

Vacuum cleaners: Recommendations for policy design

February 2013

1. Summary

The implementation of an energy label and Ecodesign requirements for vacuum cleaners is very welcome. The proposed power cap is absolutely key and should be introduced without delay, but with a more ambitious tier 1 limit (e.g. 1100W instead of 1600W).

Apart from this, Topten recommends a simplified Energy Label: one label is sufficient for all vacuum cleaners; a distinction of different vacuum cleaner types as proposed only contributes to consumer confusion. The calculation formula for the annual energy consumption, on which the Energy Labelling scale is based, raises doubts: the inclusion of the dust pickup (performance) into the calculation formula for the annual energy consumption is misleading. A much simpler approach would be to base the labelling scale on the measured input power (reciprocal) or the measured suction power divided by the input power.

2. Introduction

So far no policy measures or voluntary labels exist for vacuum cleaners. Communication towards consumers drives them towards taking the Wattage declaration as a performance indicator, and high power is generally associated with good performance. Measurements however show that the declared input power is not related to the performance. Vacuum cleaners with high power have an unnecessarily high energy consumption, while not performing any better than vacuum cleaners with less power. For most models the effective input power is than declared.

The European Commission has been discussing Ecodesign and Energy Labelling regulations for vacuum cleaners since 2010. Now the latest proposals will be voted on end of February 2013. The near introduction of an energy label and of Ecodesign requirements, especially of a power cap, are very welcome. Topten has looked at the proposals and compared the content to the best products on the European market on www.topten.eu as well as to the specifications planned by the Blue Angel and deduces here on some improvement suggestions for the policy measures.

3. Best available technology

Topten.eu shows the vacuum cleaners with lowest rated input power and good performance. Energy consumption values on topten.eu, which are based on today's declaration on carpet, and those in the proposals are not defined identically. The energy consumption values in Wh on Topten.eu have to be divided by 100 to receive the consumption values used in the proposals. The table below shows both values for the Topten models.

There are 26 vacuum cleaner models of 12 different brands on topten.eu, all meeting the following selection criteria:

- Maximum power: 1300 W
- Minimum dust pickup on carpet: 75%
- Minimum dust pickup on hard floor: 95%
- Maximum dust re-emissions: 0.04 mg/m³

The tables below show the best model of the ten most important manufacturers that are present on topten.eu.

| Brand | Dyson | Vorwerk | Electrolux | Siemens | EIO |
|--|-----------|--------------|------------|-------------|-----------|
| Model | DC24 ball | Tiger VT 265 | ZG8800 | VSZ6GP12 66 | Vivo 1600 |
| Wattage | 650 | 1300 | 1000 | 1200 | 1200 |
| Wh/10m ² (on Topten) | 142 | 201 | 211 | 235 | 238 |
| Wh/m ² (proposal) | 1.43 | 2.01 | 2.11 | 2.35 | 2.38 |
| kWh/year (proposal) | 32.7 | 41.3 | 46.4 | 52.3 | 55.9 |
| Dust removal on carpet (%) | 79.6% | 87% | 82.3% | 81.5% | 78% |
| Dust emissions (mg/m ³) | 0.0005 | 0.0005 | 0.0002 | 0.0024 | 0.04 |

| Brand | Hoover | Miele | AEG- Electrolux | Philips | Dirt Devil |
|--|----------|-----------|--------------------|---------|------------|
| Model | TGP 1410 | S 6270-CH | CE1400BS | FC 9306 | EQU 2 |
| Wattage | 1400 | 1200 | 1400 | 1250 | 1400 |
| Wh/10m ² (on Topten) | 240 | 244 | 250 | 254 | 267 |
| Wh/m ² (proposal) | 2.4 | 2.44 | 2.5 | 2.54 | 2.67 |
| kWh/year (proposal) | 54.6 | 51.6 | 60.6 | 57.7 | 60.8 |
| Dust removal on carpet (%) | 80% | 84.9% | 76.0% | 80.1% | 80% |
| Dust emissions (mg/m ³) | 0.01 | 0.007 | 0.04 | 0.0004 | 0.01 |

Tables 1+2: Best vacuum cleaner models by ten important manufacturers present on www.topten.eu. kWh/year are calculated according to the formula in the Ecodesign and Labelling proposals for vote (January 2013), based on energy consumption on carpet.

The best vacuum cleaner has an annual energy consumption of only 33 kWh, two more models remain below 50 kWh/year. 24 of the models remain below the annual energy consumption requirement proposed for 2014.

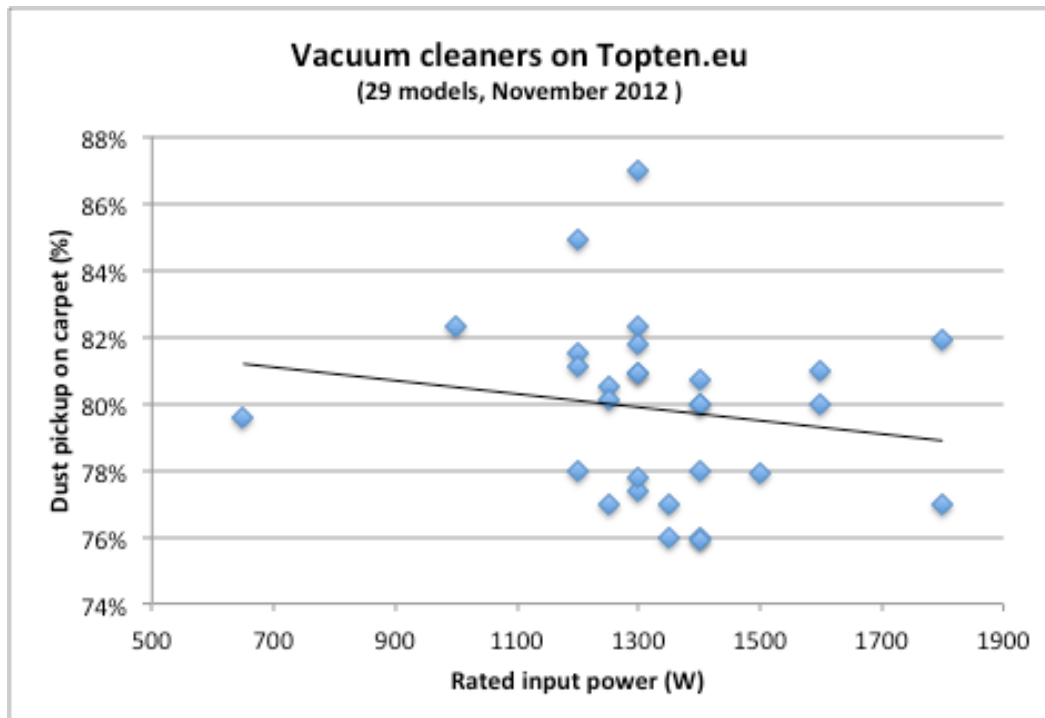


Fig. 1: Power and dust pickup values of the vacuum cleaners on www.topten.eu

Fig. 1 displays the rated input power ('Wattage') and the dust pickup of the models on Topten.eu (November 2012). 27 of the 29 models have a power of max. 1600 W (proposed tier 1, see below). With today's declaration, only one model meets the proposed tier 2 requirement of 900W. Today's communication however tends to declare too high power values – as soon as the measures are in force, lower power values will be declared and more models will meet the power cap. Furthermore Topten has much stricter requirements for dust pickup on carpet than what is proposed by the EC to set as tier 1 requirement. So many more models will comply with the power cap requirement than what was present on Topten in November 2012.

The graph visualizes that there is no correlation between rated input power and dust pickup on carpet (the trendline added to this data even shows a negative correlation). With 1000 W a dust pickup of up to 82% can be reached; higher input power does not improve the performance.

4. Topten policy recommendations summary

1. **Implementing measures** on vacuum cleaners are **welcome** and should be adopted without delay.
2. The **power cap** is absolutely key: tier 2 (900W) is highly welcome – also tier 1 should be moved to more ambitious, lower values (e.g. 1100W). Then the power cap would even be sufficient even as a standalone Ecodesign requirement. Also the labelling scale could be based on the simple information of the rated input power.
3. The **energy label** must be **simplified**: one label for all types of vacuum cleaners (hard floor, carpet and general purpose) is sufficient.
4. The inclusion of the dust pickup into the calculation **formula of the annual energy consumption** is misleading. The easiest is to completely renounce on this figure: the labelling scale could be based simply on rated input power (reciprocal) or the measured suction power divided by the input power.
5. **Measurements** should be conducted at a **partly loaded** state (e.g. 200g of dust). The performance of most models rapidly decreases with dust load, and an empty vacuum cleaner does not reflect real usage conditions.

5. Policy measures and initiatives in the EU and Topten recommendations

5.3 Proposed Ecodesign requirements

The proposal suggests the following minimum requirements for household and commercial vacuum cleaners:

| Ecodesign proposal vacuum cleaners | | kWh/a | W | dpu _{carpet} | Dpu _{hard floor} | Dust re-emission (0.4-10 µm) | Sound power | Min. lifetime |
|------------------------------------|------|-------|------|-----------------------|---------------------------|------------------------------|-------------|------------------------------------|
| Tier 1 | 2015 | 62 | 1600 | 65% | 95% | - | - | - |
| Tier 2 | 2017 | 43 | 900 | 65% | 95% | 1% | 80 dB | Motor lifetime + hose oscillations |

The proposed ecodesign requirements are in general welcome and will lead to energy savings. Topten however thinks they are unnecessarily complicated and difficult to verify. A simple power cap, low enough, would guarantee energy savings while being very simple and not leading to complicated measurements and calculations and difficult verification procedures.

The power cap is very welcome and the most important part of the regulation. The tier 2 power cap of 900W is appreciated. Tier 1 should also be moved to lower values. There is no correlation between wattage and cleaning performance/ dust removal; also vacuum cleaners with low input power are well performing. There are vacuum cleaners with 650W with dust pickup values not any worse than models with around 1800W – while using only one third of the power (see Fig. 1). Recommended power caps are: 1100W (tier 1) and 900W (tier 2). This will strongly increase the energy saving effect of the implementing measure. The power cap could also stand alone, leading to considerable energy savings while being very simple.

The maximum annual energy consumption values seem reasonable. 24 of the 26 vacuum cleaners on Topten.eu comply with the suggested requirement for 2015.

Despite the values being reasonable, Topten thinks the maximum annual energy consumption requirement is not absolutely needed on top of the power cap. The power cap has almost the same energy saving effect, but is much easier to implement and verify – no complicated measurements and calculations are needed.

Regarding the calculation formula of the annual energy consumption, the dust pickup should not be mixed into it. Measurements show that there is no correlation between dust pickup and rated power (Position paper by ANEC/BEUC). The dust pickup does not have any influence on energy consumption or cleaning time. Energy consumption and dust pickup are unrelated and should be two separate types of information – one is related to energy, the other one to performance.

The proposed minimum dust pickup values guarantee a minimum performance level of the market.

5.2 Proposed energy label

The energy label's main information is proposed to be based on the annual energy consumption (kWh/a):

| | Max. kWh/year | |
|------|---------------|----------------|
| A+++ | 10 | |
| A++ | 16 | |
| A+ | 22 | |
| A | 28 | |
| B | 35 | BAT (Topten) |
| C | 43 | |
| D | 52 | Phase out 2016 |
| E | 62 | |
| F | 78 | Phase out 2014 |
| G | > 78 | |

The labelling scale seems rather demanding – the best model on Topten reaches class B; most of the Topten products are in the proposed classes D and E. Once the declaration of the power is clearly defined and standardised, it is expected that the values will be considerably lower. Today most manufacturers are declaring too high power values, as power still is used as performance indicator in communication.

A demanding labelling scale is welcome, but the values and calculation formula it is based on are questionable. Performance (dust pickup) should not be mixed into the calculation formula of the energy consumption (see above).

The labelling scale should be based on the rated input power (assuming a sufficient dust pickup in all models), or on the measured suction power divided by the rated input power.

The main flaw of the proposal is that it proposes to introduce three different labels. It distinguishes vacuum cleaners for hard floors, for carpets and for 'general purpose'. For households this distinction is not relevant, but confusing. One label for all vacuum cleaner types is sufficient.

The A+-classes are proposed to be introduced gradually. In 2014, when the energy label will be mandatory, only the classes up to A will be shown on each label. In 2015 up to A++, and 2017 also the top class A+++ will be displayed on all products. Regarding the rather high ambition of the classification scale, this gradual introduction seems acceptable.

Additionally letters are proposed to indicate the dust removal performance and the dust re-emission. After tier 1 class G will be banned from the market. The proposed scale allows a distinction between higher and lower dust pickup values. The same accounts for the dust re-emission classification scale.

| Dust removal performance class | Dust pickup on carpet | Dust pickup on hard floor | |
|--------------------------------|-----------------------|---------------------------|----------------------------|
| A | > 90% | > 110% | |
| B | > 85% | > 107% | |
| C | > 80% | > 104% | |
| D | > 75% | > 101% | |
| E | > 70% | > 98% | |
| F | > 65% | > 95% | |
| G | < 65% | < 95% | Banned after tier 1 (2015) |

| Dust re-emission class | Dust re-emission (%) | |
|------------------------|----------------------|----------------------------|
| A | 0.1% | |
| B | 0.25% | |
| C | 0.4% | |
| D | 0.6% | |
| E | 0.8% | |
| F | 1% | |
| G | > 1% | Banned after tier 2 (2017) |

5.3 Blue Angel

The Blue Angel is also about to introduce requirements for vacuum cleaners, a product group which has not yet been covered by the environmental label. The following criteria are foreseen to be adopted in mid-2013:

| Max. Energy consumption (10m2) | Max. power | Dust pickup on carpet | Dust pickup on hard floor | Dust re-emission (0.4 - 4 µm) | Max. sound power level |
|--------------------------------|------------|-----------------------|---------------------------|-------------------------------|------------------------|
| 250 Wh | 1200 W | 80% | 98% | 0.2% | <i>tbd</i> |

Dust pickup for the Blue Angel will be measured with the vacuum cleaner filled with 200g of dust. This corresponds more to real life conditions than the new and empty bags, which are usually used for the test now. The dust pickup performance generally declines with the vacuum cleaner being filled – but at different rates for different models. Especially between bagless and vacuum cleaners with bags there are big differences in performance loss rates with level of filling. Measurement at a partly filled state avoids that only high dust pickup rates are reported (and used for calculation of the energy consumption), which however are of almost no relevance in daily life, because the vacuum cleaners are literally never empty.

5.4 Measurement standard

The current dust pickup measurements are performed with new, empty bags. The performance of most vacuum cleaners however quickly declines with the bag becoming filled. Because in daily life the vacuum cleaner is virtually never empty, a measurement with partly filled bag would better reflect real-life usage conditions. Furthermore the current empty dust pickup creates a bias between bagged and bagless vacuum cleaners, because the performance of the latter declines less with increasing dust filling.

The Blue Angel's approach could also be included in the Labelling and Ecodesign regulations: the German Ecolabel requires the dust pickup be measured loaded with 200g of dust.

6. References

COMMISSION working document (EU) No .../.. of XXX Implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to Ecodesign requirements for vacuum cleaners

Draft for vote (February 2013): http://env-ngo.eup-network.de/fileadmin/user_upload/Draft_Ecodesign_Regulation_Vacuum_Cleaners.pdf.pdf

Commission working document on the COMMISSION DELEGATED REGULATION Implementing Directive 2010/30/EU of the European Parliament and of the Council with regard to energy labelling of vacuum cleaners

Draft for vote, February 2013: http://env-ngo.eup-network.de/fileadmin/user_upload/Draft_Labelling_Regulation_Vacuum_Cleaners.pdf.pdf

Consumer organisations comments on draft Ecodesign and Labelling rules for Vacuum cleaners, ANEC/BEUC, October 2012

Blue Angel: www.blauer-engel.de/en/index.php

Topten – Best products of Europe: www.topten.eu

Coolproducts: www.coolproducts.eu/product/vacuum-cleaners