

Vacuum cleaners: Recommendations for policy design

August 2013

1. Summary

The regulations on Ecodesign and Energy Labelling for Vacuum cleaners have been published in July 2013. Especially the power cap is very welcome: from 1 September 2014 vacuum cleaners will be allowed a maximum power input of 1600W. In September 2017, this cap will be tightened to 900W. Especially tier 2 will lead to considerable energy savings, while at the same time being a simple measure. This Ecodesign requirement will reverse the trend to market vacuum cleaners with increasing power – often wrongly assumed to be a performance indicator. Apart from the maximum power requirements, the Ecodesign regulation will also introduce requirements regarding annual energy consumption, performance (dust pickup on carpet / on hard floor), and in tier 2 additionally regarding dust re-emission, sound power and durability.

The Energy Label applies also from September 2014. It will provide information on performance and energy consumption to consumers, while today there is no standardised declaration requirement. The Label however seems overly complicated, and the calculation formula for the annual energy consumption, on which the Energy Labelling scale is based, raises some doubts. Apart from the energy consumption, the Label also provides a classification of the dust re-emission, the performance on carpet and/or on hard floor.

2. Vacuum cleaners: Ecodesign and Labelling regulation in force

Before 2013 no policy measures or voluntary labels existed for vacuum cleaners. Communication towards consumers was driving them towards taking the Wattage declaration as a performance indicator, and high power has generally been 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 lower than declared.

The European Commission has been discussing Ecodesign and Energy Labelling regulations for vacuum cleaners since 2010. In July 2013 the regulations on Energy Labelling and Ecodesign have been published in the Official Journal. The introduction of an energy label and of Ecodesign requirements, especially of a power cap, are very welcome.

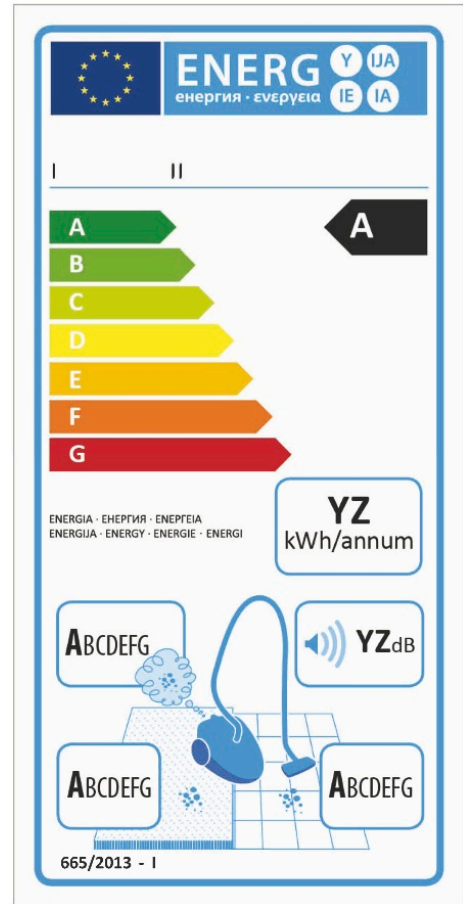
Ecodesign requirements	Tier 1	Tier 2
	1 Sep 2014	1 Sep 2017
Max. annual energy consumption	62 kWh/year	43 kWh/year
Max. Power	1600 W	900 W
Min. dust pickup on carpet	0.70	0.75
Min. dust pickup on hard floor	0.95	0.98
Max. dust re-emission (0.4-10 µm)	-	1%
Durability		40'000 hose oscillations; 500 hours operational motor lifetime

The Labelling regulation distinguishes three different Label designs for carpet, hard floor and multi purpose vacuum cleaners. The Label includes ratings of energy efficiency, cleaning performance and dust re-emission.

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

Energy efficiency	Max. kWh/year	
A+++	10	
A++	16	
A+	22	
A	28	
B	34	BAT (Topten)
C	40	
D	46	Phase out 2017
E	52	
F	58	
G	> 58	

The first tier of the Ecodesign regulation will phase out the worst performing models below G, tier 2 will cut across class D (43 kWh/year).



Dust removal performance class	Dust pickup on carpet	Dust pickup on hard floor	
A	> 91%	> 111%	
B	> 87%	> 108%	
C	> 83%	> 105%	
D	> 79%	> 102%	
E	> 75%	> 99%	
F	> 61%	> 96%	Banned after tier 2 (2017)
G	< 71%	< 96%	

Dust re-emission class	Dust re-emission (%)	
A	0.02%	
B	0.08%	
C	0.2%	
D	0.35%	
E	0.6%	
F	1%	
G	> 1%	Banned after tier 2 (2017)

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 regulations 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. As soon as the first manufacturers start to declare according to the regulations, Topten will publish these values. 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 seven most important manufacturers that are present on topten.eu.

Brand	Dyson	Electrolux	Siemens	EIO
Model	DC51 multi floor	ZG8800	VSZ6GP12 66	Vivo 1600
Power (W)	700	1000	1200	1200
Wh/10m ² (on Topten)	145	211	235	238
Wh/ m ² (regulation)	1.45	2.11	2.35	2.38
kWh/year (regulation)	34	47.1	53.2	52.3
Dust removal on carpet (%)	79.3%	82.3%	81.5%	78%
Dust emissions (mg/m ³)	0.0001	0.0002	0.0024	0.04
Energy Class	B	C	D	E

Brand	Miele	Philips	Vorwerk
Model	S 6270-CH	Silent Star Energy Care FC9306	Kobold VK 140
Wattage	1200	1250	1300
Wh/10m ² (on Topten)	244	254	200
Wh/m (proposal)	2.44	2.54	2.0
kWh/year (regulation)	52.3	58.8	42.2
Dust removal on carpet (%)	84.9%	80.1%	86%
Dust emissions (mg/m ³)	0.007	0.0004	0.0005
Energy Class	E	E	E

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 regulations, based on energy consumption on carpet.

The best vacuum cleaner has an annual energy consumption of only 34 kWh. Six models on Topten remain below 50 kWh/year. 23 of the models on Topten remain below the annual energy consumption requirement for 2014.

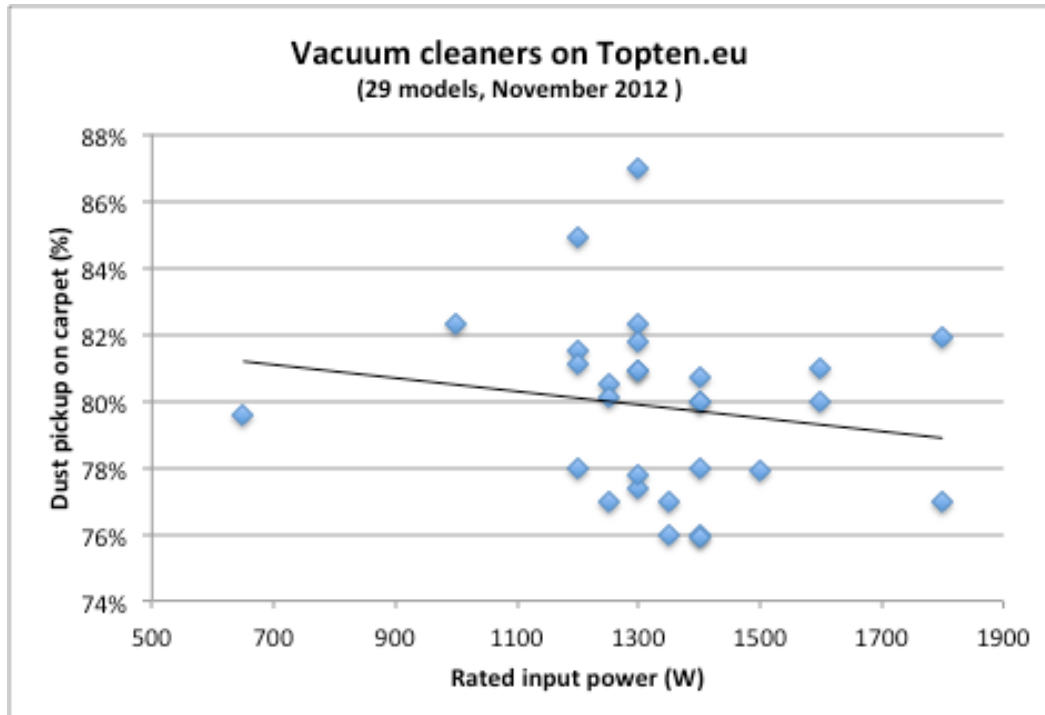


Fig. 1: Power and dust pickup values of the vacuum cleaners on www.topten.eu (data from November 2012)

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 (tier 1, see below). With today's power declaration, only one model meets the tier 2 requirement of 900W for 2017. Today's communication however tends to declare too high power values – soon 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 the Ecodesign regulation in tier 1. 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

The ecodesign and labelling regulations are very welcome. The implementation of these regulations will reverse the trend to ever-higher power input in vacuum cleaners. The **power cap is absolutely key**: especially tier 2 (900W, from Sept 2017) will lead to considerable energy savings.

First experiences with the Energy Label for vacuum cleaners in place will show if the tool has been designed appropriately. The effect of the Label and the Ecodesign regulation on the market should be monitored with a sales-based market analysis. A **market monitoring** based on sound data after the Label has been in place for the first year will show if the Labelling scale is appropriate – i.e. there are free top classes to keep pulling innovation and

models are well distributed over several classes – and the Ecodesign requirements are of effect (not too weak to have no effect).

Next to this, the appropriateness of the calculation formula of the annual energy consumption should be checked in the next review process. Topten is **sceptical about the inclusion of the dust pickup into the calculation of the annual energy consumption**, because it is not related but complicates the declaration and compliance verification activities. The measurement of the dust pickup is complicated and the result can be strongly influenced by the carpet type and the cleaning head that is used. Topten therefore recommends to use this value with caution.

The **dust pickup** should be established under conditions close to real-life usage. The most important point is that the measurement is not performed with an empty, but a **partly loaded bag** (or dust chamber, e.g. 200g of dust). The performance of most vacuum cleaners declines rapidly with dust load, and an empty vacuum cleaner does not reflect real usage conditions.

6. Measurement standard

The current dust pickup measurements based on EN 60312 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.

5. Other Labels: 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 (10m ²)	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.

6. References

COMMISSION DELEGATED REGULATION (EU) No 665/2013 of 3 May 2013 supplementing Directive 2010/30/EU of the European Parliament and of the Council with regard to energy labelling of vacuum cleaners:

<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2013:192:0001:0023:EN:PDF>

COMMISSION REGULATION (EU) No 666/2013 of 8 July 2013 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for vacuum cleaners
<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2013:192:0024:0034:EN:PDF>

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

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

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