

# **Lessons from a decade of efficient product market analysis**

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## **Abstract**

In the last ten years, Topten guides have been developed in a growing number of countries, notably in the EU. These on-line tools provide consumers with precise information about the most energy efficient products they can find in shops, for a wide range of categories. The Topten international network has been successfully expanded thanks to the support from private and public bodies, including the EU Intelligent Energy Europe programme.

The first Topten websites have now accumulated a long experience about the way the market for efficient products has evolved until now, in an interesting context of dramatic changes brought both by new technologies and regulatory decisions (such as the adoption of EU Ecodesign and Energy labelling measures).

Some of the European Topten teams have decided with this paper to look for the first time through the rear-view mirror and provide insightful analysis based on the detailed market data they have gathered since 2008 on five main product groups (refrigerators, freezers, washing machines, dishwashers, TVs).

The analysis includes France, Germany and Switzerland, and investigates the way the best products have evolved across the years, potential country differences in efficient product availability, and implications for consumers of choosing top efficient products.

Lessons can also be drawn on the adequacy of regulatory measures such as the levels of the EU energy labelling classes adopted in the last years.

## **Background**

### **The Topten programme**

Topten is an international programme to create a dynamic benchmark for the most energy efficient products, and hence contribute to transforming the market towards less energy consumption [1]. Its main activity is a network of national on-line guides informing consumers about the most energy efficient products available on the market. On Topten websites, the actual best models in several product categories are presented in detail (brand, model name, picture, main characteristics, price, etc.); they correspond to real products for sale (not prototypes).

Topten has started activity in Switzerland in 2000, and has expanded to other countries (France in 2004, Germany in 2005, etc.). The network now involves 16 European countries, as well as China. Through their daily work, the teams in charge of Topten guides monitor appliance markets, technological trends, as well as regulatory decisions affecting energy-using products.

European Topten websites attracted more than 2 million visitors in 2014 (notably 410,000 in Switzerland, 207,000 in Germany, and 150,000 in France [2] - the three countries on which this paper focuses). There is growing evidence of the potential of these guides to change purchasing behaviours, as illustrated by a visitor survey suggesting a possibly significant level of influence on respondents [3].

### **2005-2015: a critical decade for product efficiency**

After the introduction of energy labels on some appliances in the 90's, the EU has taken long before accelerating its portfolio of policy measures to increase the energy efficiency of products. With the adoption of the Ecodesign Directive in 2005 and a new Energy Labelling Directive in 2010, a new phase began ten years ago. Preparatory investigations and regulatory interventions have multiplied on many product categories. As of February 2015, about 40 Ecodesign and new Energy Labelling measures are in place covering a wide spectrum of equipment.

In the meantime, energy efficiency has gained higher visibility and interest driven by both policy agendas and concerns about energy prices and security of supply. In response, efficient technologies have been boosted. As an illustration, the lighting and TV sectors have been revolutionised in the last decade by LED developments.

An interesting question is the concrete impact of these technological and policy trends on the availability and deployment of more efficient products on the market.

**This paper aims precisely at providing insights based on the data collected by Topten throughout the years on the evolution of the top of the market.**

## **Methodology**

The findings presented in this paper are using statistics on data collected by Topten guides along the years. Topten informs about the products at the top of the market, identified through strict selection criteria. These criteria are country-dependant and adjusted according to the state of the local market. They are also adjusted over time, and when new regulatory tools are available (such as new top energy labelling classes). The number of products selected in each category or sub-category is typically around ten, but may vary depending on the criteria.

It is important to note that these statistics relate to a very small and specific portion of the products on the market. *The trends and findings are strictly limited to this portion, and are in no way representative of the entire market.* Extrapolations should be avoided. In addition, the statistics are purely model-based and not sales-based (Topten does not collect sales data).

Our analysis covers three pioneering countries for Topten: France, Germany, and Switzerland, where Topten guides have been launched a long time ago so that historical data have a sufficient timespan. This sample of three countries may not be typical of all EU Member State situations, yet it is interesting for the following reasons:

- Substantial differences in residential electricity consumption between France and Germany have been reported, with some difficulties to explain the entire gap [4]. It is therefore useful to check whether there are strong differences in the availability or affordability of top efficient products between these two markets that could be part of the reason.
- Switzerland can be seen as close to both France and Germany, however they are outside the EU so they have some flexibility to set their own efficient product policies that can differ from the EU ones. Examples are more stringent minimum energy performance requirements for cold appliances and tumble driers, and energy labels for coffee machines.

- There is a growing seller concentration in the European appliance sector. Manufacturers are in theory able to sell the same models quite everywhere on the continent. It is interesting to check whether they apply differentiated national marketing strategies with respect to very efficient products.

The analysis covers a 7-year period from 2008 to 2014. 2008 is the oldest date for which sufficiently comprehensive and comparable data could be collected from the three national Topten guides. Incidentally, it also corresponds to the beginning of the publication of the first EU Ecodesign and new Energy Labelling regulations. Topten selections are typically updated twice a year, sometimes once; hence, the statistics presented here are based on one or the average of two sets of data per year.

We have chosen to present findings for five large household appliances: **fridge-freezers, stand-alone freezers, washing machines, dishwashers, and TVs**. Together, these products represent a large share of the electricity consumed by products in homes (typically half or even more). In order to guarantee sufficiently meaningful comparisons, we have restricted the scopes to the following product types:

1. **Fridge-freezers** include only compression-types with two doors ('combined', '2-doors', and excluding American fridges), both integrated and non-integrated
2. **Freezers** include upright freezers only (excluding very small ones such as 'table top')
3. **Washing machines** are front loading ones (all capacities)
4. **Dishwashers** are integrated ones with a width of 60 cm or more (excluding models in the 45 cm range)
5. **TVs** are those with a diagonal in the range 80 to 89 cm. (TV energy consumption is so much size-dependent that it was necessary to restrict the size range for our analysis).

In the analysis, we are using annual energy consumption values as declared by manufacturers and collected by Topten teams to reflect the energy performance of products. Annual energy consumption values are based on standardised duty cycles and measurement methods and are indicated on EU energy labels. It is an interesting indicator, because it captures both technical efficiency and size/capacity aspects of products.

#### Notes:

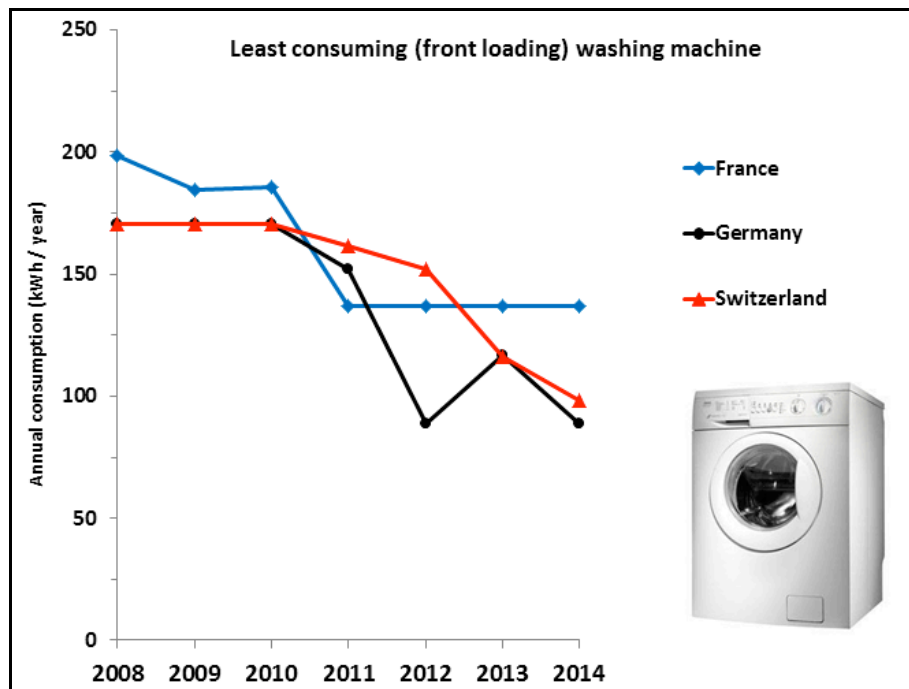
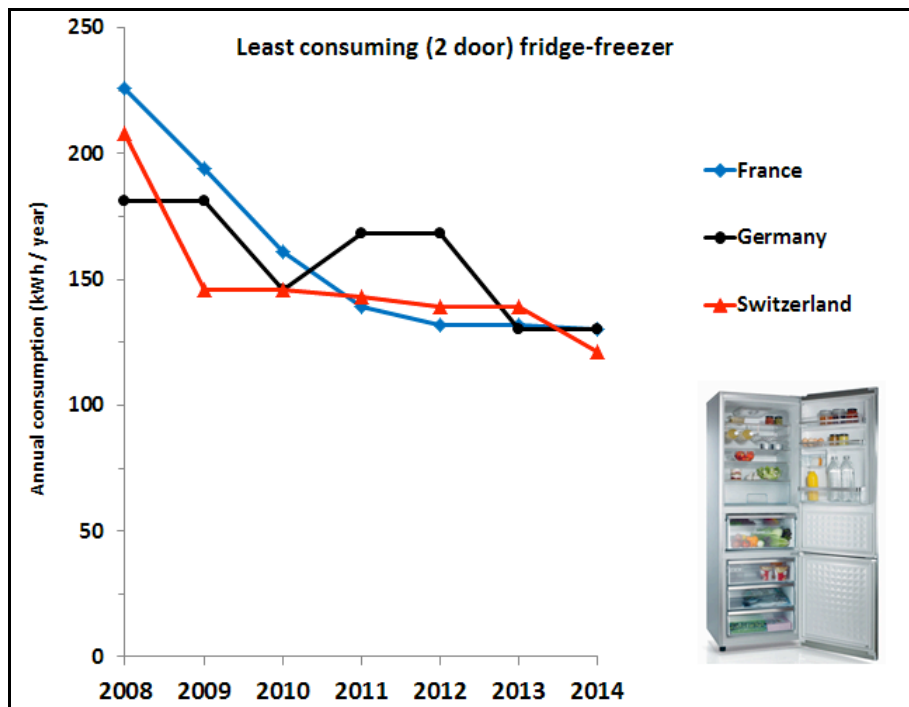
- For washing machines, the EU has introduced in 2010 a substantially new method to test and assess product energy performance. The energy consumption figure is no more based on a simple 60°C full-load cotton programme, but a mix of three programmes (60°C full-load, 60°C half-load, and 40°C half-load) over 220 annual cycles. Standby consumption has also been added. To allow better comparability, we have adjusted the consumption values prior to 2011 accordingly<sup>1</sup>. However, this remains rough and comparisons before and after 2011 should be taken with precautions.
- Similarly, data for dishwashers prior to 2011 have been adjusted to reflect the regulatory assumptions used in the new EU energy labelling measure (duty cycle of 280 washes per year, and a standby consumption).
- For TVs, new testing conditions have been introduced in the EU in 2010 to underpin the energy labelling of televisions. In particular, it has been specified that TV sets should be tested in a 'home mode' and not in another potential brighter mode. This change may have resulted mechanically in lower declared values (a 30% apparent improvement according to the industry [6]). However, we have decided not to artificially adjust our data. Comparisons to figures prior to 2009 should therefore be considered with precaution.

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<sup>1</sup> This has been done by considering that the energy consumption of a 60°C half-load programme is 0.8 that of a full-load 60°C and the consumption of a 40°C half-load 0.64 that of a full-load 60°C, and by adding 12.5 kWh of annual standby consumption. These theoretical values are those that the European Commission recommended in 2009 for transitioning between the old and new methods [5].

## Findings on top performer trends

We are presenting in this section the evolution of the performance of the top #1 product on the market (the model consuming the least energy in the Topten selections) for four of the product categories and for each of the three countries. This data provides an idea of the pace of innovation and efficiency breakthrough in the last 7 years.



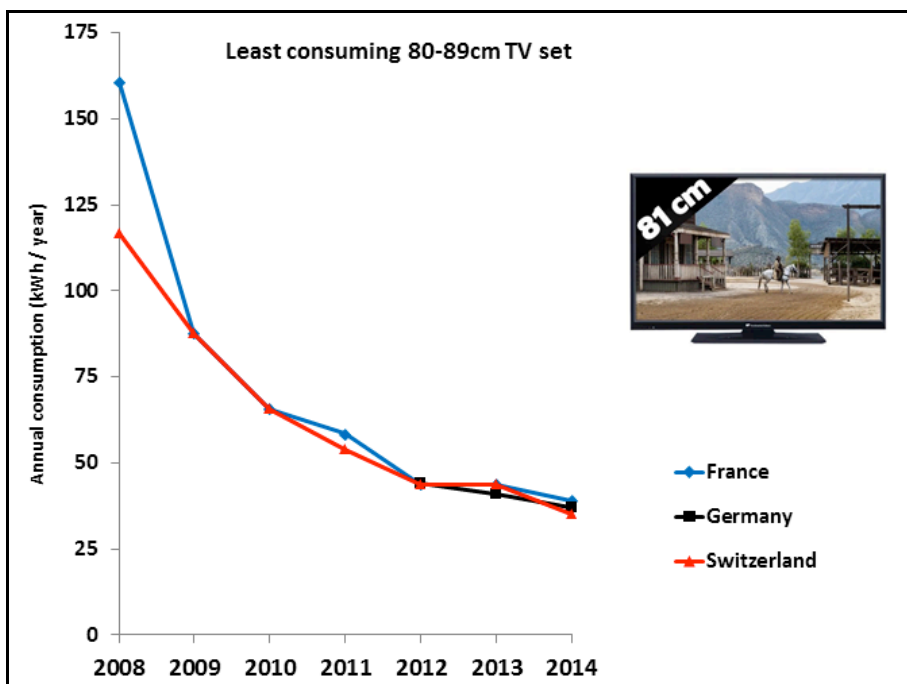
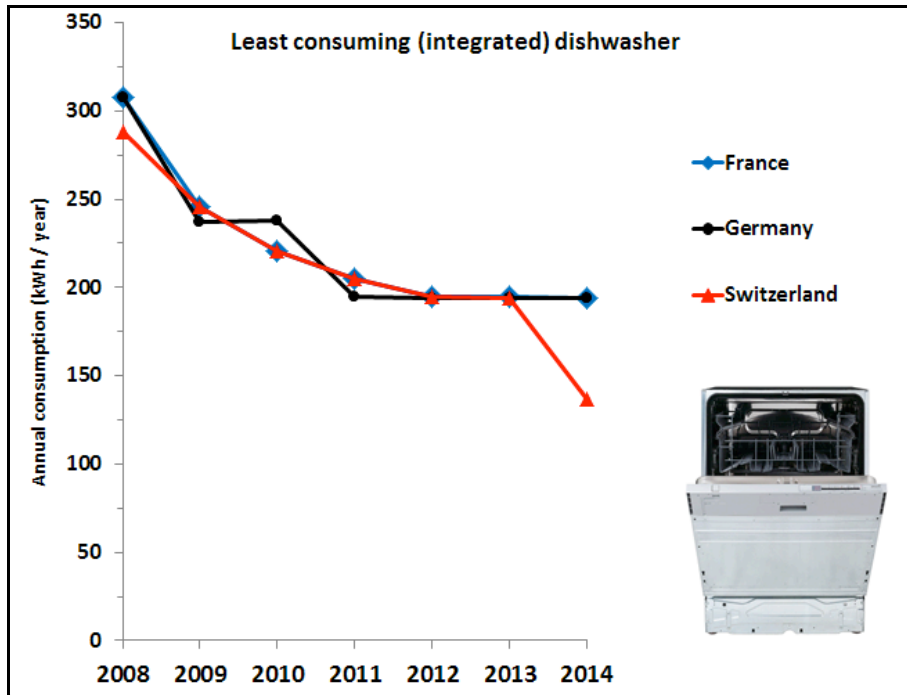


Figure 1-4: Annual energy consumption of the least consuming product model in Topten selections for France, Switzerland and Germany<sup>2</sup>

In 2008 (starting point), Switzerland and Germany had usually some relatively less consuming models on their market than France.

For all product types and all markets, there has been a very strong progress between 2008 and 2014 with **25% to 50% less consuming products** placed on the market. And this dramatic change at the top of the market has taken place despite opposing trends that may increase the annual consumption

<sup>2</sup> Note: for TVs, the data collection in Topten Germany only started in 2012.

(such as increasing capacities, more sophisticated functionalities, etc.). It is interesting to note that the least energy consuming models may be of various sizes and not systematically the smallest ones on the market.

The progress is however not linear. It has been very steep between 2008 and 2012, and it appears to be more in a sort of stabilisation trend since then. One explanation may be the high costs to reach further efficiency levels. Another tentative explanation for white goods lies in the EU policy dynamics: between 2008 and 2010, old and obsolete EU energy labels have been updated with the introduction of additional classes allowing manufacturers to differentiate again. This has been a strong push to place on the market a lot more efficient technologies and innovations, some of which they probably already had in store but couldn't promote beforehand. Now that the new highest class A+++ has been reached as well, there is less incentive for manufacturers to continue placing more efficient products on the market right now.

In 2013 and 2014, for most product categories the country differences appear limited. It means that the best technologies are evenly available across the three markets. This can be the result of a greater single market integration and concentration in the appliance sector. There is a significant exception for washing machines though. France seems late compared to Germany and Switzerland.

Concerning policy aspects, it is striking to see how quickly instruments such as new energy labels put in place in 2010 have been overshot by market evolutions:

- The best fridge-freezers on the market in 2008 were in the A++ class; in 2014 they were exceeding the highest A+++ threshold by 25%.
- The best washing machines in 2008 were in the A+ class (although the grade did not exist officially); in 2014 they were exceeding the highest A+++ threshold by 50%.
- The best dishwashers in 2008 were in the equivalent of class A+; in 2014 they were exceeding the highest A+++ threshold by 40%.
- The best TVs in 2008 were in the equivalent of class D or E; in 2014 they were in class A++ already.

It reflects both that technological progress has been sustained during the period, and that the setting of the new energy labelling classes has been insufficiently ambitious to last long enough.



Figure 5: A manufacturer promoting an 'A+++ -50%' model

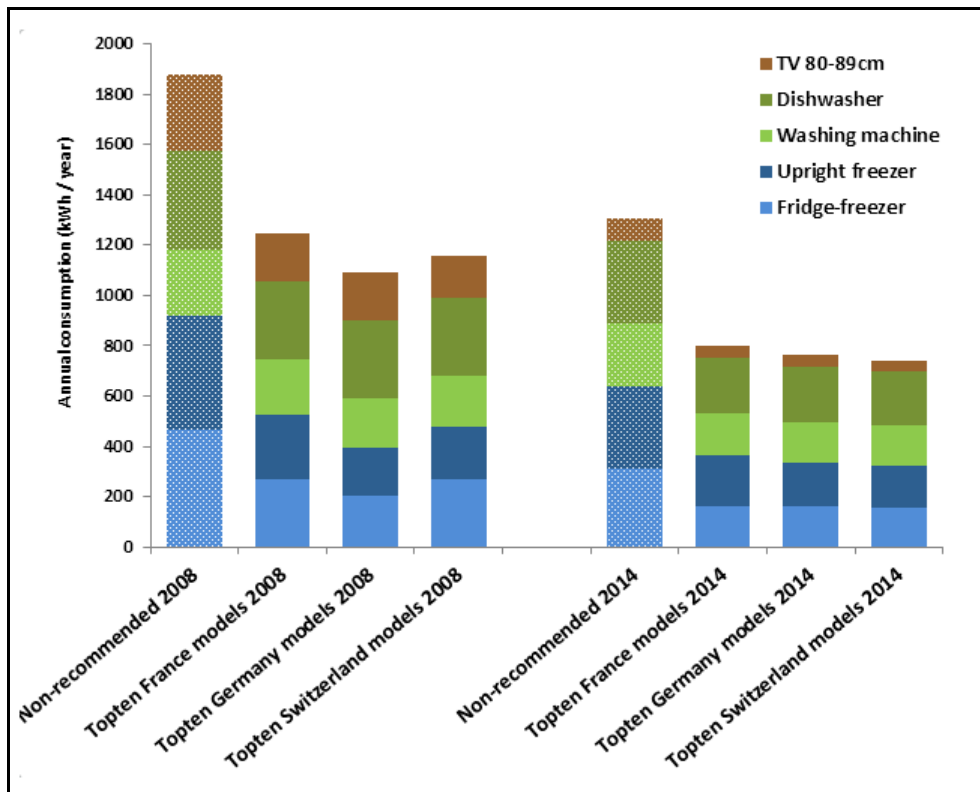
## Impact at household level

In the previous section, we have seen that substantially more efficient products have been placed on the EU market between 2008 and 2014. In the meantime, EU Ecodesign regulations have been adopted to ban from the market products that were not able to reach a certain level of energy

efficiency. A legitimate question is then: how far is it still interesting and useful to purchase Topten models instead of standard ones? What difference does it make?

A way of answering this question is to compare the consequences for a household of buying Topten-recommended instead of low-end products at different points in time. We have chosen to show the results for 2008 and 2014 for the five product groups.

The average of products recommended in the Topten selections in each of the three countries is compared to what is called '*non-recommended*' products; these correspond to low efficiency products that can be found on the market and are used in Topten guides as a point of comparison - they are very close to the least efficient level that is available or allowed on the market. For simplicity, we have considered the same set of non-recommended products for the three countries (assuming that the market bottom is comparable; the levels indicated are those from references collected in France).



**Figure 6: Average energy consumption levels for a household buying Topten-recommended products vs non-recommended ones in 2008 and 2014<sup>3</sup>**

In 2008, buying Topten products resulted in a **34% to 42% saving** on energy consumption compared to the non-recommended products (the lowest value for France, the highest for Germany). Seven years after, despite a significant reduction in the consumption of the non-recommended models (some 30%) due to technological improvement and regulation, the savings in 2014 are still **38% to 43%** compared to the non-recommended (the lowest value for France, the highest for Switzerland).

In absolute terms, a French household buying average Topten products instead of non-recommended in 2008 would have saved € 92 per year on its energy bills. In 2014, the same process led to a similar saving of € 94 / year<sup>4</sup>.

<sup>3</sup> Note: for Germany, TV data was missing for 2008. We assumed the same level than in France.

<sup>4</sup> Calculations have been made using the Jan. 2008 electricity price for the 2008 figure and the Jan. 2014 price for 2014. Full prices for a 6 kVA power regulated tariff (source: Données Pégase).

Figure 6 also shows a higher similarity in Topten-recommended levels in the three countries in 2014 compared to 2008. This may be due to higher market integration, but also to more similar Topten criteria as new EU energy labels have provided the means for facilitating the definition of such criteria (e.g. new label class levels).

It is relevant to note that in total, the 2014 non-recommended level is not very far from the Topten-recommended levels of 2008 (only 12% higher on average), suggesting that a complete market upgrade in a seven-year timeframe is feasible and that good energy efficiency policy should aim for that. However, the 2008-2014 observation has a lot to do with the spectacular increase in TV efficiency and not just with Ecodesign policy decisions, as EU minimum energy performance requirements have been far from prescribing the level of the best of 2008 (see [5] for a detailed analysis of the regulatory levels in Ecodesign).

## **Affordability aspects**

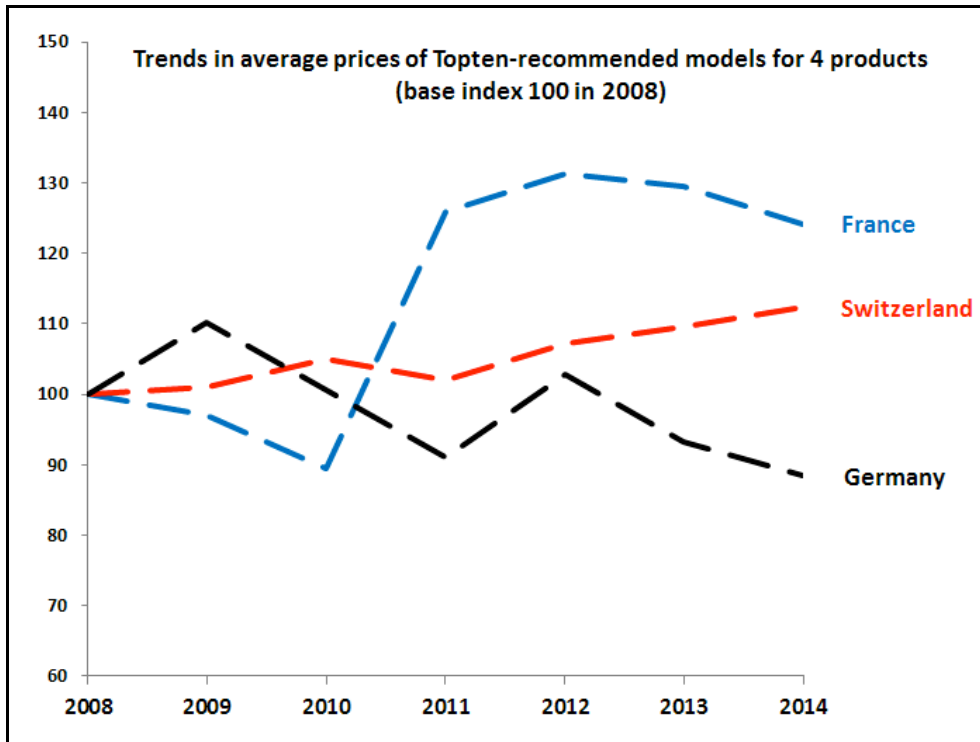
Although the previous parts have demonstrated that the top efficient segment of the market has made huge progress and is still bringing much benefit to consumers, a question remains about the affordability of the super-efficient products and their potential to become mainstream technologies for all.

A typical market rule is that more efficient products are placed on the market with a price premium (that lasts for some time until the technology eventually becomes mainstream). These premiums vary from product group to product group (they are more substantial in the appliance sector than in electronics), and have specific dynamics [7]. There is no doubt that whatever the year, buying Topten-recommended products instead of standard or low-end ones will typically be more expensive on average. In this paper, we are not making a full-market analysis, so we cannot compare the Topten levels to the rest of the market. However, what we can do is check if across the years Topten products have become more or less affordable than they used to be before.

Figure 7 shows the evolution of the average purchase price of Topten-recommended models for a basket of four products (fridge-freezers, upright freezers, washing machines, and dishwashers) from 2008 to 2014. (TVs have been left out because price trends in the 80-89 cm range are too uncharacteristic: as screen sizes increased steadily, 80-89 cm models have progressively turned from high-end to very standard products, and their prices have dramatically dropped between 2008 and 2014 irrespective of energy efficiency improvements).

Note: Figure 7 is based on average market prices collected by Topten guides at each selection update. Purchase prices can be very fluctuant, and statistics based on a small market segment should be taken with severe precautions. Discussions on detailed figures are irrelevant, and only very general trends may be looked at. This is why we are not indicating price values, but only annual evolutions using a base index 100 in 2008 for each country.





**Figure 7: Average price evolution for a basket of Topten-recommended fridge-freezers, upright freezers, washing machines, and dishwashers**

Figure 7 shows differentiated trends. While in France, the level of price premiums seems to have substantially increased around 2010-2011 (leading to 25% higher prices in 2014 compared to 2008), in Germany prices follow a downward trend with Topten-recommended models 10% cheaper now on average. Switzerland is in the middle. Several tentative explanations may be offered:

- First (as we have seen), the top of the market in 2008 in Germany was already more efficient than in France. The French market 'caught up' after 2008, leading to a more visible premium effect in the period 2008-2014.
- Second, the price of Topten appliances tended to be higher in absolute terms in Germany than in France before 2010. There has been a convergence trend, with prices becoming closer around 2011.
- Third, the trend in Germany may be explained by the fact that top-efficient products are more popular, more widespread, and have higher sales than in France, where they remain considered as high-end products. Market figures show that in the beginning of 2013, A+++ appliances represented 23% of the sales in Germany compared to only 5% in France [8].
- Last, small disparities in selection criteria may also have reinforced the contrast between trends. As an example, Topten France was recommending both A+ and A++ freezers until 2010; when the selections could then be restricted to A++ only, the A++ price premium effect materialised more visibly on the French curve. Switzerland and Germany had already been able to move to A++ only since 2008; their curves do not incorporate this effect in 2010.

All in all, the following (cautious) conclusions may be offered. On average, a Topten basket of the four products appeared even more affordable in Germany in 2014 than it used to be in 2008. In Switzerland, it cost about 10% more (a less than 2% per year increase). In France, consumers had to pay substantially more on average for top efficient appliances. However, this averaging can hide huge price variations within the same product category. For example, the prices of the Topten-recommended washing machines in France in 2014 ranged from € 500 to € 2000. French consumers should then be careful to choose wisely when they want to purchase efficient appliances.

In parallel, the average energy performance of Topten-recommended models strongly increased since 2008 as we have seen in the previous section. According to our calculations, the savings over the product lives in 2014 Topten products more than compensate the purchase price increases for Switzerland and even for France<sup>5</sup>. It means that in a total lifecycle cost perspective (including both the purchase price and energy/water running costs), Topten-recommended products in 2014 are on average more economical than in 2008 in all three countries.

## Conclusions and recommendations

In this paper, we have presented some lessons learned from historical data gathered by Topten guides in France, Germany, and Switzerland between 2008 and 2014 for five product categories.

- We have identified a very substantial progress in the energy performance of the top products placed on the three markets over seven years (25% to 50% less energy consumption, even more for TVs). Best appliances are now largely exceeding the thresholds of the top EU energy labelling classes introduced in 2010. These labels appear to have been successful in stimulating a steep improvement until 2012, but trends look flatter now. This suggests a strong need for revising the labels, ensuring the scales are sufficiently ambitious, and estimating technological potentials more accurately.
- For a typical household, it still makes much sense in terms of energy conservation to purchase super-efficient products compared to low-end ones. In 2014, consumers could still achieve around 40% energy savings by choosing Topten models, a percentage similar to 2008. And this is true despite the fact that EU Ecodesign regulations and technological progress have substantially improved the bottom of the market. A remarkable observation is that the bottom of 2014 in our analysis is not far from the best Topten levels in 2008, suggesting a nearly full market upgrade over seven years (although the situation varies from product group to product group).
- As regards the affordability of top efficient products, the situation appears quite contrasted between the three countries. While in Germany Topten products seemed on average even more affordable in 2014 than in 2008, for France there has been a substantial increase in price premiums (25% overall for a basket of four white appliances). Switzerland lies in the middle. These observations are based on limited statistics and should be taken with precautions, however it would be interesting (if they are confirmed) to do further research to better identify the root causes of these differences. All in all, in a lifecycle cost perspective Topten-recommended products in 2014 are on average more economical than what they were in 2008, even for France. It is therefore important to reinforce consumer education on the lifecycle perspective.

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