Raising standards for consumers

The Consumer Voice in Europe

Consumer organisations comments on draft Ecodesign and Labelling rules for Vacuum Cleaners

European Commission working documents of 27/08/2012

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Summary

This paper focuses on consumer-relevant proposals by the European Commission to set Ecodesign and energy labelling requirements for vacuum cleaners. The Commission first formulated proposals in 2010. The latest proposal was circulated to the stakeholders on 27 August 2012 has now reached the stage of the Commission's internal Inter-Service Consultation (ISC).

As for other products, ANEC (the European Consumer Voice in Standardisation) and BEUC (the European Consumer Organisation) support the overall aim of the proposal to reduce the energy consumption of vacuum cleaners and deem that Ecodesign requirements and the Energy Label are the best instruments to accomplish these goals. We support specifically the Commission's proposals to:

- Lower the rated input power of vacuum cleaners;
- Factor the cleaning performance in the rating of vacuum cleaners;
- Set requirements on noise and dust emission of vacuum cleaners.

We nonetheless express **reservations** on several of the draft provisions. Our comments are notably based on the results of tests carried out by our member organisations on 19 upright vacuum cleaners and 129 canister models in June 2011 and June 2012 respectively. Essential performance parameters such as rated input power, effective power output, cleaning performance on different surfaces and noise level were carefully investigated. We put forward suggestions on how the results of this testing can serve to improve the Commission's proposal. We notably comment on a selected number of unresolved issues found in the ISC working documents:

- The level of ambition for minimum requirements on cleaning performance is low. Similarly, the top classes of the various cleaning performance scales foreseen on the Energy Label are too easy to reach for a large number of models of vacuum cleaners;

- The test standard proposed to measure the cleaning performance on carpets does not correspond to a realistic use of their vacuum cleaner by consumers;

- Performance and labelling requirements on dust re-emission are not ambitious and misleading for consumers respectively;

- The number of different Energy Labels proposed for vacuum cleaners (9 different labels from the beginning) is not justified in the case of such a moderately complex product;

- Requirements on durability of vacuum cleaners are lacking despite the availability of a measurement standard addressing that aspect.

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Summary table of ANEC/BEUC position

The table hereafter summarizes the position of ANEC/BEUC on the proposed Ecodesign and Energy Labelling requirements for vacuum cleaners drafted by the European Commission's DG ENER. Points of particular importance are indicated in red. Our position is notably based on the results of tests carried out by our member organisations on 129 bag and bagless vacuum cleaners and of 19 upright vacuum cleaners, as published in June 2012 and June 2011 respectively.

	DG ENER proposal	**ANEC/BEUC position**	See page
Ecodesign requirements			
Cap on Rated input power	2014: 1600W 2016: 1200W	2014: **1250W** 2016: **1000W**	8
Dust pick-up on carpets	2014: 65% 2016: 65%	2014: **70%** 2016: **75%**	5
Dust pick-up on hard floors	2014: 95% 2016: 95%	2014: 95% 2016: **97%**	5
Load status of the test dust receptacle	Empty	**Partly filled with dust**	5
Maximum dust re-emission percentage	2014: *N/A* 2016: </= 2%	2014: **< / = 1%** 2016: **< / = 0,4%**	12
Particle diameter	0.4µm to 10µm	**0.02µm to 20µm**	12
Noise level	2014: *N/A* 2016: </=77dBA	2014: **< / =80dBA** 2016: **< / =75dBA**	13
Durability requirements	*(none)*	Requirements should be derived from IEC 60312 and target hose, motor and power cord failure.	14
Energy Labelling			
Number of coexisting energy labels for VCs	9	**1**	17
Dust filtration expressed in	percentage	**A-G scale**	18
Status of battery-operated VCs	In the scope, base standby consumption left out	In the scope, base standby consumption **included**	19

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1 – Lessons learned from consumer tests of 148 vacuum cleaners and relevance to the ISC document

In June 2011 and June 2012, our member organisations published the test results of 19 upright vacuum cleaners (VCs) and 129 canister VCs respectively. Important lessons can be learned from these tests, at times supporting the Commission's proposals but also suggesting potential improvements.

a) Cleaning performance: high on hard floors, disparities on carpets

Product tests suggest margins of improvement in cleaning performance

Most vacuum cleaners clean hard floors perfectly well. The 129 canister VCs tested by our members averaged a rating of 4,86 points out of 5[1]. The real deal breaker is the capacity to pick up dust from carpets. None of the 129 models tested achieved a 5/5 perfect rating; the average was only of 3,16/5. Yet the different levels of cleaning performance witnessed in our tests are not significantly correlated with other parameters such as the energy consumption. This later finding suggests the possibility of margins of improvement for several manufacturers and calls for a regulatory push for better carpet cleaning performance.

Current proposals are not ambitious enough

DG ENER proposes that dust pick-up on hard floor reaches at least 95% by Tier 1 and does not propose that the threshold be gradually raised. Considering that most vacuum cleaners can already easily achieve the 95% threshold, we suggest raising the bar by Tier 2. It is important to note that the pick-up can reach values beyond 100% as the head of the vacuum cleaner picks up dust laterally as well.

Proposed measurement standards are inadequate

Our members' tests point to a crucial element with regard to dust pick-up: used vacuum cleaners will perform significantly worse than new models tested for compliance and which contain no dust to start with. The hierarchy between vacuum cleaners is also impacted: when the dust receptacle is partly filled, some vacuum cleaners maintain their original level of cleaning performance better than other models. Since it is unrealistic to assume that consumers systematically empty the dust receptacle of their VC before they start using it, the cleaning performance measurement standard should be based on receptacles partly filled with dust.

[1] In our members' tests, performance was rated from "very bad" (1/5) to "very well" (5/5).

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ANEC/BEUC recommendations:

1. Ecodesign minimum requirements for dust pick-up on carpets:

	DG ENER proposal	ANEC/BEUC proposal
Tier 1	65%	**70%**
Tier 2	65%	**75%**

2. Ecodesign minimum requirements for dust pick-up on hard floor:

	DG ENER proposal	ANEC/BEUC proposal
Tier 1	95%	95%
Tier 2	95%	**97%**

3. Tests to be carried out when the dust receptacle is:

DG ENER	ANEC/BEUC
empty	**partly filled**

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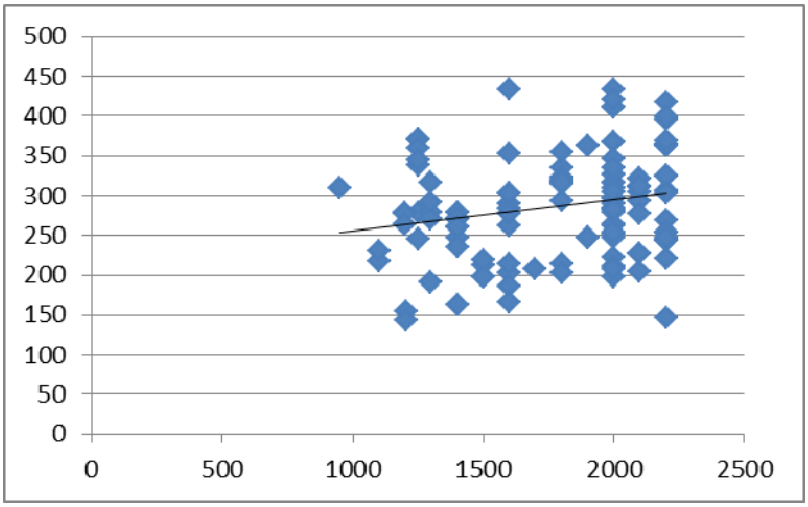
b) Wide disparities in motor efficiency support Commission's proposal to set Ecodesign requirements on Vacuum Cleaners

The European Commission proposes to regulate the energy efficiency of vacuum cleaners, on the basis of criteria *c* of article 15 of the Ecodesign Directive[2] which refers specifically to the wide disparity in the environmental performance of products.

Graph 1 below shows that there is only a weak correlation between the *rated input power* and the *available power* measured according to the standards at the end of the tube[3]. The scattered distribution of the 129 vacuum cleaners we have tested suggests that not all manufacturers have made an effort on motor efficiency. This finding directly supports the proposal made by DG ENER to regulate vacuum cleaners under an Ecodesign Implementing Measure.



Graph 1 – Rated input power against available power (in W)

[2] a15(2)c states that Ecodesign is justified notably when "*the product* [presents] *significant potential for improvement in terms of environmental impact* […], *taking into account in particular* […] *a wide disparity in the environmental performance of products available on the market with equivalent function*".

[3] In our sample of 129 vacuum cleaners, we found a positive correlation coefficient of 0.23 (it is usually accepted that correlation factors from 0 to 0.5 are "weak"; on the contrary, correlation factors from 0.5 to 1 are "strong").

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c) The rated input power is a misleading value

Consumers are led by marketing to believe that higher input power means better cleaning performance. Our test results confirm on the contrary that the *rated input power* does not give a good indication of the cleaning performance[4].

[4] The correlation factors is of -0.05.

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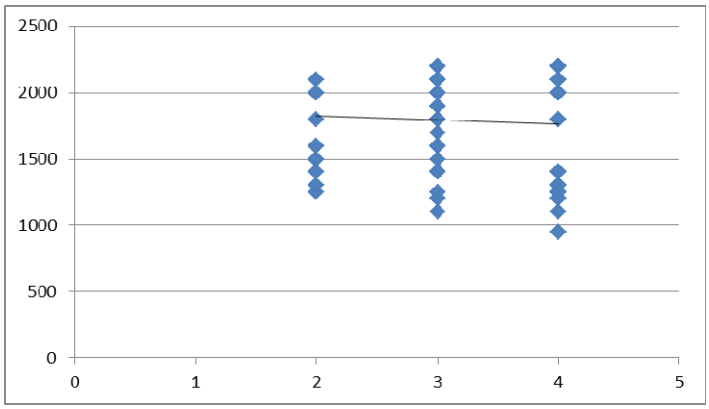

Graph 2 – Cleaning performance (scored from 1 to 5 - 5 being the best) against rated input power: there is no correlation between rated input power and cleaning performance

DG ENER's proposal to set a cap on the rated input power of vacuum cleaners will suppress a misleading marketing argument without endangering the cleaning performance. After the phase-out of the most energy-hungry references, consumers will still find a large number of vacuum cleaners with high *available power* in shops. In fact, one model rated at only 950W displays an impressive level of efficiency with 310W of available power at the end of the tube, i.e. more than the average available power (292W) of the 96 models rated beyond 1400W!

ANEC/BEUC recommendations:

In light of the aforementioned findings, we support setting a cap on rated input power and recommend the following values:

	DG ENER proposal	ANEC/BEUC proposal
Tier 1	1600W	**1250W**
Tier 2	1200W	**1000W**

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d) Dust filtration: wide disparities and impact on health

Dust filtration impacts the health of consumers

The ability of a vacuum cleaner to prevent small particles from entering and/or re-entering the atmosphere is an important performance criterion as insufficient filtration may negatively affect the cleaning performance and the user's health.

Dust particles are Particulate Matters (PM). The negative effects of PMs on human health are well documented[5]; PMs with a diameter below 10µm (micrometers) cause the most concern as they pass through the natural barriers of the human body - the nose and the mouth – to reach the lungs and sometimes the blood system and the heart. The smaller the particle, the highest the potential impact on health.

The role of Vacuum Cleaners in the re-suspension and generation of dust particles

PMs may originate from coal burning, car emissions, etc. Vacuum cleaners themselves can expose consumers to PMs in two ways:

- Through the act of vacuuming: by aerosolizing dust particles, bacteria and allergens, poor-quality VCs re-suspend the latter and consequently increase the exposure of consumers to adverse health effects;

- Through direct generation of particles: direct generation of PMs by vacuum cleaners has been investigated and evidenced in a 2012 study[6]: "*many vacuum cleaners contain universal motors in which carbon brushes can spark to a copper commutator, and this is a well-documented technique for generating Ultra-Fine Particles* [UFPs]. *The small mean CMD values* [the researchers] *typically observed, sometimes down to 14 nanometers, indicate that this process is likely to have been the dominant UFP production mechanism during* [their] *measurements*"[7]. VCs are also the source of larger particles than UFPs, as "*mechanical abrasion of the brushes and commutator can occur;* […] *this contributes to the number and mass emission of larger particles* [than UFPs]".

  The researchers have shown that the worst vacuum cleaners "emitted substantial quantities of particles in both size fractions [PM2,5 and >0.54 µm]. This indicates that particle mass emissions from some vacuums (from 0.4 to 5.4 mg min-1) can be generally comparable to those of more traditionally acknowledged strong indoor sources such as cooking (0.5-13 mg min-1), cigarette smoking (0.5-9.3 mg min-1), and re-suspension due to the act of vacuuming (□0.7 mg min-1)".

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[5] See notably the Final Report of the *Integrated Science Assessment for Particulate Matter* carried out by the US Environmental Protection Agency: http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=216546

[6] *Vacuum Cleaner Emissions as a Source of Indoor Exposure to Airborne Particles and Bacteria*, Environmental Science and Technology, issue number 46, 2012: http://pubs.acs.org/doi/pdf/10.1021/es202946w

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Wide disparities between models justify minimum Ecodesign requirements

The researchers "*observed a very large range of emissions of UFPs, particles from 0.54 to 20 µm, and PM2.5 across the vacuums* [they] *tested, with 4-5 orders of magnitude separating the lowest and highest emitters*." The fact that several VCs did perform markedly better than the worst VCs suggests that a potential for improvement exists, which minimum Ecodesign requirements would help achieve.

In fact, it appears that cheapest vacuum cleaners are often the worst offenders in terms of dust re-emission: "[The researchers] *found modest but significant negative correlation between owner-reported vacuum purchase price and cold start emission of particles from 0.54 to 20 µm and PM2.5.*"
Our members' tests substantiate this finding, as the worst machines at filtering dust were also among the cheapest models.

Setting requirements on dust filtration

When setting requirements on dust re-emission, two aspects must be considered in particular: the diameter of dust particles re-emitted and their amount.

DG ENER specifies a diameter range in the Energy Labelling document[8]: from 0.4µm to 10µm. We argue that the diameter range is not defined adequately. Indeed:

- European consumer organisations check the re-emission of dust particles sized from 0.3µm to 20µm diameter in a reliable and repeatable manner. Our own tests have shown that some models re-emitted more than 5 million of the particles between 0.3µm and 0.4µm in the ambient air, while the best performing model re-emitted none.

[8] See Page 60 of the Energy Labelling document.

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- The team led by Professor Lidia Morawska at the International Laboratory for Air Quality and Health (ILAQH) at the Queensland University of Technology has used particle number counters to measure particles down to 0.003µm. All particle number counters can go down to 0.02µm, which we therefore recommend to set as a threshold. Particle number counters capable of counting particles down to 0.02µm cost between 8,000 and 31,000 euros[9].

Moreover, we object to the way the dust reemission percentages are calculated. In DG ENER's proposal, the percentage suggested as target would aggregate all particles without distinguishing between the different diameters. We recommend that the different diameters be weighted in the calculation of the total percentage, so as to reflect the impact of smaller particles on health. The following table exemplifies the different alternatives (the diameter range and the figures are given for the sake of the demonstration and are not an indication of ANEC/BEUC's recommendations for these items).

Particle diameter in µm	Option A (based on Commission proposal)	Option B (based on ANEC/BEUC proposal)
0.4 to 0.5	6%	6% (factor 1.5)
0.5 to 0.6	4%	4% (factor 1.5)
0.6 to 0.7	1,5%	1,5% (factor 1.5)
0.7 to 0.8	1%	1% (factor 1)
0.8 to 1	0,5%	0,5% (factor 1)
1 to 1.5	0%	0% (factor 1)
1.5 to 2	0%	0% (factor 0.5)
2 to 5	0%	0% (factor 0.5)
5 to 10	0%	0% (factor 0.5)

Table 1 – Exemplification of 2 methods to determine dust re-emission percentage

With Calculation A, the average percentage is 1,44%, meaning that the fictional vacuum cleaner considered here would achieve the threshold foreseen in the draft regulation.
With Calculation B however, the weighted average percentage is 2,08%, meaning that the same vacuum cleaner would not achieve the threshold.

In addition, we regret that the requirements suggested by the Commission (2% maximum re-emission by 2016) are particularly not ambitious. Already today, most vacuum cleaners can achieve less than 1% re-emission of particles between 0.4 and 4 microns. Furthermore, it is not explained why DG ENER does not propose to set Ecodesign requirements on dust re-emission from Tier 1 on but only from Tier 2.

[9] ILAQH's equipment cost between 10,000 and 40,000 Australian dollars.

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ANEC/BEUC recommendations:

1. Size of the particles to be targeted under Ecodesign&Labelling requirements:

DG ENER proposal	ANEC/BEUC proposal
0.4µm to 10µm	0.3µm to 20µm

2. Requirements on maximum dust re-emission percentage:

	DG ENER proposal	ANEC/BEUC proposal
2014	-	**< / = 1 %**
2016	</= 2%	**< / = 0,4 %**

3. Method to calculate the dust re-emission percentage:

DG ENER proposal	ANEC/BEUC proposal
No distinction between the smallest and the largest particles within the total range	Weight the percentage of the smallest particles to reflect impact on health

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e) Ambition needed on noise levels

According to the European Commission quoting the European Environment Agency, "*noise above a volume threshold of 60 dB(A) affects not just the wellbeing but also the physical health of citizens*"[10]. The World Health Organisation[11] described noise as second only to air pollution as a public health hazard.

It has been suggested by different manufacturers that noise reduction comes as a trade-off with other aspects important to consumers. An interesting finding from our tests on 129 canister vacuum cleaners is that noise does not appear to be significantly related to energy consumption, weight or cleaning performance:

Parameter	Correlation with noise
Available power output	-0,17
Rated input/Available power ratio	-0,27
Dust pick-up on carpets	-0,31
Weight	-0,39

Our test results show that the heaviest machine (11,7 kg) emits more noise (75dB) than the average model (70,1dB) while the lightest machines (3,3 and 3,9 kg respectively) are not in the top five noisiest machines. Moreover, we argue that the use of more advanced noise insulation materials and techniques will only further reduce the minor correlation between weight and noise in the future.

Our members also tested 19 upright VCs in June 2011. 18 models emitted between 69 and 73dB (expressed as *sound pressure*), whereas one emitted 75dB and a last one emitted no less than 80dB. There was no significant correlation with other parameters.

ANEC/BEUC recommendations:

It is not explained why DG ENER does not propose to set Ecodesign requirements on noise level from 2014 (Tier 1) on.
Considering the high societal and health impact of noise and our test results, we recommend the introduction of an Ecodesign requirement from 2014 on.

	DG ENER proposal	ANEC/BEUC proposal
2014	-	**</= 80dBA**
2016	</= 77dBA	**</= 75dBA**

[10] http://europa.eu/legislation_summaries/environment/noise_pollution/index_en.htm
[11] *Burden of disease from environmental noise*, World Health Organization, 2011 http://www.euro.who.int/__data/assets/pdf_file/0008/136466/e94888.pdf

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f) Need and opportunity to tackle the durability of vacuum cleaners

Not unlike many other household appliances, vacuum cleaners experience problematic failure rates. Our UK-based member organisation *Which?* identified split or broken hose as the first cause of vacuum cleaners' failure (25% of the failures of canister models), followed by suction and motor issues[12]. Our June 2012 tests show that 15 models out of 129 (11,6%) failed a motor lifetime test of 550 hours of use[13]. The electrical cord of 8,5% of the models also failed a first series of durability tests[14].

Although Implementing Measures adopted so far under the Ecodesign Directive have mostly targeted energy consumption in the use phase, the Directive allows addressing other environmental parameters than energy in the use phase. Product durability is one such other parameter. Yet in practice technical standards have often lacked that would offer a convenient basis against which to set requirements. This absence of relevant standard has at times caused policy makers to overlook the durability issue and spend more resources on readily addressable issues for which standards exist. In the case of vacuum cleaners, a standard addressing durability issues does exist (EN 60312). EN 60312 mentions the following targets for durability:

- Motor lifetime > 600 hours;
- Power nozzle lifetime > 1,000 drum rotations;

- Hose lifetime > 40,000 oscillations;
- On-off switch lifetime > 2,500 times;
- 2-year guarantee and replacement parts available for 10 years after production ceases.

ANEC/BEUC recommendation:
Ecodesign requirements on durability should be set, deriving directly from EN 60312 standard.

[12] See Preparatory Study by AEA, Final report February 2009, page 33: http://ec.europa.eu/energy/efficiency/studies/doc/ecodesign/eup_lot17_final_report_issue_1.pdf
[13] Test standard: cycles of 14m30s at maximum power / 30s off.
[14] The cord was pulled 1000 times.

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g) Efficient vacuum cleaners can be affordable too

It has been suggested in several Ecodesign discussions that efficient products are more expensive than non-efficient products. ANEC, BEUC and the official evaluation of the Ecodesign Directive have rebutted this claim. It is worth noting that the most efficient vacuum cleaners in our tests are not necessarily more expensive than the least efficient models:

- The 8 efficient vacuum cleaners with a available/rated power ratio from 27,1% currently cost from 73€ to 269€ online;

- The 3 inefficient vacuum cleaners with a available/rated power ration below 10% currently cost from 69€ to 130€ online.[15]

[15] Prices found on price comparison website *Idealo.fr* on 3 September 2012.

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2 – Energy Label for vacuum cleaners

a) General remark

The proposal for an Energy Label is the third different proposal circulated by DG ENER. It is regrettable that stakeholders were not involved in its design and only discover the sometimes radical changes so late in the process.

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b) Nine different energy labels for vacuum cleaners is too much

DG ENER proposes that a maximum of nine Energy Labels for vacuum cleaners coexist at the same time on the market.

First, DG ENER proposes that general-purpose cleaners, carpet-only and hard floors-only carpets each have their energy label. We argue that the differences between these appliances are largely overblown and do not justify having three energy labels.

Moreover, DG ENER proposes that manufacturers can decide which energy scale they want to use on their products. For instance, a manufacturer may from 2013 label one of its products "A" on an A to G scale, while other manufacturers may label their products "A^{+++}" on an A^{+++} to D scale. This feature will mislead consumers and is therefore unacceptable. Consumers could believe that the A-rated product is the best available, unaware that other models by other manufacturers are rated three classes above the first model. It is essential that all vacuum cleaners are ranked against the same energy scale at any given time.

ANEC/BEUC recommendations:

- There should be only one Energy Label for all canister and upright Vacuum Cleaners;
- Only one energy scale should be used for all vacuum cleaners. "A la carte labelling" will mislead consumers.

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c) Misleading information on dust filtration

When it comes to informing consumers about the dust re-emission, we welcome DG ENER's suggestion to display that information on the Energy Label. However, we argue that the information conveyed on the label should be expressed on an A-G scale, instead of being expressed in percentage points. The way in which an information is presented to consumers can generate what consumer behaviour literature refers to as *anchor bias*[16]: with most vacuum cleaners filtering more than 95% dust nowadays, consumers might understand such high scores as being all very positive, when there is in fact a significant difference of cleaning experience between e.g. a model achieving only 95% dust filtration and a model reaching 99.6% filtration. The 0-100% frame is therefore inadequate and should be replaced by an A-G scale.

ANEC/BEUC recommendations:

- Information on dust filtration must be expressed in the form of an A to G rating;
- We would recommend the following classes, in line with Ecodesign minimum requirements set at 2% re-emission and the smallest particles weighted (see above):
    - A: ≥ 99,9%
    - B: 99,7% ≤ n ≤ 99,89%
    - C: 99,5% ≤ n ≤ 99,69%
    - D: 99,3% ≤ n ≤ 99,49%
    - E: 99% ≤ n ≤ 99,29%
    - F: 98,5% ≤ n ≤ 98,99%
    - G: <98,5%

[16] See for instance *Managerial Economics: a Problem-Solving Approach*, Luke Froeb&Brian McCann, 2010.

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d) Status of battery-operated vacuum cleaners

Battery-operated vacuum cleaners are currently included in the scope of the labelling measure. Yet we argue that the parameters taken into account in the labelling measure will not enable consumers to properly compare battery-operated vacuum cleaners with canister models. The Preparatory Study indicates lower input power for battery-operated cleaners, but battery-operated appliances are equipped with an integrated electrical supply using rechargeable battery storage which consume more than 4-6W on standby. A 4W charger consumes up to 35kWh/year without even using the vacuum cleaner for dust removal. We argue that the standby consumption of battery-operated vacuum cleaners should be taken into account in the calculation of the energy class.

ANEC/BEUC recommendations:

The standby consumption of battery-operated vacuum cleaners should be taken into account in the calculation of the energy class.

END.

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