

# French higher domestic electricity consumption for captive uses compared to Germany: assessment of explanatory factors

Didier Bosseboeuf  
ADEME  
27, rue Louis Vicat  
75 015 Paris  
France  
didier.bosseboeuf@ademe.fr

Bruno Lapillonne & Carine Sebi  
ENERDATA  
47, avenue Alsace Lorraine  
38 000 Grenoble  
France  
carine.sebi@enerdata.net

Sophie Attali  
SOWATT  
45 rue Bichat  
75010 Paris  
France  
sattali@sowatt.net

## Keywords

benchmarking, public policy, energy efficiency measures, electrical appliances, technico-economic analysis

## Abstract

French households consume on average 600 kWh/household more than German households regarding electricity consumption for captive uses (i.e. excluding thermal uses). This paper aims at identifying and quantifying the main factors influencing this difference.

Using a decomposition analysis of the energy demand changes, the role of the following factors has been considered: appliance ownership, appliances' size, efficiency level according to energy label class, equipment features, equipment price, consumer attitude, and electricity prices. Indicators that corrects for the effect of five of these factors of discrepancies have been developed and enable to quantify each factor's impact. The analysis has been carried-out by type of appliance. The results show that only two of the adjustments significantly impact consumption: the equipment ownership rate and the energy label penetration; however, they tend to offset each other. As a result, the five adjustments only account for one fifth of the performance gap observed between France and Germany, i.e. 125 kWh.

The rest of the difference may be due to price differences that affect consumer behaviour in the purchase and use of appliances, beyond the factors considered previously, to other qualitative factors (e.g. policies and retailers' strategies) which are presented and some of which were assessed. The analysis of the policy factors shows that presently the situation is quite similar in France and in Germany, but that in Germany Länders, cities, and more than a thousand of electricity suppliers have

implemented at local level public awareness programmes and numerous DSM programmes for longer than in France, and with more continuity. In addition, German consumers declare to pay more attention to environmental issues.

## Context and objectives

A benchmarking of household specific electricity consumption in ODYSSEE (2012) shows that France is not performing as well as Germany regarding captive uses of electricity<sup>1</sup>. Households' specific electricity consumption was 26 % higher than in Germany in 2008<sup>2</sup> (Figure 1). Italy and Spain's good ranking can mainly be explained by the lower income and consequent lower equipment rate, compared to France<sup>3</sup>.

This paper aims at identifying and quantifying the main factors influencing the difference observed in the specific electricity consumption between France and Germany. It further reviews the potential of targeted policies in both countries, and it proposes policy measures to reduce this difference.

## Explanatory factors analysis

The analysis focuses on large domestic appliances, which present the largest available benchmarking data and consume more than 40 % of captive uses, on lighting (which accounts for

---

1. Captives uses, also referred to as "specific electricity uses" or "specific electricity consumption" in short, include all non-thermal uses, i.e. small and large domestic appliances, consumer electronics and lighting.

2. 2008 is the preferred reference due to 2009's particularity with the economic crisis.

3. In addition, most Italian households benefit of a 3 kW subscription contract, because of inclining electricity tariffs, which limits their consumption level.

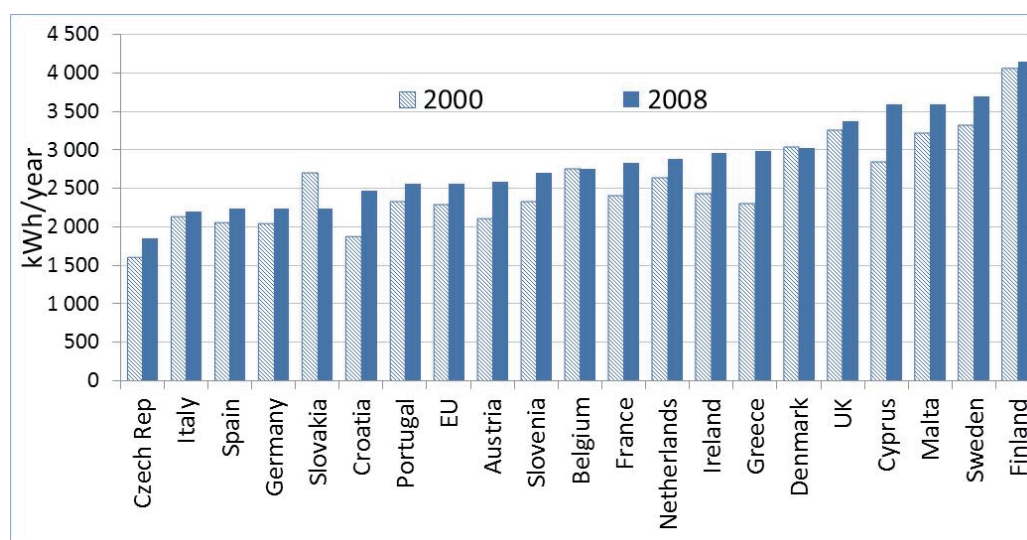


Figure 1. Household electricity consumption for appliances and lighting (source Odyssee).

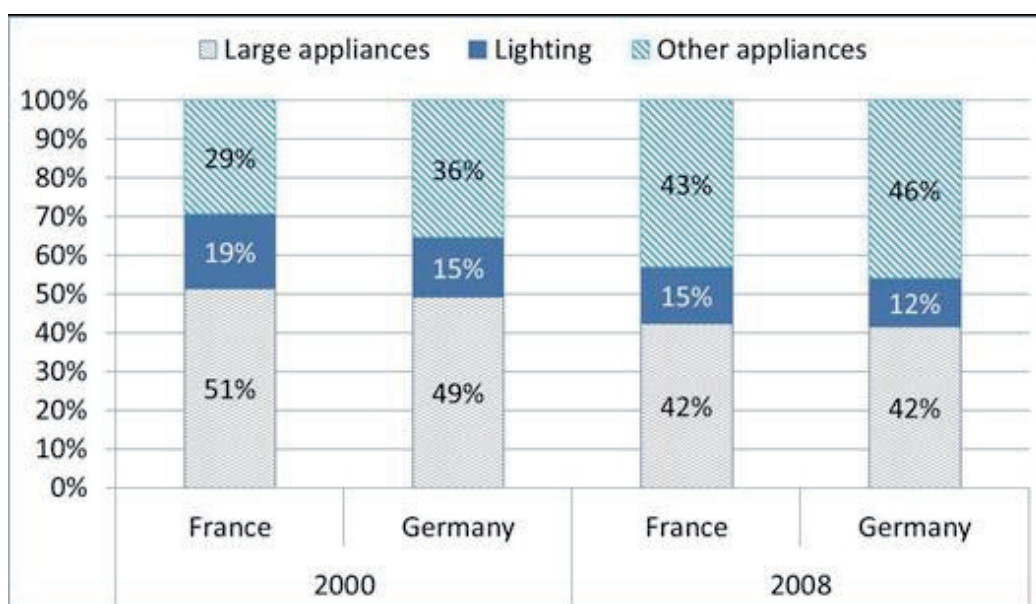


Figure 2. Electricity consumption for domestic appliances and lighting by end-use in France and Germany (source Odyssee).

15 % of specific electricity), and on the main consumer electronics (TV, computers) (Figure 2).

Several factors have been taken into account:

- Equipment rate in large appliances, home entertainment electronics (TVs, PCs) and lighting;
- Appliances' size, especially cold appliances and TVs;
- Efficiency level according to the energy label (A, A+, etc.);
- Equipment features and functionalities impacting consumption (upright versus chest freezers; frost-free and built-in cold appliances);
- Equipment price for energy efficient classes;

- Consumer attitude (frequency of use and preferred temperature for washing appliances; duration of use of TVs and lighting equipment);
- Electricity price.

#### LARGE DOMESTIC APPLIANCES

##### Equipment rate and size

Although both countries' equipment rates are close, Germany's are higher (Figure 3). But France is gradually reaching similar rates, in particular for freezers, refrigerators, and washing machines.

Refrigerators and freezers sold in France are larger than the ones sold in Germany (+30 % and +23 % respectively): it may

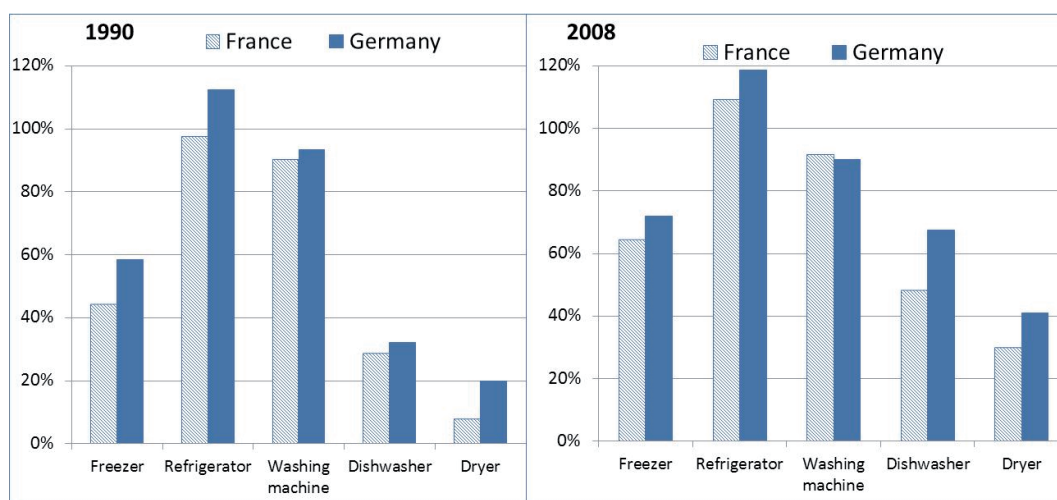


Figure 3. Equipment rate in France and in Germany (source Odyssee, INSEE, SOFRES)

be partly explained by the average size of household, i.e. the average number of inhabitant per household, that is 13 % higher in France, and by the fact that dwellings are on average smaller in Germany (by about 9 %), due a larger share of apartments compared houses. The size difference for washing machines and dishwashers is hardly significant.

#### Equipment efficiency

The penetration of very energy efficient appliances<sup>4</sup> is much higher in Germany: in 2010<sup>5</sup>, A+ rated washing machines' market share is 10 points higher in Germany; the share of A+ and A++ labels is respectively 34 and 47 points higher for refrigerators and freezers (Figure 4).

#### Equipment types and functionalities

Efficient cold appliances' (table-top, 1 and 2-doors<sup>6</sup>) sales are higher in Germany than in France. French consumers buy twice the number of frost-free refrigerators (18 % of French sales in 2008, versus 9 % in Germany). This system is more energy intensive and lessens France's performance. On the contrary, the German market share of built-in refrigerators, which are less energy-efficient, was 45 % in 2008 vs. only 13 % in France.

The market share of upright-freezers, which are more energy intensive than the chest type, is 30 % larger in Germany than in France. Frost-free freezers' market share is also higher in Germany (23 % vs. 10 %). Freezers sold in Germany are thus more energy intensive than the appliances sold in France.

Front-loading washing machines' sales are higher in Germany (90 % vs. 59 % in France), but their share has been quickly increasing in France (from 25 % in 2000 to 59 % in 2008). Top-

loading washers are usually less efficient than the front-loading type<sup>7</sup>.

While refrigerators and washing machines bought in France are overall more energy intensive than in Germany, German consumers tend to buy freezers with more energy intensive functionalities than the products favoured by French consumers.

#### Appliances' pricing

Most energy-efficient cold appliances are more expensive in France than in Germany. The price difference can reach up to 20% for class A+ or A freezers and 13 % for A+ refrigerators. In addition, the price difference between an A and an "A+/A++" washing machine is higher in France than in Germany (39 % vs. 23 %).

Sales prices according to the energy label are partly determined according to market shares. High efficient appliances (A++ and A+) market share is notably lower in France compared to Germany. The price difference can be explained by the smaller size of the market, and the lack of trust of manufacturers in the French consumer "green" awareness, which leads them to market less energy-efficient models.

#### Behaviours

If Germans use higher temperature<sup>8</sup> water to wash their laundry and dishes than French households, they will use more frequently economic cycles. In addition, German households tend to load more their washing appliances, reducing the number of cycles and the electricity consumption (Remodece, 2007<sup>9</sup>).

French households declare cleaning the refrigerator's rear grid more often (25 % monthly vs. 5 % in Germany; and 38 % once a year in France vs. 15 % in Germany (Remodece). French

4. For washing machines the most efficient label is officially A but manufacturers are allowed to use "A+".

5. There has not been massive subsidy programmes in Germany to explain such differences. Prices are on average lower in Germany for the most efficient appliances (e.g. 10 % of difference for a given A++ freezer), because demand for these types of product is higher thanks in particular to awareness programmes and the marketing strategy of suppliers and resellers (see below for further explanations). There has not been massive subsidy programmes in Germany.

6. "Table-Top" models are 1-door refrigerators, with a 90 cm maximum height.

7. Top-loading washing machines lower efficiency level can be explained by their relative small market share, and by the fact that manufacturers choose to invest in the front-loading range optimisation.

8. In Germany 50 % of households wash their laundry at 65 °C versus 29 % in France. In Germany, 44 % of households wash their dishes at 65 °C vs. 21 % in France.

9. This study involved a panel of 500 households in the two countries. Although it was led in 2006, it helps understand consumers' attitudes differences between the two countries "Residential monitoring to decrease energy use and carbon emissions in Europe"; EIE project, 2007.

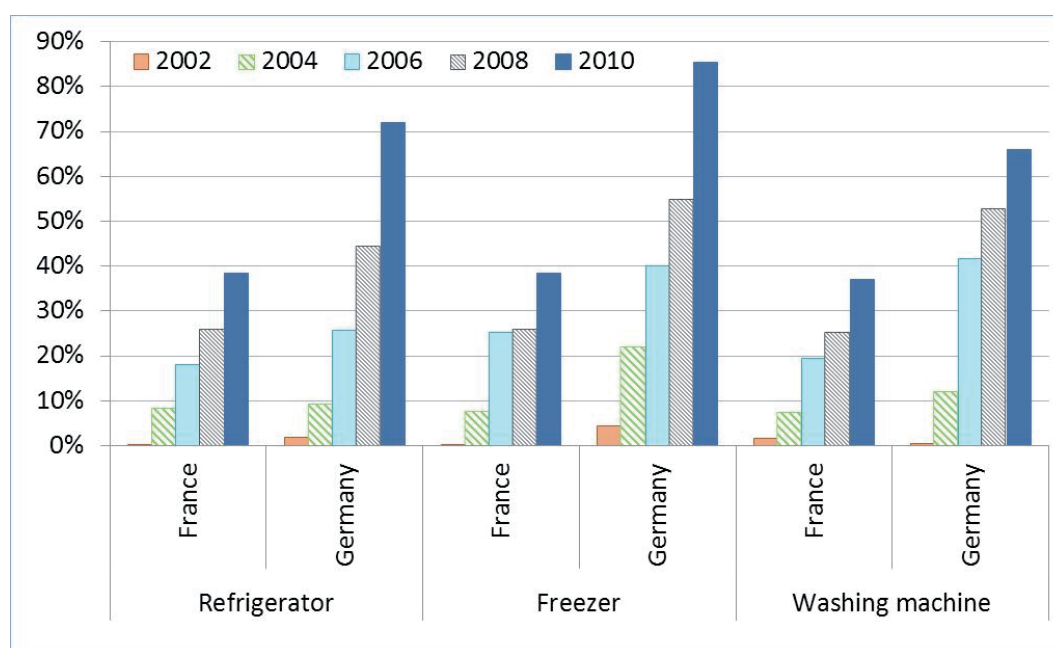


Figure 4. Penetration of A+ and A++ labels for new appliances (Source GfK).

consumers defrost their refrigerators and freezers more often. In Germany, over 20 % of respondents declare having set the thermostat on the lowest temperature, vs. only 3 % in France (Remodece).

Although it is impossible to quantify each attitude's impact in terms of consumption, they tend to partially compensate each other, and hardly play a part in the observed consumption discrepancy.

#### LIGHTING

Lighting electricity consumption is notably higher (+49 %) in France than in Germany in 2008. This consumption gap does not lie in the number of lighting points, because it is identical in both countries: 25 lights on average per household.

In contrast, the German households have installed twice as many compact fluorescent lamps as in France (6,5/house in Germany vs. 3 in France). Compact fluorescent lamps' penetration can explain most of the difference in consumption. According to Remodece report, the differences in consumers' attitude for lighting offset each other.

#### ICT AND OTHER SMALL APPLIANCES

The average number of TVs per household is similar, with around 1,5 TV/household in 2008 (ODYSSEE) in both countries. TV size and duration of use are also close. As a result, there is no significant difference in TV energy consumption.

The equipment rate in computers is higher in Germany. Screens sold in Germany are slightly larger than the models sold in France: 21" vs. 20" in 2010.

Laptops spreading encouraged multi equipment in PC's. The average number of PCs per household has grown from 56 % in 2003 to 103 % in 2010 in France; and from 82 % to 110 % in Germany. It has been paired with the Internet development, resulting in a higher penetration rate in Germany than in France (82 % et 75 % en 2010).

Set-top-box systems have also rapidly grown in the last ten years, again spreading faster in Germany than in France.

With a higher equipment rate in PCs, electricity consumption is also higher in Germany: in 2008, the consumption of these three appliances accounted for 200 kWh in France and 250 kWh in Germany.

#### ELECTRICITY PRICES

The average electricity price for households in France is currently about half of the German price. Half of the difference can be explained by cost differences and the other half by a different level of taxes. VAT weighs equally in both countries (around 15 %). Other taxes are much higher in Germany, accounting for 27 % of electricity total price (of which an 8 % eco-tax since 2000), versus 10 % in France.

In order to assess these price differences, we attempted to measure households' sensitivity to electricity price variation, through an econometric analysis. Unfortunately, the price elasticity was very difficult to gauge for the 1990–2010 period, and results lack statistical consistency.

#### Adjusted efficiency indicators

Adjusted indicators of specific electricity consumption have been designed to correct for the impact of the observed discrepancies between the two countries, and to quantify each factor's impact.

Adjustments have been made on the following factors of differences between France and Germany: equipment rate and size (for large domestic appliances<sup>10</sup>), energy labels penetration (for

10. Large domestic adjustments were calculated thanks to a model simulating stock evolution from annual sales (to take into account the impact of new appliances sold since 1990 and according to different criteria: label, type and size of appliance).



Table 1. Adjusted Germany's electricity consumption to France's equipment rate (2008, source Odyssee, adjustment calculation Enerdata).

kWh/household/year	Large domestic	Lighting	Consumer electronics	Small electric appl.	Other	Total
Germany	929	278	569	394	67	2,237
Germany, adjusted to equipment rate in France	<b>820</b>	278	<b>507</b>	<b>445</b>	67	<b>2,117</b>
France	1,195	414	507	425	284	2,825

Table 2. Adjusted Germany's consumption to France's energy label penetration rate (2008, source Odyssee, adjustment calculation Enerdata).

kWh/household/year	Large domestic	Lighting	Consumer electronics	Small electric appl.	Other	Total
Germany	929	278	569	394	67	2,237
Germany, adjusted to equipment rate in France	<b>1,002</b>	<b>372</b>	569	394	67	2,404
France	1,195	414	507	425	284	2,825

large domestic appliances and lighting), and appliances' features and frequency of use (for washing machines). They have been calculated for each appliance (fridge, freezer, TV, etc.) and then sum up by type/group of appliance: large domestic, lighting, consumer electronics and small electric appliances. This allowed calculating for each of these factors a fictive Germany's specific electricity consumption adjusted to French conditions: for example, with the equipment rate adjustment, we apply the rate observed in France to Germany for each type of appliance to calculate the fictive specific consumption of Germany adjusted to French equipment rate, all else being equal.

Adjusting the German unit consumption to the French equipment rate enlarged the initial gap between the two countries from 26 % to 33,5 % (Table 1).

The adjustment for the higher penetration of efficient appliances in Germany reduced the spread between the two countries, from 26 % to 15 % (Table 2): in conclusion, 40 % of the gap could be explained by the difference in penetration of highly efficient appliances.

The adjustment of German specific consumption to the average size of appliances sold in France only reduces slightly the spread from 26 % to 25 %. This means that the size of large domestic and lighting equipment<sup>11</sup> plays a minor role. Technical features and functionalities have also a marginal impact as the adjustment only shows a reduction of the difference by 2 points. And finally, when adjusted to frequency of use in France, the German specific consumption only increases marginally (20 kWh).

The respective weight of the above five adjustments differ, as only two adjustments significantly impact the specific electricity consumption: the equipment rate and energy labels penetration. Unfortunately, these two factors partly offset each other, which cannot explain the total performance gap between France and

Germany. The calculation shows that only 21 % of the observed difference can be explained by these factors (Figure 5).

When combining the five adjustments, France's specific consumption remains significantly higher: 20 % vs. 26 % (Figure 6).

## Qualitative factors analysis

### IDENTIFYING QUALITATIVE FACTORS

Various qualitative factors can also explain in part the remaining difference of consumption<sup>12</sup>. They are grouped under four types: factors relating to countries' structure, factors relating to the appliance market, factors relating to consumers' purchasing attitude, and factors relating to policy issues.

#### Countries' structure

Countries can be more or less well organised to promote energy savings – especially electric efficiency. Their organisation level can be assessed according to the presence of institutions dedicated to develop and to disseminate energy efficiency messages, their history and anchorage in the country's administrative structure, the support they receive, their local presence (as demand-side management requires to reach millions of users individually), their ability to launch regulatory control and incentive measures, and their ability to dialogue with manufacturers without being influenced by them, etc.

In addition, the European countries have set up different structures to enforce European regulations, including market assessment and control (ATLETE 2010): do they have the capacities to test appliances and sanction if necessary?

Finally, public buyers' commitment to prefer efficient appliances can also greatly impact performance, as they act as opinion leaders.

11. Indeed, the equipment rate for lighting corresponds to the number of lighting points, which is the same in France and Germany: on average 25 lighting points per dwelling.

12. The analysis relies on a study for the British government "Study on the factors influencing the penetration of energy efficient electrical appliances into national markets in Europe", Attali/Bush, DEFRA – MTP, 2009.

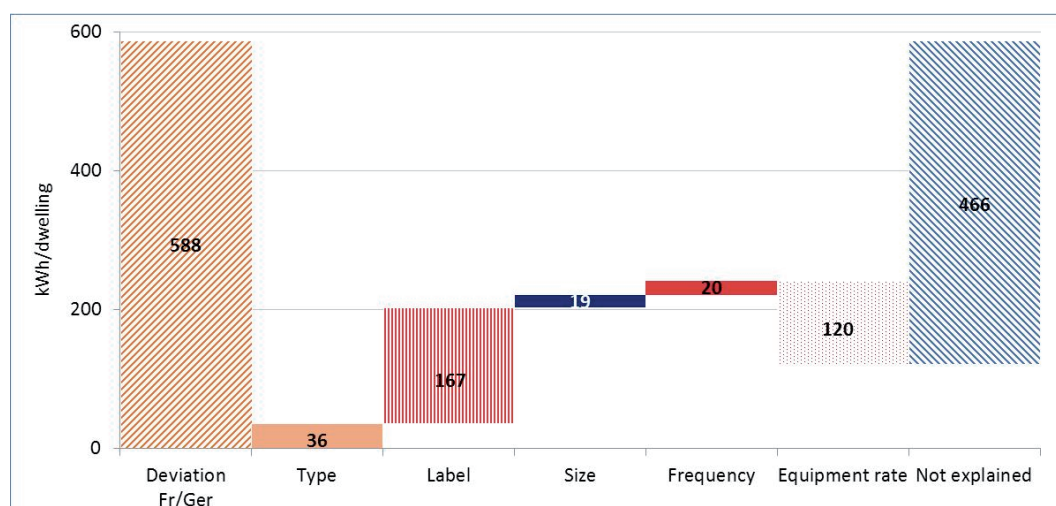


Figure 5. Decomposition of the difference in the electricity consumption per household between France and Germany for captive uses (source Enerdata).

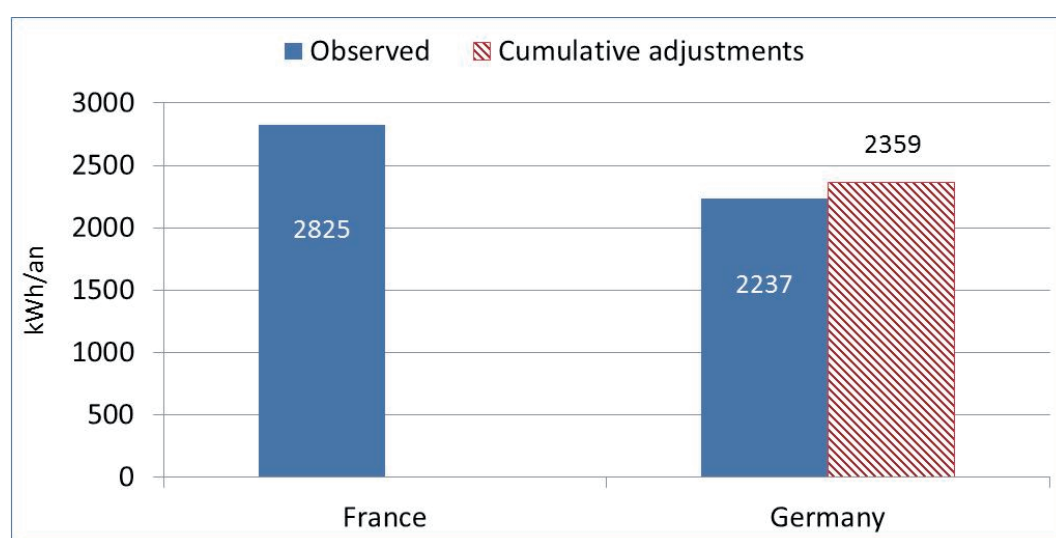


Figure 6. Specific consumption per household of Germany adjusted to France's characteristics (2008, source Enerdata).

#### Appliance market structure

- The market for electrical appliances is composed of a chain of actors where each link has a specific role to play, but where actors can vary in their positioning. For example:
- Manufacturers view national markets' consumers more or less ready to pay for energy efficiency; the ranges proposed to retailers will reflect their perception;
- Wholesales (for franchised shops) negotiate margins more or less aggressively;
- The retailing market is more or less concentrated, with varying degrees of freedom to build their range in shops, and of independence from manufacturers;
- Retailers either favour quality products sales which benefit from larger margins or on the contrary will promote lesser

quality products, with a lower margin but which are sold in massive quantity;

- Online sales can interfere with these scenario and extend the offer to a wider range of appliances;
- In shops or online, retailers will either choose to provide information of quality on their products, or minimal information;
- Business ties between manufacturers and retailers are multi-layered, which makes pricing analysis complex, as for example, discounts can be offered on specific refrigerators if the washing machines sold under the same brand reach the agreed quota;
- Prices are generally too low to incite buying efficient appliances;

- Efficient appliances' prices are so high that they remain niche products<sup>13</sup>.

### Consumers' purchasing behaviour

Products sold in Europe vary, and so do consumers: cultural factors have to be taken into account as they can influence consumers' perception of:

- Environmental issues: when consumers are aware of the environmental degradation, when they know the energy label, when they can connect appliances, electricity and climate together, then the sales speech relating to environmental issues is more effective and weigh on their decision even if it may not represent the decisive factor.
- The energy label scheme: if the label is well known, and has been promoted through on-going campaigns targeting consumers and trainings have been provided to retailers, it will tend to become an important buying decision criterion.
- Brands: "quality" brands generally market a larger range of efficient appliances, and in countries where customers declare paying attention to brands, efficient appliances' market share is also rather more important (e.g. Germany).
- Trends: trends can be more or less in favour of energy savings issues – in one case, sales will promote the modernity and gadgets of American refrigerators, which consume a maximum of electricity; in the other, they will promote silent high-end built-in appliances (which are very often also highly efficient) to be fitted in open-plan kitchens. Manufacturers develop large volume washing machines, which will achieve a better rating on the energy label, and promote their "flexibility of use", thus creating a new need (whereas the average load remains approximately 4 kg, whatever the model used);
- Appliance price: price perception is not a sufficient explanation for the national market shares' breakdowns, but it plays a major role as in countries sensitive to branding, consumers will benchmark high-end products' prices, while in other countries priority is given to the lowest price of acquisition, consumers are reluctant to spend more, and even financial advantage on the product's lifetime are not incentive.

### Policy Issues

Most European countries have tried to pull their market towards more efficient appliances, through national or regional measures. Without going into details of the main implemented policy instruments, national European markets, have been influenced – on the short and/or long term- by:

- Informative tools targeting the end-consumer, such as labels to distinguish specific appliances. With these tools, manufacturers and retailers are legally bound to publish measures and data with harmonised processes. Before the introduc-

tion of the Energy label, energy efficiency information was not available to consumers.

- In order to be seen as reliable, the manufacturers' declaration must be tested and controlled, with sanctions if necessary, which is not always the case everywhere in Europe. Many consumers NGOs and some manufacturers are addressing this issue.
- The national authorities' understanding of the specificities of the market: some countries closely follow-up the market and the products, and look to adapt policy instruments accordingly (with more or less success); certain countries are able to benchmark on a European level, while others lack the basic data to take action.
- The national authorities' ability to negotiate, and their flexibility: institutions' response and time frameworks can become incompatible with the market's deadlines.

### ANALYSIS OF RESPECTIVE QUALITATIVE FACTORS AND POLICY INSTRUMENTS

The analysis of Germany's and France's respective policies and instruments show considerable similarity, with the following notable exceptions:

- When the right conditions are met, electricity prices are higher in Germany, and the long term benefits from buying energy efficient appliances are more obvious in that country.
- When the financial advantage is not convincing enough, the better environmental performance is taken into account: Germany has been implementing awareness programmes about environmental issues for longer than France, with more continuity.
- Manufacturers present in Germany are very proactive and push high-end high-efficiency appliances on the market.

Germany further has two other advantages over France, which may be difficult to quantify, but which most certainly influence consumers positively regarding electricity consumption: German consumers are more sensitive to environmental issues; they value brands they perceive as "quality" brands, and they ponder their needs before buying domestic appliances. This is the result of the awareness programmes.

German households also benefit from numerous demand-side management programmes run locally by Länders, cities and over 1,000 electricity providers, some of which are managed by local authorities and have been involved in DSM for decades.

### POLICY RECOMMENDATIONS

Several policy measures have proven to effectively impact the electricity consumption for specific uses. Implementation can be innovative, even if the instruments are well known: the challenge rather lies in the continuity with which the action will be implemented, and the level of ambition.

First of all, regular and on-going information and awareness campaigns must target the general public. Countries like Denmark or Germany, where children have been continuously exposed to awareness campaigns since the 70's and the first oil

13. The energy label's revision makes it particularly difficult to pay at least €200 more for an A+++ than for an A appliance, as A might be perceived as excellent, and each "+" apparent value would seem marginal.

crisis, show better results<sup>14</sup>. Regulatory instruments must be accompanied by recommendations on buying and using ever evolving products. Information programmes should aim at ambitious objectives, even if it means going against the market actors' habits, including manufacturers and retailers. Many sociologists reported the need to differentiate consumers, to get them on-board, to win their trust, and to explain issues in a way that they can personally relate to, and to help them globally change their consuming attitude.

Very strong and structuring measures are decided and implemented on the European level (Energy Label and Eco Design Directives). Member States can influence decision with technical expertise, and defend more ambitious positions and tightened agendas that those proposed by the European Commission. Such audacious positions are crucial, as experts agree that minimum energy performance standards (MEPS) and energy labels are the most effective tools available. In particular, the design of MEPS or energy labels should encounter for a maximum absolute energy consumption level whatever the size of the model which would result in limiting the size of appliances (c.f. "progressive standard" for TVs in the USA).

In order to strengthen the European Directives, Member States have the responsibility to control their enforcement. Such controls are actually rarely done, in France or in Germany, although they would allow pointing out virtuous manufacturers and incite them to further invest in energy efficiency<sup>15</sup>. Tests and compliance are of interest to consumers and journalists, as shown by the ATLETE<sup>16</sup> European project: the tests results of several refrigerators models unveiled a 57 % rate of problematic declarations.

According to the local context and available resources, two testing programmes can be implemented:

- Official testing, on a regular basis, on a large volume of appliances, led by the market surveillance authority in charge of the enforcement of Eco-design and Energy label Directives, with specific related sets of sanctions;
- One-shot tests campaigns, on a limited scale, well organised with a communication plan targeting manufacturers, retailers and consumers.

Changing the design of electricity tariffs is another powerful instrument, implying detailed negotiations, but without contribution from the State's budget. Such actions in Italy, the United-Kingdom and California have shown that it is possible to change the structure so that electricity actors (generators, distributors, suppliers) are not encouraged to ever sell more kWh. One can quote progressive tariffs, which will incite users to invest in energy-efficient appliances, the allocation of a share of the electricity price to DSM programmes, or the good coordination of rules and respective roles of energy producers, retailers and suppliers<sup>17</sup>.

14. Based on interviews carried out within the DEFRA study (Attali/Bush, DEFRA – MTP, 2009).

15. Without fearing loosing market shares to uncontrolled and un-sanctioned competitors providing false declaration.

16. <http://www.atlete.eu/>

17. Based on the chapter related to the policy review of the DEFRA study in which market data have been used, an exhaustive literature review of more than 70 references and 29 interviews have been carried out.

Financial incentives, such as rebate programmes, are expensive but their results in terms of market shares can be rapidly measured. In addition, they push manufacturers and retailers towards more customer-tailored information and to invest in R&D. They are however difficult to calibrate, due to the market's speed of change; they are effective in Switzerland, where rebates exclusively go to the most efficient appliances<sup>18</sup>, which are re-assessed and listed at least twice a year to adapt to the market evolution pace<sup>19</sup>. They also allow achieving the full energy saving potential as they avoid supporting "not so bad" appliances, but which would anyway waste additional 50 kWh annually, during an average 15-years lifetime.

Bonus and malus could be combined to balance the operation, but the relatively low and ever-changing prices together with the retailers' range policies (most manufacturers market both efficient and lower-end products) make this approach more complex. It seems difficult to add the objective of fighting against fuel poverty to such a rebate or a bonus/malus programme, because energy efficient appliances are still too expensive for people suffering from fuel poverty. It is advised to implement separate measures for each objective, with for example, a market transformation rebate programme on one hand, and working on fuel poverty with bulk buying, retailers and social housing actors, on the other hand.

Finally, new technologies allow for more fine-tuning and personalised tools: in Germany, "smart meters" could be used to give feedback to consumers and help them manage their electricity consumption, beyond the support these tools can provide regarding the power grid's peak management.

## Conclusion

The German average electricity consumption per household for appliances and lighting was 26 % lower than in France in 2008, with comparable income levels. The aim of this report was to determine which quantitative and qualitative factors could explain the 600 kWh consumption gap.

On the quantitative front, 2 main factors partly explain the higher consumption in France:

- Large domestic appliances are larger in France than in Germany: over 20 % larger refrigerators and freezers, which are both the most common and the most energy consuming appliances in households.
- A larger penetration of very efficient large appliances in Germany (washing machines, cold appliances, and lighting), which can mostly be explained by the lower price of these products in Germany.

On the opposite, some factors may compensate for the difference observed:

- The refrigerators, washing machines and dryers sold in Germany usually have more energy-consuming features and functionalities (frost-free refrigeration, built-in models, condensing driers, etc.) than the appliances types sold in France.

18. See [www.topten.ch](http://www.topten.ch).

19. The lists also serve as a guideline for public buyers.



- The equipment rate of large domestic appliances is slightly lower in France.

Additional factors, such as consumers' attitude, equipment rate of consumers' electronics and of lighting have been reviewed but their impact is non-significant on the observed differences.

In order to quantify the respective impact of these factors, we have calculated a fictive specific consumption per household for Germany adjusted to France's specificities. First, we adjusted each factor respectively (equipment rate, size, energy label penetration, technical features, and consumers attitude), and then we combined all these adjustments.

The results show that only two of the five adjustments significantly impact the consumption: the equipment rate factor and the energy label penetration; however, they tend to compensate each other. As a result, the five adjustments only account for 21 % of the performance gap observed between France and Germany, i.e. 125 kWh for an initial difference of approximately 600 kWh.

How could the residual gap be explained? One can think of qualitative factors such as prices, policies and all other qualitative factors reviewed above. Electricity is 50 % cheaper in France; it certainly plays a role, but an econometric analysis carried out in the framework of the study failed to quantify the impact. It could be linked to the statistical problems<sup>20</sup>. Many other factors need to be examined to explain the residual gap such as miscellaneous historical, structural and demographic factors that could be identified with more attention<sup>21</sup>).

The analysis of the policy and instruments factors in France and in Germany shows that the situation is quite similar in the two countries, with the important exception that Germany has implemented public awareness programmes for longer than France, and with more continuity.

Germany further has two other advantages over France; they may be difficult to assess and quantify, but certainly have a positive influence on consumers' attitude concerning electricity consumption:

- German consumers declare to give more attention to environmental issues; they value brands perceived and "quality", and they assess their needs before buying a domestic appliance; this is the consequence of long years of consistent awareness programmes.
- German households also benefit from numerous DSM programmes implemented locally by Länders, cities, and more than a thousand electricity providers, some of which belonging to local authorities who have often been proactive in DSM programmes for decades.

## References

- Arimura Toshi H. , Li Shanjun , Newell Richard G. and Karen Palmer (2011), Cost-Effectiveness of Electricity Energy Efficiency Programs, NBER Working Paper No. 17556, October 2011
- ATLETE, <http://www.atlete.eu/>
- ATLETE 2010, Report on the national legislations regarding energy labelling, Deliverable 2.1, work package under the lead for ADEME, Therese Kreitz
- Attali, Sophie and Bush, Eric (2009) Factors influencing the penetration of energy efficient electrical appliances into national markets in Europe, DEFRA – MTP 2009
- Odyssee, 2012, <http://www.odyssee-indicators.org/>
- National French Institute of Statistics, INSEE, [http://www.insee.fr/fr/themes/document.asp?ref\\_id=T10F062](http://www.insee.fr/fr/themes/document.asp?ref_id=T10F062)
- TNS SOFRES, <http://www.tns-sofres.com/>
- GfK, <http://www.gfk.fr/>
- REMODECE, <http://remodece.isr.uc.pt/>

## Acknowledgements

This article is derived from a report commissioned by ADEME, the French Environment and Energy management Agency, that monitors energy performance in the residential market according to detailed technical and economical energy efficiency indicators<sup>22</sup>.

20. In particular to the way thermal uses have been assessed to get by difference the captive electricity consumption, especially in the case of France where electric thermal uses are well developed.

21. See for instance it has been done in Arimura et al. (2011).

22. <http://www.odyssee-indicators.org/publications/PDF/Summary-benchmark-electricity-EN.pdf>