	**Emissions**
Electricity	8,74 MJ/m2
Fuel oil 1 + diesel	3,2 MJ/m2
Fuel oil 4	1,31 MJ/m2
Plasticiser waste incinerated	0,28 MJ/m2
Emissions to air (not from fuel)	

[112] European Commission. 2004. PVC- Life Cycle Assessment of PVC and of principal competing materials http://ec.europa.eu/enterprise/sectors/chemicals/files/sustdev/pvc-final_report_lca_en.pdf

N-methyl-pyrrolidone	1.4 g/m2
Dioctyl phthalate	0.22 g/m2
CH4	2.77 g/m2
Solid Waste	
Sector specific waste	131 g/m2
Non-sector specific waste	126 g/m2
Hazardous waste	5.2 g/m2

Source: Adapted from environmental life cycle analyses (LCAs of PVC) and competing materials by the European commission, 2004

The study does not explicitly identify the most significant impact categories or life cycle stages for vinyl floors. However, the study emphasizes that the production phase plays a major role for the environmental impacts (i.e. processes from the resource extraction of crude oil and rock salt up to the vinyl chloride monomer (VCM) production).

According to Castro (1992), more than 80% of the energy requirements of cushion vinyl can be attributed to the production of PVC (45%) and plasticisers (35%). While, the environmental impacts of the use phase are mainly due to VOC emissions contained in glue and adhesives used for fixing flooring. Cleaning and maintenance of the floors is not taken into account.

A study by Jönsson (1995)[113] examined the life cycle impacts of three flooring materials: linoleum, PVC flooring and solid wood flooring (pine). Considered in the analysis were production, transport, installation, maintenance, and end-of-life disposal. The functional unit is 1 m². The estimated lifetimes were: linoleum, 25 years; PVC flooring, 20 years; and solid wood flooring, 40 years. Impact assessment was carried out via three different methods: Environmental priority strategies in product design (EPS), CML (1992), Ecological scarcity.

Environmental impact categories- vinyl. The studies analysed did not explicitly reveal the most relevant impact categories and life cycle stages for vinyl floors. However, we can infer based on the available literature that energy consumption and climate change are two important impact categories. Life cycle stages which are important relative to these impact categories are production of PVC as well as incineration at the end-of-life.

To improve product performance from a product related life cycle perspective, it would generally be favourable to increase the amount of recycled PVC entering new life cycles.[114]

Nylon and Wool Carpets

The analysis of carpets is based on an LCA study by Bijleveld & Sevenster (2010) on Belgium carpets.[115] The focus of the study is on energy consumption and climate change, of the raw materials used in carpets. The raw materials analysed were wool, cotton, and polymers PP and PA. ReCiPe (2008) endpoint method was the impact assessment used. Table x shows a comparison between nylon and wool based on two impact categories.

Table 6 - Climate change and energy consumption comparison of primary raw material

	Nylon	**Wool**
Climate change	9.74	68.58

[113] Jonsson,A, Tilmann,A-M,Svensson,T.,(1996),Life cycle assessment of flooring materials – case study, Building and environment, 32, 3

[114] European Commission 2004.

[115] Marijn Bijleveld, Maartje Sevenster, (2010),The environmental impact of the Belgian carpet supply chain, CE Delft publications, (in Dutch)

(CO2 eq/Kg)		
Energy consumption (MJ/Kg	132.8	514.1

Five impact categories were dominant for the environmental impact of raw materials: fossil fuel depletion, land use, particulate matter formation, climate change (ecosystem), and climate change (human health). For nylon based carpets fossil fuel depletion and climate change (human health) were the most important impacts whereas for wool land use and climate change (human health). The study identified raw material acquisition as being the most significant life cycle stage relative for the total environmental impact. According to a study by Peterson & Solberg (2004), the worst flooring based on GHG emissions was found to be wool carpeting followed by polyamide carpeting.[116]

Environmental impact categories- carpet. The number of LCA studies was very limited. There is not enough information to make a definitive statement on the main impacts. Nevertheless, based on the available information it would appear that climate change and energy consumption are two important impact categories.

Analysis of applying the MEEuP method for floor coverings

This section assesses the appropriateness of the Ecodesign was the comparison of the LCIA presented earlier with the MEEuP-based approach would have on floor coverings. The analysis indicates a number of key issues and missed opportunities resulting from a possible use of the MEEuP methodology in the case of floor coverings. They are presented here by topic and the associated impact category, and summarised in table 7 to demonstrate the limitations of the method.

Overall, the MEEuP approach has the following shortcomings related to this product category:

- The postconsumer waste would not have been accounted for. Waste is also not well reflected in other LCA methods and it is usually analysed separately as an add-on indicator;
- The water use in the use phase would not have been accounted for. We expect this to be a severe shortcoming especially for hard floor coverings considering that the impacts related to maintenance and cleaning are considered to be significant;
- Human toxicity and eco-toxicity would not have been very well accounted for.

For bio-based products i.e. Linoleum, wood and wool:

- Land use impacts would be lost using the MEEuP method. This includes indirect land use change as well as loss of biodiversity;
- The MEEuP method does not provide guidance on how to deal with CO2 emissions (climate change) as a result of land use change. Additionally, it is not clear how the method deal with biogenic carbon uptake. This is particularly relevant for wood, which is a carbon sink, until it is incinerated;
- Water use impacts in the production phase of raw materials would also be missed. The MEEuP method only takes into account total volumes of processing water and does not include water scarcity measures;
- Impacts related to the use of pesticides would not be accounted for since toxicity in the MEEuP method focuses primarily on metals;
- A shortcoming of the MEEuP method is how it deals with allocation issues. A sheep, for instance, produces wool in addition to meat, and the allocation of impact between the carpet industry and

[116] Ann Kristin Petersen and Birger Solberg, (2004), Greenhouse Gas Emissions and Costs over the Life Cycle of Wood and Alternative Flooring Materials, CLIMATIC CHANGE, Volume 64, Numbers 1-2, 143-167

the meat industry remains a point of contention. There is no clear guidance on how to allocate the environmental impacts amongst different products.

Table 7: Summary table- Environmental Impact Categories and relevant lifecycle stage

	Most relevant impact categories	Most relevant Life cycle stage(s)	Implications of using the MEEuP
Ceramic tile	Climate change Human toxicity Acidification	Production - Preparation of the body - Fusion if the frit - Firing of the glazed body	➢ Toxicity only limited to metals and does not include a fate and exposure step
Wood	Energy consumption Photo-oxidant formation	Production - Kiln drying Use - Solvents - Fixing/laying	➢ No guidance on biogenic carbon uptake. ➢ Fate and exposure step is missing for VOC's. ➢ Land use not included.
Vinyl	Climate change Energy consumption	Production - Vinyl End-of-life - incineration	➢ No energy reclamation at the end-of-life
Linoleum	Eco-toxicity Acidification Photo-oxidant formation	Raw materials - Cultivation of linseed	➢ Land use not included. ➢ Water use not well addressed. ➢ Toxicity only limited to metals and does not address pesticide use. No guidance on biogenic carbon uptake.
Wool	Land use Climate change	Raw materials - Production of wool	➢ No guidance on how to allocate environmental impacts amongst different products. i.e. wool is a by-product
Nylon	Fossil fuel depletion Climate change	Raw materials - Production of Nylon	➢ Insufficient data

As outlined in Table 7, the production of the materials is influential for environmental results, but the use phase related to installation and maintenance may influence the results more significantly. Hence, studies that neglect floor laying and possible maintenance or service of the applications are inconclusive, and it appears that there are significant gaps on the impact of the laying process, including in the range of fastening and adhesive choices that could potentially affect the environmental impact of flooring choices.

Although a study on maintenance was identified (Paulson, 1999), more detailed information about maintenance and cleaning processes is required to provide an estimation of the impact.[117] In spite of the lack of detail, it is nevertheless possible to identify the significance of the installation method as an impact category.

The initial analysis of the appropriateness of using Ecodesign approach to address the environmental impacts of floor coverings leads to a number of conclusions:

[117] PAULSEN, J., (1999), Life Cycle Assessment For Building Products - With Special Focus on Maintenance and Impacts from The Usage Phase, TRITA-BYMA, Royal Institute of Technology - Sweden.

- The MEEuP approach misses many of the non-energy related impacts, such as toxicity and VOC exposure;
- MEEuP is not effective for natural products due to difficulty of full lifecycle analysis with land use issues;
- Significant failure to take post-consumer and recycled products into account (wood, vinyl, carpets, linoleum, ceramic tiles);
- Extension of product durability not taken into account;
- Existing technology could be better leveraged through regulations;
- International dimension undermines efforts in Europe; risk of outsourcing unsustainable practices;
- Standardisation and R&D/ innovation efforts are currently being pursued;
- Little is known about the performance and relevance of the use phase of the various flooring options. For instance, carpets could possibly demand electricity and filter materials due to vacuum cleaning, and this produces solid waste. In comparison, many hard applications require water, solvents, and chemicals for wet cleaning and produce waste water. A comprehensive analysis of this subject is recommended. In general, there is little LCA information about carpeting, a main type of flooring application. Moreover, the relative contribution of particular flooring types to indoor air quality is a significant human factor that is not linked to the MEEuP approach.

Improvement potential for flooring products

Creating a general set of minimum standards is limited by the range of materials used to develop flooring products. While the functional use of the various flooring materials is similar (but not in all cases), the material and production inputs across the various categories creates a disparate set of environmental impacts.

Nevertheless, on the basis of the life cycle analysis conducted, the key/priority areas that an Ecodesign based regulation could focus would be related to the various impact categories. On the basis of the analysis provided, a number of areas for improvement potential for the various types of floor coverings can be identified. At the product design level, the main possible areas of product improvement include:

- Standards to promote the use of sustainably-sourced materials;
- Standards to minimize the material input and amount of waste in the production process;
- Materials requirements in the case of processed or manufactured flooring;
- Installation standards to reduce the toxicity and other impacts of fasteners and sealants;
- Indoor air quality standards, including limiting formaldehyde emissions and volatile organic compounds (VOC);
- Maintenance standards regarding cleaning detergents and solvents, and extended product durability;
- End-of-life requirements including reuse and enhanced recyclability.

Current Policy framework - Review of existing policy tools

The products examined in this case study are covered by a number of mandatory and voluntary policy initiatives/tools at the European level, extending from measures on particular materials up to measures to influence the choice of materials in the design of buildings. These have been analysed from the perspective of the key environmental impact and the respective life cycles stages addressed. A summary table is included. We included instruments that address environmental impacts at an international, European, and member state level.

It is important to note that member state regulations continue to be among the most important instruments from the perspective of the industry in spite of the actions taken at the European level. Within some sectors of the flooring industry, the standards set by the largest member states function as *de facto* European standards, although in some cases these member state regulations overlap and cause difficulties for producers. This is especially true of industries that are concentrated in particular regions (e.g. ceramic tiles in southern European states, carpet in Belgium and the UK).

Regulatory instruments

The following section outlines the main European initiatives to reduce environmental impacts covering flooring products.

IPPC Directive -The IPPC Directive requires producers of industrial or agricultural products causing pollution to receive a permit. They will receive this permit only if certain environmental conditions are met. The Directive requires that producers fulfill certain obligations such as employing best available technologies, prevent, recycling and disposing waste and preventing large scale pollution. The specifics of the Directive require that applications for permits will be addressed to the authorities of the member state concerned. The information regarding the specific applications must be made publicly available and parties involved must be allowed time to react and to have their opinions taken into account.

The Construction Product Directive (repealed by Regulation (EU) N. 305/2011) - The Construction Product Directive (CPD) aims at remove any obstacles to trade between member states of the European Union and ensures free movement of construction products. This should be achieved through a harmonization of national legislative systems in respect to requirements to these product groups in relation to health and safety. The CPD ensures that European producers face a system harmonized technical specifications. These technical specifications will be set out the EU standardisation bodies CEN and CENELEC.[118] Furthermore the Directive has developed an Attestation of Conformity ensuring that all member states share the same attestation levels for similar products. **Regulation (EU) N. 305/2011** was introduced in March 2011 and repeals the CPD and strengthens the initiative by creating a regulation that sets out basic requirements for products and regulates the **full life-cycle of the construction products**. This include requirements within mechanical resistance and stability; safety in case of fire; hygiene, health and the environment; Safety and accessibility in use; protection against noise; energy economy and heat retention; Sustainable use of natural resources.

Regulation (EC) N. 1907/2006 (REACH) -This mandatory regulation concerns the registration, evaluation, authorization, restriction of chemicals and establishes a European Chemicals Agency. The legislation covers substances and mixtures contained in floorings and it was introduced in 2006. A new version of the legislation has been adopted in May 2011 containing 12 amendments. The implementation of REACH is in progress until 2018 and the regulation is not conducted through standardisation. A present a review of the legislation is being conducted analyzing the costs of implementation as well as the impact on competitiveness and innovation of companies within the EU. The review is due to be finalized in 2012.

Regulation (EC) N. 1272/2008 -The regulation covers classification, labelling and packaging of substances and mixtures contained in floorings. The regulation was introduced in 2006 and adapted twice. A new version is expected to be published in 2011.

The revised ETS directive 2009/29/EC- Floor covering materials are subject directly or indirectly to the European Union Emissions Trading System. This means there is a "cap", or limit, on the total amount of certain greenhouse gases that can be emitted by the factories, power plants and other installations in the system. Within this cap, companies receive emission allowances which they can sell to or buy from one another as needed. The limit on the total number of allowances available ensures that they have a value.

[118] EN 14041:2004 covers “Resilient, textile and laminate floor coverings - Essential characteristics”

Energy Efficiency in Buildings (Directive 2010/31/EU- recast of 2002/91/EC) - The Directive covers the energy performance of buildings. Specifically, it sets requirements for construction products that are developed to ensure energy efficiency of buildings. The Directive on energy performance of buildings (2002/91/EC) was the main legislative instrument at EU level to achieve energy performance in buildings. Under this recast Directive, the Member States must apply stronger minimum requirements as regards the energy performance of new and existing buildings, ensure the certification of their energy performance and require the regular inspection of boilers and air conditioning systems in buildings.

Member States' initiatives - In addition to the mandatory requirements from the EU bodies, mandatory national requirements exist. In **France** the **decree N. 2011-321** covers labelling of construction products including floor coverings. The main issue regulated in this piece of legislation is the Emissions of Volatile Organic Substances (VOCs). In **Germany** VOCs in relation to floor coverings is also covered through the **AgBB system**. In **Spain**, the decree of Eco-efficiency 21/2006 makes it compulsory for construction products to comply with European Eco-label or European label type III (Environmental Product Declaration, EPD) to be used in a new building.

Voluntary standards

Besides the mandatory legislative requirements that companies will have to follow to legally introduce their products to the market, a range of voluntary requirements and labels exist. The following section will introduce some of the most prominent.

European Eco-label - The European Eco Label was established by the European Commission in 1992 as a voluntary scheme to promote companies to market products that take environmental concerns into consideration. The Eco-label flower, awarded to products complying with the standard, is given on the basis of a thorough analysis of the product characteristics, life-cycle analysis and impact assessment. The idea behind these ecological criteria is to create a label that consumers can trust and ensures that a certain products meet high environmental and performance standards. The Eco-label has been expanded in recent years and covers now both products and services and is part of a broader scheme on Sustainable Consumption and Production and Sustainable Industrial Policy adopted by the Commission on July 16th 2008.

The European Commission established the criteria for the floor covering product groups in 2009. Hard floor coverings, textile floor coverings and wooden floor coverings all fall under the Eco-label and require that the products live up to a range of different requirements related to the production, use and to a certain extent the disposal phase.[119] More specifically the label ensures compliance with requirements on extraction and selection of raw materials, packaging, and consumer information among others. The waste management and disposal phase of the products is not as heavily covered for textile and wooden floor coverings as for hard coverings.

The Blue Angel - The Blue Angel label is one of the oldest labels related to the environmental impacts on products and services. It was created in 1978 by initiative of the German government. The label aims at highlighting positive environmental features of products and services and today about 11,500 products and services from 90 different product categories carry the label. Products that carry the Blue Angel Label compared to products that do not have less impact on the environment, conserves resources during production, require less resources in use and production, do not contain harmful substances to the environment or health while at the same time performing their functions on a high quality level.[120]

[119] Water and energy consumption during manufacturing are limited, residues of dangerous substances for health and the environment are minimized, harmful emissions to air and water are limited, the product includes waste management instructions.

[120] http://www.blauer-engel.de/en/blauer_engel/index.php

The label covers a range of different products groups including construction materials. Within the category of construction materials some categories of floor coverings are covered.[121] The Directive states that the materials used in those products must not pose a risk to the indoor living environment. Furthermore products should mainly be made from wood as it is a renewable material.

Besides the voluntary labels already mentioned a range of national and regional labels exist. The aims of these initiatives resemble the aims of the above mentioned labels.

The **Nordic Eco-label** covers products within the five Nordic countries and besides environmental concerns the label also set specific climate change related requirements. The label complies with ISO requirements and a survey recently showed that in the Nordic countries 94 % recognized the label. The Nordic Eco-label covers wood, bamboo and textile floor coverings. The **Austrian Eco-label** also contains provisions for floor coverings. It covers in total 32 products categories and was introduced in 1990 covering both goods and services. This label awarded based on a life-cycle analysis. The aim of the label is to offer consumer information on the point of sale. The **Czech Environmental Eco-label** also deals with hard floor coverings and is an example of another national initiative. Other national voluntary initiatives also exist concerning indoor air quality in for example **Finland** with the standards developed by the Finnish Society of Indoor Air Quality and Climate (FiSIAQ) and in **Denmark** and **Norway** with the Indoor Climate Label.[122] In **Germany** a group of manufactures of flooring installation products developed the EMICODE system that is based on test chamber procedures and classification criteria. **Error! Bookmark not defined.** The Association of Environmentally-Friendly Carpets, also from Germany, developed the voluntary GuT standard in 1990 that prohibits the use of certain substances.

Other Instruments

Environmental Technologies Action Plan - The Environmental Technologies Action Plan serves the purpose of promoting environmental technologies within the European Union. The aim of the plan is to reduce dependence on natural resources, spur economic growth and improve the quality of life. The purpose of the action plan is to remove obstacles in applying the most efficient environmental technologies and in the process to include all relevant stakeholders. By improving the efficient management of resources and a reducing the energy consumption cost will decrease and competitiveness will increase while ensuring fewer emissions and less waste. In achieving these goals the aim of the action plan is to get the environmental technologies from the laboratories to the market and to crate market conditions that promote the adoption of these technologies. Furthermore it is desired to promote the environmental technologies at the international level.

Industry Initiatives- The industry associations point out that although there is not a formal initiative in place, market pressures and industry trends are driving a general movement toward sustainability. This is supported by the creation and close interaction with **research and development** and new initiatives to connect materials research to the market place, including actions at the member state level and European

Retailers have a strong influence over the environmental standards in the industry and occupy a key position in the supply chain. In some cases, retailers have used their market position to generate significant changes in the industry.[123]

Standardization (ISO/CEN). The most significant changes at an industry level are being driven by the international standardisation process already underway through ISO/ CEN. Although notably slower than a regulatory approach, the standardisation approach is developing international set of standards and would also be more in line with innovation in the industry. Under the CPD Directive and the EU standardisation bodies, the standards for flooring products have been harmonized. For the floor covering industry, this has

[121] Wood flooring, laminate flooring, textile flooring, flexible floor coverings
[122] http://www.nrc-cnrc.gc.ca/obj/irc/doc/pubs/rr/rr204/rr204.pdf
[123] We are awaiting for examples from the relevant industry associations.

been a positive experience and there is a strong commitment to continue the process. As it stands, a range of various standards have been developed all organized through the **horizontal** CEN approach. Some of the standards covering floor covering products include:

- EN 14041 - covering essential characteristics of resilient, textile and laminate floor coverings
- FprEN 15978; Sustainability of construction works- Assessment of environmental performance of buildings
- FprEN 15804 Sustainability of construction works- Environmental product declarations- Core rules for product category and construction products
- EN 14342 - covering characteristics, evaluation and marking of wood flooring
- EN14111 – definitions, classification, characteristics and marking of ceramic tiles
- EN 14904 – specification for surfaces for sports areas and multi-sport use

Building Rating Systems: Finally, several industry-led and government-supported **building rating systems** are influencing the use of materials in design, construction, and in some cases when considering renovations and retrofits to existing buildings. The international Leadership in Energy & Environmental Design (LEED), common in North America but growing in Europe, and the Building Research Establishment Environmental Assessment Method (BREEAN) system more common in the UK, have created a set of design standards that are increasingly tied to incentives programmes and government procurement policy, as well as increasingly in demand by the market.

Table 8 – Existing policy tools and main environmental impacts

No	Name of regulation	Main aspect regulated/addressed
Raw Materials		
	Eco Label (hard floor covering only)	Material inputs, sustainable sourcing
	National labelling schemes	Certification of sustainability, absence of toxicity (lead)
Production phase		
	IPPC Directive	Mutual acceptance of national regulations, various aspects; sustainable use of natural resources.
	Environmental Technologies Action Plan	Research and development/commercialization of newer, more sustainable flooring materials
	French Decree N. 2011-321	Design of flooring materials
	Building rating systems (LEED , BREAM)	All aspects of flooring
	Germany AgBB system	All aspects of flooring, including VOC and toxicity
	European Eco-label	Covers toxicity and energy consumption
	REACH (Regulation 1907/2006- Registration, Evaluation, Authorization, and Restriction	Toxicity and eco-toxicity of chemicals used during the production of chemicals
	CEN/TC350 (various)	Assessment of environmental performance and EPD related to various impact categories
	EU ETS	Carbon emissions
Use phase		
	Energy Efficiency in Buildings	Efficiency of product, contribution of home energy use
	The Construction Product Directive	Attestation of Conformity with various aspects, including hygiene, health and the environment; energy efficiency;

No	Name of regulation	Main aspect regulated/addressed
	CEN/TC350 (various)	Assessment of environmental performance and EPD related to various impact categories
	Various national systems	Various aspects of toxicity, contribution to energy efficiency of buildings, VOC
End-of-life		
	Eco-label	Disposal standards
	Building rating systems (LEED and BREEAM)	Lifecycle approach to various aspects of flooring
	Waste Directive	Disposal and landfill standards
	Construction Products Directive	Disposal and landfill standards

Conclusion

The floor coverings product group is a diverse and complicated set of individual industries, with different sector dynamics, material inputs, manufacturing processes, installation needs, and thus diverse impact categories. Due to the range of material inputs—ranging from biotic materials found in nature as well as produced commercially to processed chemicals—the range of regulations that apply to floor coverings is necessarily broad. The table below outlines regulations identified as being relevant to the floor coverings product group.

Policy Analysis

Description of a possible Ecodesign regulatory measure

On the basis of the life cycle analysis conducted, the key/priority areas that an Ecodesign based regulation could focus would be related to the various impact categories. On the basis of the analysis provided, a number of areas for improvement potential for the various types of floor coverings can be identified. At the product design level main possible areas of product improvement include:

- Standards to promote the use of sustainably-sourced materials;
- Standards to minimize the material input and amount of waste in the production process;
- Materials requirements in the case of processed or manufactured flooring;
- Installation standards to reduce the toxicity and other impacts of fasteners and sealants;
- Indoor air quality standards, including limiting formaldehyde emissions and volatile organic compounds (VOC);
- Maintenance standards regarding cleaning detergents and solvents, and extended product durability;
- End-of-life requirements including reuse and enhanced recyclability.

Moreover, in spite of the heterogeneity of the products that compose the floor coverings category, Ecodesign standards could include generic product requirements for a life cycle analysis, developing the ecological profile of the specific product, and identifying alternative options against benchmarks. This generic requirement could be combined with a requirement to provide information to consumers on the key aspects related to these products

Definition of alternative options

Against the possible coverage under an Ecodesign Directive IM the industry discussion point to a number of alternative options.

Business as usual - The business as usual scenario includes a combination of existing market forces that are increasingly dominated by building standards and certification schemes, toxicity related regulations, and

other existing European actions to address sustainable production and indoor air quality. This option would also involve supporting or at least avoiding duplication of effort with regards to the international standardization process already underway through the ISO/CEN process. Various working Groups have been created to facilitate the standardization process, including WG 7 "Sustainability issues for ceramic tiling systems" as well as other flooring-specific groups.

Although notably slower than a regulatory approach, the standardization approach would have the benefit of creating an international set of standards and would also be more in line with industry practice. Members from the floor covering industry favor the use of already established challenges in working towards developing requirements for aimed at securing energy efficiency. CEN and other established standardization bodies are already in place and in order to avoid undermining the effects of these current standards, new systems would be implemented in such a way as to avoid overlap or avoid stalling the standardization process.

Moreover, a business as usual approach could potentially include the various measures affecting floor coverings to continue, including certification systems for the supply chain as well as at the building level.

Mandatory labelling or other mandatory information scheme could include the labelling of products on the various floor products. This would be in addition to the existing labelling efforts at the European and national levels and could involve repealing or making redundant (through 'crowding out') existing labels at the national and European level.

Voluntary agreement in the context of Ecodesign – This would see the industry self-regulate along the lines outlined in the description of the regulatory measure outlined above, but would be based on industry self-regulation and would require the support of key stakeholders in the building design and construction industry.

Financial instruments- Financial instruments could include the increased use of research and development initiatives, commercialization tools, and procurement tools linked to sustaining the market for sustainable floor coverings. Instruments could also include developing a system with member states to issue home renovation/ construction tax credits to individuals that use flooring types that meet certification standards. Because the products under consideration are linked to residential use, the impact of financial tools appears to be an indirect approach.

Assessment of alternative options

The criteria used for comparing the Ecodesign requirements against the alternative options were:

- The expected effectiveness of the measures in bringing improvements;
- The costs involved;
- Ease of implementation (including the use of the MEEuP methodology);
- Impact of any necessary changes to existing Ecodesign requirements.

From the implementation point of view, the establishment of some of the above eco-design requirements could help address issues such as minimum performance, material selection, and enhanced product recyclability at the end-of-life stage. The main differences exist at the degree of intervention and the time frame in which the desired changes would be reflected in the floor coverings industry. Moreover, in terms of a generic requirement – establishing requirements for some form of simplified LCA, the development of an ecological profile and consideration of alternative certain aspects of the life cycle appears feasible – a minimum requirement appears to be feasible. Such an analysis would be especially important in the case of raw materials and could potentially push producers to introduce changes in the requirements to suppliers to improve certain aspects.

One limitation is related to price and the capacity of the industrial base to respond to the new requirements without increasing costs to consumers. In all product categories, there are various best available techniques (BAT) that could be used to improve environmental performance. Pure market pressure is driving some producers toward sustainability, and this trend is being reinforced by the increasing popularity of building performance testing and a heightened awareness by consumers, building professionals, and retailers. However, this development is occurring at different speeds across industries but also within some industries, with differences among particular producers. In this sense, a mandatory requirement such as an Ecodesign requirement could be of significant advantage for focusing the industry on improving product performance.

However, some solutions require advanced technologies, high capital outlays, or are currently not scalable to SMEs. Therefore, a careful preparatory study would be required to understand the various impacts to creating both generic and specific requirements.

There are several key issues related to any potential option regarding floor coverings. In addition to the general trend toward sustainability already underway in the marketplace, further consideration of the existing patchwork of regulations and labelling schemes. Based on the existing sets of measures in place and the current Ecodesign system, a series of considerations would need to be taken into account. These are explained below.

Linkages to labelling measures. With the Ecodesign Directive, the EU Commission would be introducing a new regulatory requirement to a market where a significant amount of mandatory and voluntary labels exist. These requirements are both in the form of standards, Directives and information labels. According to industry representatives, a total of 350 labels within this field already exist and some members of the flooring industry organizations have around 20 labels to consider. Furthermore, not all labels are the same in terms of scope. Some labels cover only one single feature of a product, while others are designed to be more comprehensive. It is generally the concern for the industry that “over-information kills the information” and concerns have been raised that consumers and building professionals will be overloaded with information that counteracts the actual purpose of information, which is to provide information. In this respect, a single set of requirements could offer an advantage by phasing out or making redundant many of the labels that currently exist.

Functional Unit. In the case of floor coverings, the flooring type (that is the material) generates the differences in environmental impact categories. Creating a generic standard for ‘floor coverings’ could yield less benefits than taking a ‘material-specific’ approach and regulating the individual flooring types.

National legislation. The flooring industry faces various mandatory requirements from different countries within the EU, most notably the German and French systems. Alongside the issue regarding the wide range of labels and voluntary requirements, the lack of harmonization between these systems is a concern in particular for the part of the flooring industry. It is unclear if a harmonized EU system would be in a position to replace the national systems already in place, though a European approach could offer advantages through a single regulator and less fragmentation.

Standardisation. In general, the industry favors the introduction of requirements through already established channels of standardisation. The ISO/ CEN standardisation bodies are already in place and have produced clear improvements that are international in scope. A system within the ISO/EN standards is in place where the EU is cooperating with other large markets such as Japan and the US in order to move towards common standards. It is the belief that once such standards are in place other markets, such as the BRICS, will align with the prevailing standards. The process of developing and setting standard is slow but is often more dynamic than regulations, which risk conflicting with industry standards. In this sense, the introduction of an eco-labelling approach could have the detrimental effect of delaying or pulling attention away from the ISO/CEN process. However, information-provision requirements as part of a generic

requirement could be used to support and reinforce the standardization process. This could include supporting the diffusion of ISO/CEN standards to regions or sectors that are non-compliant.

Existing EU regulations. The industry supports the Construction Products Regulation and the REACH initiative, and many products are already covered by the **Regulation (EU) N. 305/2011** (This repeals the Construction Production Directive). An additional regulation would need to address areas that are not yet covered, or risk duplication. The proliferation of European level regulations is reinforced by the mixed signals from the Directorate-Generals legislating within the areas covering flooring products. From the perspective of the industry, the DGs appear to be addressing similar issues independently of each other. DG Enterprise appears to focus on construction and the REACH Initiative, while DG SANCO focuses mainly on indoor air quality. DG Environment appears to address many of these issues with an entirely different set of concepts (for example, eco-toxicity rather than the provisions found in REACH). According to the industry representatives, multiple and in some cases overlapping regulations creates a burden for the industry without adding to environmental performance.

System performance approach. To achieve the desired benefits, several of the floor covering stakeholders favour environmental requirements that focus on the holistic performance of a building and not on any specific construction products, since the efficiency of one product does not ensure the efficiency of the whole building. Building-level Lifecycle Analysis is a growing trend and several national systems are in place either through the building code or external certification. However, it should be noted that according to the IMPRO[124] studies, the total impact of flooring is limited in terms of the environmental impact of a dwelling during the use phase, with much of the overall contribution of flooring to the environmental impact of a house coming during the construction phase. It is difficult to identify overlap between Ecodesign requirements and building performance approaches; however, the synergies between them could create powerful incentives for improvements. Ecodesign Directive requirements could be used as minimum requirements for building codes, drawing on the example of the Spanish Eco-efficiency 21/2006 initiative, which requires builders to comply with eco-labelling provisions.

Need for more standardized and stronger LCA. Extending the Directive to certain products without first developing the scientific evidence base could cause arbitrary discrimination, and threatens to impose costs on the industry without improving product performance. As is clear by the analysis of the impact of the MEEuP with regards to the individual material sources that make up flooring, the current MEEuP is limited and several relevant impact categories are left out. In the absence of a rigorous and evidence-based LCA, an extension of the Directive should not be considered.

Table 9- Summary table of assessment of Ecodesign-based requirements against alternative options

Option	Effectiveness	Costs (for industry and authorities)	Ease of implementation	Impact on other EU product policies including existing Ecodesign
Ecodesign requirements	Likely to accelerate current market trends	Costs for development of research studies and consultation. Significant compliance cost to industry	Need to develop new standards. Significant monitoring costs	Significant revisions to the MEEuP.
Business as usual	Gradual improvement in line with market pressures	Medium costs to industry and public certification scheme	Existing system requires further development On-going	Little impact

[124] http://ftp.jrc.es/EURdoc/JRC46667.pdf

			standardization process in industry	
Mandatory labelling	Little change from current	High cost to industry, transfer of resources to labelling agencies	High administrative costs, additional costs for industry	Little impact
Voluntary agreement	Gradual but inconsistent improvement	Planning costs nearly equal to regulation for industry, plus additional monitoring costs	Very difficult due to fragmented market and risks of substandard imports	Little impact
Financial instruments	Long term change, medium impact	High costs to authorities, transfer of resources to industry	Low, straight-forward expansion of existing programmes	Little impact

Initial conclusions from the case study – lessons in relation to the broader product group

The floor coverings product group is a diverse and complicated set of individual industries, with different sector dynamics, material inputs, manufacturing processes, installation needs, and thus diverse environmental impact categories and range of opportunities for improvement. The impact profiles within this small set of housing products reveal that the wider category will likely have equally strong variation with respect to environmental implications and effectiveness of certain instruments. The examination of floor coverings suggests that several opportunities exist to leverage existing frameworks, though important considerations would need to be addressed before implementing new measures.

The BIO IS report identified that the use phase was the most significant aspect of energy consumption and other environmental impacts generated from housing.[125] It also found that the construction phase was significant and that the end of life was of less importance. However, these findings appear to differ from the profile of floor coverings, as the use phase is almost unaffected by flooring. Where the floor coverings had a more significant impact was in the construction phase. Thus, a regulation designed to target the broader category would need to take into account the differing impact profile. This difference is reinforced by the differences that exist between product types.

The initial analysis of the appropriateness of using the Ecodesign approach to address the environmental impacts of floor coverings leads to a number of conclusions. A primary finding is the MEEuP approach that forms the basis of the current scope of Ecodesign would require revision. Thus, for many of the products likely to be grouped within the housing products category, the MEEuP approach would be similarly inappropriate and would need revision. Building certification and standardisation appear to be driving improvements, and these could be supported through narrower, tightly designed initiatives under an Ecodesign measure.

Moreover, biotic materials (or bio-based materials) would need to be properly addressed with a strengthened LCA approach, as they are used in many housing products is related to major impacts occurring before the time raw resources are transformed into the inputs that eventually constitute the final consumer products. Linseed, wool, and wood based products would require standards that are specific to natural fibers. While an Ecodesign approach appears feasible, it would need to be tailored to the type of

[125] Bio Intelligence Services. 2010. Technical support to identify product categories with significant environmental impact and with potential for improvement by making use of eco-design measures.

material and not the type of product or application. In this respect, generic requirements could be more relevant.

An Ecodesign measure to shift to post-consumer or certified organic materials or to reduce the quantity of material used could have an impact in some cases. The failure to take post-consumer and recycled products into account (wood, vinyl, carpets, linoleum, ceramic tiles) runs counter to efforts to increase the recyclability of home products, which is consistent with trends in the broader home products category. Consumer and market pressures, along with changing preferences, are dictating that post-consumer material be considered as first options in many construction projects. This shift would need to be emphasized in a new Ecodesign standard.

Another major issue is linked to the increasingly globalized supply chain of many home products. This is true for floor coverings and is increasingly the case for many home products, especially those that have more than one step along the production chain (e.g. in cases where more than one source is used, and the manufacturer is based outside Europe). Thus, effective market surveillance systems will need to be implemented, adding financial costs to public authorities as well as compliance costs to industry while providing a potentially accelerated timetable to the existing trends in the floor coverings market.

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CASE STUDY 5: PASSENGER CARS

Product category overview

Passenger cars have been selected to represent the mode of transport sector in the study. The transport sector accounts for 33% of the final energy consumption in the EU and contributes with 41% of ozone precursors, 32% of particulate matter, 20% of acidifying substances and 19% of greenhouse gases. Overall transport in Europe has a severe impact on the environment and current trends which is expected to increase. Road transport is the most dominant transport mode, representing 82% of the total energy consumed in the transport sector in 2007, while cars accounted for 83.4% of all passenger transport.

The product scope in the case of passenger cars is based on the definition of passenger cars according to annex II of Directive 2007/46/EC referring to category M - Motor vehicles with at least four wheels designed and constructed for the carriage of passengers. Category M includes three subcategories:

- Category M1: Vehicles designed and constructed for the carriage of passengers and comprising no more than eight seats in addition to the driver's seat.[126]
- Category M2: Vehicles designed and constructed for the carriage of passengers, comprising more than eight seats in addition to the driver's seat, and having a maximum mass not exceeding five tonnes (Vans).
- Category M3: Vehicles designed and constructed for the carriage of passengers, comprising more than eight seats in addition to the driver's seat, and having a maximum mass exceeding five tonnes (busses).

Category M1 corresponds to passenger cars (as provided by ACEA), although there is some deviation in relation to the data from PRODCOM and the COMEXT where the limit set for passenger cars is 10 passengers.

Market analysis

Market data

According to ACEA data, the total number of registrations of new passenger cars in 2010 was 13,360,599. The production of passenger cars inside Europe in 2009 was 13,948,124 vehicles, reduced from 17 million in 2007. According to Eurostat data, the EU has a positive trade balance in the case of passenger cars, that in 2008 was close to 2.8 million net exports of units (3 million imports against 5.8 million exports) and in 2009 it was around 1.2 million units (2.3 million imports against 3.5 million exports).[127] The total car fleet in EU23 (excluding Bulgaria, Romania, Malta and Cyprus) in 2008 was close 223 million cars with an average car age of 8.2 years.[128] [129]

[126] Relevant ISO standards: AA Saloon ISO Standard 3833-1977, term No 3.1.1.1, but including also vehicles with more than four side windows. AB Hatchback Saloon (AA) with a hatch at the rear end of the vehicle. AC Station wagon ISO Standard 3833-1977, term No 3.1.1.4 (estate car) AD Coupé ISO Standard 3833-1977, term No 3.1.1.5 AE Convertible ISO Standard 3833-1977, term No 3.1.1.6

[127] http://www.acea.be/images/uploads/files/20100518_2010_KEY_FIGURES_5_Trade.pdf

[128] http://www.acea.be/images/uploads/files/20100427_EU_Motor_Vehicles_in_Use_2008.pdf

[129] The life cycle studies typically refer to a life cycle of 10-12 years.

Supply chain structure

The passenger cars market is rather concentrated in comparison to other consumer products' sectors. The brands produced by the four larger manufacturers represent more than 50% of the total market, while in 2010 the ten larger manufacturers controlled 94% of the EU passenger cars market. Almost all car manufacturers – European or not – are multinational companies with market presence and production facilities across the globe.

Furthermore, a key element of the sector is the very advanced level of supply chain linkages between brand manufacturers/assemblers of cars and the more than 8,000 suppliers of components and equipment in Europe and more so around the world. Assemblers and important suppliers of cars cooperate in the design of certain key components. The technical specifications and requirements set by assemblers – including on issues such as material used but also on the adoption of environmental management systems - have a determining role on suppliers at all stages of the supply chain.

Trends in the market

According to industry representatives, the car manufacturing industry has been working since the early 1990s on a number of approaches to Ecodesign strategies, including the design for disassembly to help recover larger proportion of cars after the end of life, design for recyclability to increase the recycled material content and design for environment on the basis of a life cycle analysis. The results, as proposed by ACEA, have been rather limited. In all cases the use phase represents they determining phase. At this stage the focus of industry is on the sustainable design of vehicles that will balance environmental impacts with the key issues of costs, safety and quality of cars.

Life Cycle Analysis – main environmental aspects and key stages of the life cycle of the product

Life cycle of passenger cars

The life cycle of passenger cars is associated with a wide range of impacts associated with. Before we present existing LCA studies, we provide a brief presentation of the key impacts associated with the different stages of the life cycle of cars.

The initial stage concerns the **extraction or production of raw materials** (metal, glass, textiles, rubber, plastic or other composite materials) used in the production of the various components a cars.

Important amount of waste is also resulting from the various processes included in the initial phases. The subsequent phase of the **production of the cars** is associated with energy use (and greenhouse gas emission) and the emission (VOCs) connected with the painting of cars and the waste from the production processes. The **distribution** phase (transfer to various points of sale) contributes, primarily, to the consumption of fossil fuels and greenhouse gas emissions.

The **use phase of passenger cars** (Tank-To-Wheel) concerns primarily the energy use and the resulting greenhouse and other air pollution emissions (NOx, Hydrocarbons, particulate matter, CO) from the consumption of fossil fuels. Waste is also generated as part of the maintenance process of cars and the replacement of spare parts that are not recycled. The use of air conditioners in cars is also a contributing factor to the emissions. Besides the technology used in the cars' engines, the type of fuel consumed and the weight of the car, consumers have an important role in determining the amount of fuel consumed and the resulting emissions on the basis of their driving behaviour, tyre pressure and number of passengers.

In parallel, the use phase is linked with the extraction of fossil fuels, the production of petrol or diesel fuel used by most cars and their distribution to the gas stations (Well-To-Tank). Besides the depletion of fossil fuel sources there are important emissions of greenhouse (methane) and other chemical substances (NOx, SOx) during the distillation and the distribution of fuels.

Passenger cars create also waste at the **end of their life**. However, nowadays more than 90% of the material from cars is reused, recycled or recovered (mainly the metals, batteries, fluids and tyres).

The above brief introduction on a passenger car life cycle and the relevant impact is followed by an analysis of existing life cycle analyses to help identify the main environmental impact and the relevant improvement potential for passenger cars.

LCA analysis

The key LCA study used was the IMPRO Car (2008) by the JRC that aimed to identify improvement options and assess their feasibility.[130] The indicators of the overall impacts from cars were calculated by assigning monetary values to the different impact categories.

Production:

1. Car production (raw material extraction, material transformation and car assembly).

2. Replacement and spare parts production (tyres, battery, lubricants and refrigerants).

Use phase:

3. Fuel transformation processes prior to fuel consumption (well to tank - WTT).

4. Fuel consumption to drive the car (tank to wheel - TTW).

End of life:

5. Car disposal and waste treatment (EOL).

Furthermore, the project considered the following impact categories:

- Abiotic depletion (AD);
- Climate change (GWP);
- Ozone depletion (ODP);
- Photochemical oxidation (POCP);
- Acidification (AP);
- Eutrophication (EP);
- Particulate matters (PM2.5);
- Primary energy (PE);
- Bulk waste (BW).

The IMPRO study provides an overview of the major contributions to the impact from the different lifecycle stages. Table 1 summarises the findings of the study. The car production phase appears to be the main contributor to the depletion of minerals (including the production of spare parts), acidification, particulate matter and bulk waste. The use phase (tank to wheel) is the prime contributor to greenhouse gas emissions and energy use through the combustion of fuel during driving. However, the fuel production (well to tank) contributes to most other impact categories with the exception of mineral depletion and global warming. According to IMPRO, the main issue in the end of life of cars is the bulk waste.

[130] IPTS (2008), Environmental Improvement of Passenger Cars (IMPRO-car), http://ipts.jrc.ec.europa.eu/publications/pub.cfm?id=1564

However, we should note that in the case of diesel cars, the tank to wheel use phase is the main contributor of particulate matter and but also, through the emission of NOx, in acidification, eutrophication and photochemical pollution.

Table 1: Impacts of petrol car along the different stages of the life cycle (IMPRO, 2008)

Impact categories	Production		Use Phase		End of life
	Car[131]	Spare Parts	Well to Tank	Tank to Wheel	
Abiotic depletion	49%	51%	0.1%	0%	0%
Global warming	8%	1%	13%	78%	0%
Ozone depletion	3%	1%	96%	0%	0%
Photochemical ozone	15%	4%	63%	19%	0%
Acidification	27%	1%	69%	2%	0%
Eutrophication	32%	1%	60%	6%	0%
Particulate matter 2.5	23%	3%	74%	0%	0%
Primary energy	9%	2%	11%	79%	0%
Bulk waste	39%	2%	25%	0%	34%

Source: IMPRO study

The above results are supported by another LCA from Castro et al (2003) that estimated the environmental impact of an average passenger vehicle in the Netherlands.[132] This study examined also the issue of human toxicity and eco-toxicity contribution to a total eco-indicator, although it focused only on carcinogenic substances emitted during the lifecycle. It concluded that overall importance of carcinogenic toxicity was low, (less than 5% of the total impact), with the highest contribution in the production phase. The eco-toxicity share in the total indicator was higher with the production phase being again the main contributor (23% of the overall environmental load).

Along with the above studies, the European car manufacturers association (ACEA) provided its own an analysis of the environmental impacts along the life cycle. The responses were based on the LIRECAR (2004) study that identified the environmental impacts over the life cycle of a vehicle. [133] There are certain differences in the functional units used as well as in some of the environmental aspects examined.[134]

While direct comparisons are not possible, there are only few differences in comparison to the results of the IMPRO study. The use phase (tank to wheel and well to tank) again represents the key stage in relation to most impacts. One difference is the conclusion that the end of life has a very limited share in aspects, even waste and a reduced share of the production stage to acidification. In relation to the toxicity, ACEA notes that life cycle analysis does not represent an appropriate methodology as, in contrast to other aspects, the toxic impacts of different substances of same substances emitted in different times cannot be added together.

[131] Includes both raw material extraction and car assembly.

[132] Maria B. G. Castro, Johannes A. M. Remmerswaal and Markus A. Reuter(2004), Life cycle impact assessment of the average passenger vehicle in the Netherlands, The international journal of life cycle assessment, Volume 8, Number 5, 297-304

[133] Wulf-Peter Schmidt, Elisabeth Dahlqvist, Matthias Finkbeiner, Stephan Krinke, Silvia Lazzari, Dirk Oschmann, Sophie Pichon, Christian Thiel (2004),Life cycle assessment of lightweight and end-of-life scenarios for generic compact class passenger vehicles, The International Journal of Life Cycle Assessment (2004), Volume: 9, Issue: 6, Pages: 405-416

[134] 12.5 years life span and 211.250 km distance driven in IMPRO; 12 years and 150,000 km in LIRECAR

Table 2 - LCA of passenger cars – ACEA response (percentages are approximate)

	Raw Materials extraction	Production	Distribution	Use	End of life
Resource depletion	20%		<1%	80%	~1%
Climate change	20%	1-2%	<1%	80%	~1%
Ozone depletion	Not relevant				
Acidification	35%	1-3%	<1%	60%	~1%
Photochemical ozone	10%	10%	n/r	80%	n/r
Particulate matter	N.d.	N.d.	N.d.	N.d.	N.d.
Eutrophication	60%	<1%	<1%	>35%	<5%
Land use	N.d.	Low	Depending on allocation		Not relevant
Ionizing radiation	Depending on grid mix		n/r	n/r	n/r
Hazardous waste				Main stage	
Non-hazardous waste	90%	<1%	n/r	10%	n/r

Source: ACEA

The LIRECAR study examined also the impact of lightweight design of cars concluding that the environmental benefits are not as significant as generally believed. The LCA analysis indicated that the use of lightweight materials shifts important part of the impact to the production phase. This implies that some of the gains made in the use phase results in higher losses in the production. Still, the overall impact of weight reduction is still positive.

Issues from the use of MEEuP

The next step of the case study was to examine what would be the results of using the MEEuP in the case of passengers' cars and what could be the missed opportunities. On the basis of a review of the MEEuP guidelines the following issues were identified:

- The main shortcomings from the use of the MEEuP would arise in the data collection phase:
  - Allocation: MEEuP does not allow flexibility to allocate recycling in EOL;
  - Recycling: MEEuP provides fixed calculation rules for the allocation of credits from recycling.
- The limitations in relation to the impact categories would concern:
  - Mineral resource depletion: The MEEuP report has a limited scope in the case of resource depletion focusing only on the use of energy. While this is currently not a very relevant impact category for cars it may become more important as more lightweight materials are used in the future;
  - Acidification and Eutrophication aspects that are quite important and where MEEuP has certain limitation in the way these aspects are addressed;
  - Toxicity – MEEuP has important limitations the way it addressed toxicity but this is an impact category that is not as relevant for cars.

Overall, MEEuP is expected to have certain shortcomings when assessing passenger cars but these are not as important as in other categories of products. There are substantial similarities between cars and energy using products, as car use significant amounts of energy and are primarily made of metals and plastics that are also found in many EuPs.

Policy framework

The review of the existing regulatory framework aimed to assess how the various environmental issues during the passenger cars life are addressed under the current policy framework.

Mandatory standards and labelling

A number of EU regulations and Directive aim to address the impacts during the use phase of cars' life cycle and with direct impact on the design of the car. These concern primarily the emission from passenger cars setting performance requirements as part of the Community's integrated approach to reduce CO2 and other air emissions from light-duty vehicles. According to **Regulation 443/2009** EU car manufacturers' fleet average has to be aligned with a target of 130g CO2/km - partially as of 2012 and completely by 2015. Recently, **Regulation 725/2011** added also provisions in relation to achieving the above target that support the introduction of eco-innovative technologies (that reduce emissions and that cannot be counted by existing test procedures.[135] **Regulation 715/2007** (Euro 5 and 6) sets also targets for other types of air emissions. At the same time, **Directive 1999/94/EC** requires the provision of information to consumer at the point of sale in relation to the fuel economy and the CO2 emissions of new passenger cars.

Further to that, the **Regulation 661/2009** sets additional Ecodesign requirements, among others, requirement for establishment of tyre pressure monitoring systems in new cars from 2012 on and the use of low resistance rolling tyres by 2013. It also sets requirements for the establishment of gear shift indicators that help drivers drive more efficiently.

In parallel, the existing legislation (**Directive 2009/28/EC**) sets standards concerning the fuel characteristics in order to reduce air emission and improve efficiency (well-to-tank phase). The **regulation on labelling of tyres** that will come to force in 2012 will set requirement on the provision of information to consumer in the form a label on the impact on vehicle fuel efficiency as a result of the tyre's rolling resistance, the impact on vehicle safety associated to the tyre's wet grip and the tyre's external noise level.

The environmental impacts during the production phase are primarily addressed through process rather than product specific legislation. It includes the former **IPPC (now Industrial Emissions) Directive** in terms of emission to soil, water and air, **Directive 2004/42/EC** concerning the use of VOCs in paints in the manufacturing process but also via REACH regulation in terms of the toxicity and ecotoxicity of chemicals used in the production process.

The end of life of vehicles is primarily addressed through the **ELV Directive (2000/53/EC)** which sets also requirements concerning the design of cars, aiming to reduce the use hazardous substances in vehicles, prohibiting certain substances, preventing their release into the environment, increase their recycling and to avoid the disposal of hazardous waste. It also sets design requirement to support the dismantling, reuse and recycling of end-of life vehicles and components and require manufacturers to set up system for the collection of end of life vehicles and the spare parts. In addition, **Directive 2005/64/EC** requires that vehicles may be put on the market only if they are re-usable and/or recyclable to a minimum of 85% by mass or are re-usable and/or recoverable to a minimum of 95% by mass. Furthermore, the **2006/66/EC Directive** on batteries and accumulators prohibits the use of batteries – including those users in cars – with certain levels of mercury and cadmium content and sets certain targets for the collection and recycling of batteries and requires that manufacturers bear the costs of setting and operating the systems.

They regulatory instruments identified are summarised in the following table, which indicates the main environmental aspect addressed in the relevant legal instrument.

Table 3 - Summary of regulatory instruments that apply to passenger cars

No	Name of Regulation/Directive	Environmental issue/aspect addressed
Production phase		
1	DIRECTIVE 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions	Mandatory standards concerning air, water and soil emissions during the production of cars'

[135] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2011:194:0019:0024:EN:PDF

No	Name of Regulation/Directive	Environmental issue/aspect addressed
	(integrated pollution prevention and control)	components and their assembly
2	Regulation (EC) No 1907/2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)	Toxicity and ecotoxicity of chemicals used during the production of chemicals
3	DIRECTIVE 2004/42/CE of the European Parliament and of the Council of 21 April 2004 on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain paints and varnishes and vehicle refinishing products and amending Directive 1999/13/EC	Mandatory standards concerning the emission of VOCs (photochemical ozone formation) in the production process.
4	DIRECTIVE 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC (EU ETS)	Market based tool setting maximum greenhouse gas emission in the production of cars
Use phase		
5	REGULATION (EC) No 443/2009 setting emission performance standards for new passenger cars	Mandatory standard on CO2 and other emissions produced during the cars' use (climate change, acidification)
6	Directive 1999/94/EC relating to the availability of consumer information on fuel economy and CO2 emissions in respect of the marketing of new passenger cars	Mandatory labelling concerning the use of resources (fuels) CO2 emissions during the cars' use
7	Regulation (EC) No 715/2007 on type approval of motor vehicles with respect to emissions from light passenger and commercial vehicles (Euro 5 and Euro 6) and on access to vehicle repair and maintenance information.	Mandatory standard concerning non-CO2 emissions (NOx, CO, PM, evaporative emissions) produced in the use phase
8	Regulation (EC) No 661/2009 of the European Parliament and Council of 13 July 2009 concerning type-approval requirements for the general safety of motor vehicles, their trailers and systems, components and separate technical units intended therefore	Requirements on the integration of certain functions in cars to help consumers reduce fuel consumption
9	Directive 2006/40/EC of the European Parliament and of the Council of 17 May 2006 relating to emissions from air conditioning systems in motor vehicles	Mandatory standard on emissions produced from air conditioning systems in cars (climate change)
10	Commission Directive 2007/34/EC amending Council Directive 70/157/EEC concerning the permissible sound level and the exhaust system of motor vehicles.	Mandatory standard on the noise created during the use of motor vehicles
11	DIRECTIVE 2009/28/EC on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC and DIRECTIVE 2009/30/EC amending Directive 98/70/EC as regards the specification of petrol, diesel and gas-oil and introducing a mechanism to monitor and reduce greenhouse gas emissions and amending Council Directive 1999/32/EC as regards the specification of fuel used by inland waterway vessels and repealing Directive 93/12/EEC.	Minimum standards on the characteristics of the fossil fuel consumed during the use of cars
12	Regulation 1222/2009 on the labelling of tyres	Mandatory labelling concerning
End-of life		
13	DIRECTIVE 2000/53/EC on end-of life vehicles	Mandatory standard setting minimum requirements for the collection and treatment of end of life vehicles and the prevention of hazardous materials

No	Name of Regulation/Directive	Environmental issue/aspect addressed
14	DIRECTIVE 2005/64/EC on the type-approval of motor vehicles with regard to their reusability, recyclability and recoverability	Mandatory standard setting minimum requirements on the level of reusability and/or recyclability of materials used in vehicles.
15	Directive 2006/66/EC of the European Parliament and of the Council of 6 September 2006 on batteries and accumulators and waste batteries and accumulators	Waste - Collection and treatment of End of life batteries, prevention of the use of hazardous materials

Self-regulation and voluntary initiatives

According to the information provided by ACEA there are currently no self-regulatory initiatives targeting one or more aspects of the Ecodesign of passenger cars. The voluntary agreements at the sector level for the reduction of greenhouse emissions initiated in 1998 did not bring the expected results (140g/km to be reached by 2008). It led to the Commission to take action that resulted in the regulation 443/2009 in emissions from new vehicles stated earlier.

However, according to ACEA, the automotive industry does use life cycle analysis on the basis of ISO14040/14044 internally, when appropriate. According to an UNEP already in 1999, all major automotive manufacturers were using life cycle based approaches. However, ACEA suggests that there are weaknesses with the LCA methods including uncertainties in data, issues of confidentiality and complexity of the automobile product.

Other instruments

In addition to the mandatory standards and information requirement, financial instruments are also used in most Member States to support energy efficiency and reduction of emissions. The taxation of cars on the basis of their CO_2 and other regulated emissions is one instrument. Furthermore, Member States have periodically used financial incentives (subsidies or tax exemptions) for the purchase and/or use of green vehicles with low emissions (including hybrid or electric cars) or for the replacement of old passenger cars with new more efficient cares.

In parallel, there are a number of financial support instruments towards the development of more energy efficient cars, including R&D on green cars, the development of more efficient technologies or the use of ICT systems to enhance eco-driving.

Conclusion

It is not possible at this stage to assess the effectiveness of existing policy framework and the relevant tools in relation to the various impacts. According to ACEA, the legislations concerning the CO_2 emissions levels and the provision of information to consumers on fuel economy have already led to important emissions reductions and, in conjunction with the relevant specification on fuels, provide an effective framework for the reduction of all types of emission. In the case of the end of life related legislation the view is that recycling of vehicles is already done and the Directive did not add much.

The study of the BIO IS on the possible extension of the Ecodesign to passenger cars[136] concluded that the issues related to the manufacturing and use phase are relatively well covered by EU legislation but suggested that there is still scope for use of Ecodesign requirements for further improvements given the influence that manufacturers' design has on the use phase. The life cycle stage of raw materials extraction is also considered a potential area that could be influenced by Ecodesign requirements. The study of BIO IS indicates that the level of influence is limited but we consider that the highly integrated supply chains and the requirements for suppliers to work on the basis of specification set by manufacturers indicate a certain

[136] BIO IS (2010), Technical support to identify product categories with significant environmental impact and with potential for improvement by making use of Ecodesign measures- Final Report - April 2010

level of leverage. In contrast, the study assessed that end-of-life stages are rather effectively addressed and that Ecodesign requirements can only have a marginal effect.

Table 4 - Passenger cars life cycle stages, applicable regulation and scope for eco-design requirements

Criteria of assessment	Life cycle stage				
	Raw materials	Manufacturing	Distribution	Use	End of life
Coverage of existing impacts by EU legislation	Low	Medium	Low	Medium	High
Degree of influence of main actor on impacts	Low[137]	High	Medium	High	Medium
Potential contribution of eco-design requirements	High	Medium	Low	High	Medium

Source: Adopted from BIO IS study

Analysis of alternative policy options

Description of a possible Ecodesign regulatory measure

On the basis of the life cycle analysis conducted, the key/priority areas that an Ecodesign based regulation could focus could be related to the following aspects:

- Targets for the reduction of the weight of cars (e.g. -5%, -10%, -15% in relation to a set standard) over a certain time period (without compromising safety issues);
- Requirements on the type of tyres used (green tyres) and the use of tyre pressure monitoring systems;
- Requirement on the fuel efficiency of cars' engine and transmission systems;
- Requirement for cars to be able to run on petrol/diesel containing certain level of biofuels;
- Requirement on the level of recycled and recyclable of materials used in cars;
- Requirement on the efficiency level of air-conditioning systems in cars;
- Requirement on the use of systems to guide driver behaviour (gear shift guide).

The above requirements have been the topic of analysis in the context of the IMPRO study that examined the possible results in terms of environmental improvement, costs associated and other possible issues that may need to be considered. The analysis provided also a review of existing policy tools in relation to the above measures.

In addition to that, generic requirements requiring the development of an ecological profile of passenger cars on the basis of a simplified life cycle impact assessment, the provision of information and the taking of action against certain benchmarks.

Definition of alternative options

Against the possible coverage under an Ecodesign Directive Implementing Measure a number of alternative options were examined.

Business as usual scenario - The business as usual scenario includes a combination of market forces, the existing product specific legislation that covers the issues of emissions, waste, fuel characteristics and information provision tools. It also includes the existing labelling schemes on cars and tires.

[137] BIO IS indicated low level of leverage but we consider that this does not consider the important integration of the supply chain of the automotive sector and the advanced relationships developed with suppliers.

Mandatory labelling, besides the existing tools, would cover additional aspects besides CO2 emissions (other types of emissions, bio fuel suitability, and noise) and would require the introduction of a color coded scheme in all Member States. It could also require the indication of whether the specific car meets more advanced CO2 objectives (Light-duty Environmentally Enhanced Vehicle). It should be noted that some of the above may be included in the revision of the 1999/94/EC Directive.[138]

Voluntary agreement in the context of Ecodesign - A possible alternative would be the promotion of self regulation in relation to some of the aspects that have not yet been addressed from existing regulation. This could take place inside or outside the context of the Ecodesign Directive although the former will add the requirement for longer term commitment.

Financial tools – there are already significant financial tools (taxes on fuels or tax exemptions) used to promote the demand for more energy efficient and less polluting cars and to affect consumer behavior in terms of driving patterns. Furthermore, EU and Member states support the R&D in various aspects of car design that should also lead to addressing some of the impacts.

Assessment of alternatives[139]

The criteria used for comparing the Ecodesign requirements against the alternative options were:

- The expected effectiveness of the measures in bringing improvements;
- The costs involved;
- Ease of implementation (including the use of the MEEuP methodology);
- Impact of any necessary changes to existing Ecodesign requirements

The key issue in the case of the implementation of Ecodesign requirements in the context of an IM under the Ecodesign Directive is the fact that all important aspects appear to be under the scope of existing EU legislation. As a result, the expected added-value of the development of Implementing Measures can only come from the coverage of additional aspects not currently covered or the adoption of more ambitious targets for the respective legislations. In the areas already addressed by legislation, Ecodesign would have to replace the existing regulation or else there is a danger of overlap or duplication. Such a process may help simplify the existing regulatory framework but it may also lead to complications and costs if the typical route of preparatory study, stakeholder consultation is to be followed. From a point of view of the use of public money, at least in the short term it would mean changes to existing structures and duplication of work.

On the more specific proposals for requirements indicated above, the industry representatives consider that the reduction of weight of cars cannot be a subject of regulation as it can lead to trade-offs with safety aspects that should always be given priority. On the basis of the IMPRO study analysis, the reduction of vehicle weight is expected to lead to substantial environmental gains regarding energy and GHG emissions and air pollution but there also trade-offs with waste reduction. Furthermore, there are trade-offs between the improvements achieved in the use phase with increased impacts on the production phase. Thus despite

[138] http://www.ieep.eu/assets/660/Study_on_consumer_information_on_fuel_economy_and_CO2_of_new_cars.pdf

[139] The assessment of the alternative options is again based on the input from IMPRO study that examined in detail most of the possible requirements that could be included in an Ecodesign Directive. We have also asked industry (ACEA) and NGOs to provide their own comments but they had not provided feedback by the time of the submission of the report. Thus, possible changes or additions may be necessary on the basis of their input in following weeks. Further input will be obtained following the publication of the report and the presentation during the second stakeholder meeting.

the costs for the necessary changes in the production processes, this would mean - in the current policy context - extra costs to industry for compliance with the IPPC regulation.

The IMPRO study suggests rather important benefits in terms of fuel savings and CO_2 emissions' reduction from measures related to tyres (low rolling resistance and tyre pressure monitoring) that add up to 4.5% under the conditions examined with rather limited costs. However, Regulation 661/2009 already introduces such requirements.

The introduction of more efficient engines and transmissions systems provides, according to IMPRO study, high potential for achieving emissions reductions (ranging 15 to 29% for petrol cars) but this is again an issue already covered by legislation (Euro 5 and Euro 6) and it difficult to consider additional requirements in this direction.

In relation to a possible requirement for higher level of biofuel blends, on the basis of the IMPRO study indicates there are important trade-offs among different environmental aspects and the results depend also the type of biofuel used. Furthermore, according to ACEA, already by 2010 all new car models were required to be able to run on petrol containing up to 10% ethanol (E10)and diesel containing up to 7% fatic acid methyl ester (B7) subject to the quality of the pure biofuel.[140]

In relation to the level of recycled and recyclable of materials used in cars, the existing regulations already sets targets that for reuse, recovery and recycling although earlier reports indicated that these targets had not been met[141] and that there were important implementation issues.[142] ACEA points to the fact that the manufacturers' experience from the use of design for dismantling and design for recycling indicates limited potential, something that is also reflected in the IMPRO study.

The introduction of systems to guide driver behaviour (e.g. gear shift guide) have, according to IMPRO study, potential for contributing around 1.5% fuel savings if properly used. However, the adoption of other eco-driving habits has an even higher potential (3% according to IMPRO, 7% according to ACEA). Furthermore, the requirement for gear shift guide is already covered in existing regulation.

Finally, in the case of air conditioning systems the analysis identified potential savings but indicated that the most effective measure is the setting of the temperature to temperature closer to outside temperature (consumer behaviour parameter) has a much greater impact. At the same time, as stated earlier, the technical aspects of the operation of air conditions in cars are already covered by regulation.

The costs related to the compliance with the requirements described are not expected to be particularly high – assuming that compliance with existing measures is already happening. The main costs are the administrative costs involved. As far as the ease of implementation is concerned, standards, test and measurements methods are largely in place for most of the requirements and the same applies to the surveillance and enforcement structures. The main difficulty will be to agree on specific requirements and address possible trade-offs among the different environmental aspects. The MEEuP methodology is not particularly helpful in this direction.

Concerning the possibility of introducing generic requirements for the development of an ecological profile of passenger cars, again the main apparent issue is the acceptance of a relevant methodology. The view of industry is that the existing methodologies are not appropriate in mandatory context given the high level of uncertainty and the absence/confidentiality of data. On the basis of existing information it is not possible to verify these claims. Clearly the publication of an ecological profile can serve as a tool for continuous improvement. However, to the extent that the various environmental aspects are addressed by existing

[140] http://www.acea.be/collection/fuels_faq/#Q3
[141] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2009:0635:FIN:EN:PDF
[142] http://www.europarl.europa.eu/comparl/envi/pdf/externalexpertise/end_of_life_vehicles.pdf

legislations, the added-value may not be significant. The mandatory adoption of some form of life cycle assessment will also bring no real change in a sector that is already using similar tools.

In comparison to the aforementioned scenario, the business as usual scenario seems to be able to achieve – at least to a great extent - most of the important environmental improvements with no additional costs. Certain aspects not currently covered by policy tools (weight of cars) are considered to be regulated in the future, with a separate regulation which will be easier to introduce than attempt to revise Implementing Measures. Considered against the business as usual scenario, Ecodesign requirements may have limited, if any, added value in terms of effectiveness and probably introduce additional costs.

The possibility of voluntary agreements on one of the few areas not currently addressed or for setting more ambitious targets, should also be considered with a certain level of skepticism given the rather poor experience in relation to emission reductions during the early 2000s. Industry representatives themselves suggest that it is most probably a not effective tool. From the cost side, it would be beneficial in comparison to adoption of regulation and would also provide flexibility to industry. Within the context of the Ecodesign Directive, a VA could be more effective for achieving improvements while maintaining the same flexibility and not incurring substantial administrative costs. However, it is difficult at this stage to envisage what specific aspects a VA could cover.

Finally, the option of mandatory labelling that would go beyond existing requirements is feasible from the implementation point of view. The effectiveness depends on the clarity of the scheme and there is a danger for consumer confusion if too many aspects are included. Furthermore, existing studies indicate that the result of the provision of environmental information on consumer choice is often rather limited.[143]

Table 6 - Assessment of alternative policy options

Option	Effectiveness	Costs (for industry and authorities)	Ease of implementation	Impact on Ecodesign
Ecodesign Implementing measures	- Level of **additional improvement most probably marginal** as most aspects are already covered by regulation or used in practice - Possibly significant in the case of weight requirements but with trade offs	- High administrative costs for amending Directive, and developing IMs Implementation/enforcement costs for authorities - Some compliance costs but limited due to existing legislation	- Depends on the type of requirements. Most standards and measurements methods exist although not accepted LCA method - Danger of overlaps if existing legislation remains	- Need for change of MEEuP to cover other issues - Additional resources with possible complications/delays for the overall management of the Directive
Business as usual	- Existing regulation already covers the key aspects. Certain minor aspects missed	- No additional costs to industry and authorities	- No additional issues	- No expected impact
Mandatory labelling	Unclear - Effectiveness of existing label scheme not clear - Possible danger of consumer confusion if too complicated	Medium-high administrative costs for industry and authorities for development and implementation - Compliance costs for testing of products low	Relatively easy - standards for labelling already exist - Possible difficulties for aspects not currently addressed	No expected impact
Voluntary agreement outside	Questionable (based on past experience from voluntary agreement on	Costs for industry to establish VA and costs for achieving target	Expected to be easy to implement	No expected impact

[143] http://www.ieep.eu/assets/660/Study_on_consumer_information_on_fuel_economy_and_CO2_of_new_cars.pdf

Case studies – Passenger cars C5

Option	Effectiveness	Costs (for industry and authorities)	Ease of implementation	Impact on Ecodesign
Ecodesign	fuel economy and emissions)	(depending on level of ambition)		
Voluntary agreement inside Ecodesign	Similarly effective as introduction of IM with increased flexibility – overall limited additional effects	Low costs for authorities (mainly related to the initial development)	- Relatively easy to implement and monitor - Agreement on targets issues to address and targets may be difficult	Possibly changes to Annex required

Initial conclusions – main lessons in relation to the broader product group

The conclusion of the study is that while it would be rather feasible to cover passenger cars under the Ecodesign Directive and to develop and implement relevant eco-design requirements, the expected added value would, most probably, be rather limited since most of the important aspects are already covered by existing legislation. The cost effectiveness of covering passenger cars under the Ecodesign Directive would most probably be rather low. An eco-design requirement on car weight is one aspect that could bring raw material reduction but there are important safety and environmental trade-offs and in any case of focused legislation could be easier to implement. From a practical side, the industry considers that a life cycle approach – similar to the MEEuP methodology - would not be appropriate. One would still expect that an appropriate methodology for a simplified LCA could be found if an extension were to take place – especially since all manufacturers do use some form of life cycle analysis. The key aspect remains the fact that a possible development of an IM may not bring substantial added value.

The main lesson drawn from the case study for the broader group of means of transport is that a key consideration should be the presence of relevant legislation that covers the relevant aspects. The assessment does not conclude that the development of Ecodesign based requirements is not feasible, even though the level of complexity of some of the products may make its application rather difficult.

Sources of information

Interview: European automobile manufacturers association

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Case studies questionnaire D

Annex D - Case studies questionnaire

Evaluation of the Ecodesign Directive – Assessment of the appropriateness of extending the Directive to cover non-Energy related products and means of transport

Case study examined: [product name]

CSES and Oxford Research are undertaking a study to assess the feasibility of extending the Ecodesign Directive to cover non-energy related products and means of transport. The study is based on an initial analysis of five case studies that will be used to draw conclusions on the appropriateness of developing eco-design requirements in the context of the Ecodesign Directive. Following initial analysis and feedback from the European Commission All purpose cleaners and hand detergents have been selected as representative of the broader category of non-durable consumer and industrial products.

The subsequent stages of the analysis will examine the following issues:

- Market structure
- Life Cycle Analysis and identification of the key environmental impacts
- Review of the existing legal framework, self regulation and standards covering the environmental impacts of all purpose cleaners and hand detergents and assessment of its effectiveness
- Assessment of possible alternative policy options and their expected potential impact

This following questionnaire asks you to provide us with available data or qualitative information to support our analysis. We also ask you to provide an assessment of the appropriateness of alternative policy tools that are able to address the key environmental issues related to all purpose cleaners and hand detergents.

A - Market structure

Please provide information available in relation to the market of [product name]. If you do not have such information readily available please refer to any relevant data source or study that you are aware of.

Indicator	Data	Source
Total size of EU market (in units, kgs or other)		
Total size of EU market (€ million)		
Imports into the EU (in units, kgs or other)		
Imports into the EU ((€ million)		
Exports from the EU		
Exports from the EU ((€ million)		
Total number of EU firms		
Total number of employees		

What is the level of concentration of the industry at the EU level? (please indicate using X in the appropriate cell)

Very concentrated (4 firms controlling over 80% of the EU market in terms of sales value)	
Medium concentration (4 firms controlling between 50 and 80% of the EU market in terms of sales value)	
Low concentration (4 firms controlling between 10 and 50% of the EU market in terms of sales value)	

Very low concentration (4 firms controlling less than 10% of the EU market in terms of sales value)	
No concentration (no firm controls more than 1% of the market)	

To what extent is the market of [product name] characterised by the dominant role of local/national producers in the different EU markets or of multinational firms across the EU internal market? Please explain briefly.

What is the distribution of firms by size in the specific sector across the EU?

	Number	Percentage of total
Large firms (over 250 employees)		
Medium size firms (20-250 employees)		
Small firms (10-50 employees)		
Micro firms (<10 employees)		

Is there any other important information that should be taken into account concerning the structure of the [product name] sector?

B - Existing legal framework (EU or national)

Please indicate the name of EU regulations or Directives applicable to [product name] and the issues regulated

No	Name of regulation	Main Issue regulated
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

Please provide us with more information about any of the <u>above regulatory measures that address – directly or indirectly – the environmental impacts of</u> all purpose cleaners and hand detergents products. (please copy and paste the table provided in case you want to refer to more than 3 regulatory measures)

Name of the regulation				
Type of the regulation (please underline those applicable)				
Mandatory minimum standard	Mandatory labelling		Other, please specify:	
Product life cycle(s) regulated (please underline those applicable)				
Material extraction	Production	Distribution	<u>Use</u>	Disposal/recycling
Environmental issue(s) addressed (please underline those applicable)				
Resource depletion		Photochemical ozone formation		

(metals, minerals, energy, water)	Particulate matter/respiratory inorganics
Human toxicity	Eutrophication
Ecotoxicity	Land use
Climate change	Ionizing radiation
Ozone depletion	Hazardous waste
Acidification	Non-hazardous waste.
Please provide an assessment of the effectiveness of the specific legislative measure in addressing the issues targeted (please refer to any studies or other information sources)	
Please provide an assessment of the efficiency and costs of implementation of the existing legislative measure (please refer to any studies or other information sources)	
Please provide any other comment related to the experience from the existing legislative measure (please refer to any studies or other information sources)	
What is the difference in the case of institutional/industrial uses?	

C. Existing self regulation

Please indicate any voluntary agreements or other self regulatory instruments (SRIs) applicable to [product name].

No	Name of self regulation/voluntary agreement	Issue addressed
1		
2		
3		
4		

Please provide additional information and an assessment on any of the currently applicable SRI <u>that address– directly or indirectly – the environmental impacts of</u> [product name].

Name of the SRI				
Type of SRI (please underline those applicable)				
Minimum standard	Labelling		Other, please specify	
Product life cycle(s) addressed (please underline those applicable)				
Raw Materials	Production	Distribution	Use	End of life
Environmental issue addressed (please underline those applicable)				
Resource depletion (metals, minerals, energy, water) Human toxicity Ecotoxicity Climate change Ozone depletion Acidification			Photochemical ozone formation Particulate matter/respiratory inorganics Eutrophication Land use Ionizing radiation Hazardous waste Non-hazardous waste.	
Please provide an assessment of the effectiveness of the SRI in addressing the issues targeted				

(please indicate any studies or other information sources, if available)
Please provide an assessment of the efficiency and costs of implementing the SRI (please refer to any studies or other information sources available)
Please provide any other comment related to the experience from the SRI (please refer to any studies or other information sources)

D. Other policy tools

Please refer to any other existing policy tool at the European or national level including financial instruments (taxes, subsidies, R&D and innovation support, public procurement, information campaign) that aim to address the environmental impacts of [product name]. If possible, please provide a brief assessment of their effectiveness or any other comments related to their implementation.

1	Name of policy tool	European GPP
	Country applied	
	Type (e.g. tax, subsidy, R&D grant, information/awareness raising, other)	
	Environmental impact and product life cycle addressed	
	Assessment of effectiveness of the tool and comments on any implementation/enforcement issues	
2	Name of policy tool	
	Country applied	
	Type (e.g. tax, subsidy, R&D grant, information/awareness raising, other)	
	Environmental impact and product life cycle addressed	
	Assessment of effectiveness of the tool and comments on any implementation/enforcement issues	
3	Name of policy tool	
	Country applied	
	Type (e.g. tax, subsidy, R&D grant, information/awareness raising, other)	
	Environmental impact and product life cycle addressed	
	Assessment of effectiveness of the tool and comments on any implementation/enforcement issues	
4	Name of policy tool	
	Country applied	
	Type (e.g. tax, subsidy, R&D grant,	

	information/awareness raising, other)	
	Environmental impact and product life cycle addressed	
	Assessment of effectiveness of the tool and comments on any implementation/enforcement issues	

F. European and international standards

Can you please indicate any existing national, European or international standards related to [product name]?

No	Name of standard	Organisation responsible	Type of standard/issue addressed (test, measurement, performance, other)
1			
2			
3			
4			

E. Life Cycle Analysis and improvement potential

Are you aware of existing life cycle analysis and impact assessment studies on [product name]? Please indicate their name and source.

Based on the existing studies, what are the main issues of environmental impact and at which stage of the life cycle are they evident? (if possible, please indicate the level of importance – High/Medium/Low/Not relevant)

	Raw Materials extraction	Production	Distribution	Use	End of life
Resource depletion					
Human toxicity					
Ecotoxicity					
Climate change (energy use)					
Ozone depletion					
Acidification					
Photochemical ozone formation					
Particulate matter					
Eutrophication					
Land use					
Ionizing radiation					
Hazardous waste					

Non-hazardous waste					
Other					

What could be relevant/appropriate eco-design requirements addressing the above issues? Are there differences between industrial and consumer products? What are they?

In your view/experience, would a product (versus of process) focused strategy be appropriate for addressing the various issues?

Are there already developments in the sector towards addressing these issues? Please explain:

Are there any reasons or obstacles that may lead industry not to adopt more environmentally friendly technologies? What are they? How important are they?

F. Assessment of policy options

The assessment of the Ecodesign Directive is considering the following generic policy options against a possible scenario of no further action over and above the existing legislation and initiatives:

- Mandatory eco-design standards addressing the environmental issues in the context of the Ecodesign Directive
- Mandatory labelling schemes (similar to that of Energy Label Directive)
- Voluntary standards and/or labelling schemes
- Financial and other support instruments (taxes, subsidies, public procurement, R&D support)

Alternative policy tools may also be proposed by the stakeholders.

With the following questions we ask you to provide your views on the possible use (and effectiveness) of alternative policy tools that could be used to address important environmental issues arising with the specific product all purpose cleaners and hand detergents under consideration, in scenarios where further measures are to be introduced.

How effective can the following different policy options be in addressing the key environmental impacts arising with [product name] under consideration? Please indicate which specific issues/aspects they can possibly address.

Mandatory eco-design standards	
Mandatory Labelling	
Voluntary standards or labelling	

Financial or other support instruments	
Other	

Would they be possible to develop and implement? Are there differences between industrial and consumer products?

What are, in your view, the advantages and disadvantages of the different policy options for addressing the key environmental issues arising?

	Advantages	Disadvantages
Mandatory eco-design standards		
Mandatory Labelling		
Voluntary standards or labelling		
Financial and other support instruments		
Other option		

What are, in your views, the cost elements for the industry that would arise with the implementation of the different policy options? How do they compare against each other?

Mandatory eco-design standards	
Mandatory Labelling	
Voluntary standards or labelling	
Financial and other support instruments	
Other	

In you view, to what extent would it be possible to use the different policy tools to address the environmental issues concerning the broader sector you represent?

Mandatory eco-design standards	
Mandatory Labelling	
Voluntary standards or labelling	
Financial and other support instruments	
Other	

ANNEX E – COST ESTIMATIONS

	Units	Unit price	2006-2011 (6 years)		2012-2017 (6 years)	
			Number	Total	Number	Total
Commission						
Initial adoption				€ 1,000,000	-	-
Staff						
EC staff	FTE/year	€ 120,000[144]	10	€ 7,200,000	14	€ 10,080,000
JRC support	Man Months	€ 8,333	126	€ 1,050,000	126	€ 1,050,000[145]
Preparatory studies						
Completed	Number	€ 300,000	22	€ 6,600,000	-	-
On going	Number	€ 300,000	15	€ 4,500,000		
Designated	Number	€ 300,000	5	€ 1,500,000		
Expected					10	€ 3,000,000
Work plans	Number	€ 150,000	2	€ 300,000	-	-
IM reviews	Number	€ 200,000			12	€ 2,400,000
MEEuP						
Methodology	Number	€ 300,000	12	€ 300,000	-	-
Review		€ 75,000		€ 75,000	-	-
Other studies	Number	-	2	€ 760,000	n.d.	€760,000
Standards		n.d.			n.d.	n.d.
Evaluation	Number	€ 300,000	1	€ 300,000	-	-
NGOs/SME support	Number	€ 1,000,000	1	€ 1,000,000	1	€ 1,000,000
Commission costs				**€ 24,585,000**		**€18,290,000**
Cost/year				**€4,100,000**		**€3,658,000**
Member states(30)						
Initial adoption				€ 4,000,000		
Staff						
IM development + market surveillance	FTE	€ 80,000[146]	80	€ 38,400,000	110	€52,800,000
Tests & studies	Cost/year	€ 7,000,000	1	€ 42,000,000	€17,000,000	€ 42,000,000
MSs costs				**€ 84,400,000**		**€ 94,800,000**
MSs Costs/year				**€14,066,000**		**€15,000,000**
Total costs				**€ 108,985,000**		**€ 112,330,000**
Total costs/year				**€ 18,164,000**		**€ 18,721,667**

[144] Includes overhead
[145] estimate
[146] Includes overhead

Annex F- Analysis of potential issues from the use of the MEEuP methodology for non-ErPs

One of the key features of the process of development of Implementing Measures for energy using products within the context of the Ecodesign Directive is the use of the MEEuP methodology and specifically the use of the EcoReport tool that is the basis of Tasks 4-7[147] of the MEEuP. The methodology provides the basis for the identification of important environmental impacts and the relevant life cycles stages for the different products and for the development of the proposals for generic or specific requirements. This methodology is currently revised as result of the extension to energy related products (MEErP).[148]

In this section we provide a more detailed analysis of the appropriateness of the MEEuP methodology in relation to non-ErPs like products from the agricultural sector on the basis of a comparison with the guidelines of the ILCD handbook issued by the Joint Research Centre and the experience from trying to follow the MEEuP methodology for the 5 products examined in the case studies. This analysis does not yet consider the updating of the MEEuP which is ongoing and taking place in parallel. The purpose of this chapter is to flag issues that could be a source of concern and that would have to be addressed within a context of a possible extension going beyond ErPs. The first part provides a discussion concerning general principles while the second focuses on the possible limitations that will have to be addressed.

General principles

System boundaries

The MEEuP methodology refers to ISO14040 standard but does not provide further guidance on the definition of system boundaries. This could pose a problem since the ISO standard leaves a lot of room for interpretation. Since the report was written, new publications provide more guidelines and specific rules (that are also compatible with ISO14040/44). The most important are the following:

- ILCD handbook, developed and published by the JRC in ISPRA
- The GHG protocol standard for products, developed by WBCSD/WRI

For energy using products the system boundary issues are relatively simple to solve, even with the current guidelines. But for agriculture related materials and products, more guidance is needed. The MEEuP methodology would have to be updated considering the ILCD handbook rules and other guidelines, if appropriate

Allocation of impacts

The MEEuP methodology follows a relatively simple approach, which is not often used in LCA for allocating impacts to different outputs. In essence, it advocates that each time a process has more than one output, the main output should be selected and all impacts allocated to it, without giving credits for any by-products. The report also eliminates the frequently used allocation method based on a physical causality (mass or energy content) or a social economic causality (often interpreted as economic value). This means that the share of the environmental load associated with one of the byproducts depends on the mass, energy content or economic value of that by-product.

While this approach eliminates ambiguity in the case of energy related products, there are important problems when this approach is applied to other sectors, especially in the agricultural sectors where

[147] The Commission's MEEuP methodology divides the study of a product into eight individual tasks. These include: Product definition (Task 1), Economic and market analysis (Task 2), Consumer behaviour (Task 3), Technical analysis of existing products (Task 4), Assessment of base cases (Task 5), BAT and BNAT analysis (Task 6), Improvement potential (Task 7) and Scenario, policy, impact and sensitivity analysis (Task 8)

[148] See ongoing Study on the update of the MEEuP methodology: www.meerp.eu

multiple allocations often occur. This can be illustrated in the case study for leather jackets and sausages (a cow produces, milk, meat and leather). Industry and other stakeholders will most likely need further guidance on this point.

Recycling

The recycling discussion has always been problematic in LCA, and this is also evident in the MEEuP methodology. The main problem is how to determine and allocate credits from recycling (and energy recovery from incineration). The EcoReport uses a pragmatic set of descriptive calculation rules, but these are based on the energy related products sector and are linked to the WEEE Directive. For other sectors, the WEEE approach is less relevant, and the fixed calculation rules used[149] cover only the relevant ErP materials.

Functional unit

Where design or product alternatives must be compared, it is important to define a functional unit. Usually this is based on a function provided by the products, like the cleaning of a certain surface, the use of a car over 100 kilometers, etc. The text on functional units can be used for a wide range of products, although the table with examples should have a broader scope to cover other product types.

Data collection

The data collection methodologies would have to be revised as they have been designed to cover energy related products and have significant gaps in the case of materials used for non-energy related products. The ILCD handbook approach would be one possible reference, this would miss the more pragmatic "calculation rule approach" of the MEEuP report.

Limitations of the MEEuP environmental aspect approach for non-ErP.

Since the MEEuP methodology was developed following Annex I of the Ecodesign Directive, the ILCD guidance on impact assessment methodologies has been published providing criteria to judge the quality and appropriateness of impact assessment methods[150]. In this section, we applied the ILCD guidelines to assess the approach used by the MEEuP methodology.

Climate Change (GWP) and Ozone Layer Depletion

Most impact assessment methods use the IPCC equivalent factors for GHG emissions and the WMO equivalence factors for Ozone depleting substances (based on Montreal/London Protocol). There is general agreement that these authoritative sources should be used for LCA. The MEEuP GHG factors need to be updated to the most recent 2007 figures, something that is already taking place in the context of the revision of the MEErP methodology.

However, while the MEEuP approach is in line with the accepted methods, more guidance is needed on how to assess carbon uptake by plants, and assessing (or incorporating) GHG emissions from direct and indirect land-use. GHG emissions from land use changes can have very significant impacts for biomaterials and biofuels. These additional specifications would be needed in the case of products like processed meat and other food products or for clothing.

Photochemical ozone formation and Particulate matter

[149] Recycling credits are given depending on what should in theory happen in the market. So recycling of plastics based on 75% thermal recycling (displacement of oil) is assumed on the basis of the WEEE Directive requirements. If there is a closed loop recycling of plastics then there is a credit of 75% for all plastics used. For recycling of metals compliance with the requirement under the WEEE Directive is also assumed, so 85% recycling rate for all metals is assumed. This is possible for the MEEuP because the WEEE sets targets for recycling of electric and electronic products.

[150] http://lct.jrc.ec.europa.eu/pdf-directory/ILCD-Handbook-LCIA-Framework-requirements-online-12March2010.pdf

In the MEEuP methodology these two impacts are covered as separate impact categories, which is not uncommon in LCA methods. The ozone forming substances are simply added up, without any differentiation between fate[151] and effect. Although this is not an uncommon approach in older LCIA methods, it does not fulfill the criteria in the ILCD evaluation. However, despite the incompatibility with the ILCD requirements, the analysis performed in the case of the 5 case studies did not suggest any major problems due to the limitations of the method.

For particulate matter the modeling used is very simple with no real consideration of the relevant environmental mechanism. In the update of the MEEuP to the MEErP methodology characterization factors for particulate matters are introduced.

Toxicity

In the MEEuP report, toxicity is not a category in itself but considered through the emissions to water and air of metals (in particular substances covered by RoHS Directive Hg, Cd, Cr and Pb), persistent organic pollutants (POP) and polycyclic aromatic hydrocarbons (PAH). The ILCD criteria require a fate and exposure step in the case of toxic pollutants, which is missing in the MEEuP method as only the toxicity of the substance is taken into account. This means that there are two substances with an equal toxicity, but with very different environmental residence times and exposure efficiency will be judged as equally serious, even if there are in practice differences in fate and exposure factors of many orders of magnitude.

In the case of the implementation of the MEErP for ErPs this shortcoming is not as critical, since the toxicity scope is most often limited to metals, which all have a long lifetime (although still different exposure efficiencies and other characteristics). In the case that the scope is broadened to non-energy related products, important problems may arise such as usage of pesticides in agricultural production, toxic organic substances emission in the processing of textiles, cars or from end-of -life processes. All the above would have to be incorporated in a revision of the MEErP.

The ILCD final recommendations suggest applying the USEtox framework that is a model developed under SETAC/UNEP guidance[152]. However, in such a case the coverage of toxic factors may become very wide.

Acidification

The scope (coverage of substances) of the MEEuP approach is similar to other LCA methods, but as in the case of toxicity related impacts, the fate step is not considered in contrast to the ILCD guidelines. This may cause problems in assessing emissions from fossil fuel combustion, and from agricultural production.

Eutrophication

In the MEEuP the eutrophication impact are based on the nutrient (nitrogen and phosphorus) content and the emission of organic compounds (BOD, COD). The scope is similar to other methods but, again, no fate is considered.

Furthermore, the MEEuP does not differentiate between freshwater and marine water as suggested in ILCD guidance. Emissions of nitrate generally do not create any problem in freshwater, but are relevant in marine water, while phosphate emissions impact fresh water and not marine water systems. This

[151] The fate step determines what happens with a substance after it is released in to the environment, for instance how long it takes before it is removed from the atmosphere. The fate step is an important element in international agreements like the greenhouse gas protocol, where an important differentiation is made between greenhouse gasses with different environmental lifetimes. Also in the Montreal protocol and legislation on toxic substances, like pesticides and particulate matter this plays an important role. There is also legislation that does not include the fate step, but only addresses the hazard of a substance once people are exposed to this.

[152] See www.usetox.org

difference can be important when assessing agricultural systems and in case of chemical products that contain phosphorus.

Land use

The land-use impact category reflects the environmental damage when natural land is converted for other applications, like agriculture, mining, forestry, urban application etc. It also covers land occupation since keeping land occupied means that it cannot be restored to natural conditions. Land-use is a very important factor when dealing with agricultural production, as is evident in the case study for textiles (cotton and wool, the case study for meat products, and for some flooring products.

In the Ecodesign Directive for energy-related products, land-use is not considered, but in the future, it is advised to assess it on an ad-hoc basis, as for example in the case of biofuels. It is assumed that otherwise it would only be relevant for mining where emissions of solid waste could be an adequate indicator. However, in the case of non-ErPs such as textiles (cotton production) or food products (crop production or livestock breeding) this could be an important issue that will have to be considered[153]. Guidance on assessing land conversion and indirect land-use change will need to be added to a future methodology. For instance the production of soy for cattle feed can cause destruction of habitats (Land conversion).

Water

MEEuP methodology does addresses the issue of water scarcity in a rather simple way by adding all processing water used as total water use. It does not distinguish water use in water scarce and water abundant areas. It is also not very clear how processing water is defined and in agricultural systems processing water can have many different meanings (e.g. irrigation with surface water and ground water). The issue of water use is already addressed in the preparatory studies of washing machines and dishwashers but it is considered that industry and other stakeholders will most likely need further guidance on this point in the case of EuPs.

Waste

The waste impact category is a somewhat unusual category that is included in the MEEuP methodology. The ILCD handbook does not consider this as a separate impact category since in the LCA methodology waste is “translated” as emissions to air, water and soil plus land occupation. The use of waste and hazardous waste categories in the MEEuP methodology provides a pragmatic shortcut and the distinction between toxic and general waste is also relevant. However, for non-energy related products there is a need to provide further guidance, especially for waste in the agricultural sector and products like wood paper or concrete.

Resource depletion

The MEEuP methodology had a limited scope in the case of the impact of resource depletion. Only the use of energy, water and materials – in line with the Ecodesign Directive – are taken into account while the depletion of scarce minerals is neglected. This was an important shortcoming of the methodology for a number of products. The update of the MEEuP methodology has therefore taken into account 14 raw materials identified critical at EU level.

[153] While it is relatively simple to stipulate to only report the square meters of land occupied times the length of occupation. This would make it much easier to cover agricultural systems.

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