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COMMISSION STAFF WORKING DOCUMENT

IMPACT ASSESSMENT

Accompanying the documents

Commission Regulation implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for vacuum cleaners

Commission Delegated Regulation supplementing Directive 2010/30/EU of the European Parliament and of the Council with regard to energy labelling of vacuum cleaners

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1. PROCEDURAL ISSUES AND CONSULTATION

1.1 Organisation and Timing

The products discussed in the underlying impact assessment (IA) report are electric dry vacuum cleaners (VCs) in the domestic and commercial sector. Wet, wet & dry, industrial, central, robot, wet filter and large battery vacuum cleaners are not included (see also par. 4.5.1). Within the measures it is not proposed to differentiate between different types of vacuum cleaner which perform the same function. The measure will thus cover cylinder, upright and stick appliances as well as those with or without bags.

Implementing measures on ecodesign of vacuum cleaners (VCs) is one of the priorities of the Action Plan on Energy Efficiency[1], and is part of the 2008 Catalogue of actions adopted by the Commission (EC) for the year 2008.[2] Legal basis of the Ecodesign Directive is Art. 114 TFEU (*internal market*)[3] and the Energy Labelling Directive is based on Art. 194 TFEU on energy policy, aiming amongst others at ensuring *security of energy supply* in the Union and *promoting energy efficiency and energy saving*.

Ecodesign and energy labelling requirements for products constitute an important instrument for meeting the policy objectives under the '*Resource-efficient Europe - Flagship Initiative*'[4], the '*Energy 2020*'[5] strategy paper and the Commission's '*Energy Efficiency Plan 2011*'[6]. The Ecodesign directive references the objectives of the *EAP6*[7] and *ECCP*[8].

At an operational level the *'20-20-20'* target is relevant, which aims amongst others at a 20% reduction of energy consumption and carbon emissions in 2020 with respect of the reference year 1990.[9]

In contrast to many other domestic appliances, vacuum cleaners have not been subject to mandatory energy labelling or other mandatory measures in the EU addressing their environmental impact before.

The proposed implementing measure is based on the Directive 2009/125/EC of the European Parliament and of the Council establishing a framework for the Commission, assisted by a regulatory committee to set ecodesign requirements for energy-related products[10] in combination with energy labelling under Directive 2010/30/EU. An energy-related product, or a group of energy-related products, shall be covered by ecodesign implementing measures, or by self-regulation (cf. criteria in Article 17), if the products represent significant sales volumes, while having a significant environmental impact and significant improvement

1 COM(2006)545 final.
2 COM(2008)11 final.
3 Treaty on the European Communities (TEC) was replaced by the Treaty on the functioning of the European Union (TFEU) which entered into force on 1st of December 2009, following the Treaty of Lisbon 13 Dec. 2007. The content of article 95 TEC was moved to article 114 TFEU.
4 A resource-efficient Europe – Flagship initiative under the Europe 2020 strategy, EC, 26.1.2011, COM (2011)21.
5 Energy 2020, A strategy for competitive, sustainable and secure energy, EC, 10.11.2010, COM(2010) 639 final
6 Energy Efficiency Plan 2011, EC, 8.3.2011, COM (2011) 109 final.
7 Decision No 1600/2002/EC of the European Parliament and of the Council of 22 July laying down the Sixth Community Environment Action Programme OJ L242/1 10.9.2002.
8 European Climate Change Programme. http://ec.europa.eu/clima/policies/eccp/index_en.htm
9 Formulated in 'Energy Policy for Europe', Presidency conclusions, European Council, March 2007
10 Directive 2009/125/EC of the European Parliament and of the Council of 6 July 2005 establishing a framework for the setting of ecodesign requirements for energy-related products (recast) , OJ L 285, 31.10.2009

potential (Article 15). The structure and content of an ecodesign implementing measure shall follow the provisions of the Ecodesign Directive (Annex VII).

Article 16 provides the legal basis for the Commission to adopt implementing measures on this product category.

Consultation of stakeholders is based on the Ecodesign Consultation Forum as foreseen in Article 18 of the Directive (see next section for details), including the consultation of stakeholders during a preparatory technical study from 2006 until February 2009 in order to assist the Commission in analysing the likely impacts of the planned measures.

Article 19 of the Directive 2009/125/EC foresees a regulatory procedure with scrutiny for the adoption of implementing measures. Subject to qualified majority support in the regulatory committee and after scrutiny of the European Parliament, the adoption of the measures by the Commission is planned by mid- 2013.

1.2 Impact Assessment Board

The Commission's Impact Assessment Board (IAB) gave its favourable opinion in the meeting of March 2012 under the condition that the report should be improved in a number of respects. In response, the underlying report has revisited the following aspects:

Subsection 2.1 of the IA report (heading to 'sales volume and market structure') now includes a fuller description of the market structure and a clear indication of the categories in scope was added in chapter 1 of the IA report and in the summary.

A table with key figures was added to the main text of the IA report in Chapter 2. The methodology, inputs and assumptions for the projections were better explained in the main body text and in the Annex. A fuller description in chapter 2 was included, explaining how the market structure discussed in 1 above has led to distortions.

In chapter 4 on policy options an explanation was included of the absence of international comparisons, and in sections 4.2 and 4.3 a fuller explanation as to why options 2 and 3 have been discarded.

In chapter 5, include a fuller explanation was added as to why the measures are on balance likely to a) increase market competitiveness, even though they will lead to the elimination of a high proportion of existing models from the market, b) benefits SMEs, distribution channels and consumers and c) lead to better more efficient vacuum cleaners worldwide.

The text was improved to better take account (updated) IA guidelines, and to improve readability for the lay reader. Tables and graphs were moved from the Annex D to the main body text to improve understanding.

1.3 Transparency of the consultation process

Starting in 2007, the EC commissioned a study of vacuum cleaners, called 'Lot 17, Vacuum Cleaners, Preparatory Studies for Eco-design Requirements of EuP.' (in the following called 'preparatory study'), carried out by external consultants[11] on behalf of the Commission's Directorate General for Energy and Transport (DG TREN, now DG ENER). The purpose of the Lot 17 study was to perform a technical, environmental and economic analysis for vacuum cleaners in order to improve their environmental performance, within the framework of Directive 2005/32/EC.

[11] The work was carried out by AEA Energy & Environment, Intertek, and Consumer Research Associates between November 2007 and January 2009.The study has followed the European Commission's MEEuP methodology . The study website is off-line, but the study is available on Circa

The preparatory study was developed in an open process, taking into account input from relevant stakeholders including manufacturers and their associations, environmental NGOs, consumer organisations, and EU Member State experts. The preparatory studies provided a dedicated website[12] where interim results and further relevant materials were published regularly for timely stakeholder consultation and input. The study website was promoted on the ecodesign-specific websites of DG ENER and DG ENTR. Open consultation meetings for directly affected stakeholders were organised at the Commission's premises in Brussels. The final stakeholder meeting took place 19 January 2009 in Brussels to discuss and validate the preliminary results of the studies. Minutes of the final stakeholder meeting are attached in **Annex C**.

Further to Article 18 of the 2009/125/EC Directive, formal consultation of stakeholders was carried out through the Ecodesign Consultation Forum consisting of a 'balanced participation of Member States' representatives and all interested parties concerned with the product group in question'.

The meetings of the Ecodesign Consultation Forum took place on 25th of June 2010 and 8th September 2011. Building on the results of the study, the Commission services presented a Working Document suggesting ecodesign requirements based on scenario developed under the preparatory study.[13] The working documents were sent out three weeks before the meeting to the members of the Consultation Forum, and to the secretariats of the ENVI (Environment, Public Health and Food Safety) and ITRE (Industry, Research and Energy) Committees of the European Parliament for information. The working documents were published on DG ENER's ecodesign website, and they were included in the Commission's CIRCA system alongside the stakeholder comments received in writing before and after the Consultation Forum meeting. Minutes of the Consultation Forum meetings can be found in **Annexes A and B**.

1.4 Preliminary results of stakeholder consultation

The general approach to set mandatory minimum requirements in the framework of ecodesign was largely supported by **Industry**[14] associations. However, the main discussion was on the definition of the scope and on the rating methodology. As regards the scope, the industry was in favour of tackling only dry vacuum cleaning systems and predominantly domestic systems and commercial products of that typology. For wet systems, robot vacuum cleaners, industrial products, central vacuum cleaner systems, etc. there are no suitable measurement methods. Most manufacturers initially also appeared to be sceptic towards the suggestion of the preparatory study to use the Ecodesign Directive to set an absolute power cap and were in favour of limits based on an 'efficiency rating', i.e. power consumption required to reach a specific cleaning performance. After a number of bilateral meetings, however, they proposed the addition of caps on absolute power consumption in combination with a minimum cleaning performance. After the second consultation forum, they proposed a compromise 'metric' for estimating energy consumption, that is influenced by cleaning performance but far less than their previous formula. For energy labelling, there was agreement on a labelling scheme that is coherent with that of washing machines and dishwashers, i.e. separate labelling schemes for specific energy and cleaning performance.

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12 ***now* off line**

13 Available on DG ENER's ecodesign website: http://ec.europa.eu/energy/efficiency/ecodesign/eco_design_en.htm

14 See e.g. position papers of CECED, available on their respective websites.

Environmental NGOs and **consumer's associations** were also in support of the proposed measure, not just for energy but also for noise, filtration performance and possibly also on other environmental aspects such as banning brominated and chlorinated flame retardants.

Regarding energy, the ECOS position papers of 22 June 2010 and 5th September 2011 supported a power cap of 1000 W by 2013 (then 750 W by 2015) in combination with a minimum cleaning performance and an energy label that would mainly be based on power consumption, but possibly with some small influence from cleaning performance. ECOS supports not mentioning the power on the label. As regards the scope, ECOS would like to incorporate small hand-helds (because of standby power), robot cleaners and an energy label that should also apply to commercial vacuum cleaners.

Member State representatives at both Consultation Forums the necessity of both measures, ecodesign minimum requirements and labelling, was not under discussion. Instead they discussed the various aspects of implementation. On the subject of noise, most countries were in favour a lenient noise limit of variously (80, 77 or 76 dBA), while the label should mention a dBA figure rather than include an A-G scale) . Austria was in favour of strict noise limits. Denmark was concerned over the correlation between noise and energy. Very strict requirements on filtration efficiency would mean it was redundant to give this information on the label. Cleaning performance was seen as necessary item for the label, but the discussion focussed on having 2 scales –hard floor and carpet cleaning—or 1 combined/weighted performance scale. The initial discussions on regulating/labelling the energy consumption was inconclusive, with some Member States in favour of power caps and others in favour of efficiency caps. However, it was agreed that a compromise method of estimating energy consumption, with some influence of cleaning performance on cleaning time (and so energy consumption) but less than had been suggested by the industry would be closer to reflecting reality.

2. POLICY CONTEXT, PROBLEM DEFINITION, AND SUBSIDIARITY

2.1 Policy context

Article 15(2) of the Ecodesign Directive formulates the main criteria that make a product group eligible for Ecodesign measures, i.e. *significant sales volume*, a *significant environmental impact* and a *significant improvement potential without excessive costs*. The latter is to take into account the absence of other relevant Community legislation or *failure of market forces* to address the issue properly and a *wide disparity* of environmental performance for functionally comparable products.

The following sections will subsequently address the three main eligibility criteria. Note that, as vacuum cleaners have not been subject to mandatory EU energy labelling in the past, data availability is poor. Also, vacuum cleaners have not yet been studies or regulated in third countries, apart from South-Korea from which no further data is available.

2.1.1 Sales volume and market structure

Sales domestic VCs

The preparatory study reports sales of around 45 million domestic vacuum cleaners per year in 2006[15]. Thus domestic vacuum cleaners most certainly meet the minimum sales criterion of Article 15.[16] The preparatory study states that less than one-third, around 14 million units,

[15] Source: AEA, Preparatory study vacuum cleaners, 2009. Relating to sales of vacuum cleaner types in the scope of the study

[16] Art. 15 Ecodesign directive: minimum sales of over 200.000 pieces/a.

were produced in the EU-27 in 2006. Approximately 31 million units were imported from mainly China (30 million).

The Eurostat (ProdCom) data suggest that the EU production represents a turnover in manufacturer selling prices (msp) of around € 1,25 billion, i.e. a unit msp of € 90,-. At the usual retail margin and VAT (msp x 2,5) this results in an average consumer price of around € 225,-/unit and a total consumer investment of over € 3 billion per year.

Production and trade of domestic VCs

The preparatory study reports that major EU producers are Germany (5,3 million unit sales in 2006), Italy (2,5 million) and the UK (1,8 million). Over the period 2000-2005 the EU27-imports of domestic vacuum cleaners have almost doubled to approximately 54,5 million units, whereas exports have remained stable at around 18-20 million units. Over the same period, EU-27 production has almost halved and the declining trend is expected to continue with manufacturers moving their production to Asia.

Market trends domestic VCs

Sales of domestic vacuum cleaners are increasing due to a combination of declining product life and increasing market penetration with more and more households owning 2 or more units. Over the period 2000-2005 the average annual units sales growth rate has been around 9%.[17] Around 40 million out of 45 million unit sales are replacements. At an average product life of 8 years this means a stock of over 320 million units.[18] For 2010, at 200 million EU27-households, this results in 1,6 vacuum cleaner per household.

As with most domestic appliances, vacuum cleaners continued this trend up to and including 2007, followed by a few years of heavy decline in sales, making the expected turnover for 2010 roughly the same as for 2005, i.e. 45 million annual unit sales. From then on, based on the ECFIN rebounce scenarios, the sales growth may pick up its old pace of ca. 9% per year to arrive at a total market of 100 million units in 2020.

Growth in the number of EU27-households over the 2010-2020 period is projected to be 1% per year, so 8% out of the 9% sales growth is due to either a shorter product life or an increased market penetration; the preparatory study does not have any specific indication. Assuming that two thirds (5%) is due to a shorter product service life and the product life of the stock in 2010 is still 8 years, the life expectancy of the average vacuum cleaner in a household will drop to 5 years in 2020. If the other 3% growth is caused by an increased market penetration then this would rise from 1,6 in 2010 to approximately 2 vacuum cleaners per household in 2020.[19] Note that this is a technically plausible assumption for the benefit of making scenario calculations; no statistical time series on VC product service life nor projections of VC market penetration are available.

Correlation between sales and energy impact

More sales and higher market penetration does not mean in itself that there is a higher electricity consumption during use. The total number of operating hours per household of vacuum cleaners is the relevant parameter. Having a vacuum cleaner on every floor of the

[17] Apparent consumption derived from Eurostat Prodcom and trade data, as published in the preparatory study.

[18] The preparatory study stock model mentions a stock, excluding handheld battery units, of 332 million units but tends to overestimate the stock of commercial vacuum cleaners.

[19] Given that 44% of households live in apartments, i.e. where usually 1 vacuum cleaner will be enough, this implies that the other households that live in individual houses would own and use around 3 vacuum cleaners (e.g. 1 for each floor, plus 1 in the garage). This is already at the limits of probability, but still perceivable.

house may be a sign of increased wealth, but the preparatory study found no indication that cleaning the house is becoming a more desirable activity. Therefore, in the energy scenario's the increased market penetration will play only a limited role, i.e. as the ownership goes up, the average operating hours per unit will go down (at least) at the same rate. In policy scenarios the shorter product life plays an ambiguous role: on the one hand it will promote the stock replacement of old inefficient vacuum cleaners by new, regulated types. On the other hand, the energy and environmental impact of production, distribution and end-of-life vacuum cleaners will become relatively more significant as compared to the use phase.

Market for non-domestic VCs

For non-domestic vacuum cleaners, there is even less hard data available than on domestic products. Non-domestic vacuum cleaners are estimated by the preparatory study to account for around 1,3 million unit sales, with the 'tub' type being the most popular (75% share). Statistical price information is not available, but at prices that are easily 3-4 times higher than those for domestic vacuum cleaners, the industry turnover may well be over € 0,4 billion in 2010. Furthermore, also as regards energy impact non-domestic vacuum cleaners may well be significant as they have much more operating hours in their useful product-life. For instance, at 3 hours per day over a useful life of 4 years, every unit will have 10 times more operating hours over its product life and around 15 times more operating hours per year.[20] Assuming that these 1,3 million sales are used to keep 'alive' a stock of around 5 million non-domestic vacuum cleaners then –at the same power consumption—these 5 million will count as much as 75 domestic vacuum cleaners in terms of energy impact. This is around 25% of the domestic energy impact.

2.1.2 Environmental impact

Electricity in the use phase

The preparatory study predicts an average rated power consumption of 1500 W per domestic vacuum cleaner owned and a time expenditure of 1 hour per week (say 50h per year) for vacuuming per household. At 200 million EU27-households in 2010, this means an average electricity consumption during use phase of 75 kWh/hh/a (divided over 1,6 vacuum cleaners per household) and a total EU27-consumption of 15 000 million kWh (15 TWh) per year. To this, around 25% for non-domestic vacuum cleaners have to be added, which brings the total to 19 TWh. At 0,43 Mt CO2 equivalent per TWh electricity this equals approx. 8 Mt CO2 equivalent in 2010. In primary energy 19 TWh electricity, at a primary energy power conversion factor of 2,5, is equivalent to 170 PJ (peta Joules) of fossil fuel enthalpy (*Hs*, Gross Calorific Value).[21]

As mentioned, for the trend in electricity consumption during the use phase of the product, the number of vacuum cleaners per household is not relevant. What is relevant is the increase in number of households (around 1-1,5%/a), the increase in average dwelling size (also around 1-2%/a) and the power consumption of the vacuum cleaner (approx. 2,5%/a). Trends in flooring, e.g. more or less labour-intensive carpets, may play a role, but the preparatory study givens no indications in this respect. Also changes in habits and hygienic standards have an influence, but again there are no indications of particular changes in this respect. Taking into account only household numbers, dwelling sizes and specific vacuum cleaner power consumption, the electricity consumption of vacuum cleaners –without measures-- should be

[20] This assumes around 4000 hrs life, brushless motor or possibly 2 carbon brush exchanges for motors with carbon brushes (change after a brush life of around 1500 h).

[21] 1 TWh= 2,5 (primary energy) x 3,6 (conversion TWh to PJ) PJ

just over 70% higher in 2020 with respect of 2010. For a 'BAU' scenario this means an EU-27 electricity consumption of around 32 TWh in 2020 (ca. 12,8 Mt CO2 eq.).

For comparison: 32 TWh/year is close to the current electricity consumption of Denmark. The greenhouse gas emissions of 12,8 Mt CO2 eq. are more than the current greenhouse gas of e.g. washing machines and dishwashers put together. Based on this environmental aspect alone, the environmental impact is significant enough to be elected for policy measures.

Production energy

At an average product weight of 7,2 kg and 40 million unit sales to keep the stock level, there is a net materials consumption of 288 000 tonnes per year. Given the overall Gross Energy Requirement of 130 MJ/kg[22], the total energy required in the EU-27 for production, distribution and end-of-life of vacuum cleaners amounts to around 37 PJ per year. It is still only 22% of the total energy impact but it is –as one of the few products that have been studied in the context of Ecodesign thus far—not insignificant, especially if the sales growth continues up to 100 million units per year.

Waste

The waste output from discarded vacuum cleaners lags some 10 years (product life+ time 'on stock' in the house) behind the developments in sales and relates to a smaller stock. The preparatory study estimates that 100 000 tonnes of discarded vacuum cleaners are collected through the official channels. An estimate of the amount discarded 'illegally', through the normal garbage or dumped, was not given.

Other waste includes disposable bags and filters, on average 5 bags and one filter per domestic vacuum cleaner per year[23], resulting in approximately 75 000 tonnes of waste. Waste from repairs (20% of products being repaired in the first 6 years of life) may include new hoses, carbon brushes, fans, etc., but the amount of waste from repairs is generally negligible.[24]

Noise

Noise is another environmental impact, but there is definitely a negative relationship with energy efficiency and most stakeholders are reluctant to set stringent limits for an appliance that will be used only indoors and at one hour a week.

Dust re-emission

Re-emission of small particulate dust (0.3-10 µ) from the vacuum cleaner is an important health factor for an increasing part of the population suffering from respiratory disease and allergies. It is also clear that reducing the level of small particulates in indoor air will provide a substantial benefit to the general population. The exact relationship between its effective removal from the floor and other surfaces, and their subsequent level in indoor air is not clear. On the other hand there is general consensus from stakeholders (in particular manufacturers)

22 The preparatory study finds GER-figures between 128 and 140 MJ/kg for the 4 different types.

23 Preparatory study mentions an annual cost of 12 Euro per average vacuum cleaner, based on 5 bags and one filter. This equals, including packaging a consumption of 5 x 50 g= 250 g paper/cardboard per year plus a negligible part for a filter. At a stock of 320 million units this results in waste of 75 million kg. The market share of 'bagged' vacuum cleaners (vs. 'bagless') is estimated at 85%.

24 The preparatory study mentions a cost of 50 Euro per repair, which comes down to 10 Euro per average vacuum cleaner

that a maximum level of 1% re-emission is possible without significant increases in product prices or energy consumption. There is also a case for declaring the level of dust re-emission, to enable those with relevant health concerns to pick vacuum cleaners that will meet their needs.

2.1.3 Saving potential

There is a wide disparity in vacuum cleaners as regards electricity use and there is no specific EU legislation tackling their energy and environmental impact.

As mentioned, the preparatory study identified an annual increase in power consumption of 2,5% per year. While the overall average may be 1500 W, the German national average is as high as 2300-2400 W. Also in other countries like the Netherlands the share of machines above 1800 W has grown to well over 40% and the baseline projection is that the average vacuum cleaner in the EU-27 will be substantially more than 2000 W in 2020.

At the same time, and at (at least) a comparable cleaning performance, there are several machines in the range of 650 to 900 W[25] that prove that a power cap of 1000 W or – in a few years – 750 W as proposed by the preparatory study seems feasible at first glance. Nevertheless, these are all upright ('vertical') vacuum cleaners, which are particularly popular in the UK. When looking at normal canister types – the ones with a hose – the lowest rated power consumption on the market is 1100-1200 W. Thus a 1000 W cap would eliminate all current models. For these types a higher initial power cap (1500-1600 W) would seem more appropriate and would still eliminate the 'worst' 40-50% of today's models. In a second stage, more ambitious targets could be set (e.g. 1100 W, see scenario's) and/or targets could be achieved through mandatory energy labelling. Note that the power values mentioned relate to an average nozzle width (25-30 cm); for a fair comparison 'power caps' should be capacity-specific, e.g. in W per cm nozzle width or – the same thing but more transparent to the consumer – Wh per m² floor area at a fixed number of double-strokes.

Energy savings of at least 30% (with respect of 2010) or 50% (with respect of baseline 2020) seem realistic. The latter translates into a saving of 16 TWh electricity and 6,4 Mt CO2 equivalent. Compared to savings for other domestic appliances subject to eco-design measures this is more than significant and confirms eligibility for measures.

The technical design options that would bring about these saving were identified in the preparatory study as follows:

(1) Maximising fan efficiency: reduce energy losses in fan/motor/drive from current 60-70% to 45% through improved fan case and impeller design;

(2) Improved efficiency airways: reduce energy loss of current 5-10% to the BAT level of 5%;

(3) Reduced filtration energy losses: increasing the filtration area surface;

(4) Reduced leakage losses: by using better seals reduce the current 10-20% loss to 5%;

(5) Nozzle improvements: reduce current loss at the nozzle from current 15-25% to 10%;

[25] Like the Vorwerk Kobold (900 W), Electrolux Envirovac (800 W), Dyson DC24 (650 W).

(6) Combinations of options 1 to 5 above: taking into account all of the above in a well-balanced design current overall vacuum cleaner energy efficiency can be improved from the current 11-25% to as high as 40%.

(7) Reduced materials/ light-weighting: Reduce product weight by up to 50%, using best materials options (e.g. foamed plastics)

(8) Increase product lifetime: Increase the product lifetime from 8 to 12 years by using better and – probably – more materials. This option is counteracting the effects of option 7.

In terms of product weight, there are vacuum cleaners that weigh 3,3 kg and those that will go up to 15 kg, suggesting that at least a 20-30% weight (and production energy) saving is possible.

When looking at the significant waste from bags and filters the obvious and hardly spectacular answer would be an even greater move towards 'bagless' vacuum cleaners, of which there are already many on the market with an increasing market share. But there is a practical limit as allergy sufferers would not willingly buy 'bagless' types due to the 'messy' emptying procedure, which may lead to much of the small particulate dust captured by the vacuum cleaner being re-emitted.. In other words, there is a likely negative health impact in making 'bagless' vacuum cleaners mandatory overall.

Noise is still problematic. Certainly there are silent vacuum cleaners at reportedly 66 dBA instead of the louder 80 dBA that one might expect from the average vacuum cleaner. But still, the power consumption is around 2200 W. Combinations of noise at those levels and a low power consumption can currently not be found. Note that, because of this negative correlation between noise and energy, stakeholders are not in favour of overly stringent noise requirements (see Annexes A to C).

Dust re-emission is another area where it is difficult to look at the possible improvement in isolation. For sure, better filters (HEPA, etc.) will help tremendously for those suffering from respiratory diseases, but for the average consumer it is questionable if a top filter performance is really needed, whereas certainly it will increase the aerodynamic resistance and thus power consumption. However, a maximum level of 1% re-emission, equivalent to a 'filter efficiency' of 99%, appears unlikely to significantly increase power consumption.

2.1.4 Legal basis

The Ecodesign Directive and, more specifically, its Article 16 provides the legal basis for the Commission to adopt an implementing measure that would tackle this problem. Note that the Ecodesign Directive relates to Article 114 of the Treaty of the Functioning of the European Union ('single market') and uses 'CE marking' of products brought on the market by manufacturers as the legal tool. **Subsidiarity in this context is not applicable**, because the problem is trans-national and actions by Member States alone would restrict free circulation of goods. Furthermore at the scale of EU level any action would be far more effective than at Member State level.

2.2 Problem definition

The main market and regulatory barriers hampering a larger market penetration of energy efficient vacuum cleaners were identified in the preparatory study and are as follows:

1. Lack of consumer information

The ecodesign preparatory study made clear that there has been very little policy action either in the EU or in third countries to reduce the energy consumption of vacuum cleaners. The

ecodesign and IA studies both found that the only information normally provided for vacuum cleaners was their power input. This has been marketed as a proxy for their performance.[26] As has been acknowledged by stakeholders for example in the Consultation Forum and in view of the market structure described in section 2.1.1, this has led to high power input and low efficiency. Some consumers use performance information from consumer organisations but this does not place much emphasis on energy consumption and has not halted the trend in increasing input power.

2. Externalities

As with other consumer goods, it is clear that even with good information available, many customers will either not understand implications, or will not care. Some of the impact will be on the users (energy cost, noise, dust re-emission in their own home, etc.), other impacts will be externalities (impact of energy production, noise to neighbours etc.). One justification of ecodesign requirements is to reduce the environmental impact of the vacuum cleaners people buy both for themselves, and for others.

3. Lack of specific policy measures

Specific measures

Apart from a voluntary EU Ecolabel program for vacuum cleaners in the period 2003-2008[27]and some similar national initiatives of a voluntary nature (France, Sweden[28]) the vacuum cleaner has so far escaped the attention of policy makers. Mandatory measures and financial incentives have also never been introduced, neither inside nor outside the EU.

At a component level, imminent Ecodesign regulations on fans and motors will have no effect on vacuum cleaners:

The Ecodesign Commission Regulation 327/2011 on Fans >125 W will have no impact on vacuum cleaner energy efficiency, because fans that operate at a speed above 8 000 rpm are exempt from the energy efficiency requirements (though not from information requirements). Vacuum cleaner fans operate at 30 000 rpm or – with brushless motors – up to 100 000 rpm.

The Ecodesign Commission Regulation No. 640/2009 on Motors >750 W, published d.d. 23.7.2009, will have – at least on the short run – no positive impact on vacuum cleaner energy efficiency, because it applies only to (brushless) squirrel cage motors. Motors with carbon brushes are, according to the preparatory study, still by far the most common type of vacuum cleaner motors and thus out of scope of the measure. Only the latest generation (more efficient) brushless vacuum cleaner motors, i.e. permanent magnet motors with variable speed drive, will be subject to Regulation No. 640/2009 and have to reach IE2 level on the 16tht of July 2011 and (for motors <7,5 kW) meet either the IE3 level or be equipped with a variable speed drive by 1 January 2017.

So far there has been no significant action by Member States to distort the internal market, but in the absence of EU action, the problems described may lead Member States to act on their own (as already has happened in the case of other products, such as circulators).

General legislation applicable to (certain types of) vacuum cleaners

[26] Ecodesign preparatory study, section 2.3.8, table 8

[27] Commission Decision 2003/121/EC of 11 February 2003 establishing the ecological criteria for the award of the Community eco-label to vacuum cleaners, OJ L 047 , 21.02.2003 P. 0056 - 0060. Article 4: 'This Decision shall apply from 1 April 2003 until 31 March 2007. If on 31 March 2007 revised criteria have not been adopted, this Decision shall apply until 31 March 2008.' The criteria were not revised and hence the Eco-label for VCs no longer exists, presumably because of lack of sufficient participants.

[28] www.environdec.com

At a more general level, the possible use of brominated or chlorinated flame-retardants is tackled in the RoHS Directive (2002/95/EC), but from literature it is clear that these are not a 'hot' environmental issue.

The WEEE Directive (2002/96/EC) was set up to handle recovery/recycling of electronic and electrical waste, amongst which vacuum cleaners. Given the recovery of some 100 000 tonnes through the official channels, this seems fairly successful. But no particular design measures were found – apart from the usual[29] – that would be particularly helpful in recovering and recycling of vacuum cleaners.

The packaging of vacuum cleaners has long been regulated through the Packaging directive (92/62/EC) and after the switch to simple mono-material solutions (cardboard/paper inside and outside) it can actually no longer be considered a priority environmental issue.

The Low Voltage Directive LVD (2006/95/EC) regulates electrical safety of domestic vacuum cleaners, but in terms of environmentally related issues the most relevant are references to harmonised standards on emissions of toxic materials under fault (on fire) conditions. For non-domestic vacuum cleaners the safety is regulated under the Machinery Directive (2006/42/EC) which came into force on 29 December 2009.

Other applicable legislation, all with very little bearing on the environmental impact, include the directive on Electromagnetic Compatibility EMC (2004/108/EC), the Batteries Directive (2006/66/EC) for vacuum cleaners with battery powered heads, the REACH Directive (2004/121/EC) for vacuum cleaners using chemicals in wet (filter) systems, the ATEX directive (94/9/EC) for non-domestic vacuum cleaners operating in potentially explosive atmosphere, possibly the Construction Products Directive (89/106/EC) for central vacuum systems and possibly specific directives on noise of appliances.[30]

4. Lack of appropriate measurement standards

Although consumer associations have been rating the cleaning performance of vacuum cleaners in all sorts of possible ways over the past decades, a harmonised test standard for domestic vacuum cleaners that would give consumers clear and unbiased quantitative performance rating is still lacking.

The most relevant for this purpose is the IEC 60312-1 (Vacuum cleaners for household use– dry vacuum cleaners – methods for measuring performance), which appears to be frequently under revision. It describes tests for dust removal from hard floors (with or without crevices), carpets, dust (re) emission, durability tests, maximum volume of dirt receptacle and – in the 4th version currently underway – energy consumption measurement. For the noise tests, where Sound Power (LwA) is measured expressed in decibels (dBA), of vacuum cleaners IEC 60704 applies. The EN 60335 (parts 1 and 2.2) is mainly a safety standard, but for the scope definition it may be useful to know that this standard defines 'nominal input power': the arithmetic average of maximum electric input power in W (at highest airflow) and the minimum input power in W (at zero airflow). The standard allows a 10% tolerance in the nameplate-declaration of both the 'nominal' and a 'maximum' value in Watts.

In Mandate 353, the Commission asked the European Committee for Electrotechnical Standardization (CENELEC) to prepare methods to measure the energy consumption, cleaning performance and dust re-emission of vacuum cleaners. A working group of their relevant technical committee (TC 59X WG 6) is preparing the necessary amendment of IEC

[29] E.g. design for disassembly, easy recovery of metals parts, avoid to use a mix of plastics that would make the product more difficult to handle in shredder-based recycling, etc. .

[30] The preparatory study mentions for outdoor leaf suction machines the Noise Emissions for Outdoor Equipment Directive (2000/14/EC).

60312. For the cleaning performance, the latest publication describes the measurement of the dust removal in % after 5 double strokes on hard floors with crevices or carpets.

For carpets the double strokes are performed on a test area of 700±5 mm long and as wide as the width of the cleaning head. Stroke speed is 0,5 ± 0,02 m/s and stroke length is (at least) 1200 mm with the cleaning head staring 200 mm before the test area and ending at least 300 mm past the test area. The amount of test dust is uniformly distributed at an amount of 125g/m² test area. Dust removal ability for carpets is calculated as the ratio between the dust captured in the dust receptacle and the dust originally applied to the test area.

For hard floors the double strokes are performed on a hard floor test area with a diagonally placed insert ('the crevice', e.g. a U-profile), positioned at an angle of 45° with respect of the direction of the stroke. The insert is filled with mineral dust, weighted to determine the amount of dust and then inserted in the hard floor test area. The dust removal ability for hard floors is ratio between the amount of dust removed from the crevice and the amount of dust that was originally in the insert at the width of the cleaning head, accounting for the oblique 45° angle.

The dust removal test result in %, both for hard floor and carpet testing, is the average result of a number of cleaning cycles.

Ring-tests were done and the test method proved to be accurate and repeatable. The question (and discussion, see chapter 1) is whether it is realistic to test dust removal by going over the same piece of floor 10 times or rather whether it is acceptable to perform unrealistic tests as long as the relative ranking does not change. A second problem, probably solvable by introducing it as a transitional method, is the fact that the protocol is at the very beginning of its approval procedure within CENELEC and has currently not even the status of prEN standard.

5. Comfort and habits

Upright vacuum cleaners often outperform the cleaning performance of canister vacuum cleaners (with a hose) with lower purchase price and lower energy consumption. However, many people find it difficult (heavy and tiring) to manipulate all of the machine (rather than just the light hose for canister types). Furthermore, 'uprights' are almost unsuitable for cleaning stairs, the interior of cars and below furniture. The figure below from Which? consumer magazine shows pros and cons.

Table 1. Vacuums: upright vs cylinder (from Which? magazine)

		
Type	**Upright**	**Cylinder/Canister**

Pros	Better for removing pet hair; particularly good at cleaning large, clear surfaces.	Better reliability than uprights; good under furniture and on stairs.
Cons	Harder to use on stairs; noisier and usually heavier than cylinders	Poor at removing pet hair unless motorised brush heads are provided; more difficult to store – unless it's a compact model.

http://www.which.co.uk/reviews/vacuum-cleaners/page/choosing-a-vacuum-cleaner/

On the subject of 'bagged' or 'bag-less' vacuum cleaners the same source mentions that 'bag-less' vacuum cleaner *'.. saves pennies and earns you some environmental brownie points'* but *'emptying the dust container can be messy and it's easy to spill dust – a big problem for allergy sufferers'.*

Finally, for those suffering from respiratory diseases and allergies, the energy efficiency is probably a minor concern. Allergens are substances that cause the human immune system to trigger and fight against them, causing an allergic reaction. Cat and dog allergen particles are often widely found in homes and the amount of dog and cat allergens retained by each vacuum cleaner is highly relevant. Which? magazine states that *regular vacuuming can be part of a wider strategy to minimise reactions to dust mites or pet allergens. And several vacuum cleaners are fitted with HEPA (high-efficiency particulate air) or S-class filters, which are designed to prevent allergens escaping.*

The problem of these HEPA and other fine dust filters is of course that they cause a significant pressure drop and thus a significantly higher energy consumption.

For comparison, the table 4 in Annex D shows (for commercial air handling units) the pressure drops that can be expected, according to EN 13779. Air velocities and flow rates in these air conditioning systems are quite different from those in vacuum cleaners, but it shows e.g. that a HEPA filter (500 Pa) has a very high pressure drop, which is also taken into account in the relevant legislation (e.g. EnEV 2009, through allowances of 50 to 100% on the maximum Specific Fan Power, in W/l/s, on these products.

2.3 Baseline scenario for the electricity consumption

In order to carry out a technical, environmental and economic analysis the preparatory study has constructed a baseline ('BAU') scenario 2007-2020, built on a simplified analysis of representative models for domestic vacuum cleaners (base case 1) and non-domestic vacuum cleaners (base case 2).

In particular the study has, amongst others, provided the following key elements:

1.1. A set of definitions of characteristics and operating conditions applied for the 2 categories;

1.2. A stock model ('vacuum cleaners in use'), based on the projections for the dwelling size and number of dwellings with functional unit for floor-cleaning is m² or km² per week;

1.3. Annual sales, derived from the stock model and based on typical product life per category;

The floor-cleaning performance is derived from DG ENER Lot 1 data on building volume (see fig. 1), whereby for residential dwellings a floor height of 2,85 m was assumed and for commercial/public sector a floor height of 3,6 m was employed.

According to this study, the total heated building volume 2005 was around 110 billion m³, of which houses account for 29,3% (32,2 billion m³, 11,3 billion m²), apartments for 14,5 % (16 bln m³, 5,6 billion m²). Together they account for around 17 billion m², or 17 000 km², of floor area to be cleaned. Note that only households, i.e. 'primary dwellings' actually in use, are counted. The growth of EU-27 households between 1990 and 2000 amounted to 10,1% (1% annually) and from 2000 onwards amounted to 7,6% (0,75% annually). The average dwelling size, with 87 m² in anchor year 2005 is estimated at 1% annually.

The commercial sector accounted for 14,5 % (16 billion m³, 4,4 billion m²), the public sector for 19,4% (21,3 billion m³, 5,9 billion m²). Together these tertiary sector buildings account for around 10,3 billion m², or 10 300 km², of floor area to be cleaned.

Naturally, especially in the public and retail sector with sturdy hard floor surfaces, very often dry vacuum cleaners will not be used, so –for lack of better data—the projections for the tertiary sector will assume the use of dry vacuum cleaners only in 50% of the tertiary sector floor area (offices, hotels), which means around 5,1 billion m², or 5 100 km² of floor area will actually be cleaned with dry vacuum cleaners and this size is kept constant over the projection period.

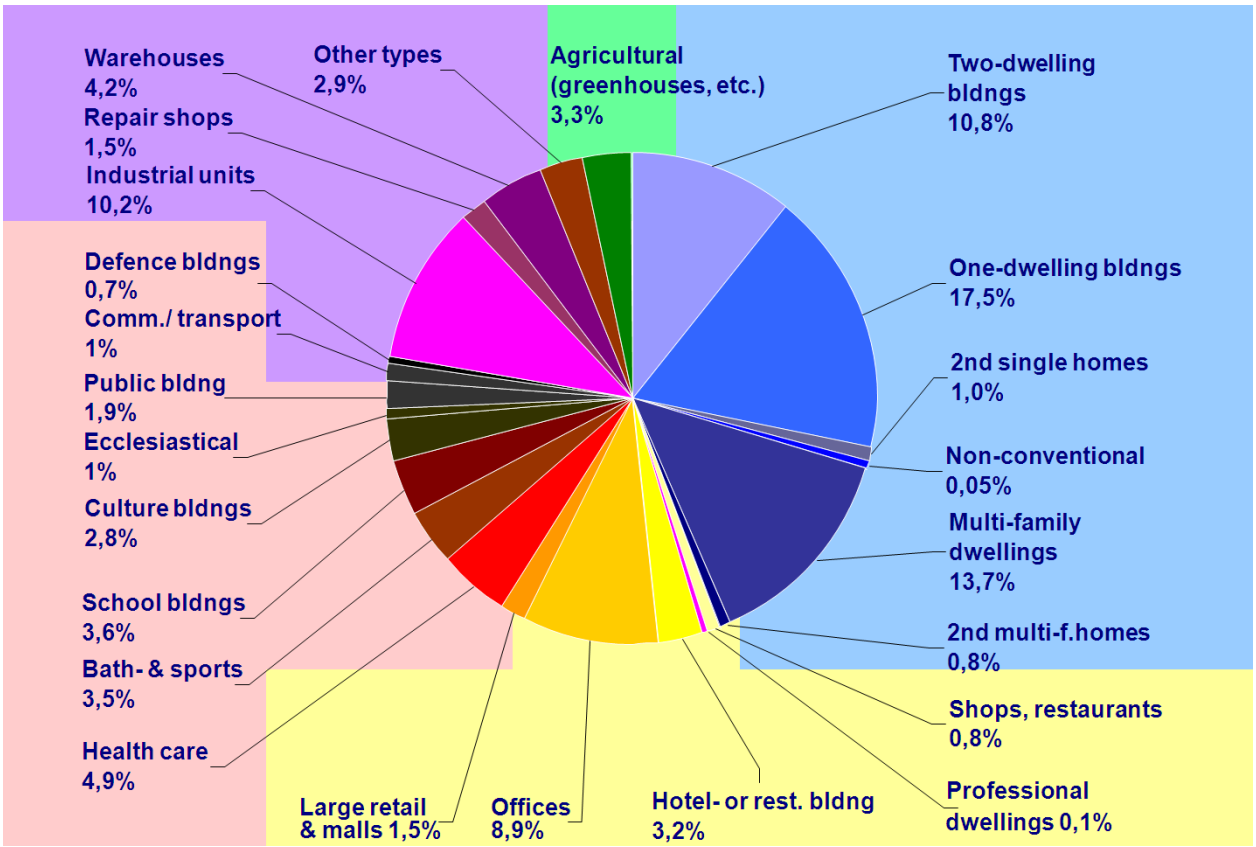

Fig. 1. Split-up of 110 billion m³ heated volume equivalent at 18°C indoor temperature in the EU. (source: VHK, Ecodesign Boilers, Lot 1, preparatory study)

The technical consultant for the underlying impact analysis has extended the model backwards to the reference year 1990 (reference for Kyoto Treaty and '20-20 in 2020' target) and forward to the year 2025.

The structure of the methodology of the technical, environmental and economic analysis is contained in **Annex D**.

The graph below shows the total weekly floor-cleaning demand, expressed in the functional unit of km² (=million m²) per week.

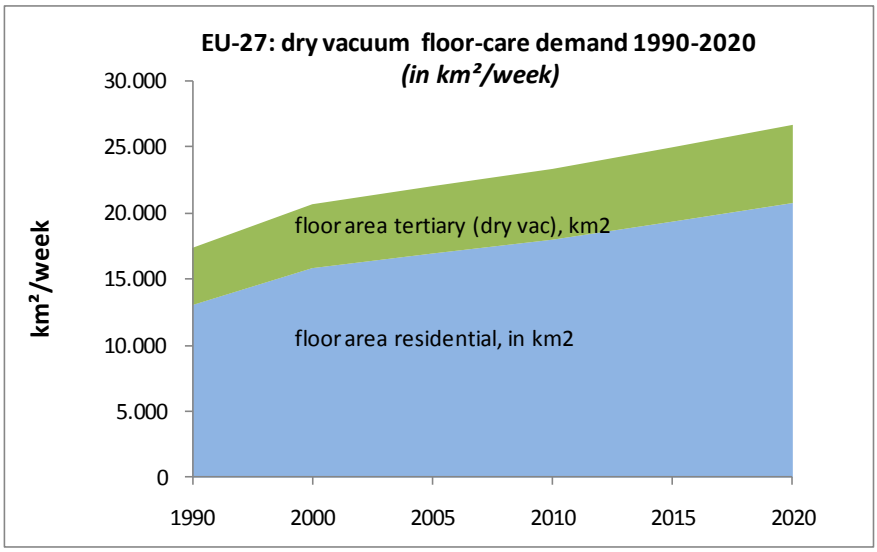

Fig. 2. Vacuum cleaners: Baseline floor-cleaning demand in km² floor-care/week .

The main outcomes of the baseline ('BAU', Business-as-Usual) scenario are summarized in Table 2 below.

This BAU scenario shows a rapidly growing energy demand rising from 18 TWh in 2005 to 43 TWh in 2025 (domestic and commercial). This is driven by increasing floor area, coupled with increases in average power input.

Table 2: Vacuum cleaners: EU-27 Key figures 'Baseline'

	1990	2000	2005	2010	2015	2020	2025
DEMAND (floor area to clean)							
primary dwellings EU-27, million	172	186	194	202	210	218	227
dwelling size, m²/dwelling	76	84	88	93	97	102	108
floor area residential, in km²	13072	15637	17103	18706	20459	22377	24474
floor area tertiary (dry vac), km²	4333	4840	5100	5360	5634	5921	6218
total floor area, km²	17405	20477	22203	24066	26093	28298	30692
ENERGY-RELATED PARAMETERS							
operating hours/km² dom.*, h/clean	11364	11364	11364	11364	11364	11364	11364
op. hours/km² non-dom.**, h/clean	10196	10196	10196	10196	10196	10196	10196
rated domestic VC power, W	1275	1423	1500	1739	2016	2337	2711
rated non-domestic VC power, W	929	1107	1200	1293	1393	1500	1500
electricity domestic, in TWh	9,5	12,6	14,6	18,5	23,4	29,7	37,7
electricity non-domestic, in TWh	2,1	2,7	3,1	3,5	4,0	4,5	4,8
energy total, in TWh	11,5	15,4	17,7	22,0	27,4	34,2	42,5
primary energy electricity, in PJ	104	138	159	199	249	311	392
primary energy disposables use, in PJ	2,2	2,3	2,4	2,5	2,6	2,7	2,8

prim. energy production & eol, in PJ	15	31	46	46	64	77	85
total primary energy PJ	121	165	200	234	295	371	371
GHG EMISSIONS							
Mt CO2/TWh	0,50	0,46	0,45	0,43	0,41	0,38	0,36
Mt CO2 electricity	4,7	5,8	6,6	7,9	9,6	11,3	13,6
Mt CO2 other	1,0	1,3	2,1	2,0	2,7	3,5	3,5
Mt CO2 total	6,7	8,4	10,0	11,2	13,5	15,7	15,7
ECONOMICS****							
€ billion electricity	1,9	2,6	3,0	3,7	4,6	5,8	7,1
€ billion disposables	2,1	2,3	2,4	2,5	2,6	2,7	2,8
€ billion purchase	4,0	8,4	12,2	12,2	17,0	20,6	22,7
€ billion total consumer expenditure	8,1	13,2	17,5	18,3	24,2	29,0	32,6
PRODUCT SERVICE LIFE VC							
product life sales domestic VC	9	8	7	6	5	4	4
product life stock domestic VC	9,0	8,6	7,6	7,3	6,2	5	5
SALES & STOCK							
sales growth domestic VC.***	8,0%	8,0%	0,0%	7,0%	4,0%	2,0%	2,0%
sales domestic VC, million units	16,66	35,97	52,86	52,86	74,13	90,19	99,58
sales non-domestic VC (1%/a growth)	1,1	1,2	1,2	1,3	1,3	1,4	1,5
total sales VC	17,8	37,1	54,1	54,1	75,5	91,6	101,1
in stock, domestic VC	150	194	288	355	387	411	474
in stock, non-domestic VC	5,5	6,2	6,5	6,8	7,2	7,5	7,8
market penetration, domestic (VC/hh)*	0,87	1,04	1,49	1,76	1,84	1,88	2,09

*=based on 87 m² per dwelling and ca. 1 h per week in 2005; 50 h/dwelling per year

**=based on 500h/a * 5,2 million units in stock = 2600 million h per 5100 km² x 50 weeks/a

***= in the year 2005 0% growth means that in the period 2005-2007 sale continue to grow at a rate of 8-9% per year, but during the crisis 2008-2009-2010 they drop again to a level of around 2005

****=based on product price constant in 2005 Euro

Comparing impacts to policy goals and other yardsticks: At 18 TWh/a in 2010 the VC represented around 0,7% of EU-27 electricity consumption.[1] The carbon emissions of 8,5 Mt/a represent 0,2 % of EU-27 total.[1] For 2020, taking the 2010 electricity use and carbon emissions as a reference, the share of VCs would be 1,1% and carbon emissions around 0,35% of the EU-27 total in the baseline scenario.

The baseline projection builds on the existing trend with a growth rate of 9% annually.

Environmental impacts

The environmental impact especially shows that for non-domestic vacuum cleaners the use phase is much more important than for domestic vacuum-cleaners. For domestic VCs it is remarkable that at least the production phase is not insignificant.

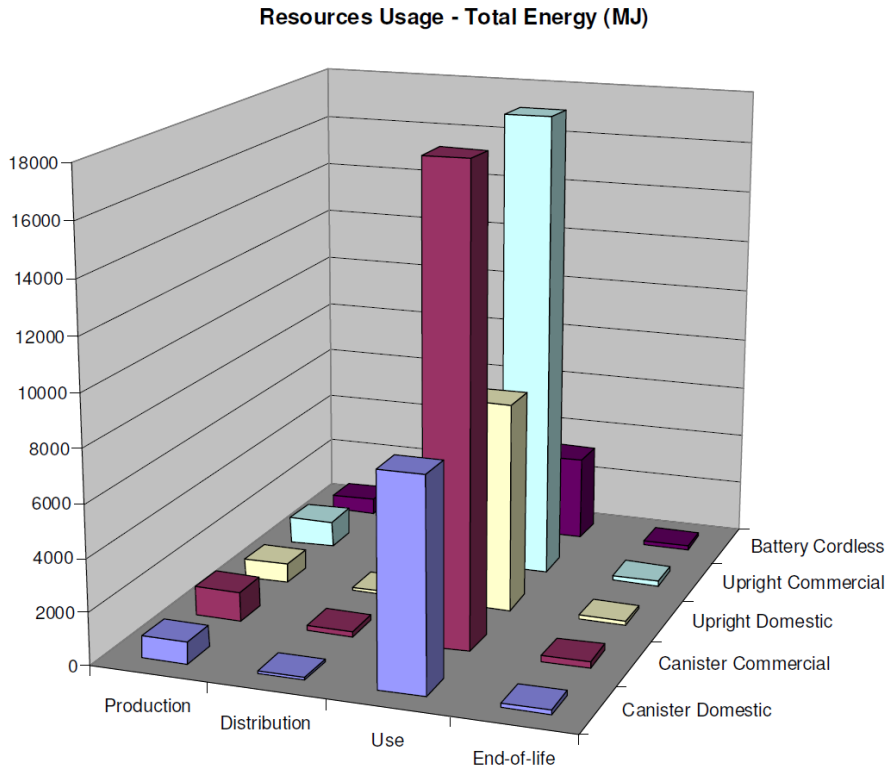

Fig. 3. Resources Usage (example from preparatory study)

As regards the monetary situation, the table 1 gives an overview of the direct and indirect consumer expenditure due to domestic vacuum cleaners today.

Actors and market structure

Currently the European domestic vacuum cleaner market is dominated by manufacturers such as BSHG (DE), Vorwerk (DE), Miele (DE), Rowenta (FR, SEB group), Philips (NL, EU site in PL), Electrolux (SE, EU sites in HU), Indesit (IT, Merloni group), Hoover Candy Group (IT, site in CZ), Dyson (UK, site in Malaysia), Numatic (UK), etc.. In non-domestic dry vacuum cleaners Nilfisk Advance (DK, also EU sites in IT, HU) is a leading manufacturer. EU dry vacuum cleaner related industrial employment, for production, R&D, distribution centres and head offices is estimated at around 7000 - 10 000 employees, of which roughly half in production. OEM employment will not exceed around 3000 people. Most EU manufacturers also have manufacturing sites in especially Asia (China, Malaysia).

Domestic vacuum cleaner manufacturers are represented at an EU-scale by the manufacturer's association CECED. Non-domestic vacuum cleaner manufacturers are represented by ICMMA, the Industrial Cleaning Machine Manufacturer's Association, and EUnited Cleaning, the European association of commercial cleaning machine manufacturers.

The retail and wholesale sector for vacuum cleaners in the EU-27 is estimated at around 300-350.000 companies. This estimate by the technical consultant VHK is based on a proprietary analysis of national and EU NACE statistics (see Table 4). The most important outlets are

stores for household appliances, DIY-stores, and the non-food section of larger supermarkets (>100 m²). Table 3 gives an overview of the number of companies.[31]

The added value of vacuum cleaners for the trade sector is assumed at 40% of sales in consumer prices, resulting in around € 1,3 billion for 2010. The total added value of the trade sector in the EU-27 is 11% of GDP, i.e. around € 1.300 billion[32]. So vacuum cleaners represent 0,1 % of the trade total.

Employment in the trade sector is 31 million jobs. Partitioning on the basis of revenue, this means that around 75.000 retail/trade jobs depend on vacuum cleaners.[33] These figures imply € 41.000 added value and € 96.000 turnover per employee in the trade sector. In addition to the 75000 jobs mentioned, independent door-to-door salespeople still represent a significant part of the market. For instance, the direct-selling German manufacturer Vorwerk sells its vacuum cleaners (brand 'Kobold') and kitchen mixers through 35.000 independent door-to-door 'advisers', of which a substantial part in the EU.

The trade sector is represented at EU level by Eurocommerce.

Table 3. Retail outlets EU, ca. 2005 *(source VHK analysis of Member State and Eurostat NACE statistics)*

NACE number & Descriptions	No. of companies
52.113 Superettes (100 m² - 400 m²)	50192
52.114 Supermarkets (400 m² - 2500 m²)	124985
52.115 Hypermarkets (>2500m²)	15213
52.121 Other department stores, non-food (>2500m²)	1772
52.122-129 Retail sale in non-specialized stores n.e.c.	18703
52.445 Stores for household appliances n.e.c.	17408
52.461 Stores for hardware, plumbing and building materials	94522
52.462 Do-it-yourself / paint stores	37982
Total	360776

The national government tax offices collect the taxes and levies. In the scenario calculations some 19% VAT and taxes were assumed on top of the consumer price without taxes. This translates into around 17% of sales, i.e. around € 510 million in 2010.

The electricity costs of vacuum cleaners in the EU are around € 3 billion in 2010. The electricity companies, represented at EU level by Eurelectric.

As mentioned in Table 1, the total consumer expenditure in 2010 at a total of almost € 15 billion in 2010[34]. Per capita this comes close to ca. € 30 and per household close to € 75,-. Consumer associations are represented at EU level by ANEC/ BEUC.

Other relevant stakeholders are the green NGOs (e.g. ECOS) and the Member States.

2.4 Sensitivity analysis of baseline

[31] Note that one company may own several outlets. On the other hand, a part of the population may choose not to have reflector lamps on stock, which together makes for the estimate of 250-300.000 outlets.

[32] Source www.eurocommerce.be

[33] Total employment data are based on Eurocommerce data. Note that the figure of € 41.000 added value per employee is used in the analysis of suboptions.

[34] At € 0,16/kWh this is € 2,4 billion in electricity + at € 12,-/a for bags gives € 2,4 billion + at € 225/unit and 45 million unit sales resulting in € 10,1 billion

How robust are the projections in the baseline scenario? First of all, it must be mentioned that the data availability for this sector is very poor. This is not only due to the 'usual' confidentiality issues, but also because the VCs have largely been ignored from an energy perspective by most stakeholders. As a result, not only market data but also technical data regarding efficiency are difficult to find and a large part of the underlying analysis had to be based on anecdotal rather than systematic information. An extra difficulty is introduced by the fact that VC projections relate to both the domestic and the tertiary sector.

Economic Crisis

In several consumer product sectors the 2008-2009 crisis has led to drops in sales up to 20 or 25% (air-conditioners, boilers, etc.), after a considerable growth in the 2006-2007 period. The overall effect that is assumed, in line with scenarios given by EC DG ECFIN, is that the 2010 sales equal those of 2005. This scenario has been compared with other standard crisis scenarios proposed by the Commission and appears fairly robust (deviations <10%).

As regards the influence of the electricity rates the scenarios have been adapted to the latest findings in the MEErP study[35], which signals that the electricity rates – which were previously in line with inflation – were subject to an escalation rate (real growth, i.e. above inflation) of 3-4%.

Functionality

The development of vacuum cleaners has been evolutionary rather than revolutionary. Hence no drastic changes are expected for the future.

Rebound effect

The 'rebound effect' is a phenomenon whereby the increased popularity of an energy-saving technology has not only triggered replacement of inefficient products, but – presumably because consumers no longer felt 'guilty' – also created completely new applications in places where no energy was consumed before.

With vacuum cleaners the chances of these rebound effects are very slim, because no matter how wonderful the new vacuum cleaner the activity of floor-cleaning is very unlikely to become more popular for that reason.

Conclusion

Based on the above, the accuracy of the baseline scenario in predicting the electricity consumption of vacuum cleaners in 2020 is estimated not be higher than ± 20%.

2.5 Risk Management

For a sector like vacuum cleaners there are no issues that meet the conditions for a risk assessment as a part of the impact analysis as addressed in the EU IA Guidelines.[36]

3. OBJECTIVES

As laid out in Section 2, the preparatory study has confirmed that a large cost-effective potential for reducing electricity consumption of vacuum cleaners exists. This potential is not captured, as outlined above. The general objective is to develop a policy which corrects the market failures, and which:

[35] Kemna, R. , Methodology for the Ecodesign of Energy-related Products (MEErP), VHK for European Commission, Nov. 2011.(see www.meerp.eu)

[36] European Commission, Impact Assessment Guidelines, SEC(2009)92, 15 Jan. 2009.

1.4. I) Reduce energy consumption and related CO2 and pollutant emissions due to vacuum cleaners following Community environmental priorities, such as those set out in Decision 1600/2002/EC or in the Commissions European Climate Change Programme (ECCP);

1.5. II) Promote energy efficiency hence contribute to security of supply in the framework of the Community objective of saving 20% of the EU's energy consumption by 2020.

The Ecodesign Directive, Article 15, requires that ecodesign implementing measures meet all the following criteria:

1.6. a) there shall be no significant negative impacts on the functionality of the product, from the perspective of the user;

1.7. b) health, safety and the environment shall not be adversely affected;

1.8. c) there shall be no significant negative impact on consumers in particular as regards affordability and life cycle cost of the product;

1.9. d) there shall be no significant negative impacts on industry's competitiveness;

1.10. e) in principle, the setting of an ecodesign requirement shall not have the consequence of imposing proprietary technology on manufacturers;

1.11. f) no excessive administrative burden shall be imposed on manufacturers.

1.12. As regards the operational objectives it is clear that the 2020 time horizon, used in several overarching policy objectives for energy security of supply and environment, is very important. Savings in 2020, with respect to the reference year 1990, will indicate the relative contribution of measures.

4. POLICY OPTIONS

4.1 Option 1: No EU action

This option would have the following implications:

1.13. The market failures would persist, and only very slowly the consumers would become aware of the advantages and disadvantages of the different types. The impact of this option is described in more detail in Section 2.

1.14. It is to be expected that Member States may want to take individual non-harmonised action on vacuum cleaner efficiency. This would hamper the functioning of the internal market and lead to high administrative burdens and costs for manufacturers, in contradiction to the goals of the Ecodesign Directive.

1.15. The specific mandate of the Legislator would not be respected.

Therefore this option is discarded from further analysis.

4.2 Option 2: Self-regulation

This option would have the following implications:

1.16. No initiative for self-regulation on vacuum cleaners has been brought forward by any industrial sector.

1.17. Industry has called for a clear legal framework ('level playing field') ensuring fair competition, while voluntary agreements could lead to competitive advantages for free-riders and/or non-participants to the 'self-commitment'.

1.18. The specific mandate of the Legislator would not be respected.

The relevant industry association (CECED[37]) made a number of 'voluntary agreements' in the 1990s in respect of some white goods(washing machines, dishwashers and refrigerators and freezers) However in the mid-2000s they decided they would prefer statutory limits as this gave a level playing field, and so ruled out agreeing to self-regulation. This remains their position. Moreover, as explained in par. 2.1.1, the market structure (low concentration and low market power) would probably rule out an effective self-regulation.

Therefore this option is discarded from further analysis.

4.3 Option 3: Energy labelling targeting vacuum cleaners

This option would include the labelling of vacuum cleaner efficiency in seven efficiency classes as under the Energy Labelling Directive

This option would imply the following:

1.19. In general, two main objectives of labelling schemes are to increase the market penetration of, in this case, energy efficient products by providing incentives for innovation and technology development, and to help consumers to make cost effective purchasing decision by addressing running costs.

1.20. Furthermore, the energy label would be an ideal vehicle to inform the consumers on the performance characteristics of the new(er) technologies.

Option 3 would result in savings. However, it would miss out on the substantial initial reduction in energy consumption from minimum requirements which will eliminate a high proportion of current models from the market (though design changes will be relatively small). Based on the experience from white goods energy labelling, it seems likely that a labelling only policy would allow substantial continuing sales of existing high input power (low efficiency models). This might be particularly marked for the low price models. Especially with vacuum cleaners having been turned into a relatively cheap commodity product, a large part of the possible buyers are relatively insensitive to ‘rational’ economic and environmental arguments. These buyers would not be reached by labelling alone and for this reason ‘labelling only’ is discarded as an option.

4.4 Option 4: Ecodesign implementing regulation on vacuum cleaners (MEPS)

This option aims at improving the environmental impact of vacuum cleaners, i.e., setting minimum efficacy levels for their power consumption. Details of the rationale for the elements of the corresponding regulation, as listed in Annex VII of the ecodesign framework directive, would apply.

In itself this is an effective measure, because it is largely independent on consumer and market behaviour and would take the worst performing products from the market.

On the other hand, it would not address the considerable saving potential from new technologies as it would not provide the necessary guidance and ‘market pull’ towards these new technologies. For that reason the options of ‘MEPS only’ is discarded.

4.5 Option 5: Labelling and Ecodesign MEPS combined

The most adequate solution is a combination of options 3 and 4, i.e. labelling and MEPS. It combines the advantages of the two options discussed earlier and it avoids the pitfalls.

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But within that option there are still several sub-options related to timing and target levels, elaborated in Chapter 5.

4.5.1 Definition of the types of energy-using products covered

The scope of the product categories addressed by an ecodesign measure is in line with the scope of the preparatory study and stakeholder consultations. This means that in principle domestic and non-domestic dry vacuum cleaners are addressed. The following table gives an overview of the scope:

Table 4 . Products in scope

Products within scope	**Proposed definition**
Domestic VCs	A vacuum cleaner (including hybrid products that can be both mains and battery powered) used primarily in household or domestic situations; the manufacturer declares the product's compliance with the Low Voltage Directive (LVD) in the Declaration of Conformity (DoC).
Commercial VCs	A vacuum cleaner for professional housekeeping purposes and intended to be used by laymen, cleaning staff or contracting cleaners in office, shop, hospital and hotel environments; the manufacturer declares the product's compliance with the Machinery Directive (MD) in the Declaration of Conformity (DoC).
Products excluded from scope or to be included with delay	**Proposed definition**
Industrial VCs	designed to be part of a production process, including vacuum cleaners designed for cleaning hazardous material, or as part of an industrial machine or tool and/or with a head width exceeding 50 cm
Wet VCs	A vacuum cleaner that can store dirty water or water-based cleaning solution, previously placed on the surface to be cleaned or dried by the same appliance or separately by the end-user.
Wet and dry VCs	A vacuum cleaner designed to remove a significant volume (more than 2.5 litres) of liquid.
Robot VCs	An appliance equipped with built-in energy source that recognize environment autonomously navigated and performs autonomous and/or semi-autonomous cleaning function.
Central VCs	With a fixed (not movable) underpressure source location and the hose connections located at fixed positions in the building
Battery VCs	Battery powered domestic or commercial VC
Water filter VCs	An appliance that uses water as filter medium; the suction air is forced through the water entrapping the removed dry material as it passes through.(Label and ecodesign when measurement method.)

Measurement standards

The applicable standard will be EN 60312, including the latest amendments. If the standard is not approved by the standardisation bodies in time, relevant parts will be published as a 'transitional method' in the Official Journal.

4.5.2 Implementation of ecodesign requirements

According to the 2009/125/EC the target levels for measures should be set at least life cycle cost (LLCC), which presumes that at some point the price of the product increases so much with extra design options to save energy that the life cycle costs (purchase price plus running costs) will start to rise again.

However, as has been argued in the preparatory study, most design options can be realised at low costs and negligible effect on Life Cycle Costs (e.g. +€ 10/unit). Exceptions may occur for increased product life (consumer price +€ 50/unit) or when the MEPS would impose the

use of VSD permanent magnet motors. The latter may typically occur at second stage MEPS and would drive the average price to around € 275-€ 285 from the current (in constant €, 2005) from the current € 225/unit.

Generally speaking, the LLCC point typically coincides with the BAT (Best Available Technology) point and it will be mostly the maturity of the latest technologies and the affordability to restrict target levels.

Efficiency requirements vacuum cleaners

The preparatory study proposes to introduce a power cap of 1000 W (first tier, 2014) and later 750 W (second tier, 2017). Given the stringent limits, energy labelling in whatever form is not expected to play a role until after 2020. This is known as ***'sub-option 1'*** in the scenario calculations.

Compared to the baseline domestic vacuum cleaners in 2020 (2337 W, see Table 3) stage 2 requirements imply a 67% saving. Compared to the baseline non-domestic dry vacuum cleaners (1500 W, see Table 3) stage 2 requirements give a 50% saving.

Stage 1 is foreseen 2 years after entry into force of the regulation and stage 2 is foreseen 4 years after entry into force of the regulation.

This proposal heavily relies on the fact that industry will be able to develop effective and efficient products in the future, as it bans all currently available canister type vacuum cleaners on the market today.

Sub-option 2 is the industry counterproposal presented in May 2010 regarding energy labelling. Energy consumption is estimated on the assumption that the consumer will continue to operate the vacuum cleaner until a minimum cleaning performance is reached (e.g. 65% for carpets, 90% for hard floor used in a combined index). Hence a vacuum cleaner with low cleaning performance will have far higher annual energy consumption than one with good cleaning performance.

In 2010, the industry did not propose to use limits of any type, but for the sake of the analysis it is assumed that eventually an elimination of class F (in stage 1) and D (in stage 2) would be plausible. Figure 5 below illustrates the energy labelling classes (in kWh/yr[38]), the cleaning classes in '% dust pick up' (dpu) and the allowed power consumption (wattage, in W) for carpets. Note that in this Sub-option 2 the cleaning performance plays a large role. Even after stage 2 (elimination of D class) it is possible to produce vacuum cleaners with almost 3000 W power consumption (out of reach of the diagram), as long as the cleaning performance is good enough (e.g. cleaning class better than D). There is little evidence as to how users behave in reality, but two small studies undertaken by manufacturers indicate a limited influence of cleaning performance on cleaning time (and so energy consumption). [39]

[38] The original proposal was in Wh/10m² . But for the annual energy consumption the industry proposal entailed that this figure would be multiplied by 50 times a year (once a week) and by 10 x 10 m² (home with 100 m² surface).

[39] As mentioned the industry proposal entailed a combined cleaning index, composed of a normalized carpet cleaning index (normalized to 65% dpu) and a normalized hard floor crevice cleaning index (normalized to 90% dpu). For the sake of simplicity the diagram only shows the results for carpet only vacuum cleaners.

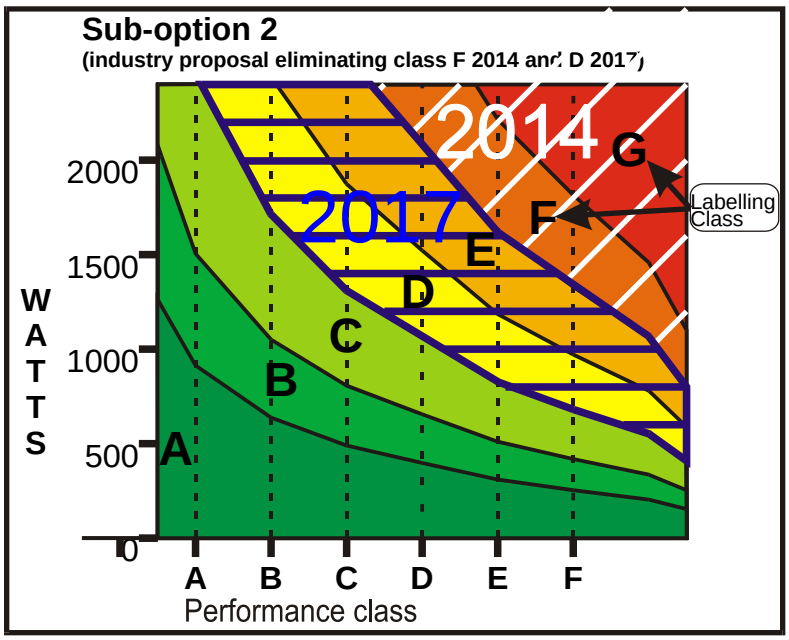

Fig. 5. Sub-option 2: industry label proposal + eliminating class F (stage 1) and D (stage 2)

This makes it very hard to predict a saving potential, because there is only anecdotal information on the cleaning performance (i.e. from consumer association tests) based on the new EN 60321 standard still under development. Based on this scarce information and an assumption that the market will not accept a cleaning performance below 'C' (in combination with a minimum 'C' energy class due to the regulation) the average power consumption will not reach the level of 2337 W projected for 2020, but will stay at a level of around 1800-2000 W for domestic vacuum cleaners (20% saving versus baseline). For non-domestic vacuum cleaners the level may be at 1200 W (also 20% saving versus baseline).

Sub-option 3, i.e. the 2011 Working Document, is a compromise that takes largely into account the stakeholder comments and that does not run the risk of eliminating canister types of the market. It proposes a 1st tier power cap of 1600 W plus the elimination of energy classes F and G and a 2nd tier maximum power of 1200 W plus elimination of energy classes D and E. At the first tier classes 'A+' and 'A++' will be introduced and at the 2nd tier energy class 'A+++' will be added. As with sub-option 2, for sub-option 3 stage 1 is foreseen 2 years after entry into force of the regulation and stage 2 is foreseen 4 years after entry into force of the regulation.

The metric for the energy labelling includes an effect to the cleaning time dependent on the cleaning performance, but considerably smaller than that of the 2010 industry proposal. It also has a smaller bandwidth for the energy classes. For instance, where sub option 2 proposes an F class lower limit at ca. 250-270 kWh/yr (at 100 m² surface) for carpet vacuum cleaners, the sub-option 3 proposes an F class lower limit at ca. 78 kWh/yr.

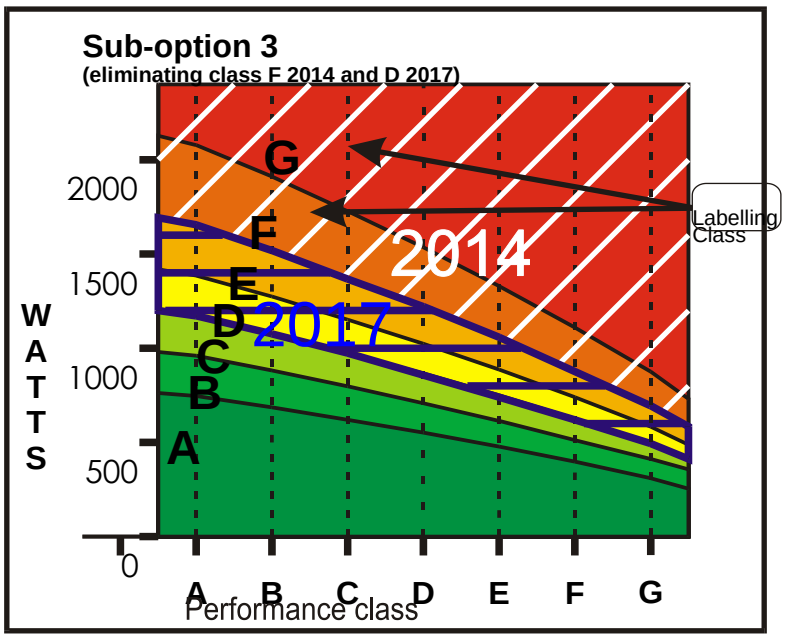

Fig. 6. Sub-option 3: commission proposal labelling + power caps (1600 and 1200 W in tier 1 and 2 respectively) + eliminating energy classes F&G (tier 1) and D&E (tier 2).

The maximum ecodesign power requirement will be accompanied by *minimum performance requirements,* i.e. for carpet cleaning the dust removal ability must be 65% at 5 double strokes ('DS') and for hard floor cleaning (with crevice) a minimum dust removal ability of 95% at 5 DS applies. The minimum performance requirements will be effective 1.1.2017.

Energy labelling, showing separate energy (A-G scale) and cleaning performance (A-G for carpets and A-G for hard floors), is expected to give an extra energy saving that is 15-20% below the power caps. For the suboption 3 scenario, power values of 1350 W (1st tier) and 1050 W (2nd tier) will be used.

Considering that also in the period 2017-2020 the energy label will have its effect, the energy saving for domestic vacuum cleaners , compared to the baseline, will be in the range of 55-60% for the domestic vacuum cleaners and 35% for non-domestic vacuum cleaners.

Note that there are no regulations on vacuum cleaners in third countries. Apart from some no longer active, voluntary labelling efforts, only South-Korea seems to be active in this field. As a result, there is no comparison-basis for the ambition level of the above mentioned savings of 55-60% for domestic and 35% for non-domestic vacuum cleaners.

Apart from minimum requirements on energy consumption and main performance (dpu), the sub-option 3 also sets minimum requirements in the 2nd tier for dust retention (maximum 1% [40]) and noise power (maximum 80 dBA).

Product Information requirements

Product information requirements should help the transition process and help avoid disappointing consumer experience with energy-saving vacuum cleaners.

[40] Dust retention is the fraction of the dust picked up that leaves the vacuum cleaner (and re-enters the room) through its exhaust opening

All information should be available on free-access websites, the URL of which should be in the packaging of the product (6 pt font)

4.5.3 Implementation of energy labelling

The energy label identifies manufacturer and model name and it contains information on

- annual electricity consumption (in kWh/yr, calculated from annual surface area to clean as well as power consumption and cleaning performance of the model),
- energy efficiency class (class A-G, based on annual electricity consumption),
- carpet cleaning performance (class A-G),
- hard floor cleaning performance (class A-G),
- dust re-emission (class A-G) and
- noise power (in decibel).

Implementation of the label is mandatory 1 year after entry into force of the delegated regulation. Extra labelling classes are to be introduced (and lowest labelling classes eliminated) 2 years (add 'A+' and 'A++') and 4 years ('A+++') after entry into force of the delegated regulation.

4.5.4 Date for evaluation and possible revision

The main issues for a possible revision of the Regulation are

1.21. appropriateness of the product scope;

1.22. appropriateness of the levels for the ecodesign requirements

The second stage of the ecodesign requirements becomes effective 4 years after entry into force of the Regulation. With a view to the level of requirements proposed and the still immature market for new technologies, a review can be presented to the Consultation Forum 5 years after entry into force of the regulation. For this revision, it is important that the necessary measurement standard is fully developed and tested

4.5.5 Interrelation with other ecodesign implementing measures — implications on scope

As mentioned in Chapter 2, there is hardly any overlap at the present time with other Ecodesign regulations such as e.g. the Motor or Fan Regulation.

4.5.6 Options related to production phase

As was noted in section 2.3 (environmental impacts) the energy embedded in domestic vacuum cleaners was perhaps 10-15% of total energy, and so not insignificant. The preparatory study identified different options such as light weighting and increased durability for reducing the overall material content of performing the vacuum cleaning functions, thus addressing this significant impact. The option that appears most beneficial at this stage is increasing the durability of vacuum cleaners along with information requirements on disassembly for repair/maintenance and recycling/recovery/disposal.

The preparatory study suggested that:

- the number of vacuum cleaners bought annually is increasing due to a combination of declining product lifetime and the increasing trend towards multiple ownership;
- the top reasons for breakdowns were "split or broken hoses" (first cause) and "motors" (second/third highest cause depending on the type of vacuum cleaner);

- vacuum cleaners dominate the "small mixed WEEE" (category 2) waste stream in terms of waste generated (and collected);

Durability requirements addressing the hose and the motor can be introduced, because applicable test methods are included in the IEC 60312 standard. Information requirements on disassembly for repair/maintenance and recycling/recovery/disposal are also feasible.

5. IMPACT ANALYSIS

5.1 Introduction

Given that options 1 to 4 have been discarded in Section 4, this Section looks into the impacts of option 5. To this end an assessment of possible sub-options as regards the 'intensity' of the measure - the combination of the levels of requirements for the levels pursuant to Article 15(4f) of the Ecodesign Directive - is carried out, in terms of economic, environmental and social impacts. The savings calculated in this chapter relate to measures for vacuum cleaners.

The assessment is done with a view to the criteria set out in Article 15(5) of the Ecodesign Directive, and the impacts on manufacturers including SMEs. The aim is to find a balance between quick realisation for achieving the appropriate level of ambition and the associated benefits for the environment and the user (due to reduction of life-cycle costs) on the one hand, and potential burdens related e.g. to un-planned re-design of equipment for achieving compliance with ecodesign requirements on the other hand, while avoiding negative impacts for the user, in particular as related to affordability and functionality. The methodology of the analysis is explained in **Annex D**.

The sub-options 1, 2 and 3 are explained in par. 4.5.3.

5.2 Impacts

5.2.1 Electricity

The graph below gives the results for the baseline and 3 sub-option scenarios.

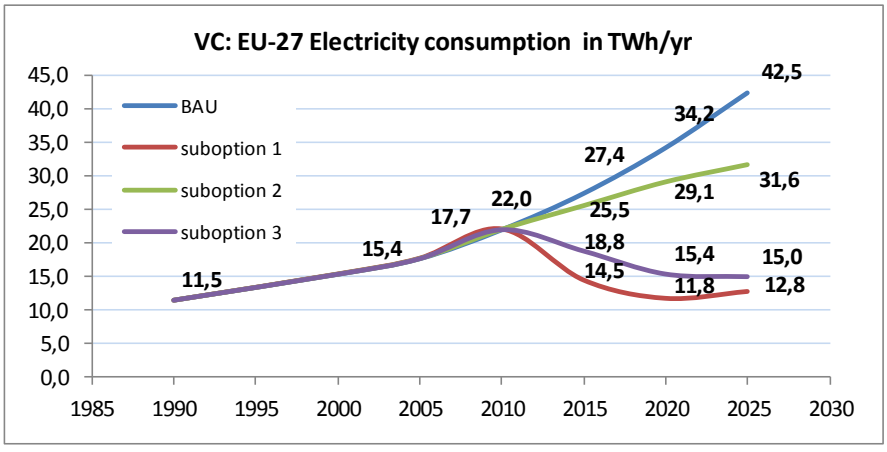

Figure 7

The graph shows that in 2020 the BAU scenario amounts to around 34 TWh/yr, whereas sub-option 1 promises a saving of 22,4 TWh/yr. Sub-option 3 saves around 3,6 TWh/yr less, but still 18,8 TWh/yr (55%). Sub-option 2 saves considerably less, i.e. only 15% in 2020. In 2025 the savings further increase.

5.2.2. Emissions: Carbon

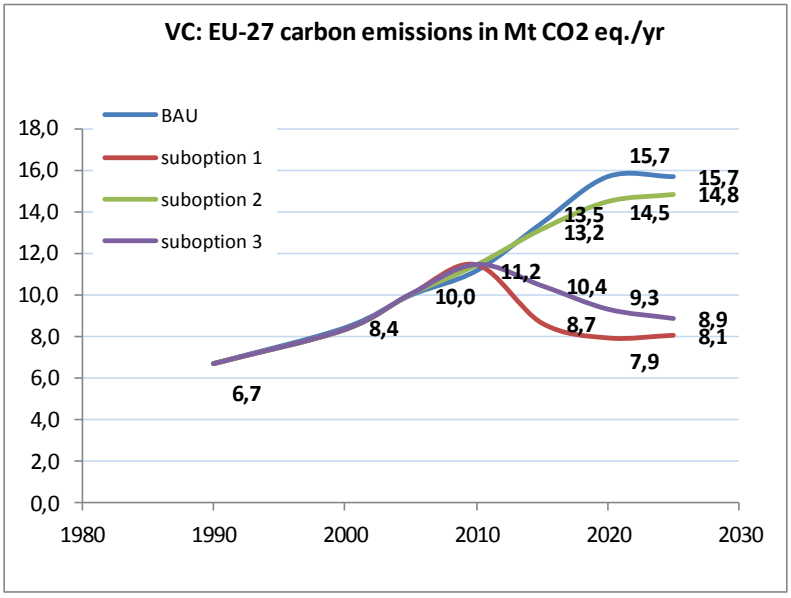

Figure 8

The picture for greenhouse gas emissions is similar to that of the electricity consumption, which is the main contributor to the carbon emissions with vacuum cleaners. In 2020 sub-option 3 saves 6,4 Mt CO2 equivalent and sub-option 1 around 7,8 Mt CO2 equivalent, which are both substantial savings versus the baseline. The CO2-saving of sub-option 2 is relatively small, i.e. 1,2 Mt CO2.

5.2.3 Consumer impact

The graph below gives the total annual consumer expenditure on dry vacuum cleaners (purchase and running costs).

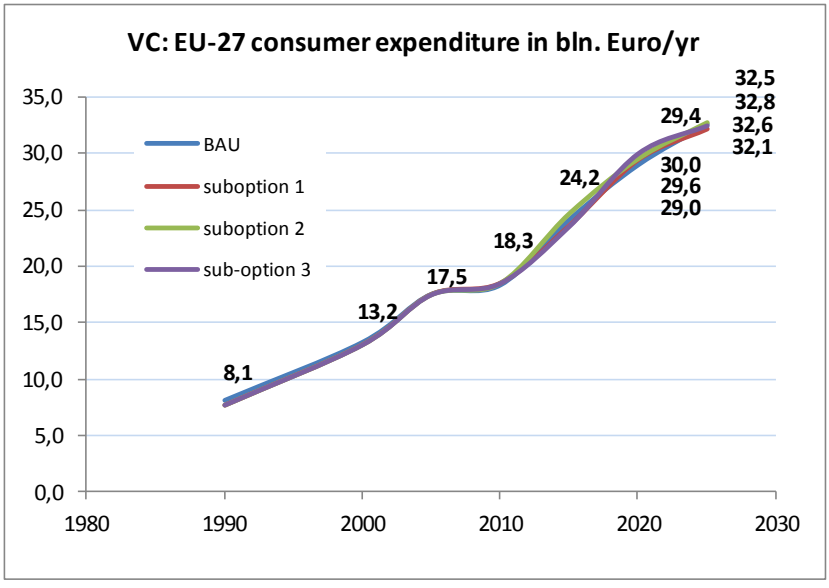

Figure 9

The graph shows that, despite the considerable differences in electricity consumption, the 4 scenarios are very close together. The reason is that for this product the purchase price and - to a lesser degree - the

disposables play a more important role in the expenditure than the electricity consumption.

Overall the effect on consumers should be beneficial as the reduction in their energy costs should offset a modest increase in purchase price. It will also guarantee a reasonable level of performance and give health benefits from the limit on dust re-emissions. At the cheapest end of the market, it is possible that the price increases will be more significant, but even here it should be easily offset by lower energy costs.

5.2.4 Business economics

The graph below gives the projected sales value in billion EUR per year of the baseline and 3 sub-options. It is estimated that sub-options 1 and 3 cause the highest production costs and thus the highest sales value at equal unit sales. At ultimately a price level of around € 270 per VC the sales value is around 20% higher than at the baseline (€ 225 per baseline unit). Sub-option 2 requires considerable less investment in new components and the sales value is estimated to be relatively lower than sub-options 1 and 3.

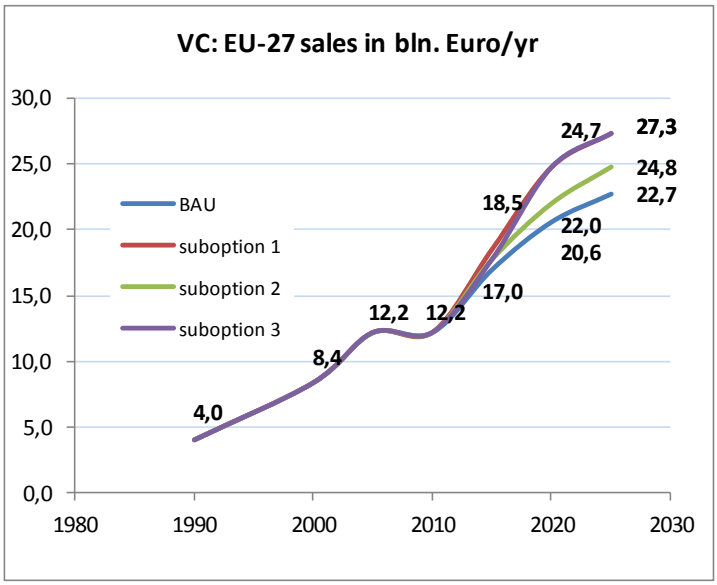

Figure 10

The graph and table below give an estimate on how the revenues from the sales are divided over EU-trade and industry.

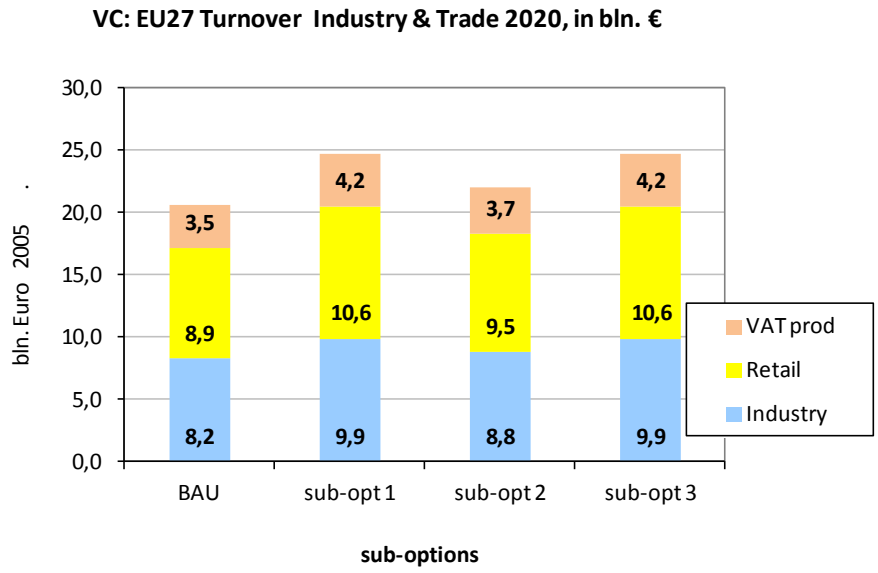

Figure 11

Table 6.

TURNOVER 2020 (million€*/a)

	BAU	sub-opt 1	sub-opt 2	sub-opt 3
Industry	8,2	9,9	8,8	9,9
Retail	8,9	10,6	9,5	10,6
VAT prod	3,5	4,2	3,7	4,2
subtotal purchase costs	*20,6*	*24,7*	*22,0*	*24,7*
Electricity costs	5,8	2,0	4,9	2,6
Disposables (bags)	2,7	2,7	2,7	2,7
Total costs consumers	**29,0**	**29,4**	**29,6**	**30,0**

5.2.5 Competitiveness proofing (CP)

Competitiveness Proofing is described in Commission Staff Working document SEC (2012) 0091[41] as a complementary instrument to reinforce the overall assessment of economic impacts of a new proposal with a better account of impacts on enterprise competitiveness at sector and aggregate level by identifying, and – where proportionate – by quantifying the likely impacts of the new proposal in three dimensions of enterprise competitiveness, i.e. costs, capacity to innovate and international competitiveness [of the European industries]. Unfortunately for the VC sector not enough data are available for quantification and thus the following describes the three dimensions only qualitatively:

While the proposed measures will remove a high percentage of models from the market, the effect of this will be limited as the technical analysis in the Ecodesign study suggests that the ***costs*** of redesign to meet proposed requirements is not particularly great. In fact one recent test suggested (albeit on a small sample) that most current models could meet the requirements simply by reducing the power of the motor (5 out of 6 models would conform to the requirements with a motor of 500W).

[41] http://ec.europa.eu/governance/impact/key_docs/docs/sec_2012_0091_en.pdf

EU-industry is firmly convinced that strong measures both on the energy and the performance side will have a positive impact on their ***competitiveness and their innovation capacity***. It will ban inefficient the low-cost imports which have had a highly negative impact on profitability and has forced manufacturers (in order to survive) to choose OEM suppliers from Asia to do most of the manufacturing. The EU-industry focus is now on distribution and sales, R&D, marketing and management. Manufacturers have indicated that they will gladly carry the (modest) costs of printing costs and handling, because in fact the label and the proposed minimum requirements are seen as having a positive impact on competitiveness. The price of labelling, at costs of less than € 0.10 per label and thus less than € 4.5 million for the sector, is a price the industry is happy to pay.

On the ***international market*** EU direct exports are modest (less than 4 million units) when compared to Chinese sales into the EU (perhaps 30 million units). It is not clear that the measures will have any significant effect on these numbers. Indirectly if third countries follow the EU lead, this would probably help EU producers' competitiveness.

5.2.6 Effect on SME (manufacturing)

The move to low-labour cost countries has had a negative impact not only on employment of manufacturers, for which only anecdotal data are available, but most certainly also on the European SMEs that previously supplied the product-parts to the vacuum cleaner manufacturers. If the measures reverse the decline in EU manufacturing of vacuum cleaners, this will no doubt also help (SME) producers of components.

5.2.7 Effect on distribution channels

Between 1990 and 2010 the total consumer expenditure for vacuum cleaners, both acquisition and running costs, has more than doubled from € 8 to 18 billion. Up to 2025 it is not expected that this trend will cease (with or without measures). The figure shows total consumer expenditure to be more or less equal for the baseline and all policy scenarios.

The measures should ensure that the consumers will spend less money on energy, but instead use some of the savings on buying long-lasting high quality machines. It is possible that the higher acquisition costs will also halt the growth of the penetration rate but because this is by no means proven, a continuation of the trend is projected to continue. Taken together, these factors will probably mean that the measures will increase the value of sales, so benefiting distribution channels. As there is a relatively large proportion of SMEs in these channels it should also benefit them.

5.2.8 Effects in third countries

The process for establishing ecodesign requirements has been fully transparent, and after endorsement of the regulation by the Regulatory Committee a notification under WTO-TBT will be issued.

As mentioned, the market is dominated by a handful of players. For that, it is relevant that the requirements in the EU do not dramatically differ from the rest of the world. This has been investigated and it is found that the proposed level is ambitious but realistic. No competitive disadvantages for EU manufacturers exporting affected products to third countries are expected.

There are very few regulations on vacuum cleaners in third countries. Apart from some legacy, i.e. no longer active, voluntary label efforts, only South-Korea seems to be active in this field. The way how EU-measures in the field would affect third countries is difficult to predict. The EU has often been leading in standardisation and energy labelling and it is thus likely that many countries like China would follow the EU example. This will strengthen the

global effort of fighting low-efficiency appliances. In the short term this will constitute a negative impact for manufacturers of these low-efficiency appliances around the globe. On the long run, the production of high-quality appliances, once they have made the transition, will also allow them to be more profitable.

5.2.9 Social impacts: Employment

The analysis shows positive employment impacts for the considered sub-options (see graph)

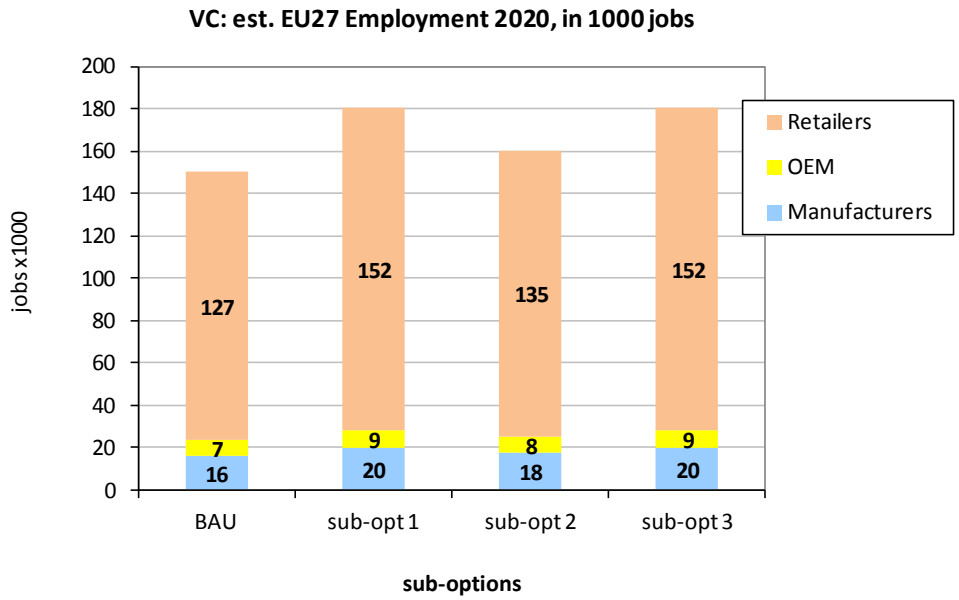

Figure 12

Table 7.

	EU-27 EMPLOYMENT 2020 (jobs x 1000)			
	BAU	**sub-opt 1**	**sub-opt 2**	**sub-opt 3**
Manufacturers	16	20	18	20
OEM	7	9	8	9
Retailers	127	152	135	152
Total jobs	**150**	**180**	**160**	**180**

5.2.10 Territorial impact

Territorial impact assessment (TIA) is one of the possible elements of the impact assessments. As stated in a recent presentation of the Commission services[42], TIA is only required when the policy explicitly targets a (type) of a region and/or the policy targets some regions or areas more than others. In the case of the ecodesign policy for vacuum cleaners, these conditions do not apply and thus the TIA is not appropriate.

5.2.11 Administrative costs for Member States

The form of the legislation is a regulation which is directly applicable in all Member States. This ensures no costs for national administrations for transposition of the implementing legislation into national legislation.

[42] Dijkstra, Lewis (European Commission, DG Regio), "Assessing territorial impacts as part of the general impact assessment guidelines, presentation ESPON Workshop, 6 June 2012.

The Impact Assessment on the recast of the Energy Labelling Directive SEC(2008) 2862 calculates the administrative burden of introducing a new implementing Directive, similar to the proposed to the ecodesign implementing measure, in accordance with the EU Standard Cost Model.

It estimates the administrative cost of implementing measures in the form of a Directive at € 4,7 million of which € 720.000 for administrative work on the amendment/development of the new Directive and €4 million for transposition by Member States. It follows that the administrative cost of an implementing Regulation - as is currently proposed - would save € 4 million in avoiding the transposition cost.

Administrative costs of enforcing the Regulation are difficult to estimate. Enforcement could involve random spot-checks by the authorities, but from experience with other regulations of this type most spot-checks are not random but follow indications of competitors or third parties (e.g. industry or consumer associations). In those cases, the probability of not only recuperating testing costs and legal costs, but also of collecting fines is high. Therefore, no extra enforcement costs for Member States are anticipated from the measure.

Also for business, extra administrative costs, if any, will be modest. In current practice, VCs are subject to efficacy and performance tests for a number of reasons (CE-marking, client specification, etc.). The proposed Regulation will not change this situation. There is no difference in this respect between various sub-options.

5.2.12 Specific impact of production phase: durability requirements

The preparatory study calculated that if durability of all vacuum cleaners is increased by 50% (for 8 years to 12 years) annual reduction of the following environmental impacts over the life cycle of VC (in stock across all EU, 2005 data, compared to BAU scenario) would occur:

- non-hazardous waste generation: reduction by around 18% (or 170,000 tonnes)
- hazardous waste generation: reduction by around 27% (or 22,000 tonnes)
- emission of particular matters: reduction by around 30% (or 11,000 tonnes)
- some smaller reduction in other impacts, such as emission of heavy metals and PAHs

While upfront cost to consumer would increase, annual Life Cycle Cost (including upfront, running and any repair costs) for consumers will be reduced compared to the BAU scenario. There are no excessive costs for industry, because a large part of the vacuum cleaners currently produced does not show pre-mature failure on hose and/or motor and such appliances are affordable.

There could be a trade-off between durability and energy savings in the use phase as more durable products may delay sales of newer, more efficient products. Such trade-off can be avoided by introducing durability requirements only at a later stage once also stringent energy efficiency requirements apply. This would also give time to the industry for any re-design of their products for these requirements.

5.3 Summary economic, social and environmental impacts

The table below gives an overview of the most important savings for the 3 sub-options versus the baseline.

Table 8a. Savings 2020

	Sub-option 1	**Sub-option 2**	**Sub-option 3**
Versus Baseline			

TWh saving in 2020	22,4	5,2	18,8
Accumulative TWh saving 2011-2020	134,6	31,1	112,9
Mt CO2 saving in 2020*	7,7	1,2	6,4
Accum. Mt CO2 saving 2011-2020	46,4	7,1	38,2
El. costs saving in 2020 (in billion Euro)	3,8	0,9	3,2
Accum. el.costs saving 2011-2020 (billion Euro)	22,6	5,2	19,0
Extra purchase cost in 2020 (in billion Euro)	4,1	1,4	4,1
Accum.extra purchase cost 2011-2020 (billion Euro)	24,7	8,2	24,7
Total extra cost in 2020 (in billion Euro)	0,4	0,5	1,0
Accum. extra costs 2011-2020 (billion Euro)	2,1	3,0	5,8

Table 8b. Savings 2025

	Sub-option 1	**Sub-option 2**	**Sub-option 3**
Versus Baseline			
TWh saving in 2025	29,6	10,8	27,4
Accumulative TWh saving 2011-2025	273,9	100,1	253,4
Mt CO2 saving in 2025*	7,6	0,8	6,8
Accum. Mt CO2 saving 2011-2025	70,3	7,7	62,9
El. costs saving in 2025 (in billion Euro)	5,0	1,8	4,6
Accum. el.costs saving 2011-2025 (billion Euro)	46,0	16,8	42,6
Extra purchase cost in 2025 (in billion Euro)	4,5	2,0	4,5
Accum.extra purchase cost 2011-2025 (billion Euro)	42,0	18,7	42,0
Total extra cost in 2025 (in billion Euro)	-0,4	0,2	-0,1
Accum. extra costs 2011-2025 (billion Euro)	-4,0	1,9	-0,5

5.4 Sensitivity analysis sub-option scenarios

At the electricity prices used in the scenarios the extra total expenditure of measures results in extra costs of 0,4 (sub-option 1), 0,5 (sub-option 2) and 1,0 billion Euro (sub-option 3) in 2020.

Doubling the electricity price these extra costs become savings of € 4 (sub-option), 0,4 (sub-option 2) and 2,2 billion (sub-option 3). This means that consumers could be making a small profit of 1,3, 7,3 or 13% but it would not change the priorities or target values.

Doubling the estimated price increase of the product due to measures would lead to an extra € 4,1 (13%) extra costs for the consumer in the case of sub-options 1 and 3 (see Table 8a). For

sub-option 2 the price increase is 1,4 billion (almost 5%). This may seem significant, but when taking into account that there is an autonomous production rationalisation driving prices down - which was not considered in the scenarios - the likelihood of such a steep price increase is very small.

The introduction of EU energy labelling is supported by all EU stakeholders: industry, consumer associations and Member States. Prescriptions for internet publication are not new but merely a requirement in line with what is customary in mandatory energy labelling. Member States have not indicated their desire to introduce their own stringent requirements for vacuum cleaners.

As regards the external societal costs, they are mostly linked to electricity consumption. They would add in the order of magnitude of 10% of electricity costs, but would hardly differentiate between the scenarios.

All in all, it is considered that the scenarios are robust.

6. CONCLUSIONS

Following the principle of proportionality in the analysis, policy options 1 to 4 were discarded at an earlier phase of the analysis.

The analysis shows that the combined MEPS/Label sub-options offer the best energy savings and strongest reduction in CO_2. Sub option 2 provides substantially smaller savings than the other 2 options. The differences between the other MEPS/Label sub-options are smaller. While sub-option 1 provides highest savings by 2020, its introduction may cause difficulty for manufacturers as the 750W 'power cap' may represent the limit of what can be achieved for the normal canister model. Manufacturers and so consumers may be pushed towards 'upright' or 'stick' models that are less easy to manipulate, and make it difficult to vacuum under furniture, or on vertical or other surfaces. However, manufacturers have participated in the development of the new efficiency measurement method and have been aware of the possible forthcoming requirements since the start-up of the preparatory study in 2006. Consequently, the MEPS/Label sub-option 3 is considered to offer the optimal solution between fast savings and minimum strain for the industry.

The additional option on increasing the durability of vacuum cleaners is also considered desirable in terms of reduction of environmental impact and reducing annual life cycle costs to users/consumers while they do not seem to entail excessive upfront costs for consumers nor industry. In order to eliminate or minimise any small negative impacts on energy during the in use phase, it is recommended that durability requirements are introduced at the second tier of requirements only.

Finally, most vacuum cleaner manufacturers are global companies. SMEs are considered to be only significantly present in the wholesale and especially retail sector. The analysis shows that the policy options will have no negative impact on them. On the contrary, they would benefit from a stronger demand for new technologies and a higher turnover.

The comparison of options and sub-options shows that the appropriate policy option for realizing the improvement potential of vacuum cleaners is a Commission Regulation setting ecodesign requirements combined with an Energy Labelling delegated Regulation to guide customers towards the most efficient appliances. The ecodesign requirements would be set in two tiers with entry into force two and four years after publication of the measures respectively, and the labelling requirements one year after the proposed regulation has entered into force. Within this option, the scenario analysis shows that the saving for sub-option 3 is 16% less than for sub-option 1 but is still very substantial. At the same time sub-option 3

avoids the negative impact on functionality, affordability and competitiveness of sub-option 1, i.e. cutting out all current domestic canister models. Compared to sub-option 2, sub-option 3 yields substantially higher savings and is thus preferred.

This approach ensures that:

– the least energy efficient vacuum cleaners will be removed from the market, increasing competition on energy efficiency instead of price and additional features;

– on-going energy improvements are fostered by setting a transparent legislative framework that will provide the industry with the long-term security needed to invest in innovative technology;

– information on product differentiation provides consumers with an effective and reliable tool to compare energy consumption of products in an economic setting where there is demand for energy efficient appliances;

– cost-effective potentials to reduce the electricity consumption of vacuum cleaners are quickly realized leading to at least 60%[43] increase in average efficiency;

– by 2020, the annual electricity consumption and CO_2 emissions of vacuum cleaners will be reduced by 19 TWh and almost 6 Mtons of CO_2 compared to a business as usual scenario (2025 27 TWh and 10 Mtons CO_2);

– significant material savings and reductions in life cycle costs for consumers are achieved;

– a clear legal framework for product design leaves flexibility for manufacturers to achieve the efficiency levels; and gives them a level playing field, ensuring fair competition and free circulation of products.

– requirements for vacuum cleaners are harmonized in the Community, leading to a minimization of administrative burdens and costs for the economic operators;

– market failures are corrected and the internal market functions properly;

– that the specific mandate of the Legislator is respected;

– a reduction in accumulated electricity consumption by 2020 amounts to 113 TWh, 38 Mt of CO_2 at a reduction in electricity costs of € 3,2 billion/yr in 2020 versus the baseline. For 2025, at complete stock change after stage 2 of the measures, the accumulated savings are more than twice as high. The saving on electricity costs, at a higher rate than in the period before 2020, is also more than twice as high.[44]

– costs for re-design and re-assessment upon introduction of the regulation, which are limited in absolute terms, and not significant in relative terms (per product); disproportionate burdens for manufacturers are avoided due to transitional periods which duly take into account redesign cycles;

– the measures have no significant impacts on the competitiveness of industry, and in particular SMEs.

– the measures have positive impact on employment, in particular for SMEs.

[43] The average power input of domestic vacuum cleaners was about 1700W in 2010. Introduction of measures will boost reduce this to around 1050 W without affecting performance in the medium term (a 60% increase in efficiency)and higher savings on the long term.

[44] After 2010 an escalation rate of 4% is applied for electricity prices (see also www.meerp.eu)

As laid out in Section 7 of the impact assessment, monitoring of the impacts will mainly be done by market surveillance carried out by Member State authorities ensuring that the requirements are met, whereas the appropriateness of scope, definitions and concepts will be monitored by the on-going dialogue with stakeholders and Member States.

7. MONITORING AND EVALUATION

The appropriateness of scope, definitions and limits will be reviewed after maximum 5 years from the adoption of the measure (as required by Annex VII.9 of the Ecodesign Directive and laid down in the implementing measure). Account will be taken also of speed of technological development and input from stakeholders and Member States. Compliance with the legal provisions will follow the usual process of 'New Approach' regulations as expressed by the CE marking.

Compliance checks are mainly done by market surveillance carried out by Member State authorities ensuring that the requirements are met. Further information from the field as e.g. complaints by consumer organisation or competitors could alert on possible deviations from the provisions and/or of the need to take action.

Input is also expected from work carried out in the context of upcoming ecodesign activities on further product categories and related activities.

ANNEX A

MINUTES OF CONSULTATION FORUM MEETING 2010

CONSULTATION FORUM ON VACUUM CLEANERS – JUNE 25, 2010

DRAFT MINUTES

The Chairman informed that a working document had been circulated prior to the meeting. This session would focus at the most fundamental questions relating to the ecodesign and energy labelling of vacuum cleaners (VCs). There will later be a 2nd consultation forum based on a more concrete text on VCs.

SCOPE

On the scope, **the Commission staff** informed that the intention was to cover both domestic and commercial VCs. A distinction between the two could be made by applying the low voltage directive (household) and the machinery directive (commercial). Industrial VCs, wet and dry VCs, carpet cleaners, robot VCs and central VCs should all be excluded. Large battery VCs and wet filter VCs could be included when measurement methods allows it.

Battery driven VCs

ECOS asked whether battery handhold models are covered by standby or battery charges regulations.

DE agreed that there is a problem of measurement methods. These should be developed before the product is included.

CECED informed that if the appliance has a plug in, there is a limit on the standby consumption. When the battery is used, it will not be under the definition for standby

Robot and central VCs

ECOS suggested to include robot VCs in the revision of the legislation.

NL pointed out that robot and central VCs should be included if the scope is defined from functionality. Robot and central VCs would compete with normal VCs and may in that respect need a labelling.

CECED wanted robot and central VCs to be included in a later stage as the current measurement methods do not allow the comparison of models.

The **Commission staff** informed that robot VCs have not been looked at by study and could not yet be covered in terms of current measurement standards. They may however be included in the revised legislation. The central VCs have the same function as a normal VC but its energy consumption would depend considerably on the particular installation and is hence more difficult to measure.

Commercial and domestic VCs

NL and **DE** suggested all VCs in the scope to have a label as it might be difficult to distinguish between domestic and commercial VCs.

DE added that the labelling of commercial products is a horizontal question and should be discussed on a horizontal level.

ICMMA (The I***ndustrial Cleaning Machine Manufacturer's Association)*** supported having the same requirements for domestic and commercial VCs

NOISE

The **Commission staff** presented different policy options with regard to the labelling and ecodesign requirements on noise. On the energy label, a dBA-figure or an A-G scale could be given. An alternative could also be to set an ecodesign limit on noise as the impact is quite significant.

Ecodesign

UK did not see noise as particularly relevant for the product and suggested setting an ecodesign limit using a dBA limit, if to set a limit at all.

DE gave its support and suggested a limit of 80 dBA.

IT and **CECED** said that a limit on noise should not be too strict.

AU welcomed having an ambitious ecodesign limit for noise.

DK wanted the correlation between noise and energy consumption to be further studied. Energy consumption should be considered more important of the two.

CECED could confirm there is a link between the two.

Energy label

F, **BE**, **I**, **ENV NGOs** and **CECED** asked for the level in dBA on the label.

ENV NGOs, CECED and **BE, F** added that an A-G scale could be confusing for the consumer as there would be a risk of having too many scales.

AU said one should be careful not having too many scales on the label, but a noise scale could be helpful.

I commented that as it will now be mandatory on the label to show the numbers, Member States and others should start measures to explain what the figures mean.

DE emphasized that all products to be treated in the same way with regard to the labelling of noise.

Filtration efficiency

The **Commission staff** informed about the negatively health impact by small particulates of dust. A question raised was whether a very good filtration of a VC would make a significant improvement on the dust level or whether the most important would be to vacuum more regularly. It was asked whether filtration should be presented as a figure for re-emission or filtration, in percentage or as an A-G scale and whether there should be an ecodesign limit.

Ecodesign

CECED and the **ENV NGOs** stated that an increased retention level would also increase the energy consumption.

ENV NGOs added that the fiche needs to inform about the size and kind of particles.

BE suggested to have a reasonable, but not too strict limit in order to guarantee a high level of filtration efficiency.

Energy labelling

CECED meant that a classing system for filtration efficiency would trigger increased energy consumption as consumers without a specific need would opt for class A.

DE and **BE** said that a labelling of filtration efficiency could run the risk of not being understood by the consumer.

BE added that giving an absolute value of mg/M³ could be more understandable for the people affected.

Cleaning performance

The **Commission staff** informed about different ways of measuring cleaning performance. In the current standard, 5 double strokes are used to see how much dirt is removed from a standard hard floor or carpet. Fewer double strokes (2 or 3) might be closer to reality. Alternatively one can measure how many double strokes are required to reach a certain level of cleanliness (65 % for carpets and 95 % for hard floors). The label could give an A-G scale or a percentage figure separately or combined for hard floors and carpets. More information can alternatively be given in the fiche. The question was raised whether one should set limits on cleaning performance.

Measurement method

NL asked for a measurement method that is reliable and repeatable. This is more important than having a realistic measurement method as long as the ranking stays the same.

F meant it did not matter much whether one used 2 or 5 for the measuring as one will compare the different products with each other.

DK stated that the measurements should be as realistic as possible, hence supported 1-2 double strokes.

CECED and **ICMMA** agreed that 2 double strokes would be more realistic, but informed that a measurement would be more accurate with 5 double strokes as the standard deviation is lower. The hierarchy of the performance would however be the same.

The **Commission staff** agreed that the data from the recent round robin test would give a clear indication of the relative reproducibility and repeatability of different measurements using numbers of strokes .

Ecodesign

F stated that limits might not be too useful.

DE and **DYSON** supported ecodesign requirements for cleaning performance.

Energy labelling

AU, **BE**, **DK**, **DE**, **F**, **CECED** asked for one scale for cleaning performance hard floors and one scale for cleaning performance on carpets.

NL supported having an A-G scale, but a differentiation between hard floor and carpet could be made in the fiche.

ECOS was concerned that consumers would look firstly at cleaning performance and then at the other parameters on the label. Consumers should be educated so as to use a more efficient VC less. This could be done by showing the number of double strokes to reach a reference level of cleanliness or by indicating the time needed to clean a certain surface.

CECED replied that informing about a VC's cleaning performance would allow consumer's to change behaviour.

Energy consumption

The **Commission staff** informed that there is close link between the discussion on cleaning performance and the one on energy consumption. There is however no good knowledge on how performance of VCs affect their use. Energy consumption can be measured by vacuuming a certain area with a given number of double strokes or as in the current standard

by reaching a reference level of cleanliness for hard floors and carpets. Energy consumption is then calculated by the fractional number of double strokes needed to reach the given level. Measuring energy consumption in a certain area and with a certain number of double strokes is simpler in terms of reproducibility and repeatability. By incorporating the performance, the reproducibility and repeatability would go down.

Measurement methods

ECOS asked for clarification on what programs and levels are used for the assessment of energy consumption. The measurements should be done as close as possible to reality.

NL said that the most important would be to have reliable and reproducible measurement methods.

CECED explained that measurements in the current standard are done at the maximum power for the appliance and with the nozzle recommended by the manufacturer for hard floors and carpets.

Energy labelling and ecodesign

DE, CECED and **ICMMA** supported having a combination of performance and energy consumption. Such a method would secure that high input power appliances would not be allowed to reach the higher classes.

NL, **ECOS** and **DYSON** preferred to set caps on the electric power.

ECOS added this would be easier to measure than a mixed measure of energy consumption and cleaning performance.

CECED replied that such a measure would leave little flexibility to manufacturers.

NL asked for more information on the different proposals for the measurement of energy consumption and how to derive a scale.

CECED invited all stakeholders who are interested to have bilateral discussions with them for clarification.

ANNEX B

MINUTES OF CONSULTATION FORUM MEETING 2011

CONSULTATION FORUM ON VACUUM CLEANERS – September 8, 2011

DRAFT MINUTES

The Chairman informed that a working document had been circulated prior to the meeting. This gave detailed proposals for both Ecodesign and Energy Labelling measures. It was agreed that the meeting would deal with the Ecodesign and Energy Labelling jointly as in most cases the technical issues would be similar. The Commission gave a presentation which was the basis on which these discussions would be organized.

SCOPE

On the scope, **the Commission staff** informed that the intention was to cover both domestic and commercial VCs. A distinction between the two could be made by applying the low voltage directive (household) and the machinery directive (commercial). Industrial VCs, Wet VCs (which spray liquid)

ANEC felt that there should battery vacuum cleaners should be dealt with at some stage.

DE mentioned that measurement methods for battery operated appliances were missing.

ECOS felt the revision clause should deal with the excluded categories.

EU Cleaning suggested that commercial appliances with large heads (more than 50cm) should be excluded. There should be a definition of 'large battery operated models', which should be dealt with in a second stage.

The European Power Tool Association explained that 'industrial' vacuum cleaners included products supplied with power tools to remove the dust produced by cutting grinding etc. and could not be directly compared with general purpose machines. Many of them also had to deal with hazardous dust.

CATEGORIES

The **Commission staff** explained that it was not proposed to distinguish between any 'technical' categories (such as canister v. upright; motorized brushes; bags v. bagless (cyclone etc) as all the products were performing the same function. There was a need to allow for VCs designed for general use with those either for hard floor only, or for carpets only (used by customers whose floors were either all carpeted, or 'hard'), As there were a number of such products, and it would not be reasonable to set requirements for example related to a hard floor vacuum cleaner performed on carpet (or vice versa).

EU cleaning agreed that the measures would need to be adapted to allow for such machines.

Impacts

The Commission staff explained that the main environmental impacts of vacuum cleaners were energy use, noise, increased hygiene (from cleaning their primary function) and small particulate dust (where they removed such dust and so lowered levels in the internal environment).

Noise

The Commission staff explained that it was not proposed to have an Ecodesign limit for noise, but the dBa figure would be included on the label.

DE suggested there should be a noise limit, and suggested a figure of 77dBa. **Austria** agreed. Belgium suggested a figure of 76 dBa. **Cenelec** noted that the test standard would be available soon. **Dyson** suggested that it was not only the sound power level, but also its quality that was important. CECED had sympathy with the idea of a noise limit, and noted that that for commercial vacuum cleaners the Machinery Directive defined limits, which should be followed. They also noted that it was perhaps the vibration transmitted to the floor that was most important, rather than the sound power emitted to the air.

Dust re-emission

The Commission staff explained that this was important in reducing the level of small particulate dust in the indoor environment so reducing the health damage they cause. The working document included a limit of 3% for the particle size range of 0.4 – 4 microns. The Energy Label would include a dust re-emission figure.

DE suggested a tougher limit of 2% would be preferable. Austria and Sweden agreed. The UK suggested a tough limit perhaps as low as 1%.

ANEC/BEUC suggested 0.3µ would be possible, or even 0, 2µ (though with less accuracy). The level of the smallest particles was important, as these had the most health impact. The limit should be strict for example 1% in phase 1 and 0,4% in phase 2.

CECED (BSH) suggested an upper limit on particle size of 20µ would be possible but testing for particles smaller than 0.3-0.4µ would be difficult.

Cleaning Performance

The working documents proposed that cleaning performance should be measured after 2 double strokes. This was less repeatable and reproducible than measurements after 5 double strokes, but the proportionate difference would probably diminish as more experience was gained, and the accuracy was probably sufficient for a performance declaration.

DK mentioned that 2 double strokes was quite close to real life vacuum cleaner use. The test accuracy would be acceptable, particularly if repeated. There should also be an Ecodesign limit on cleaning performance.

DE would like to use 5 double strokes for testing cleaning performance, and there should be an Ecodesign limit. Measures based on 5 double strokes would be enforceable; any on 2 double strokes would not.

ECOS wanted a performance limit on cleaning performance. They felt that test using 2 double strokes were closer to real use, and could provide reasonably accurate results.

Cenelec suggested that the ring test implied that it was not realistic to use 2 double strokes, and that performance tests at 5 double strokes would give more repeatable and reproducible results.

CECED, **NL, ECMA** agreed with Cenelec

Dyson agreed that 5 double strokes gave more reliable results. However, tests should also be done with (half) full dust receptacles. The performance of vacuum cleaners decreased as they filled up with dirt. This reduction varied considerable between machines (with in general a greater reduction in machines with dust bags as opposed to 'bagless' cyclone machines). **ANEC** supported this point.

The Commission staff concluded that the majority of the consultation forum favoured the use of 5 double strokes for performance testing as it was more reliable albeit further from real life use**.**

Minimum Performance Requirement

The **UK** had doubts whether this should be included in the Ecodesign measure, indication on the label was sufficient.

The **NL** considered it should be there but not at too high a level. **DE** agreed.

EUcleaning felt labelling information only would be sufficient.-

Push Force

The Commission staff explained that the working documents included a factor which increased the 'cleaning time' and so the annual energy consumption of those machines which require a high push force (of over 25 Newtons). This could be interpreted as saying that if the machine were too hard to push, users would move the machine more slowly, and so energy consumption would increase.

DE was not convinced that push force was a relevant factor. **BE** agreed**.**

FR suggested as it should not be included as this would be too complex.

ECOS suggested that the reasoning was somewhat speculative, and suggested it should be considered in any revision.

Cenelec mentioned that the current measurement method does not deal with push force.

NL felt that push force should be included. In practice measurement should not present a problem. It might be better to set an upper limit. A level of 30 Newtons would be more appropriate.

Austria suggested it could be included on the label.

The **UK** suggested it should not be included in the Ecodesign measure.

Energy Consumption

The Commission staff explained the formula for estimating annual energy consumption used in the working document, and compared it with the formula suggested by CECED. The main difference related to how users reacted to difference in cleaning performance in different vacuum cleaners. The working document was based on the premise that at least for machines with average or better cleaning performance, they still vacuumed for an average equivalent to 2 double strokes, though it was plausible that with very low performance machines they would clean for longer. A small test by Dyson backed this up. The formula suggested by CECED implied that with high performance machines users would only vacuum for as little as 1 double stroke. It also involved the extrapolation of the performance of vacuum cleaners after as few as 1 or 2 double strokes, information which many stakeholders considered unreliable (see cleaning performance above).

CECED explained their suggestion, but agreed that it might be possible to come to a solution that took account of possible changes in user behaviour depending on cleaning performance, but using cleaning performance measured at 5 double strokes, and with less variation in cleaning time than was suggested by their formula.

They also expressed concern that the Commission formula would allow very low performance vacuum cleaners with very low input power to gain an A label for Energy consumption, albeit with a G for cleaning performance. This could confuse consumers, as in practice such machines would not clean.

There was a general discussion on the respective formulae, and it was agreed that further discussions were needed to see if a better formulation could be arrived at.

ANNEX C

FINAL STAKEHOLDER MEETING PREPARATORY STUDY, JAN. 2009

Summary of Final Stakeholder Meeting, EuP Vacuum Cleaners
Brussels, 19 January 2009
Present:
Mathew Kestner, European Commission (Chair)
Martin Buchele, European Commission
Laurent Caro, Groupe SEB
Maya de Groot, Federale Overheidsdient Volksgezondheid
Harry Langdon, Numatic
Hakan Messler, Electrolux
Sandra Mueller, BSH
Peter Mueller-Baum, United Cleaning
Dietlinde Quack, Oeko Institute
Matteo Rambaldi, CECED
Morris Rollo, Hoover
Harald Schellenberg, BSH
Wolfgang Siefert, Miele
Paul van Wolfren, Philips
Steffen Reiser, Kaercher
Steve Ogilvie, AEA (Project manager)
Grahame Capron-Tee, Intertek
Chris Evans, Consumer Research Associates
Phil Dolley, AEA
Purpose of the Meeting:
To review the consultant's findings and the technical assessment contained in Task 7. If time allowed, Task 8 to be discussed.
Discussion
a) Tasks 1 to 6 – further comments were requested, none were raised. The presumption was that stakeholders are content with the findings of Tasks 1 to 6.
b) Task 7 – SO gave a brief presentation of the key findings and results. Several questions were raised:
Is it possible to go beyond 40% efficiency?
Key limitation is **fan design** and its influence on fan efficiency. If more attention was paid to developing more refined fan blades then efficiency gains could be realised. Stakeholders queried the assumed cost increment for such design saying there would be significant tooling costs and some material costs per fan.
Other **design types** are possible such as coaxial fans and displacement technology. Both would result in physically larger vacuum cleaners though. Neither is being considered for production.
Robot designs are expected to increase market share in coming years. They may evolve to be able to sense the amount of dirt present and alter their energy consumption accordingly.
There may be some efficiency to be gained in **motor design** (e.g. switched reluctance motors with electronic control) but the consultant's work has assumed that current technology remains dominant for some years to come, only such switched reluctance motor powered vacuum cleaner design exists for sale on the Japanese market but is very much a premium price product. For reasons of cost, stakeholders agreed. Lower speed, higher torque motors, whilst an option, would require up to an additional 40% by weight of materials and cost perhaps up to an extra five euros . .

How was BNAT chosen?

Difficult area to discuss as producers are unwilling, for obvious reasons, to discuss their R&D work. The identified BNAT solutions are those that the study team's experience of VC development has allowed them to identify.

How did the consultants identify consumer behaviour parameters (hours spent cleaning etc)?

From the limited information available and in discussion with stakeholders at earlier meetings. Experience from surveys in the USA also suggests that consumers typically spend around an hour a week cleaning. Whilst all parties accept the same for Europe the ideal would be for a European survey to be conducted. This would have additional benefits – for example, it would help correlate test method protocols with actual cleaning behaviour - a subject presently not well understood.

The above discussion was completed with plenty of time remaining. MK remarked that he was pleased with the Task 1 to 7 work and the input stakeholders have made facilitating such an efficient discussion today. MK progressed the meeting to discuss Task 8.

c) Task 8 – SO gave a brief presentation of the key findings and results. There are a number of key issues for EuP implementing to take into consideration:

- that VC ownership is increasing,
- that input power ratings have increased markedly since the 1970s,
- energy efficiency has decreased over this period,
- CECED has developed proposals for an Energy Label,
- Current EN test standards are flawed,
- There is good technical potential for achieving energy savings,
- These savings can be won at little cost to producers and significant savings to consumers,
- Technology developments can be accommodated within existing design cycles.

Broadly the discussion centred on:

- Limiting rated input power (caps). Some stakeholders oppose caps arguing that high power allows consumers to clean to a certain level more quickly.
- Others are supportive if the time frame for implementation was adjusted to a later date. MK remarked that additional market data would be helpful to inform the Commission what the outcome of a cap might be.
- Active brush head. Canister VCs can achieve better cleaning performance with a motorised head. MK asked the consultants to include active brush heads in the scenario work – what are the benefits and costs?
- A proposal for an Energy Label. Both the consultants and CECED have identified that an Energy Label would drive product improvement. However, the two approaches differ in one key regard; that CECED's proposal combines energy consumption and cleaning performance into a single parameter. The consultants argue that the assumption that consumers will change their behaviour and use high powered VCs for less time is questionable. It is more likely that consumers will continue to use their VC for the same length of time.
- DQ advised that consumers would want energy and cleaning performance kept separate. CE remarked that there is a precedent for this in the Energy Label for

washing machines where energy, cleaning and drying performance are all separate items leading to very good designs being 'triple A rated'. DQ added that consumers would also want additional information e.g. regarding noise and dust emissions included in the Energy Label.

- Test methods. The proposed CENELEC Working Group method produces an average result of the testing on a carpet and a hard floor. Results are skewed by the hard floor test where it is not uncommon for VCs to achieve 105% or higher. The issue is recognised and accepted by some stakeholders. It was noted that the ASTM method uses four different carpet types so producers cannot 'tune' their VC to a single type to achieve good performance. MK remarked the Commission will consider the case for a new test method. GCT added that the correlation between EN test methods and actual home cleaning is not known.
- Carpet cleaning. GCT noted that some carpets are easier to clean than others. MK remarked that this is part of the 'system' – perhaps carpets should be labelled. He asked the consultants to note the point in their report.

Actions

- Task 7 to include a scenario for active brush heads
- The effect of an Energy Label to be factored into the scenarios. What might it achieve if the worst performing products are phased out?
- Are there any differences in the way VCs are used in different member states that need to be considered? The consultants will comment in their report.
- The consultants will provide further commentary regarding the perceived need for updating test methods.
- Reported results to make clear whether data and figures refer to rated power or max input power.
- Need to review the proposed definition of commercial vacuum cleaners

MK requested the meeting not to provide feedback on the Task 8 discussion. He said that the development of policy options was the responsibility of the Commission

ANNEX D

STOCK MODEL METHODOLOGY & DETAILED RESULTS

The impact analysis uses the variable **inputs** as defined in the following paragraphs and used in Chapter 5.

The **calculation method** for the analysis is a so-called **Stock Model,** which means that it is derived from accumulated annual sales of VCs over the period 1990-2020 (with a start-up period 1986-1990).

The stock-model sets the pace for the sub-options. The direction is determined by trends in dwelling size, number of households and characteristics (operating hours, W). From these stock data the fitting sales data were calculated

Outputs for each sub-option are:

- Electricity consumption in TWh/a;
- Primary energy consumption in PJ/a (conversion 1 TWh electric = 2,5 *3,6 PJ primary);
- Carbon emission in Mt CO2 equivalent/a, using a multiplier based on electricity and gas shares (see below) and the values from the EcoReport in the preparatory study;
- Customer-related economical parameters: purchase price, energy expenditure, repair cost and total expenditure in € billion/a (2005 Euro, inflation-corrected at 2%/a);
- Business-related economical parameters: turnover per sector (industry, trade, etc.);
- Employment: calculating job creation/loss using the sector-specific turnover per employee.

Final outcomes are presented at a high aggregation level (totals), but in the intermediate stages a distinction is made by the typology and by size.

For the economic calculations, an average energy price in €/ kWh primary energy is built from:

- Electricity rates per kWh primary energy. For electricity, the assumption is to use industrial (SME) electricity rates excluding taxes in 2006, i.e. € 0,153/kWh;
- Annual (long-term 2000-2006 average) electricity price rate increase of 2%.

Data from Chapter 2 and 5 are used for the definition of the base case and calculated on the basis of the relative market shares of the lamp categories considered. The table below gives the characteristics of the base-case vacuum cleaners and their substitutes. Note that not all levels are filled

Table 11 . Economic and mercury-related data used in the stockmodel

ECONOMIC VARIABLES		
Rel	**0,153**	Electricity rate 2006 [€/ kWh electric]
Relinc	**0,02**	Annual price increase electricity / a
PriceDec	**0**	Annual product price decrease / a
ManuFrac	**0,4**	Manufacturer Selling Price as fraction of Product Price [%]
RetailMargin	**0,43**	Margin Retailer on product [% on wholesale price]
VAT	**0,17**	Value Added Tax [in % on retail price]
ManuWages	**0,1**	Manufacturer turnover per EU employee [mln €/ a]
OEMfactor	**1,2**	OEM personell as fraction of WH manufacturer personell [-]

RetailWages	**0,041**	Retail turnover per employee [mln €/ a]
ExtraEUfrac	**0,8**	Fraction of OEM personell outside EU [% of OEM jobs]
Inflation	**0,02**	Inflation rate/a
Discount	**0,04**	Discount rate/a

The Figure below shows EU27 Electricity rates 2007.

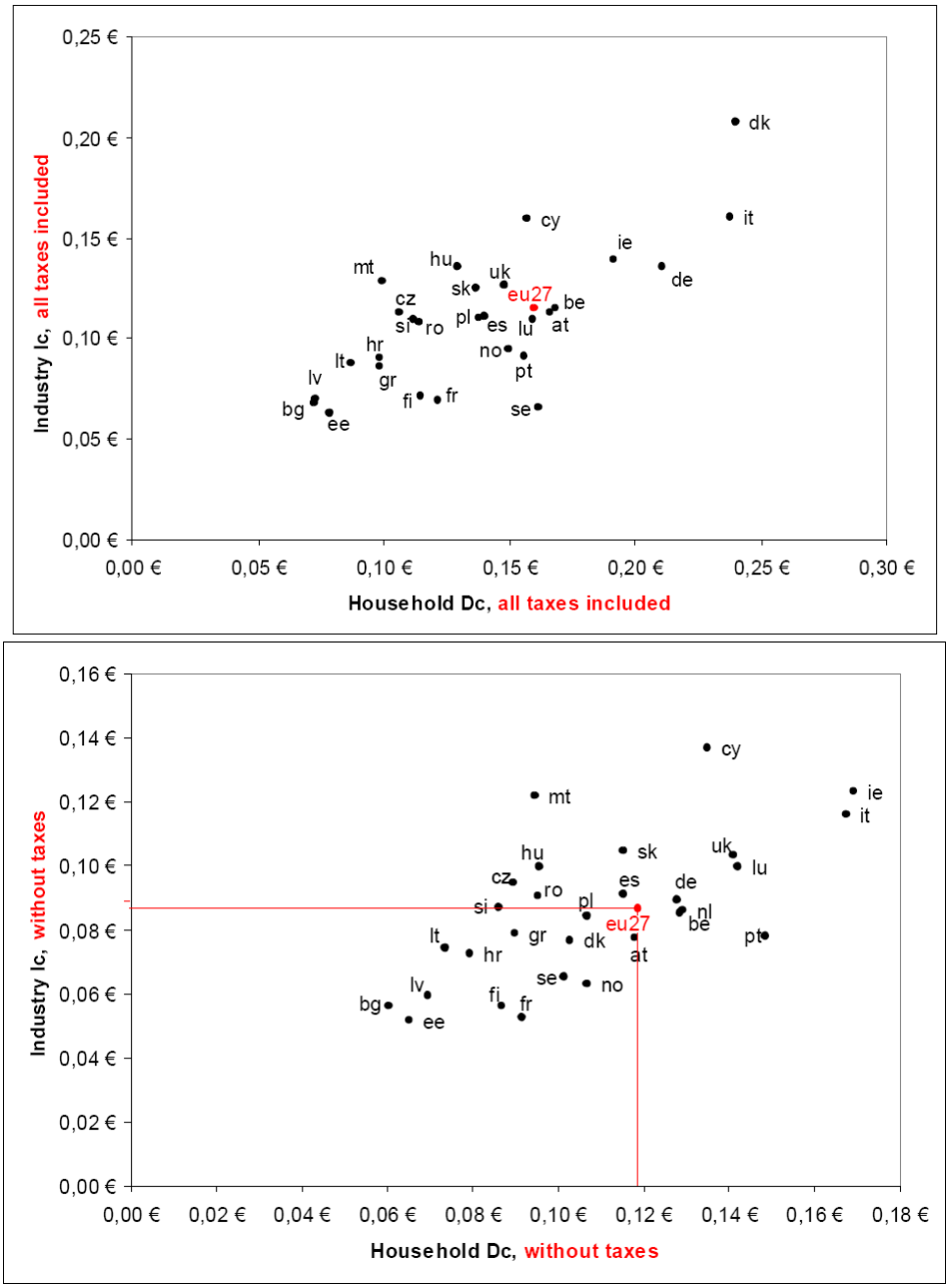

Figure 11.

The following tables are in addition to the baseline data from Table 3 and give the detailed results from section 5 for the sub-options in tabular format:

Baseline	**1990**	**2000**	**2005**	**2010**	**2015**	**2020**	**2025**
€ bln.turnover industry	1,6	3,3	4,9	4,9	6,8	8,2	9,1
€ bln.turnover trade	1,7	3,6	5,2	5,2	7,3	8,9	9,8
€ bln.VAT	0,7	1,4	2,1	2,1	2,9	3,5	3,9
TOTAL							
jobs industry	16	33	49	49	68	82	91
jobs OEM	7	14	21	21	29	35	39
jobs retail	25	51	75	75	104	127	140
jobs total	47	99	144	145	201	245	270
jobs EU industry	12	10	10	10	14	16	18
jobs EU OEM	5	4	4	4	6	7	8
jobs EU retail	25	51	75	75	104	127	140
EU jobs total	42	66	89	89	124	150	166

Suboption 1	**1990**	**2000**	**2005**	**2010**	**2015**	**2020**	**2025**
rated dom. VC power, W	1275	1423	1500	1739	1000	750	750
rated non-dom. VC power, W	929	1107	1200	1293	1000	750	750
electricity domestic, in TWh	9,5	12,6	14,6	18,5	11,6	9,5	10,4
electricity non-domestic, in TWh	2,1	2,7	3,1	3,5	2,9	2,3	2,4
energy total, in TWh	11,5	15,4	17,7	22,0	14,5	11,8	12,8
Mt CO2 electricity	5,8	7,1	8,0	9,5	5,9	4,5	4,6
Mt CO2 other	1,0	1,3	2,1	2,0	2,7	3,5	3,5
Mt CO2 total	6,7	8,3	10,0	11,4	8,7	7,9	8,1
Price	225	225	225	225	245	270	270
€ bln. electricity	1,9	2,6	3,0	3,7	2,4	2,0	2,2
€ bln. disposables	1,7	2,1	2,3	2,6	2,6	2,7	2,7
€ bln. purchase	4,0	8,4	12,2	12,2	18,5	24,7	27,3
€ bln. total consumer expenditure	7,6	13,0	17,5	18,5	23,6	29,4	32,1
€ bln.turnover industry	1,6	3,3	4,9	4,9	7,4	9,9	10,9
€ bln.turnover trade	1,7	3,6	5,2	5,2	8,0	10,6	11,7
€ bln.VAT	0,7	1,4	2,1	2,1	3,1	4,2	4,6
jobs industry	16	33	49	49	74	99	109
jobs OEM	7	14	21	21	32	43	47
jobs retail	25	51	75	75	114	152	168
jobs total	47	99	144	145	219	293	324
of which							

jobs EU industry	12	10	10	10	15	20	22
jobs EU OEM	5	4	4	4	6	9	9
jobs EU retail	25	51	75	75	114	152	168
EU jobs total	42	66	89	89	135	180	199

Suboption 2

	1990	**2000**	**2005**	**2010**	**2015**	**2020**	**2025**
rated dom. VC power, W	1275	1423	1500	1739	1900	2000	2000
rated non-dom. VC power, W	929	1107	1200	1293	1200	1200	1200
electricity domestic, in TWh	9,5	12,6	14,6	18,5	22,1	25,4	27,8
electricity non-domestic, in TWh	2,1	2,7	3,1	3,5	3,4	3,6	3,8
energy total, in TWh	11,5	15,4	17,7	22,0	25,5	29,1	31,6
Mt CO2 electricity	5,8	7,1	8,0	9,5	10,5	11,0	11,4
Mt CO2 other	1,0	1,3	2,1	2,0	2,7	3,5	3,5
Mt CO2 total	6,7	8,3	10,0	11,4	13,2	14,5	14,8
Price	225	225	225	225	235	240	245
€ bln. electricity	1,9	2,6	3,0	3,7	4,3	4,9	5,3
€ bln. disposables	1,7	2,1	2,3	2,6	2,6	2,7	2,7
€ bln. purchase	4,0	8,4	12,2	12,2	17,7	22,0	24,8
€ bln. total consumer expenditure	7,6	13,0	17,5	18,5	24,7	29,6	32,8
€ bln.turnover industry	1,6	3,3	4,9	4,9	7,1	8,8	9,9
€ bln.turnover trade	1,7	3,6	5,2	5,2	7,6	9,5	10,6
€ bln.VAT	0,7	1,4	2,1	2,1	3,0	3,7	4,2
jobs industry	16	33	49	49	71	88	99
jobs OEM	7	14	21	21	31	38	43
jobs retail	25	51	75	75	109	135	152
jobs total	47	99	144	145	210	261	294
of which							
jobs EU industry	12	10	10	10	14	18	20
jobs EU OEM	5	4	4	4	6	8	9
jobs EU retail	25	51	75	75	109	135	152
EU jobs total	42	66	89	89	129	160	180

Suboption 3	**1990**	**2000**	**2005**	**2010**	**2015**	**2020**	**2025**
rated dom. VC power, W	1275	1423	1500	1739	1300	980	880
rated non-dom. VC power, W	929	1107	1200	1293	1300	980	880
electricity domestic, in TWh	9,5	12,6	14,6	18,5	15,1	12,5	12,2
electricity non-domestic, in TWh	2,1	2,7	3,1	3,5	3,7	3,0	2,8
energy total, in TWh	11,5	15,4	17,7	22,0	18,8	15,4	15,0
Mt CO2 electricity	5,8	7,1	8,0	9,5	7,7	5,9	5,4
Mt CO2 other	1,0	1,3	2,1	2,0	2,7	3,5	3,5
Mt CO2 total	6,7	8,3	10,0	11,4	10,4	9,3	8,9
Price	225	225	225	225	235	270	270
€ billion electricity	1,9	2,6	3,0	3,7	3,2	2,6	2,5
€ billion disposables	1,7	2,1	2,3	2,6	2,6	2,7	2,7
€ billion purchase	4,0	8,4	12,2	12,2	17,7	24,7	27,3
€ billion total consumer expenditure	7,6	13,0	17,5	18,5	23,5	30,0	32,5
€ billionturnover industry	1,6	3,3	4,9	4,9	7,1	9,9	10,9
€ billionturnover trade	1,7	3,6	5,2	5,2	7,6	10,6	11,7
€ billionVAT	0,7	1,4	2,1	2,1	3,0	4,2	4,6
jobs industry	16	33	49	49	71	99	109
jobs OEM	7	14	21	21	31	43	47
jobs retail	25	51	75	75	109	152	168
jobs total	47	99	144	145	210	293	324
of which							
jobs EU industry	12	10	10	10	14	20	22
jobs EU OEM	5	4	4	4	6	9	9
jobs EU retail	25	51	75	75	109	152	168
EU jobs total	42	66	89	89	129	180	199