

Innovation goals household refrigeration appliances

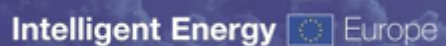
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1 Introduction

Topten is a consumer-oriented online search tool, which presents the most energy efficient appliances in Europe in various categories of products. Crucial precondition for the meaningful and well accepted Topten market surveys are appropriate selection criteria.

Obviously the market offers in European member States differ significantly in terms of price level, configuration, finishing as well as shares of energy classes and energy consumption corresponding to levels of purchasing power and behavioural aspects (mentality, customs, etc.). From the perspective of the enhancement of the European wide Topten project, however, the higher the level of congruency within the national websites the higher will be awareness (consideration) amongst manufacturers since supply side markets are rather focused on the entire EU market or even on the international market (especially for consumer electronics and ICT).

Within the context of the German EcoTopTen project, dialogues were held with manufacturers in recent years, in which criteria for future market surveys and thus also for possible product developments were discussed. In the case of some product groups, even formal innovation goals were characterised and substantiated, and were communicated to branch associations and manufacturers, with lead times of one to two years in order to give sufficient time for product developments. The targets could also refer to product features which support low-impact and low-cost behaviour on the part of consumers, such as consumption displays in cars, automatic dosage systems for detergents in washing machines etc..

In the herewith presented paper possible innovation targets for **household refrigeration appliances** are discussed against the background of a dialogue with innovative manufacturers that took place in the forefront. After a short introduction in chapter 1, chapter 2 outlines the framework conditions concerning existing legislation, environmental labels and Topten / EcoTopTen criteria and according changes to be expected in the nearer future. In chapter 3 the possible innovation goals are presented and discussed against the background of the dialogue with the manufacturers. In chapter 4 conclusions are drawn.

2 Framework conditions household refrigeration appliances

2.1 Ecodesign and EU Energy Label – regulation and current discussions

The Ecodesign process on household refrigeration appliances was finalized but the process on the EU energy label is only advanced but not completed yet. However a draft version of the new EU energy label is available that most probably is close to the regulation that will be adopted. As this regulation naturally is of high importance for the product development

undertaken by the manufacturers, its most important aspects are outlined in the following. The same is true for the EU energy label that is also outlined below.

Ecodesign (COMMISSION REGULATION (EC) No 643/2009 of 22 July 2009; EU COM 2009)

1. Juli 2010

- Energy Consumption: For all compressor type refrigerating appliances: “A” (EEI<55)

1. Juli 2012

- Energy Consumption: For all compressor type refrigerating appliances: “A+” (EEI<44)

1. Juli 2014

- Energy Consumption: For all compressor type refrigerating appliances: “A+” (EEI<42)

EU Energy Label (working document available; EU COM 2010)

- Energy Consumption: EEI is calculated on the bases of: net volume and appliance category
- Slight change from 1 July 2014 on (EEI <42 instead of <44 to distinguish between “A” and “A+”);
- Information on annual energy consumption, storage volume(s), noise.

2.2 Minimum criteria for Blue Angel, Topten and EcoTopTen

Blue Angel criteria, RAL UZ 137 (RAL UZ 137 2009)

- Energy Consumption: EEI<33, this corresponds to the new “A++” annual consumption equal or less then 230 kWh
- Refrigerators: exact regulation and display of temperature (degree centigrade), acoustic and/or visual warning system when door is left open.
- Fridge-freezers: exact regulation and display of temperature (degree centigrade) for cooling and freezing compartment; temperature of freezing compartment is readable from outside (except for integrated appliances). Separate regulation of temperature in cooling and freezing compartment; acoustic and/or visual warning system when door is left open.

- Freezers: exact regulation and display of temperature (degree centigrade); temperature is readable from outside; acoustic and/or visual warning system when door is left open and when temperature rises.
- Availability of (most important) spare parts for 10 years
- Materials: hazardous substances in plastic parts; insulation material; exclusion of halogene organic substances for cooling agents and foaming of insulation; exclusion of biocide silver
- Noise: operation: $\leq 38\text{dB(A)}$
- Instruction manual

Topten.ch => not yet adapted to new proposal for EU energy label / Ecodesign implementing measure.

- Energy Consumption: “A++”(old)

EcoTopTen criteria, September 2009 (ETT 2009) => not yet adapted to new proposal for EU energy label / Ecodesign implementing measure.

- Energy Consumption: “A++” (old)
- Freezers have to give an acoustical and/or visual signal, if the door is left open or the temperature rises.
- Neither cooling-, nor insulation material are allowed to contain halogen-organic substances. They also have to be produced without the help of these substances.
- If a testresult from Stiftung Warentest is available, it has to be at least "good".
- The booklet of instructions has to give advice concerning environmentally friendly usage, machine care, repairing and disposal.

2.3 Market

State of the Market (data from EcoTopTen / September 2009)

Energy consumption: only “A++” household refrigeration appliances are listed

EuroTopTen Plus: www.topten.info

It is striking that not in all countries participating in EuroTopTen Plus “A++” household refrigeration appliances are available. In some only “A+” or even “A”-appliances are listed. See e.g. Romania <http://www.topten.info.ro/index.php?page=270> litri

In others only very few “A++” appliances are available. See e.g. Poland: http://topten.info.pl/index.php?page=dwudrzwiowe_do_260

This fact is an indication that country specific framework conditions apply: As the principle availability of all different appliances including the most efficient ones (“A++”) from side of manufacturers can be presumed for all countries rather the different buying power in the EU27 countries might be the reason for the actual presence of efficient models in shops. The subsequent table illustrates this. It shows the comparative price levels for the European countries with a Topten website. The data is expressed in relation to EU 27 = 100. The comparative price levels cover a range from lowest Lithuania with 59,6 up to 139 in Norway on top. Germany is rather on average level (103,1) whereas buying power in Poland and Romania is among the lowest of the Topten countries.

Table 2-1 Comparative price levels of European countries with a Topten website and region

	Comparative price levels 2007	Availabiliy of Topten website	Region
Norway	139	yes	Northern Europe (North)
Switzerland	126,1	yes	
Finland	122,5	yes	
Luxembourg	112,4	yes	Western Europe (West)
France	108,3	yes	
Belgium	106,3	yes	
Italy	103,9	yes	
Netherlands	103,4	yes	
Germany	103,1	yes	
Austria	101,4	yes	
EU (27 countries)	100		
Spain	92,4	yes	Southern Europe (South)
Greece	89,4	yes	
Portugal	84,6	yes	
Poland	63,7	yes	Central Eastern Europe (CEE)
Czech Republic	62,4	yes	
Romania	61,5	yes	
Lithuania	59,6	yes	

3 Possible innovation goals for household refrigeration appliances

3.1 Energy efficiency

3.1.1 Innovation goal 1: Energy Consumption: A+++ (according to new label approach)

The criteria as general Topten criterion makes only sense if “A+++” household refrigeration appliances were available in all countries participating in EuroTopten with a reasonable range of products. Against this background manufacturers stated that the level of ambition should not be flatly set equal for all categories of cooling appliances and for all countries. Not in all cases energy efficiency class “A+++” (according to the new label approach) was identified as desirable criterion.

Concerning the appliances-specific level of ambition manufacturers proposed the following energy efficiency classes:

Fridges:

- For appliances with “no frost” function or “vitafresh” zones one manufacturer expected the most efficient models only to be in energy efficiency class “A+”.
- In contrast to this, fridges without these functions or zones will be able to reach “A++” or “A+++”. As temperatures are not very low (typically between 4 and 6°C) energy losses are relatively low compared to freezers.

Fridge-freezers

Manufacturers stated that rather “A++” than “A+++” should be used as criterion.

The “no frost” function combined with the energy efficiency class “A+” was favoured by one manufacturer arguing that this function indeed needs more electricity on the one hand (merely for ventilation) whereas it saves energy on the other hand by preventing ice layers in the appliances as consumers do not regularly deice the appliance.

Freezers

Both for chest freezers and for upright freezers most manufacturers stated that “A++” should be set as minimum criterion and not “A+++”.

It can be added that manufacturers made it clear that they will be ready to offer at least one “A+++” model in the most important categories of household refrigeration appliances at the time when the new label will apply.

Concerning the country specific levels of ambition the manufacturers argued as follows:

Manufacturers argued that the range of models in the shops depends heavily on purchasing power in different countries. According to estimates of one manufacturer the prices in the different European countries are more or less the same for the appliances but the incomes are very different. In countries with less purchasing power e.g. much more appliances are repaired instead of newly purchased. If appliances are newly purchased people cannot afford the relatively high prices of very efficient models (e.g. “A+++” in the future).

Therefore most manufacturers recommended energy efficiency class “A+” for these countries as criterion: “A+”-appliances are not much more expensive than “A”-class appliances but still result in cost savings even though electricity prices in these countries are rather low. The replacement of old appliances and the purchase of new “A++”/“A+++”-appliances should rather be supported by a rebate / rewards programs.

The following purchase price differences depending on energy efficiency of the appliance were mentioned:

“A” → “A+”: +20 Euro

“A+” → “A++”: +100 Euro

Higher costs of the more efficient models primarily result e.g. from improved compressors and vacuum insulation panels. Concerning the price also other features of the appliance like colour or zoning (0°C zone, vitafresh zone etc.) play a significant role.

The following table illustrates the different levels of ambition in the different countries at the example of the average of the listed Topten models and the one with the highest resp. the lowest electricity consumption per litre and 15 years. Whereas in Norway, Germany and Spain – as representative countries for Northern, Western and Southern European countries – the differences of the most efficient model are rather small, the best model on the Polish Topten website (representative for the Eastern countries) consumes significantly more electricity.

Table 3-1 Electricity demand of the analysed models in kWh for 15 years per litre net volume. Source: Deliverable D7 Prices and life cycle costs of comparable energy efficient products in Europe. Quack, D. 2010

Electricity demand	Unit	CEE (Poland)	North (Norway)	West (Germany)	South (Spain)
Average Topten models	kWh/15 years*litre	15,67	11,36	10,19	12,58
Most efficient Topten model	kWh/15 years*litre	11,14	9,84	9,31	9,77
Least efficient Topten model	kWh/15 years*litre	18,59	15,82	11,88	16,31

It can be concluded that the level of ambition for the household refrigeration appliances has to be set country specific depending on the accordant market situation. It should not flatly be at “A+++”.

3.1.2 Innovation goal 2: Exact regulation and display of temperature (degree centigrade)

The advantage of an exact regulation and display of temperature can be seen in the better control consumers have concerning the actual temperature in the appliance. They are less likely to set the temperature lower than actually necessary and that way could save energy.

The criterion was discussed controversially: part of manufacturers mentioned that a share of their models already comes with this feature, others rejected the criterion. As alternative fix temperature settings for freezing and cooling were mentioned. It was added that the display of temperature could even be contra productive as one manufacturer stated: In order to install a display at the outside of the door, the insulation of the door has to be penetrated. The resulting hole in the insulation would lead to energy losses.

A practical alternative for appliances without this feature is to place one thermometer in the cooling and one freezing part. Of course this is more intricate for consumers and it is most likely that consumers would rather not make use of this easy alternative.

One manufacturer mentioned models with eco mode: The eco mode is useful if frozen food is placed in the middle drawer and leads to energy saving of about 7%.

3.1.3 Innovation goal 3: Acoustic and/or visual warning system when door is left open

The criterion acoustic and/or visual warning system when the door is left open will help to save energy as the acoustic or visual signal is intended to call the attention of consumers to properly close the door of the appliance that by accident or unawareness was left open.

As manufacturers stated that this feature is realised in a broad range of models it would be no problem to set it as criterion for Topten. On the other hand it eventually makes not much sense to bother with a criterion that stands for a broadly available feature.

3.1.4 Innovation goal 4: Fridge-freezers: Separate regulation of temperature of refrigerating and freezing compartment

The idea behind this innovation goal is that people do have access to a fridge-freezer with both functionalities – cooling and freezing – and are at the same time able to switch off one

of the functions in case it is not needed without affecting the other. This can be the case during holiday or at other occasions when e.g. there is no need for freezing food. In both cases energy savings would occur due to the switch off of part of the appliance while the other function would still be available.

Appliances, that fulfil the criterion need to have two refrigeration cycles that are controlled separately. In general it was stated by manufacturers that the existence of two separate refrigeration cycles and adjustment controls leads to extra costs of 150 Euro per appliance.

Against the fact that savings can only be realised if people really make use of the functionality the extra purchase costs are relatively high. As general Topten criterion it therefore is not recommendable.

3.2 Other criteria

3.2.1 Innovation goal 5: Noise operation $\leq 38\text{dB(A)}$

Concerning the criterion on noise during operation manufacturers stated that the proposed level of ambition can probably be reached by a few appliances in energy efficiency class "A++" and probably also "A+++". It will in principle be difficult for appliances with "no frost" because of the therewith connected ventilation.

Therefore it is rather not recommended to set a fix noise criterion in topten.

3.3 Conclusions

In the following table the discussion of the innovation goals is summarized and conclusions are drawn concerning their suitability as future Topten criterion resp. what other option is possible.

Tabelle 3-2 Overview on the proposed innovation goals for washing machines, their suitability as Topten criterion and other options

Possible innovation goal	Suitable as future Topten criterion?	Other options
Innovation goal 1: Energy Consumption: A+++	<p>The discussions with manufacturers showed that it is not feasible to set the criterion "A+++” equally for all Topten countries and all product categories:</p> <p>Due to different reasons (e.g. technology, size) it seems to be more difficult to have "A+++” freezers than "A+++” fridges.</p> <p>Depending on the buying power in the specific country and the offer on the market, either "A+” (e.g. for Romania, Lithuania, Poland), "A++” or "A+++” should be set as minimum criterion.</p>	An eye should be kept on the development of the range of products on the markets in the different countries.
Innovation goal 2: Exact regulation and display of temperature (degree centigrade)	In principle yes	
Innovation goal 3: Acoustic and/or visual warning system when door is left open	In principle yes, but as this feature is broadly available it might not be so important.	
Innovation goal 4: Fridge-freezers: Separate regulation of temperature of refrigerating and freezing compartment	In principle yes, but as the extra costs for this feature are substantial (about 150 Euro/appliance) and the actual energy savings are uncertain due to their dependency on consumer behavior it is not recommended to set this criterion as Topten criterion.	<p>As the feature offers the chance for possible energy savings it would be good to point out if a certain appliance offers the separate regulation of temperature of refrigerating and freezing compartment.</p> <p>An eye should be kept on the development of the range of products on the markets in the different countries.</p>
Innovation goal 5: Noise operation ≤ 38dB(A)	In principle yes, but difficult for appliances with no frost	

3.4 References

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