Study on the effects on consumer behaviour of online sustainability information displays

Final report

Client: Executive Agency for Health and Consumers

Rotterdam, 27 January 2014

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Rotterdam, 27 January 2014

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Executive Summary

Background and purpose of the study

Ecorys, CentERdata and GfK were commissioned to conduct this research by the Executive Agency for Health and Consumers. The main purpose of the study was to investigate how the provision of online information on energy efficiency of household products can be improved to promote energy efficient product choices. Due to key differences between online and offline retailing, the current legislation on offline energy labelling may not be optimal for online settings. Two differences are particularly relevant for this study.

- First, in online settings, consumers typically face large assortments and can easily switch between stores against limited time costs. Even more so than in offline environments, consumers are motivated to avoid information overload and simplify choice by using a two-step decision-making process. Most European web stores that sell household products facilitate this two-step process by enabling consumers to first to select a limited number of products for the full assortment that they would like to receive more information on and compare in detail ("consideration set formation") and then to make a choice from this limited set of products ("final choice").
- Second, in contrast to offline retailing environments, information space is very limited online. Online retailers have to cope with limited screen space and provide information in a smart and efficient manner. This issue of limited screen space becomes even more important as consumers begin to use devices with even smaller screens (tables, smartphones) to make online purchases.

Based on these key differences between online and offline retailing, this research specifically investigated (1) *how* the current (full) energy label could be simplified/reduced to be more suitable in settings with limited information space without sacrificing effectiveness, and (2) *when* the energy efficiency information should be first provided: during consideration set formation or during final choice.

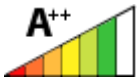
The starting point for the new energy label variants tested in this research was the recently proposed regulation on labelling of energy-related products on the Internet. The proposal outlines a nested display of energy efficiency information, with the energy efficiency class presented in a coloured arrow in left- or right-pointing orientation (a "reduced" label) at the first presentation of price information, with a mouse-click/roll-over or tactile screen expansion to the full energy label. Given the fact that the reduced label is the one that is immediately visible, the present research focused on understanding which general characteristics determine the effectiveness of such reduced-form energy labels. Based on existing theory and expert knowledge, four reduced labels – the currently proposed class-only label and three other variants – were designed and tested (see Table 1.1). The basic idea is that two specific pieces of information are missing in the currently proposed class-only label (label 1) that may cause the label not to reach its full potential in promoting energy efficient product choices: (1) meaning, and (2) a frame of reference.

The reduced energy label variants presented in Figure 1 were used to test hypotheses related to the **content** of energy information, namely:

(1) *Meaning effect*: adding (textual or visual) meaning to the reduced (class-only) label improves its effectiveness.

(2) *Frame of reference effect*: adding a frame of reference to the reduced (class-only) label improves its effectiveness, particularly in the final choice stage.

Table 1.1 Reduced label variants tested in the study

Label 1: Class-only label	Label 2: Meaning*	Label 3: Frame of reference (FoR)	Label 4: Meaning + FoR
			

"Energy" is written in the language of the specific country.

The reduced labels were tested against the full label, and two control conditions: no energy efficiency information and non-prominent (plain text) energy efficiency information. This enabled us to test additional hypotheses related to the **availability** and **display** of information:

(1) *Information effect*: consumers are more likely to choose energy-efficient products if energy efficiency information is available compared to when it is not;

(2) *Label effect*: consumers are more likely to choose energy efficient products if energy information stands out from other product information (through a label) compared to when it does not;

(3) *Reduced label effect*: consumers are more likely to choose energy efficient products if energy efficiency information is displayed online in reduced as compared to full label form;

(4) *Decision-stage effect*: energy efficiency information has a stronger impact on choices in the consideration set formation stage than in the final choice stage;

(5) *Order effect*: consumers are more likely to choose energy efficient products if these are presented at the top of the web page compared to at the bottom of the web page, particularly in the consideration set formation stage.

Method

An online study was conducted among 11.764 consumers in 10 countries (France, Germany, Greece, Ireland, Italy, the Netherlands, Poland, Portugal, Romania, and Sweden). The study included an experiment and questionnaire. In the experiment, respondents took part in a simulated shopping trip across four different web stores (selling refrigerators, televisions, washing machines, and light bulbs, respectively) and they were either asked to form a consideration set (i.e., select max. six out of twelve product alternatives) or to make a final product choice (i.e., select one out of four alternatives). Energy information was varied between-subjects. The post-experiment questionnaire assessed relevant background information (socio-demographics, online/offline purchasing behaviour) and factors that could potentially explain differences between consumers in responses to energy efficiency information (e.g., sustainability attitudes, social pressure, and perceived behavioural control).

Key findings

The key findings of the study are the following:

1. All four reduced labels promote consideration of more energy efficiency products compared to the situation in which no energy efficiency information is presented. In other words, when energy efficiency information is available, consumer tend to use this information in their decision-making process. This supports the hypothesized *information effect*.

2. Label 3 (the frame of reference label) outperforms the other reduced label variants in the consideration set formation stage. Label 4 (the pictogram label) is least effective in promoting consideration of more energy efficient products, but still outperforms the condition in which no information is provided at all. These results are largely consistent across product categories. Furthermore, the label works best in six out of ten countries, and is the second-best alternative in the remaining four countries.
3. In the final choice stage, differences in effectiveness between labels are smaller than in the first stage of consideration set formation. This supports the hypothesized *decision-stage effect*.
4. Label 3 (the frame of reference label) also performs best overall in the final choice stage, but the difference in effectiveness with the other reduced labels is small in absolute sense (and not always statistically significant), and results are inconsistent across product categories and countries.
5. The full label is less effective than the reduced label variants in promoting energy efficient (final) product choices. This supports the hypothesized *reduced label effect.*
6. Taken together, the tested energy labels (four reduced label variants and the full label) do not lead to more energy efficient final product choices compared to non-prominent energy efficiency information (i.e., plain text). Hence, the *label effect* is not supported. However, the absence of an "overall" label effect is driven by the fact that some (but not all) reduced labels perform better than plain text, while the full label performs even worse than plain text. This stresses the unsuitability of the full label for online purposes.
7. The data do not support the hypothesized *meaning* and *frame of reference effects*. Label 3 (the frame of reference label) is most effective, particularly in the consideration set formation stage, but this does not seem to be due to the presence of a frame of reference in this label per se (in that case, label 4 should have performed relatively well too). Furthermore, this best-performing label lacks explicit meaning, which suggests that carrying explicit meaning is not a necessary requirement for label effectiveness.
8. Additional analyses to better understand why label 3 is most effective in promoting energy efficient choices reveal that the relative effectiveness of label 3 compared to the other labels depends on the value consumers place on energy efficiency in their choices of household products. More specifically, the results suggest that consumers who place high value on energy efficiency search for and use energy efficiency information in their decision-making process, regardless of the specific way the information is displayed, and even if it is presented in a non-prominent manner. For these consumers, reduced labels 1 (class-only) and 2 (textual meaning) and plain text are equally effective as label 3. For consumers who place low value on energy efficiency, the labels with *no* visual or textual meaning attached to them perform surprisingly well. This may suggest that these labels are interpreted as an "overall" product evaluation with positive implications for product choices. Thus, ironically, the lack of explicit meaning might drive the effectiveness of label 3 for consumers who consider energy efficiency as a relatively unimportant product feature.

Spill-over effects

We identify two types of spill-over effects.

1. The tendency of people to adopt a similar mind set to a different situation after seeing an energy label.
2. The second type refers to the extent to which effective elements in the label for one product can also be used in labels for another product.

To provide some initial insight into the presence of spill-over effects of the labels to environmental concerns we examined the differences in respondents' general environmental concern after

exposure to energy information in the simulated shopping experiment. We also looked into what extent the knowledge of this study can be applied to other products such as food.[1] To answer these questions, we carried out a review of the literature to further develop the understanding of consumer decision making.

Consumer decision process has two possible routes (central or systematic). The route taken depends on factors such as goals, consequences of right or wrong choice, available time, motivation and ability to weigh information. Therefore does consumer's decision process on purchasing food or household appliances differ. In our study we found that labels help consumers to understand relatively complicated characteristics of products, and bring it to the fore. This is particularly relevant when consumers are (cognitively) unwilling or unable to take all relevant information into account in their decision making. The less willing or capable consumers are to process all the available information, the easier the information should be presented in order to have an impact on the consumer decision making.

Thus, whereas our study demonstrated that:

1. Label 3 is most effective in promoting energy efficient product choices, findings show that this label may not be very effective in building more favourable general attitudes towards the environment. In other words, due to lack of explicit meaning, this label may not prompt consumers to think about the environment as much as other labels. The differences between labels are very small, and effects are (although not tested) unlikely to last for a longer period. Based on this, we judged the **spill-over effects from the labels to the environmental concern as minimal**.
2. When applying the findings of this study to other products such as food, these differences in the decision making process should also be taken into account. For energy related information, the simplified label in form of colour scaling and letter identifying the energy class was found most effective (Label 3). However, whether this can inform **label design for other product categories would depend on the type of product, as well as the attribute (energy efficiency or another attribute) to be communicated** as consumers come to understand labels. They know the labels tested in this study are related to energy consumption of the product. Seeing same label on food products, might lead consumers to erroneous assumption about its meaning and confuse them. In the case of food further research should address whether pictograms or symbols could improve the efficiency of the food labels as well as test that consumers have a correct and uniform understanding of the pictograms.

Policy recommendations

Based on the findings in the study we described above, we recommend to:

1. **Use labels in the online environment –** This study has shown that if an energy label is displayed, especially in the early stage of choice-making, it is more likely that consumers choose energy efficient products.
2. **Research further the ways to optimise the energy efficiency label by exploring designs specific for the online environment.**– As smaller, simpler labels functioned better. Therefore, it is recommended to revise the design and content of the current energy label in case of using it in online setting.

[1] As our study was not specifically designed to accurately measure spill-over effects our study can only show crude, initial insights into potential spill-overs of exposure to online energy labelling. These findings can demonstrate an immediate effect of exposure to energy labels on general environmental concern and that the direction of the effect is critically dependent on the specific energy label variant. However, they do not provide insight into the long-term impact on sustainability attitudes of exposure to online energy labelling.

3. Given the rising importance of the online channel not just for buying, but also for finding information and making choices before offline purchases, **we recommend to design labels, including energy labels in such a way that it also maximizes the effectiveness of the label in the online environment**. More broadly, as more economic and social activity moves into the online environment, our study shows that it is necessary to explore how best to provide information to consumers in this new environment, where labels are no longer distinct objects but strings of data to be represented in a certain way. Insights from behavioural analysis are already widely applied by business in the online environment and policymakers need to include them more systematically in their work as well.
4. **Increase attention to energy efficiency, target groups with low environmental concern.** For consumers for whom energy efficiency has low importance in their purchasing decision, education and awareness raising measures regarding energy efficiency will increase the effectiveness of the labels as increased environmental concern improves the performance of all labels. It may be most efficient to target those groups with low environmental concern, where the largest gains are possible. Specifically, the target group could be males, house renters and people with lower education, because those are the people that on average are relatively less concerned about the environment, according to our survey. Also, some Member States may be more relevant than others to target if they show an overall lower environmental concern.
5. **Conduct further research into consumer understanding of online labels.** Further research is required to gain a better knowledge of consumers' understanding of online labels as we find indications that some consumers may misinterpret some of the tested labels. In addition, more research is required to determine the optimal trade-off between the need to make the information easy to understand, and the need to be comprehensive in the information label communicates.
6. **Promote availability of listing/sorting products by energy efficiency.** Based on the literature and findings from our experiment, we expect consumers would select the most energy efficient products, when they are by defaults sorted from most to least energy efficient. It would be therefore interesting to encourage online shops and price comparison websites to make available product sorting by energy efficiency.

1 Introduction

1.1 Problem definition

A high percentage of in-home energy consumption is associated with the use of major household appliances. There is great potential for significant energy savings for households by simply switching to more energy efficient technologies on the market. By purchasing energy efficient household products, consumers do not only contribute reducing their environmental footprint, in many cases it also pays-off financially. That is, the higher purchase price that is typically associated with energy efficient alternatives is often recouped through lower energy bills, but consumers tend to undervalue these future benefits (Gaspar & Antunes, 2011).

Information policy plays a key role in promoting energy efficient product choices. The energy efficiency of household products is a credence characteristic that cannot readily be verified by consumers prior to the purchase. To provide consumers with consistent, comparable energy efficiency information, in 1995, the European Commission introduced the European energy label, which is a compulsory label that is applied to white goods, home appliances and light bulbs sold within the EU. The energy label provides information about the product's energy efficiency, which is rated in terms of a set of energy efficiency classes, for example, from A+++ (most efficient) to D (least efficient) or from A (most efficient) to G (least efficient) depending on the specific product category. Suppliers are responsible for providing dealers with energy labels containing accurate information. Dealers are responsible for the display of energy labels in a clearly visible manner. In brick-and-mortar stores, the energy label is physically displayed on the front or on top of the product at the point of sale. In online settings, in contrast, the energy label as such does not have to be displayed.

In stark contrast to the full label which is prominently displayed on products in traditional stores, in online settings the energy efficiency class is usually provided in a visually non-salient manner and without information about the scale range. Without a frame of reference, the energy efficiency attribute becomes more difficult to evaluate, which reduces the probability that this information will be used in decision-making. Another important difference between online and offline retail outlets is the presence of retail sales staff. Store visits and salespeople are considered an important source of information for buyers of durables. To the extent that sales persons draw consumers' attention to the energy efficiency of the products under consideration, energy-related information may be more likely to be noticed and used in the choice process when purchasing in traditional stores as compared to online.

Due to differences in how energy-related information is presented online as compared to offline, energy efficiency seems to be a less important consideration for consumers purchasing online as compared to offline. An important question therefore is **how the online provision of energy-related information can be improved to promote energy efficient choices to the level observed in offline settings**.

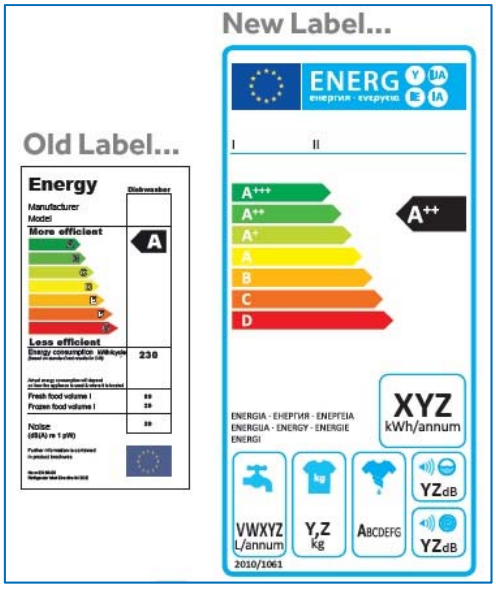
Key to answering this question is the notion that online retailing is intrinsically different from offline retailing on several aspects. In addition to the absence of sales personnel, online retail settings are often characterized by large product assortments and low store switching costs. As a result, consumers shopping online are more likely to be overwhelmed by the large number of choice options and overload of information. Adding more information does not necessarily facilitate decision-making and can even be counterproductive, a phenomenon referred to as "feature fatigue"

(Thompson et al. 2005). In order to avoid information overload and facilitate the decision-making process, most online stores provide tools that enable consumers to select and compare a limited number of items in more detail. Thus, for an energy efficient alternative to be purchased, it has to be selected by the consumer in two stages of the decision-making process. That is, it has to be selected from a typically very large assortment of products for further consideration and to gain more detailed information about the product, and it subsequently has to be the most preferred item from the set of products that are considered in more detail.

1.2 Energy labels: background

Council Directive 92/75/EC was the first piece of legislation in the EU to establish a common energy consumption labelling scheme. This directive was a “framework directive” that did not of itself specify any limits or performance levels. Rather, it provided a legislative framework into which other directives could be introduced to require performance levels and label specifications for particular types of household products. During the period 1995-2003, the directive was supplemented by further implementing Commission Directives on household washing machines (95/12/EC), electric tumble dryers (95/13/EC) washer-dryers (96/60/EC), lamps (98/11/EC), dishwashers (1999/9/EC), air-conditioners (2002/31/EC), electric ovens (2002/40/EC) and cold appliances (2003/66/EC). The energy label became a recognisable and useful tool to help consumers make informed choices when they purchase household products. Furthermore, as consumers became better informed, suppliers had a strong incentive to increase the efficiency of their products. The first labels were provided in eleven different languages. Suppliers were responsible for the provision of a label and fiche with product information to the retailer, and retailers were responsible for attaching labels to their appliances.

In 2010, the Energy Labelling Directive 92/75/EC was replaced by the recast Directive 2010/30/EU. With this new Directive, the scope changed from household appliances to energy-related products having a direct or indirect impact on energy consumption. Other main features were (1) the introduction of A+, A++, and A+++ classes on top of the A-G scale, (2) an almost language free label used across the whole internal market, and (3) distance and internet sales added to the scope. From 2010 onwards, the new Energy Labelling Directive was supplemented by a number of delegated acts which included label specifications (such as measurement standards and methods, details of the technical documentation, the design and content of the label, and the location where the label should be fixed to the product) for specific energy-related products (e.g., 1059/2010 for dishwashers, 1060/2010 for refrigerating appliances, 1061/2010 for washing machines, 1062/2010 for televisions, etc.).



Energy label elements

All labels consist of three parts. The first part is the energy efficiency scale. It has seven energy efficiency classes and either runs from A (most efficient) to G (least efficient), or from A+++ (most efficient) to D (least efficient). Thus, higher "grades" represent more energy efficient products within the category. The colour pattern correspondingly runs from dark green for the highest energy efficiency class via yellow to bright red for the lowest energy efficiency class. The second part of the label consists of other standardized information mainly related to the burden of the appliance to the environment. The information that is provided depends on the specific product category. For washing machines, for example, it includes the noise level and water consumption. The information is indicated with symbols to ensure easy comprehension by the consumer, without providing biased information due to word connotation. Finally, the label should be accompanied by a fiche with detailed technical standardized information that the supplier should make available to those requesting it. Appendix I shows the specific energy labels for the different product categories.

1.2.1 *Energy labels: the future*

The "Sustainable Consumption and Production Action Plan" describes some proposals for future key policies regarding energy labelling. This plan proposes to include additional information in the label, linked to the environment, such as the amount of emissions and the resource-use during a product's life cycle (Mori, London Economics and EAE, 2012). The Commission has already taken some steps to develop this idea. For instance, they commissioned a study on Product Carbon Footprints methods[2], and produced a consultation on the draft version of a Product Environment Footprint Assessment. [3] Finally, in December 2010 the European Council asked the Commission to come up with new quantitative methodologies in order to assess the life cycle of the products. [4]

In the future, according to the Working Plan 2012-2014, the Commission plans to extend the energy label coverage to other products, for instance vacuum cleaners, boilers and water heaters, but also non-energy consumer household appliances like windows and showerheads. [5] Currently, the

2 Product Carbon Footprinting – a study on methodologies and initiatives, July 2012, for European Commission DG Environment, Ernst & Young and Quantis.

3 http://ec.europa.eu/environment/eussd/smgp/product_footprint.htm.

4 http://www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/en/envir/118642.pdf.

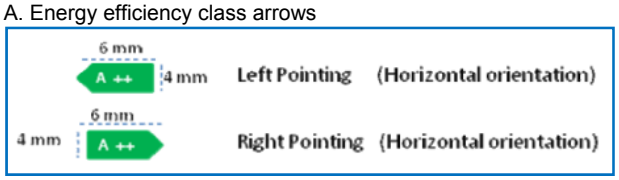
5 http://ec.europa.eu/enterprise/policies/sustainable-business/documents/eco-design/working-plan/files/comm-swd-2012-434-ecodesign_en.pdf.

European Commission is researching if more products and services are viable for energy efficiency labelling, including nutrition, housing and transport. [6]

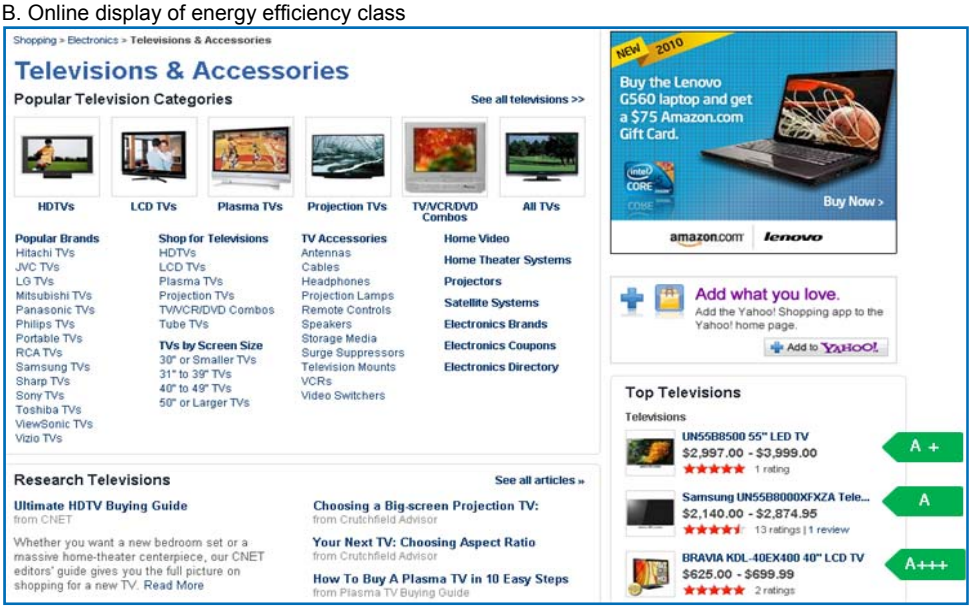
Furthermore, with the increasing popularity of online retailing, also for the purchase of household products[7], the Commission is also planning to further develop legislation for the online display of energy efficiency information. The current legislation is very specific about the design (size, colour, lay-out, location, etc.) and content of the energy label for offline environments. However, these design and content specifications appear neither practical not user friendly for online purposes. New legislation to regulate online energy label presentation has been proposed.[8] This new legislation takes into account the specific characteristics of online environments, while ensuring that consumers are presented with the *same* information irrespective of whether they shop online or offline. It dictates that the energy efficiency class is displayed in proximity to the price of the product, in left or right orientation and in appropriate colour (see Figure 1.1, A and B). Furthermore, the full energy label (as is compulsory in offline environments) should be displayed via a mouse roll-over or mouse-click on the energy class image (Figure 1.1, C).

Figure 1.1 Online display of energy efficiency information

A. Energy efficiency class arrows



B. Online display of energy efficiency class



6 http://ec.europa.eu/energy/consultations/20130702_green_paper_2030_en.htm

7 http://ec.europa.eu/consumers/consumer_research/market_studies/docs/study_ecommerce_goods_en.pdf

8 http://ec.europa.eu/enterprise/tbt/tbt_repository/EU113_EN_1_1.pdf

C. Mouse roll-over to full energy label

1.3 Study purpose, objectives and results

For environmental labels to be effective, consumers need to use them in their decision-making process. Several studies reveal a significant positive impact of energy labels on consumers' choices for energy-efficient appliances (e.g., Sammer & Wüstenhagen, 2006; Shen & Saijo, 2009; Ward et al. 2011). These studies show that consumers take energy-related information into consideration in their product choices, and that they are generally willing to pay a price premium for energy efficient products. Furthermore, energy labelling of domestic products may increase consumers' general awareness of energy efficiency and sustainability issues and increase environmental concerns, leading them to engage in more sustainable behaviour in other domains as well (Thøgerson & Ölander, 2003). However, studies on the use of energy labels in an online environment are limited.

The main purpose of the study is to provide insight into how the provision of online information on energy efficiency of energy-related products can be improved to stimulate consumers to choose more energy efficient products. The study aims to achieve the following seven specific **results**:

Result 1: Insights into the influence of online availability of the energy label on consumers' product choice

The study will provide insight in how online energy efficiency information, full and reduced versions of the energy label, affect the online consumer choice process. We study this by taking the theoretical notice that consumers usually take a two-step approach when making decision in complex situations with many alternatives available. We study how energy-efficiency information affects the composition of the consideration set (step 1) and the final choice for a product (step 2).

Result 2: Insights into the influence of energy label characteristics related to the content and display of information in online settings

The research will focus on two broad categories of information characteristics, namely the *content* of energy-related information (i.e., "what" information is presented) and the *display* of energy-related information (i.e., "how" and/or "when" information is presented). Both types of information

presentation characteristics encompass various specific information manipulations. The study will provide insight into what, how, and when energy-related information should be presented to consumers to promote energy efficient product choices in an online shopping environment. This part of the study will be streamlined along eight hypotheses that we will test empirically with an experiment. Based on the study's results, recommendations will be provided about the optimal way(s) of online information provision.

Result 3: Insights into how different consumer segments are influenced differently by the content and display of energy-related information
In addition to providing insights into the general effectiveness of different types of energy-related information provision, the study will provide insight into whether and how the influence of the framing and display of information may be different for different consumer segments. We will take on an exploratory data analysis approach to identify the most relevant consumer segments, which may for instance be groups that show different online purchasing behaviours or groups with different environmental attitudes and beliefs. In addition, we will profile the identified consumer segments on the basis of socio-demographics and other relevant characteristics.

Result 4: Insights into to what extent the content and display of information may overcome pre-identified barriers to energy efficient product purchasing behaviour
Barriers to the purchasing of energy efficient products will be identified, such as biases in decision-making that prevent consumers from adequately using energy-related information in their product choices. We theorize and test how certain changes in the type of information that is provided and/or the way it is displayed may overcome these barriers and improve decision making. This enables us not only to show *how* to optimally provide energy-related information, but also *why* this is most optimal.

Result 5: Insights into potential spill-over effects of exposure to online energy labelling
Although the study is not designed to test the long-term impact of exposure to online energy labels on general environmental concern, it can provide some insights into *immediate* spill-over effects. That is, the data may provide some initial insights into how exposure to online energy labelling in general and to specific energy label variants immediately influence consumers' general concern about the environment.

Result 6: Insights into how the findings relate to labelling in other domains
The results of this study may also inform policy making in other domains. The research team has in-depth knowledge and experience with projects on the impact of labelling across a variety of domains, and on food labelling in particular. The team will use this knowledge to translate the study's findings to labelling processes in other domains including the food domain.

1.4 Reading guide

In the next chapters, we discuss our study that will realise these results. The literature review in chapter 2 provides a theoretical foundation for the study methodology. Chapter 3 presents a detailed description of the methodology of the experiment and the questionnaire. Chapter 4 describes the data collection and the sample. Chapter 5 presents the results of the empirical study (survey and experiment). Chapter 6 discusses the spill-over effects of energy labels. Finally, chapter 7 provides policy implications.

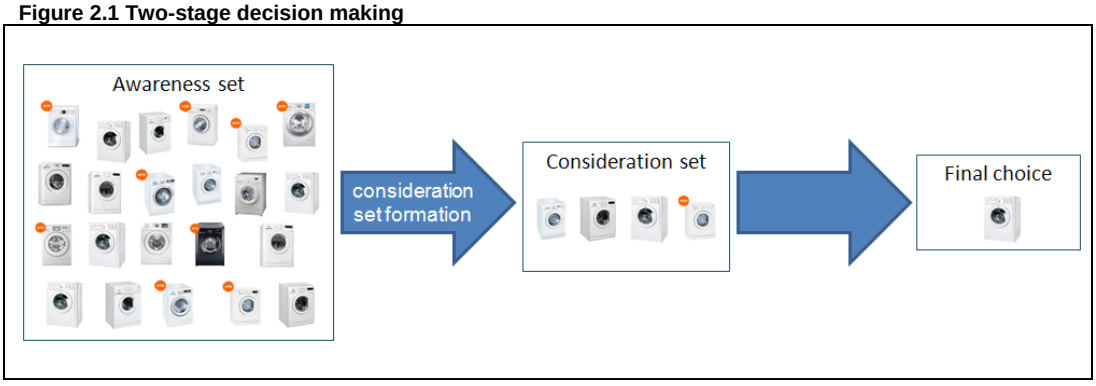
2 Literature review and hypotheses

This chapter discusses relevant literature on consumer information processing and decision-making. This chapter starts with the development of a conceptual model of online sustainable purchasing behaviour (Section 2.1), which serves as the basis for the general set-up of the experiment and development of the post-experiment questionnaire. Section 2.2 examines which important differences exist between online and offline purchasing behaviour of energy-related products and how these might explain differences in product choices across the two channels. Finally, Section 2.3 reviews literature on the influence of the content and display of energy-related information. Based on this literature, we come up with promising online energy label variants and formulate hypotheses about their impact on consumer decision-making, yielding a set of hypotheses to be tested in the empirical study.

2.1 Understanding online purchasing behaviour of energy-related products

The literature on consumer decision-making argues that consumers often simplify complex choices by using a two-step decision process (Andrews & Srinivasan, 1995; Hauser & Wernerfelt, 1990; Hauser et al. 2010; Horowitz and Louviere, 1995; Figure 2.1). In the first step, a consumer screens down the full set of available product alternatives (the awareness set) down to a smaller, more manageable consideration set (typically comprising 2 to 6 products). The alternatives in the consideration set are then studied in more detail by the consumer which will finally result in one alternative being chosen and purchased. Two-step decision making is particularly relevant when consumers face a large number of products, as is typically the case in online shopping environments. Because of limited processing capacity to evaluate all alternatives, a consumer reduces the total number of alternatives to a smaller set of “acceptable” alternatives in the first step and makes a trade-off between these alternatives in the second step.

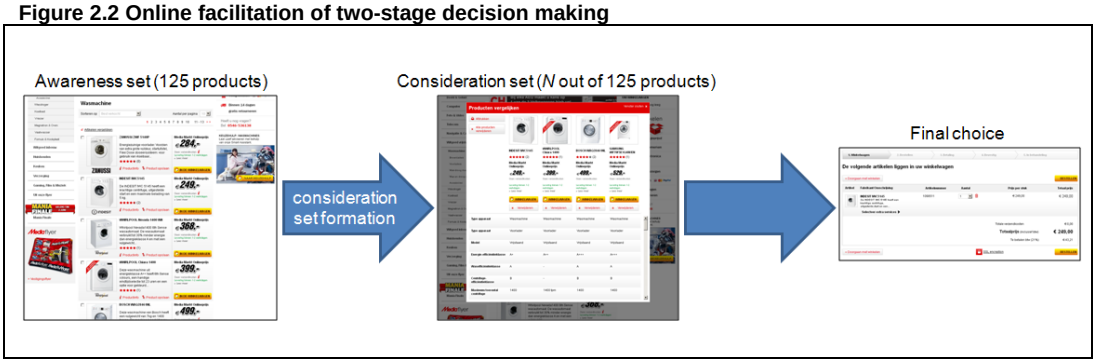
Figure 2.1 Two-stage decision making



Many studies (either academic or practical) focus on consumers’ final choice from a relatively small set of products. This does not provide a complete picture of consumers’ complex decision-making, however. Product attributes and information may receive different importance weights in the different stages of the decision process (Levin & Jasper, 1995). This implies that if consumers do not take energy efficient products into consideration at all, different information strategies may be effective as compared to a situation in which energy efficient products are considered but not chosen. To better understand the influence of energy-related information in each step of the process, our study examines the effect of energy labels and other relevant information variables on both consideration set formation and final choice.

This two-stage process is believed to be used to simplify complex decision-making in offline as well as online environments. In online stores, assortment sizes are typically larger than in brick-and-mortar stores, which increases the need for strategies to avoid information overload and minimize cognitive effort. Moreover, whereas in offline environments the consideration set is usually implicit and unobserved, most web stores explicitly facilitate the two-stage decision process by enabling consumers' to select products from the full set of alternatives for detailed comparison (see Figure 2.2). Typically, consumers are first presented with the complete set of available product alternatives described on a few important attributes such as brand, price, and overall product evaluation. From this set, consumers can select a subset of products that they want to have more detailed information on. The next screen then shows the subset of products with a more extensive list of product attributes listed in parallel for comparison (product-by-attribute matrix form). Almost all major European web stores that sell consumer electronics use a two-step design to facilitate online decision-making from large assortments. The differences between online and offline retailing will be further explained in Section 2.2.

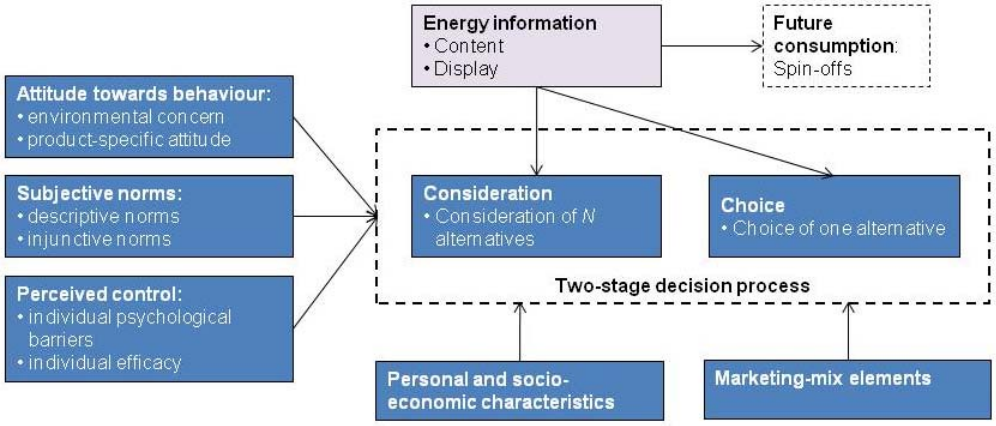
Figure 2.2 Online facilitation of two-stage decision making



2.1.1 *The Theory of Planned Behaviour*

Several studies have aimed to identify key determinants of consumers' sustainable purchasing behaviour. These studies cover several domains, such as green food choices, self-sufficiency in energy, furniture purchasing, and so on (e.g., Gaspar & Antunes, 2011; Steg & Vlek, 2009; Tanner & Kast, 2003). Many of these studies use the Theory of Planned Behaviour, a comprehensive theory of consumer behaviour developed by Azjen and Fishbein (1980), as a general framework. The theory states that people's attitude toward the behaviour, subjective norms, and perceived behavioural control, together shape an individual's behavioural intentions and behaviours. In general, the more favourable the attitude toward the behaviour, the stronger the social pressure to engage in the behaviour and the greater the perceived behavioural control, the stronger the person's intention to perform the behaviour in question. Finally, given a sufficient degree of actual control over the behaviour, people are expected to act on their intentions when the opportunity arises. In other words, these attitudinal factors increase the probability that an alternative ends up in the consideration set and will be purchased in the end. Figure 2.3 shows our conceptual model which integrates the Theory of Planned behaviour with the notion of two-stage decision-making. The next section describes the components of the model in more detail.

Figure 2.3 Conceptual model of sustainable buying behaviour



Attitude towards behaviour

People hold a general attitude towards the environment and the role of human beings in the ecological environment. An attitude can be defined as a predisposition or a tendency to respond positively or negatively towards a certain idea, object, person, or situation. The term *general* attitude refers to the fact that it concerns an attitude that exists independent of product, purchase and individual situation.

Research indicates environmental behaviours are driven more by specific attitudes and beliefs (e.g., judgments about products or behaviours) than by general environmental concerns. For energy-related product choices, environmental and financial beliefs are important determinants of behaviour:

- Environmental beliefs: The degree to which consumers think electric household appliances are damaging for the environment.
- Financial beliefs: The degree to which consumers think it financially pays off to choose for energy-efficient alternatives.

Norms

Subjective norms are an individual's perception of the social pressures put on him/her to perform or not to perform the behaviour. These norms can be divided into (Cialdini, 1993):

- Descriptive norms: the extent to which significant others (e.g., parents, spouse, friends, teachers) use energy-efficient alternatives.
- Injunctive norms: the extent to which someone thinks he should or is expected to use energy-efficient alternatives.

Perceived control

In order to motivate behavioural changes, consumers must be convinced that their behaviour has an impact on the environment or will be effective in fighting environmental degradation (Robert, 1996). In other words, consumers must believe that choosing energy-efficient household appliances makes a difference for the environment (this is known as individual efficacy). Finally, individual psychological barriers are individual beliefs that may withhold consumers from choosing energy-efficient alternatives, such as budgetary constraints that consumers may face.

2.1.2 *The role of energy information*

Knowledge is sometimes considered another dimension of perceived control. Factual knowledge refers to abstract knowledge about environmental problems (e.g., what is the greenhouse effect?). Action-related knowledge refers to knowledge about the relationship between concrete actions and environmental problems (e.g., which human behaviours are related to the greenhouse effect?). Action-related knowledge is more likely to affect behaviour than factual knowledge (Tanner & Kast, 2003). Information labels have the potential to affect consumer choice behaviour, since they provide very specific action-related information.

Information labels may affect purchase behaviour through three different processes in the model. First of all information labels may directly affect choice behaviour. At the point of purchase (either offline or online), consumers obtain information about product alternatives that may affect their purchase behaviour, for example, because it breaks their habits to focus on retail prices and focuses attention on energy efficiency, increasing the importance of this attribute in their choices. Second, the information label may serve to reduce the intention-behaviour gap consumers face as a result of situational circumstances, such as lack of information, knowledge, and time pressure. Finally, the information label may affect future consumption. Information on energy efficiency may persistently change their attitudes towards environmental behaviour in general or towards the purchase of energy-efficient household products in particular.

2.1.3 *Marketing-mix elements*

The marketing mix of products is traditionally described to exist of four P's: price, product, promotion, and place. Particularly in the area of services marketing it is often proposed that a fifth P should be added for Personnel. Sales persons play a significant advisory role in the offline world but are (typically) absent for online shopping. Therefore, stronger efforts may be required in an online setting to ensure that energy-efficient alternatives are chosen at least as frequently as in a brick-and-mortar store.

Even though the majority of people report having favourable environmental attitudes, these do not always translate into more sustainable choices and behaviour. In surveys, consumers generally indicate being highly concerned about environmental and energy issues, but in practice product features other than energy efficiency, such as purchase price and quality, seem to be more important drivers of energy-related product choices (Banerjee & Solomon, 2003).

While energy efficient products typically have higher purchase prices as compared to less energy efficient products, the extra expense for energy efficient products is often recouped through energy cost savings in the long run. In fact, cost savings are often a stronger motivation for the purchase of energy efficient products than environmental concerns (Brandon & Lewis, 1999). Hence, from a rational perspective, being price-sensitive should actually not prevent consumers from buying more energy efficient products.

Apart from price and product quality, consumers purchase may be hindered by the absence of energy-efficient alternatives. This is captured by the P of Place or in other words distribution. In addition to availability, choices are driven by the specific display of the alternatives. In an offline environment, shelf and store lay-out have turned out to be important drivers of consumer consideration and consumer choices; products at eye-level or in the walking lane are more likely to be selected. Similar effects exist in online settings; alternatives that show up at the top of a product list are more likely to be considered and chosen than alternatives at the bottom of the list, controlling for attractiveness in terms their product attributes.

2.1.4 *Personal and socio-economic characteristics*

Several socio-economic characteristics may affect consumer choice for energy-efficient or sustainable goods. From the existing literature, the following elements seem to be important:

A. Socio-economic status. SES is often measured by variables such as occupational status, income, and education, and is an indicator of purchasing power. Consumers with strong budget constraints may not buy energy-efficient alternatives even if it pays off financially to use them in the long run.
B. Living conditions: Place of residence and household size are characteristics that explain differences in buying behaviour. In addition, we include house ownership in this study. House ownership can serve as an additional indicator of purchasing power (in case the income variable contains many missing values or if incomes are difficult to compare across countries). Furthermore, consumers owning their house are more likely to pay their own (unshared) energy bills and are thus directly affected by their own energy use.

Existing research shows that consumer behaviour differs between different socio-economic groups and countries. On the other hand several studies have shown that these differences in many cases disappear if one properly accounts for consumer characteristics that can explain behaviour, such as the ones proposed above. For example, consider the situation in which consumers in country A are less likely to choose energy-efficient products than consumers in country B, but at the same time consumers in country A face higher psychological barriers than consumers in country B. When testing an empirical model for purchasing behaviour, the country-effects may disappear when both perceived control and country are included as explanatory variables of purchasing behaviour.

2.2 Online versus offline retailing

In this section we will explain the most important differences between offline and online retailing and explain how web stores facilitate the two-step decision process.

2.2.1 *Differences between online and offline retailing*

Several differences exist between online and offline shopping environments that may contribute to lower importance weights placed on energy efficiency by consumers shopping online.

Less prominent display of energy efficiency information

First, domestic products in traditional retail outlets have energy labels that indicate the energy class of the specific product and show the full scale range (from A to G) as a frame of reference. However, in online settings, if anything, only information about the energy class of the specific product is usually presented, without information about the scale range. The fact that consumers do not have a basis for comparison in the online setting is expected to decrease the importance of this product attribute in consumer choice, and therefore to increase the probability of purchasing less energy-efficient products in online as compared to offline settings.

Service through sales personnel versus self-serving technologies

Online retailing is characterized by the absence of sales personnel to provide advice to consumers. Particularly for household products, the added value of sales personnel in offline setting may be substantial. Online stores have also tried to find ways to guide customers through their decision process through the design of their websites, for example, by providing product reviews from other consumers, the option to communicate with sales employees through live chat, and by means of product sorting, filtering, and comparison tools.

Store visits and salespeople are considered an important source of information for buyers of durables (Anderson & Claxton, 1982). To the extent that sales staff focuses consumers' attention on energy efficiency of the products under consideration, energy-related information may be more likely to be noticed and used in the decision-making process when purchasing in traditional retail outlets as compared to online. This could also contribute to a difference in the energy-efficient product choices depending on whether the product is purchased online or offline.

Purchasing independent of time and location

Internet enables consumers to purchase independent of place and time. They can order products at any time they like, from every online store available, either located at their home-country or cross-border. Although a country-of-origin bias is likely to exist (and delivery abroad might not be possible for every store), consumers increasingly purchase abroad from web stores located in other EU-countries.[9] In offline retailing, however, consumers are more or less limited to retail stores located in their local environment. Because of this, retailers have for a long time considered "location" as by far the most dominant and important component of the marketing-mix. Online retailing has shifted this completely.

Large assortments and ease of store switching

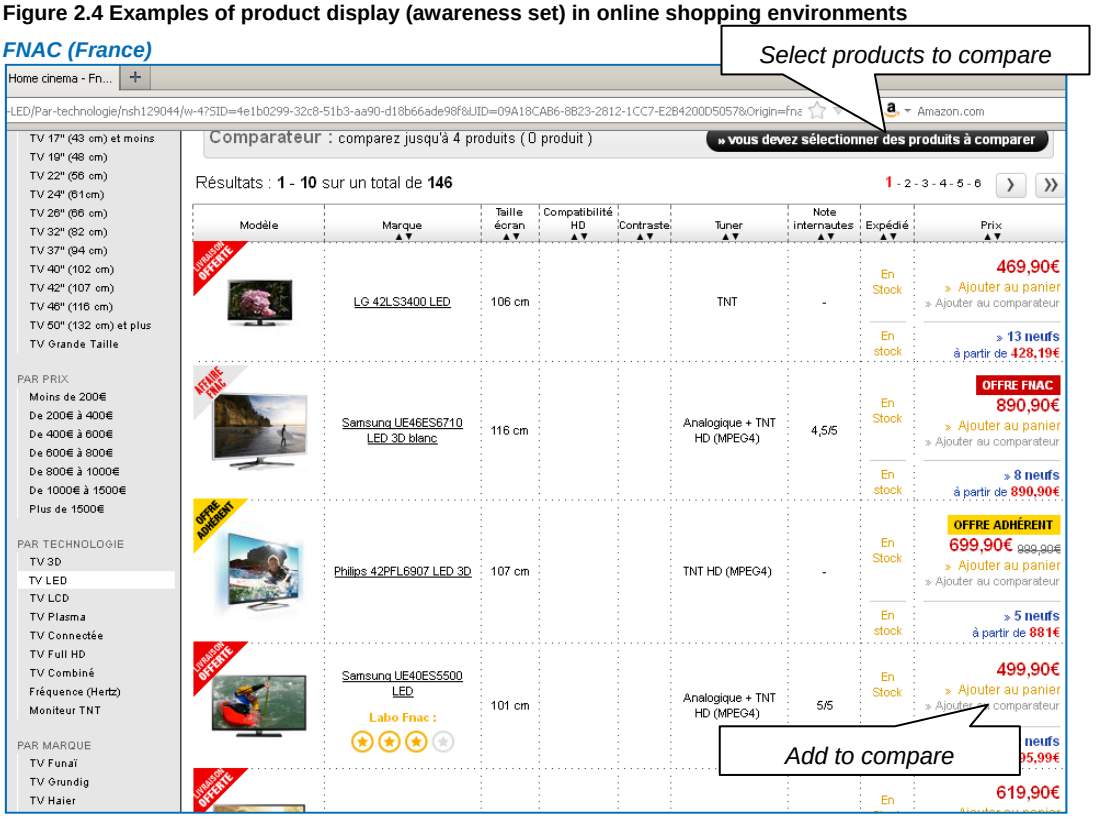
Not only do consumers have access to a greater variety of stores online than offline, a typical online store also offers a larger assortment than a brick-and-mortar store, because it is not limited by floor surface and shelf space. Somewhat related is the fact that consumers can easily switch between stores and compare all products available against limited (time) costs. On the other hand, consumers searching for products online are more likely to be overwhelmed by the large number of choice options and overload of information.

In sum, online retailers broaden the retail landscape and as a result consumers face far more options (stores and products) and information. As a result, consumers are likely to use heuristics and decision rules to avoid information overload and keep the choice process manageable. One way of simplifying the choice process is to use a two-step decision process of consideration set formation and final choice (Andrews & Srinivasan, 1995; Hauser & Wernerfelt, 1990; Horowitz and Louviere, 1995), as described in the previous section. Most European web stores that sell household appliances facilitate this two-step choice process by enabling consumers to select and compare a limited number of items in more detail. Figures 2.4 and 2.5 illustrate this with screen shots from French (FNAC), Dutch (Mediamarkt) and Romanian (EMAG) web stores.

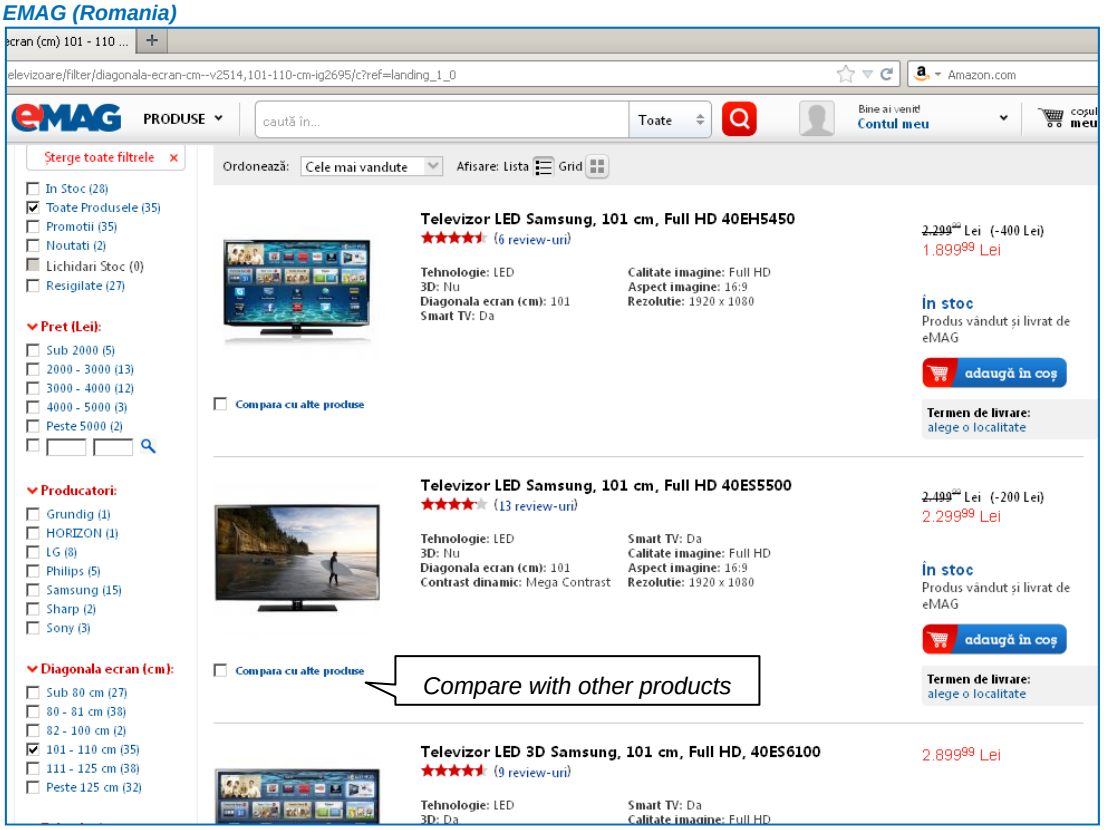
[9] Flash Eurobarometer 332 (2001). Consumers' attitude towards cross-border trade and consumer protection, research commissioned by the European Commission.

Figure 2.4 Examples of product display (awareness set) in online shopping environments

FNAC (France)



EMAG (Romania)



Mediamarkt (Netherlands)

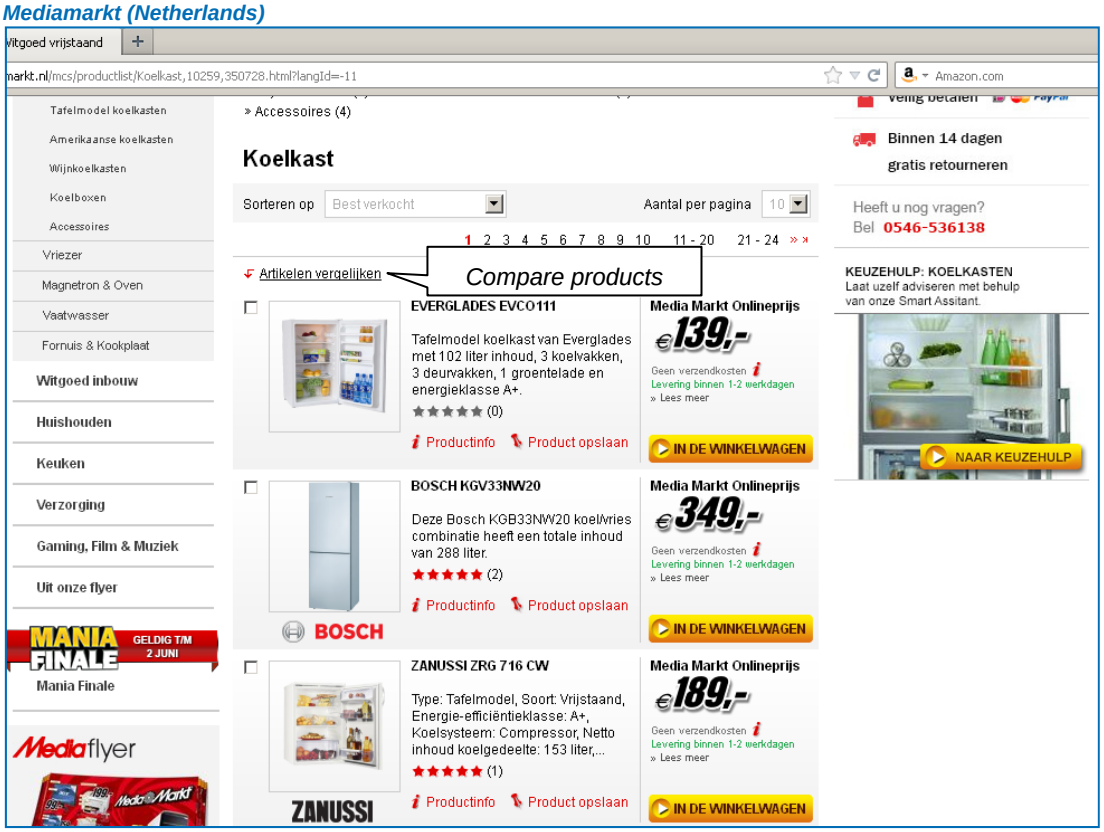
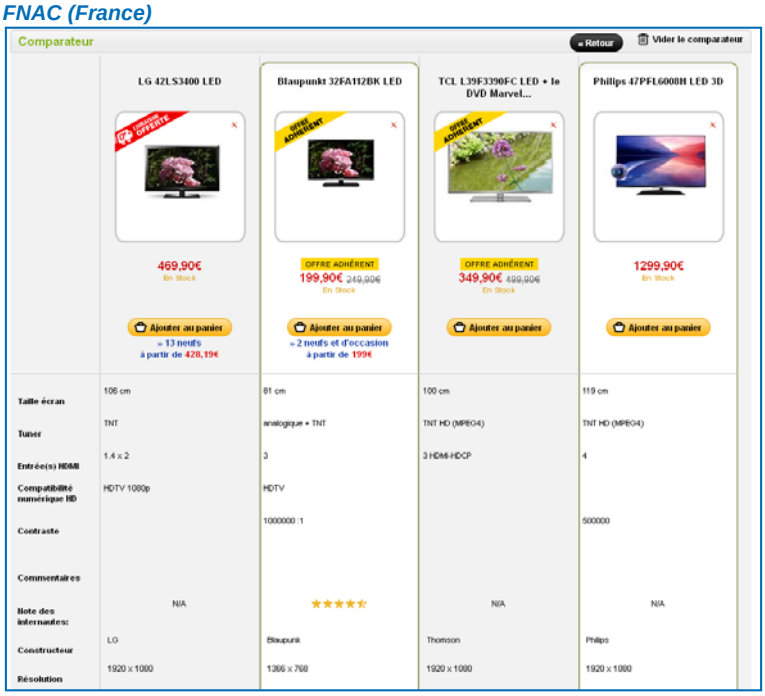
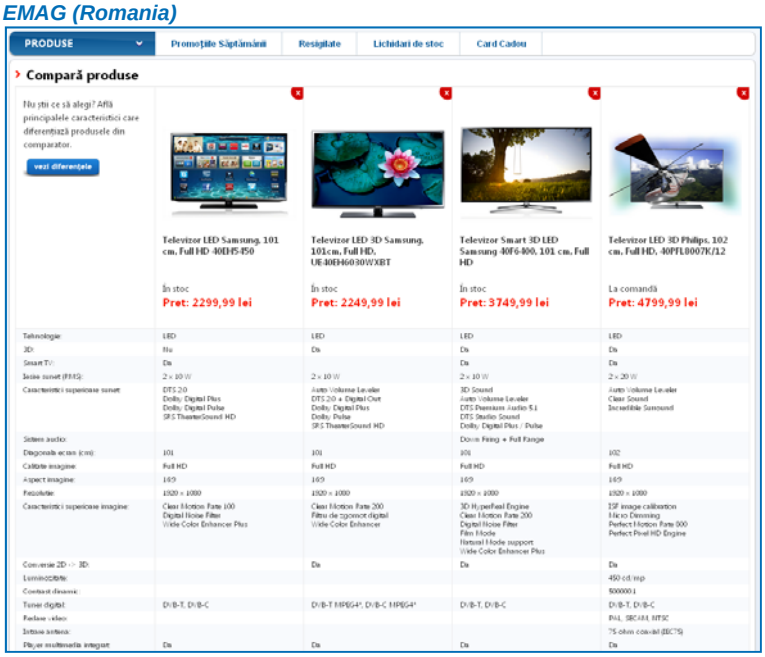


Figure 2.5 Examples of product display (consideration set) in online shopping environments

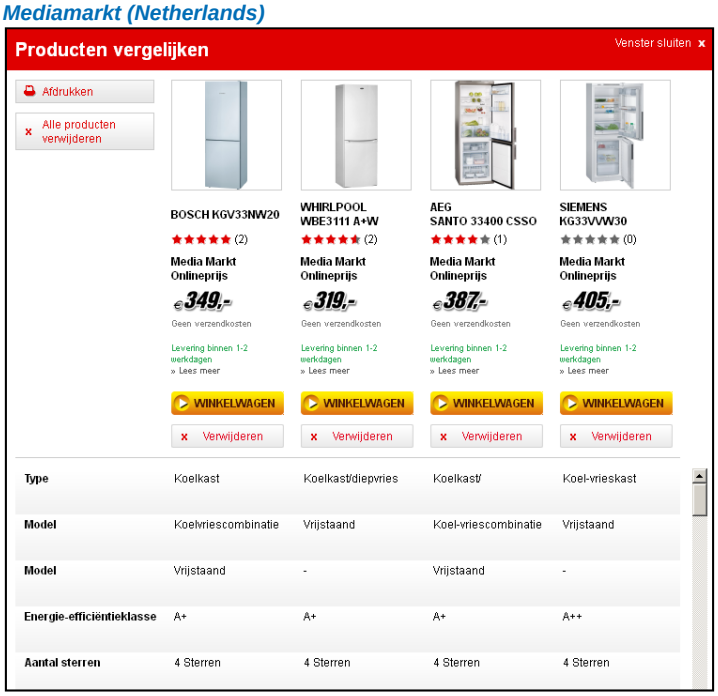
FNAC (France)



EMAG (Romania)



Mediamarkt (Netherlands)



2.3 Energy labels and consumer decision-making

This section provides an overview of relevant literature on the impact of energy information. Based on this review and expert knowledge, we formulate eight hypotheses to be tested in the experiment. We emphasize that in addition to testing these hypotheses, more in-depth analyses will be conducted, for example to explore differences in energy label effectiveness between countries, product categories, and specific consumer groups.

2.3.1 *The impact of energy-related information*

Extant literature on the influence of energy-related information can be categorized into three streams as shown in Table 2.1.

Table 2.1 Relevant literature on energy labelling

Research stream	Examples		
	Author(s)	*Product category*	*Country*
Research on the importance of energy information (relative to other product attributes such as price and brand) in consumers' purchase decisions	Heinzle (2012)	TVs	Germany
	Sammer & Wüstenhagen (2006)	Washing machines	Switzerland
	Shen & Saijo (2009)	Air conditioners and refrigerators	Shanghai
	Ward et al. (2011)	Refrigerators	US
Research on the influence of framing and display of energy-related information on consumer choice	Heinzle (2012)	TVs	Germany
	Tangari & Smith (2012)	Light bulbs	US
Research providing insight into *how* energy labels work	Thøgersen (2000)		Germany, UK, Ireland, Italy

The first stream of research examines the importance of energy efficiency information relative to information on other product attributes such as price, brand, and product performance in consumers' product choices. By including price as a product attribute in the study, research within this stream has provided estimates of consumers' willingness to pay for increases in energy efficiency (Sammer & Wüstenhagen, 2006; Shen & Saijo, 2009; Ward et al. 2011). The studies generally show that consumers are willing to pay a price premium for a product with a higher energy efficiency class, and that the price premium that they are willing to pay is higher for appliances that they use more frequently. This willingness to pay is motivated by environmental concern as well as individual benefits in the form of energy cost savings (Ward et al. 2011).

The second stream of research investigates the influence of the framing and display of energy-related information on consumer choice (Heinzle, 2012; Tangari & Smith 2012). These studies examine heuristics and biases in the interpretation and evaluation of energy-related information and their consequences for sustainable buying behaviour. For example, the compatibility principle (Slovic et al. 1990) posits that when the input is available (e.g., information on energy savings per year) and the output that the consumer wants to have (e.g., assessment of the amount of money saved) are incompatible with each other, people find it difficult to transform the information to make it compatible, and therefore are likely to inaccurately use the information in their choice process. Heinzle (2012) shows that presenting energy-related information in terms of money (energy operating costs) rather than energy-units (watts) increases the ease of interpretation, which in turn increases the likelihood that the information is being used in the decision-making process. Another well-known bias in consumer decision-making is the tendency to undervalue future costs and benefits, which is known as hyperbolic discounting (Laibson, 1997). Energy efficient products typically have a higher purchase price than less energy efficient alternatives. Thus, consumers have to incur extra costs now in order to reap future benefits, but the relatively high upfront costs may become a key obstacle for consumers preventing them from purchasing energy efficient products. The time frame in which the information is presented may influence how consumers value future benefits relative to purchase price. For example, Heinzle (2012) finds that presenting lifetime energy operating costs (e.g., €180 for TV set A vs. €340 for TV set B; expected lifetime is 10 years) is more effective in stimulating energy efficient product choices than presenting annual energy operating costs (e.g., €18 for TV set A vs. €34 for TV set B), because differences between low and

high energy efficient products loom much larger in the first case. Tangari and Smith (2012) show that this effect of temporal framing is mediated by perceptions of cost savings, and that it is stronger for future-oriented than for present-oriented consumers.

A third and smaller research stream provides insight into how and why energy labels work, that is, into the underlying psychological processes and potential barriers (e.g., Thøgersen, 2000). Yet, this stream heavily relies on general theories and a much broader literature on consumer information processing and decision-making. For energy labels to influence purchase decisions, (1) the labels must be noticed, (2) their meaning must be comprehended, (3) their information must be trusted, and (4) the consumer must believe that the label helps to attain some goal, such as protecting the environment or cost savings (Thøgersen, 2000).

Accessibility-diagnosticity framework

The next section describes our predictions regarding the effectiveness of energy efficiency information in general and energy labels in particular. It relies on the accessibility-diagnosticity framework (Feldman & Lynch, 1988), which posits that for a piece of information to be used in judgment or decision-making, the information has to be accessible and diagnostic. In other words, for energy efficiency information to be effective in encouraging sustainable choices, the information needs to be (1) **available** (2) considered **informative** or relevant for the decision at hand. Availability of information does not only relate to the physical presence of information, but also to the salience of the information, which is influenced by the way in which the information is displayed (e.g., by the size, position, or contrast with background). Informativeness or relevance of information relates to the way in which the information is interpreted and weighed in the decision-making process, and is influenced by the specific content of the information. In the next section, we formulate hypotheses about how specific changes to the **display** (i.e., presence and salience) and **content** of information influence consumers' energy efficient product choices.

2.3.2 Predictions

Preferences are often conducted on the spot rather than merely revealed, hence choices are often contingent on what and how information is presented. First, consumers tend to make choices based on the information that is readily available to them (Bettman, Luce, & Payne, 1998). Research has shown that if energy information is present, consumers take this information into account and are generally willing to pay a price premium for more energy efficient products (Sammer & Wüstenhagen, 2006; Shen & Saijo, 2009; Ward et al. 2011). If energy-related information is not present, consumers are less likely to search for it and use it. Therefore, we test the very straightforward prediction that consumers are more likely to choose energy efficient products if energy information is present compared to when it is absent.

> ***Hypothesis 1 (information effect)***: Consumers are more likely to choose energy efficient products if energy information is present compared to absent.

Second, if present, energy information is unlikely to be effective in promoting energy efficient product choices if the information is not attended to. A large body of literature has studied the role of visual attention in decision-making. For example, research has shown that information size, salience, position, and order of information have a strong impact on consumer choice via their effects on attention (e.g., Bagchi & Davis, 2012; Bettman et al., 1998; Bialkova & van Trijp, 2010; Hibbard & Peters, 2003; Shun & Yunjie, 2006). Thus, the more visually prominent energy information is displayed on the website (e.g., large, salient, first, at the top), the higher the probability that energy efficiency is being used in the decision-making process.

The prominence of energy information differs between the stages in the two-step decision-making process which is facilitated by most web stores. In the first stage, a relatively large number of product alternatives are described on just a few key attributes including brand and price. Here, energy efficiency information competes with relatively little other information, which makes it more likely that the information is being noticed and used in decision-making. In the second stage, a relatively small number of product alternatives (typically a maximum of four) are described on many attributes (typically more than ten). Here, energy efficiency information competes with a greater amount of other information, which may reduce the importance weight of this information in consumer choice.

> ***Hypothesis 2 (decision-stage effect)***: Energy information has a stronger impact on choices in the consideration set formation stage than in the final choice stage.

Energy labels

Energy efficiency information also becomes more visually salient if it is presented in the form of a label rather than in the same style (font, size, etc.) as other product information. In the present study, we examine the effectiveness of energy labels as a way to make energy information more visible.

Another reason why energy efficiency information may have a greater impact on consumers' product choices if it is displayed in the form of a label rather than non-prominently among other product information is that it influences consumers' perceptions of the source of the information.

Many studies find that labels provided by public and other independent sources are trusted more than information provided by manufacturers or retailers (MacKenzie, 1991; Thøgersen, 2000). Information in energy labels is therefore more likely to be trusted, particularly if consumers encounter the labels in various shopping environments and get more familiar with them.

> ***Hypothesis 3 (label effect)***: Consumers are more likely to choose energy efficient products if energy information stands out from other product information (through a label) compared to when it does not.

So far, we have formulated hypotheses about the general impact of energy efficiency information and the added value of energy labels over non-prominent energy efficiency information. Although these are important issues, the main goal of this study is to provide insight into the optimal design of the energy label: what should it look like?

Online display of energy labels

A key challenge in online retailing is to provide information in an optimal way given limited space. While online product assortments are often very large, computer screens are relatively small (and tablet and smartphone screens are even smaller), which forces retailers to think carefully about the content and display of information online. In their efforts to attract consumers, online retailers strive to provide complete product information, but consumers are put off by cluttered web sites and more likely to immediately leave the page (Clark 2002). Furthermore, research has generally shown an inverted U-shaped relation between the amount of information and choice quality (Lee & Lee, 2004). In other words, there is a point where more information is harmful rather than helpful (Gigerenzer & Gaissmaier, 2011).

The current energy label is originally designed for offline shopping environments. In addition to informing consumers about the product's energy efficiency class, the label shows the scale range (e.g., from A+++ to D) and also provides other energy-related information (such as the product's annual energy consumption in watts) as well as relevant performance-related features (such as the

screen size of a television). While the full label may be effective in offline consumer environments, its size and the amount of information it contains make this label less suitable for online settings where limited space is available and consumers quickly become overloaded with information. A smaller version of the energy label that contains only the most relevant information related to energy efficiency is expected to outperform the full label in online settings.

> ***Hypothesis 4 (reduced label effect)***: Consumers are more likely to choose energy efficient products if energy information is displayed online in reduced as compared to full label form.

The question then is what such a reduced label should look like. Which information is vital and which information that the current full label contains can be omitted without negative consequences for the effectiveness of the label? Performance-related information that is part of the current full energy label is usually already part of the product information that is presented in online stores. For example, the screen size of a television, the volume of a refrigerator, and the loading capacity of a washing machine are key features of these products and logically part of online product information. The most relevant information in the label seems to be the energy efficiency class of the product. The currently proposed reduced version of the energy label shows the energy efficiency class in a coloured arrow in one of two orientations (see p.8). While the full energy label would be seen upon rolling the mouse over the reduced label, in our study we focus on the reduced label because this is the piece of information that is immediately visible. Based on information processing theory, we argue that two specific pieces of information are missing in the reduced version of the label, which may cause the label not to reach its full potential in promoting energy efficient product choices: (1) meaning and (2) a frame of reference.

Meaning

If consumers are not familiar with the EU energy label, seeing only an “A” or “C” or “A+++” does not have any meaning to them and is unlikely to influence their product choice. Thus, one way to improve the reduced “class-only” label is to add appropriate meaning. We predict that providing information on what the label stands for – “energy efficiency” or even “energy” – will enhance label effectiveness because it improves the comprehensibility of information.

In this study, we examine two ways in which meaning can be added to the reduced energy label: textually (“energy”) and visually (by using a pictogram). Research supports the idea that visual communication can be more powerful than verbal communication, suggesting in many instances that people learn and remember information that is presented visually to them better than information that is presented verbally (Shepard, 1967; McBride & Dosher, 2002). Well-designed pictograms attract attention and their meaning is rapidly and accurately comprehended by the target group (Davies et al. 1998; Houts et al. 2006). They are particularly useful in situations where verbal communication is difficult (e.g., due to poor reading skills of the target group) or when the message needs to be communicated fast (e.g., road signs, safety warnings). Yet, very few pictograms are universally understood. Concrete (representational) pictograms which directly relate to the concept they represent are easier to comprehend than abstract pictograms; in the latter case the pictogram-concept relationship needs to be learned (Wogalter et al. 2006). Furthermore, familiarity with the pictogram improves comprehension (Davies et al. 1998). Therefore, it may take quite some time for a pictogram to reach its maximum effectiveness.

> ***Hypothesis 5 (Meaning effect)***: Adding textual or visual meaning to the reduced (class-only) energy efficiency label increases its effectiveness.

However, if no meaning is attached to the label, consumers might also misinterpret the energy efficiency class as some “overall” product evaluation (e.g., a product with A+ rating is generally

"better" than a product with B rating). In that case, the energy label may have a – positive! – impact on consumers' product choices, but for the wrong reason. Interestingly, if consumers indeed misinterpret the energy efficiency class as an overall product evaluation, adding appropriate meaning to the label might reduce rather than increase its effectiveness in promoting energy efficient product choices.

Frame of reference

Adding meaning alone may not be enough. Hsee (1996) distinguishes between easy-to-evaluate and hard-to-evaluate product attributes. Easy-to-evaluate attributes can be independently assessed by a consumer without the need to compare it to something else. In that case, consumers know how good a given value is, for example because they have good knowledge about the possible range of values (e.g., whether or not a washing machines has a time left indicator) or because the goodness of a value depends on personal preferences or needs (e.g., the dimensions of a refrigerator). In contrast, hard-to-evaluate attributes are difficult to assess without having a frame of reference. Whether an attribute is easy or hard to evaluate depends on consumers' knowledge, but the noise level (in dB) of a washing machine, the cooling space (in litres) of a refrigerator, the average lifetime of a light bulb, and the motion rate (in Hz) of a television are general examples of hard-to-evaluate attributes. These attributes become easier to evaluate when consumers are able to compare values across multiple products (i.e., in *joint evaluation*; Hsee 1996) or when they gain knowledge about the range of possible or common values in some other way.

The energy efficiency class of a product (e.g. "B" or "A++") is in itself hard-to-evaluate and meaningless to consumers who are not familiar with the scale. This may pose serious problems for the class-only label which – even with textual or visual meaning attached to it – is relatively difficult to evaluate because it lacks information about the scale range. Having a frame of reference for an attribute rather than merely its absolute value increases the evaluability of the attribute and hence the probability that it will be used in decision-making. Therefore, we predict that adding a frame of reference to the energy label (e.g. by using "ABCDEFG" rather than just "B" to represent a product with energy efficiency class B) increases the comprehensibility and comparability of the energy efficiency class, which further enhances the effectiveness of the label. We further predict that the effect of adding a frame of reference will be stronger in the final choice stage than in the consideration set formation stage. When consumers are exposed to many different products, as is the case in the consideration set formation stage, knowledge about the scale range of a given attribute can be acquired through the examination of attribute values of the different products. In that case, adding a frame of reference to the energy label itself contributes less.

> ***Hypothesis 6 (Frame of reference effect)***: Adding a frame of reference to the reduced (class-only) label increases its effectiveness, particularly in the final choice stage.

Product position

Decision-making is affected by the position of the product alternatives on the screen (Diehl 2005). Consumers have lay theories about the position of product alternatives in an assortment (Valenzuela & Raghubir, 2009). They may believe that products presented at the top of the list are more popular and better value-for-money, for example. As a result, products presented first will have a higher choice probability independent of their features. This implies that presenting energy efficient alternatives first (e.g., by sorting products on energy efficiency from high to low as the default sorting mechanism) may be effective in promoting more energy efficient product choices. The order in which products are displayed is likely to have a larger impact on choices when there are many as opposed to only few product alternatives to compare. Therefore, we predict the order effect to be present in the consideration set formation stage, but not in the final choice stage.

Hypothesis 7 (Order effect): Consumers are more likely to choose energy efficient products if these are presented at the top of the web page compared to at the bottom of the web page, particularly when they are exposed to many product alternatives (in the consideration set formation stage).

The hypotheses formulated above predict how changes to the **display** (i.e., presence and salience) and **content** of information impact consumers' product choices. More specifically, hypotheses 1 (information effect), 2 (decision-stage effect), 3 (label effect), 4 (reduced label effect) and 7 (order effect) relate to the way in which energy-related information is displayed, while 5 (meaning effect) and 6 (frame of reference effect) relate to the specific content of the information.

Consumer groups

The effectiveness of energy information in general and energy labels in particular is likely to depend on specific consumer characteristics. Even if consumers attend to and accurately interpret the energy information that is presented to them, that information may not influence their product choices if they do not place as much importance on energy efficiency as on other product attributes. This suggests that the impact of energy efficiency information should be stronger for consumers who have the intention to buy an energy efficient alternative than for consumers who do not have that intention. Based on the theory of planned behaviour, this should hold for consumers (1) who have positive rather than negative attitudes towards buying energy efficient products, (2) who feel strong rather than weak social pressure to buy energy efficient products, and (3) who experience high rather than low control over their behaviour (e.g., consumers who do not face budget constraints).

On the other hand, consumers who are motivated to buy energy efficient products are more likely to actively search for this information and are more likely to be familiar with the energy efficiency scale. For these consumers, adding meaning and/or a frame of reference to the class-only label may not contribute to more energy efficient product choices, because they will be able to accurately interpret the class-only label because of their high a priori knowledge. In fact, non-prominent energy information (that is, information about the energy efficiency class in the same font and size as other product information) may be equally effective as a visually prominent energy label, because highly motivated consumers will search for and use the information even if it is difficult to find and/or process.

Together, we predict that, compared to a condition in which *no information* on energy efficiency is provided, provision of energy efficiency information will be lead to more energy efficient product choices for consumers with positive attitudes towards buying energy efficient products, and/or who experience high social pressure and high behavioural control. However, the added value of a prominent energy label over non-prominent energy information is expected to be greater for consumers with less positive attitudes towards buying energy efficient products, and/or who experience low social pressure and low behavioural control.

Hypothesis 8 (Consumer groups):

H8a: The information effect is stronger for consumers who:

1) have relatively positive attitudes towards energy efficient household products (i.e. consumers with high self-reported importance of energy efficiency and favourable beliefs about energy efficient products)
2) experience high social pressure towards buying energy efficient household products (social norms)
3) have high perceived control over their sustainable behaviour (i.e. low personal barriers and high perceived efficacy)

H8b: The label effect is stronger for consumers who:

1) have relatively negative attitudes towards energy efficient household products (i.e. consumers with low self-reported importance of energy efficiency and unfavourable beliefs about energy efficient products)
2) experience low social pressure towards buying energy efficient household products (norms)
3) have low perceived control over their sustainable behaviour (i.e. high personal barriers and low perceived efficacy)

Comprehension difficulty and choice difficulty

In addition to examining the impact of energy information on product choices, we explore how different label formats influence comprehension difficulty and choice difficulty. We have no a priori predictions about how different energy label variants might influence these measures differently. Anyhow, the energy information should not *increase* comprehension difficulty or choice difficulty.

3 Detailed methodology

The study consists of two main parts: a controlled experiment (which takes about 15 minutes to complete) and a post-experiment questionnaire (which takes about 10 minutes). This chapter describes the experimental methodology in detail. Section 3.1 - 3.4 sets out the experimental design, and shows how the experimental manipulations relate to the hypotheses as formulated in Chapter 2. The post-experiment questionnaire is described in section 3.5.

3.1 General experimental approach

The experimental study aims to:

1) Examine whether changes to the "class-only" energy label increase its effectiveness.
2) Compare the performance of reduced energy label variants with the performance of the full energy label.
3) compare the influence of energy label variants in each of the two decision-making stages, that is, on consideration set formation and on final choice.

The experiment is framed as a simulated shopping trip in which respondents visit four (mock-up) web stores. They make fictive purchases in four product categories: refrigerators, televisions, washing machines and light bulbs, in that order. The experiment simulates the two stages of the decision process, by splitting the experiment in two subexperiments:

1. **Consideration experiment**
   In the consideration experiment, respondents are confronted with a relatively large assortment of products for each product category and they are asked to select (a maximum of) six products that they would seriously consider and about which they would like to receive more information if you were looking today for such a product (e.g., a refrigerator with a freezer compartment).
2. **Choice experiment**
   In the choice experiment, respondents are presented with four products for each product category, presented in a layout that allows to compare the products in detail, as is typically possible in an online shop. The respondents are asked to select the product (e.g., the refrigerator) that they would prefer to buy.

Respondents are randomly assigned to one of the two subexperiments. The mock-up web stores look like real web stores, but are presented as static images. The specific content and display of energy-related information differs between groups of respondents (see Table 3.2).

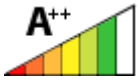
3.2 Energy label variants

The current EU energy label has three elements: (1) energy efficiency rating (i.e., a black arrow with the efficiency class), (2) energy efficiency scale (e.g., from A [green] to G [red], or from A+++ [green] to D [red], depending on the product class), and (3) absolute information about the product's annual energy consumption and additional performance indicators (e.g., the screen size of a television). The full energy label is rarely shown for products in the online environment. Rather, if anything, only the energy efficiency class is presented, and often only after the product has been clicked on first (i.e., in the detailed product page or a comparison of several products in detail on the same page). However, the new legislation that has been proposed dictates that a reduced version of the energy label must be displayed on screen at first (and subsequent) presentation of

product price information. The reduced version of the energy label shows the energy efficiency class in a coloured arrow in one of two orientations, and when a mouse is rolled over the arrow, the full energy label is displayed (as shown on p.16-17).[10]

The question is how, given limited online space, that reduced ("class-only") label can be optimized to stimulate energy-efficient product choices, given that this is the piece of information seen directly. Furthermore, it is interesting to examine whether such a reduced label can actually outperform the original full label in terms of promoting energy-efficient choices. Based on existing theory and expert knowledge, we designed three reduced label variants of the class-only label (Table 3.1).

Table 3.1 Reduced label variants

Label 1: Class-only label	Label 2: Meaning*	Label 3: Frame of reference (FoR)	Label 4: Meaning + FoR
			

"Energy" is written in the language of the specific country.

We test the effectiveness of these four label variants in the consideration as well as the choice experiment. Furthermore, we add the following three "control" conditions to the experimental design:

1. **No energy-related information presented**. This is the control condition in the consideration experiment. It enables us to assess base-line attractiveness of the product alternatives in the set.
2. **Non-prominent energy-related information**. This is a control condition in the choice experiment. Here, the product's energy class is displayed in the same font and size as other product information.
3. **Full energy label**. This is a control condition in the choice experiment. The full label condition is included to examine whether reduced label variants can actually outperform the full label in promoting energy-efficient product choices. (Note that this provides insight into the added value of a mouse roll-over to the full label).

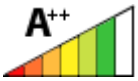
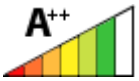
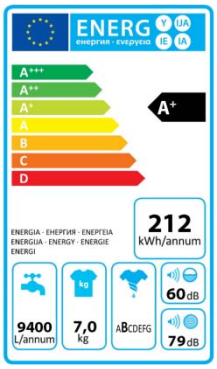
The first two control conditions reflect the current typical situation in online retailing. That is, web stores usually provide energy efficiency information in plain text (similar to other product information) in the second step, on the page with detailed product information on a single or a few products that are selected for comparison. Most web stores do not immediately provide energy efficiency information in the first step, when the full product assortment is shown. In the first step, product images are usually presented with a very limited amount of product information, such as brand and price information, which often does not include energy efficiency information.[11] The third control condition – the full energy label – is added to examine whether reduced labels can actually outperform the full label in terms of promoting energy efficient product choices. Because of the size of the full label and the limited space retailers have to deal with to present their products, it would be impossible in reality to show full energy labels for all products simultaneously on the first page. Therefore, the full label control condition is only included in the choice experiment where only four products are presented and there is more information space available per product.

[10] http://www.eceee.org/ecodesign/Energy_labelling_directive/Energy_Labelling_online_labelling

[11] When analyzing the results, it should be taken into account that the consideration and choice experiment have different control conditions. We have chosen to include control conditions that mimic the current typical situation.

In total, there are 11 energy information conditions (five in the consideration experiment and six in the choice experiment). Table 3.2 provides an overview of all experimental conditions.

Table 3.2 Overview of experimental conditions

Consideration set formation experiment			Final choice experiment		
Co_0	No information (control)		Ch_0	Non-prominent rating-only information (control)	A++
Co_1	Class-only		Ch_1	Class-only	
Co_2	Meaning		Ch_2	Meaning	
Co_3	Frame of reference (FoR)		Ch_3	Frame of reference (FoR)	
Co_4	Meaning + FoR		Ch_4	Meaning + FoR	
			Ch_5	Full label	

The energy label variants are varied between-subjects. Respondents are randomly assigned to one of the 11 conditions. They are exposed to only one of the energy label variants throughout the experiment, that is, for each of the four purchase situations, to avoid hypothesis-guessing. Because the set of product alternatives is the same for each of the energy label conditions, differences in the preference structure between the conditions can be traced back to the specific energy label.

3.3 Consideration set formation versus final choice

In each country, about 455 respondents (5/11*1000) perform four consideration tasks (refrigerators, TVs, washing machines, and light bulbs) and about 545 respondents (6/11*1000) perform four choice tasks (same product categories).

In order to have full control the information that is presented in the second stage of the decision process where consumers make a final choice from a reduced set of alternatives, we separate the two stages and present them as different experiments with different respondent samples. Thus, the product alternatives shown in the choice experiment are not contingent on respondents' choices in the consideration experiment. The advantage is that each respondent makes a final choice from the same consideration set. This enables us to assess the differential effects of energy label variants in a highly controlled way, minimizing the influence of extraneous factors. The disadvantage is that it

becomes harder to compare the influence of the energy label variants at different stages in the decision-making process in a realistic manner. In reality, if energy efficiency information exerts a strong influence on consumers' choices during consideration set formation, this would automatically mitigate the impact of energy information in the final choice stage, because the consideration set will then only contain products with high energy efficiency. In the present study, the "imposed" consideration sets always contain high as well as low energy efficiency products, which maximizes the potential effectiveness of energy information in this stage. It should thus be noted that the study will enable us to compare the influence of the same energy label variants at different stages in the decision-making process *given* that the products vary in energy efficiency. If energy information turns out to have a strong impact in consideration set formation, its impact on final choice is likely to be overestimated and should be interpreted with caution.

Hypothesis testing

The experimental manipulations in Table 3.1 enable us to test:

- Hypothesis 1: Information effect
- Hypothesis 2: Decision-stage effect
- Hypothesis 3: Label effect
- Hypothesis 4: Reduced label effect
- Hypothesis 5: Meaning effect
- Hypothesis 6: Frame of reference effect

3.4 Product selection and website image development

Respondents in the consideration experiment are exposed to an assortment of 12 product alternatives described on four to five attributes: brand, price, one or two performance indicators (such as screen size for televisions and load capacity for washing machines), and energy efficiency. Figure 3.1 provides an example. Respondents in the choice experiment are exposed to four product alternatives described on 12 to 14 relevant attributes, such as brand, price, energy efficiency class, cooling space, freezer space, number of compartments, freezer position, annual energy consumption, noise level, dimensions, weight, and manufacturer guarantee, for refrigerators. Figure 3.2 provides an example. Each respondent is exposed to the same set of product alternatives for a specific product class, but there are two product display orders to control for order effects. More detailed information and examples can be found in Appendix II.

Figure 3.1 Example website in consideration experiment (class-only energy label)

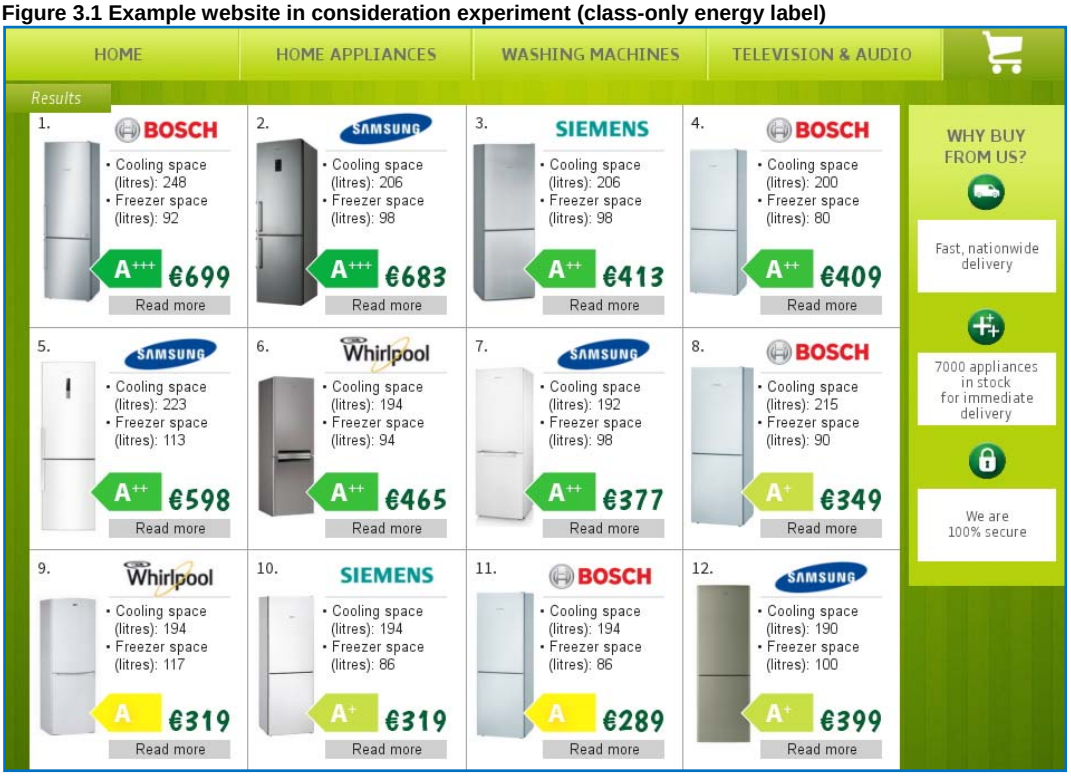
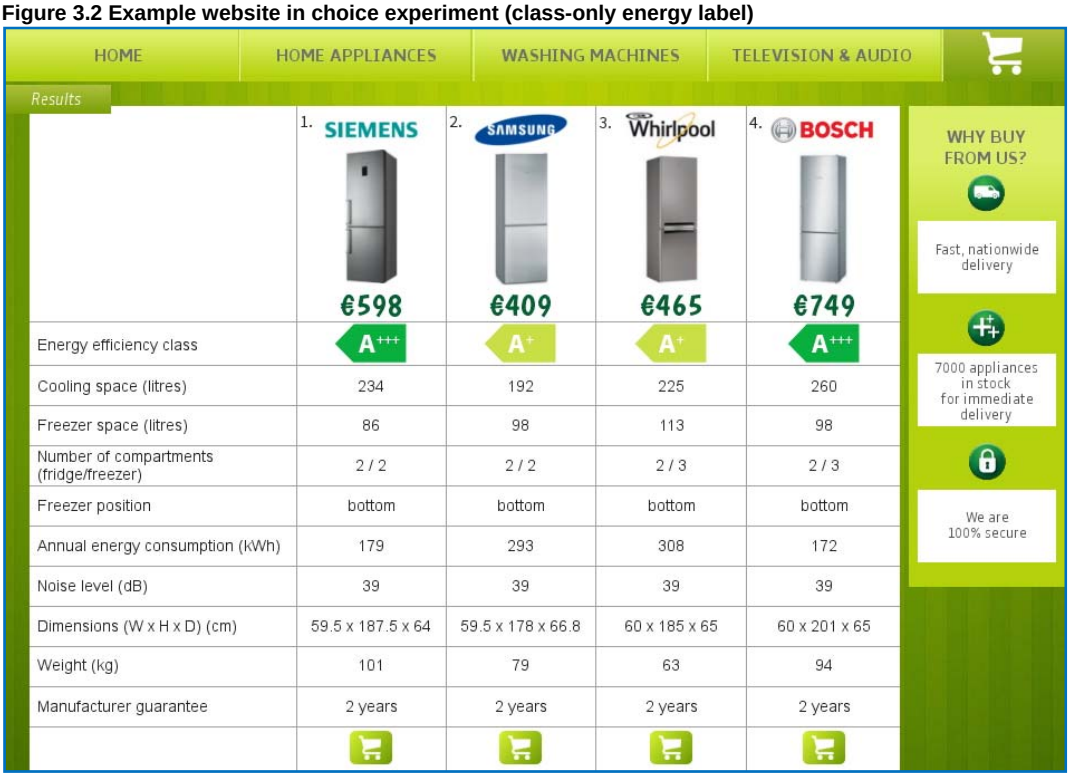


Figure 3.2 Example website in choice experiment (class-only energy label)



Product sets

The alternatives in the product sets satisfy a certain *specific* need, namely:

- “a refrigerator with freezer compartment for your kitchen”;
- “a flat screen television for your living room”;
- “a new washing machine for your laundry room”;
- “a light bulb for your hall”.

The product alternatives are selected such that (1) they are a good reflection of available products and features in the (country-specific) market, and (2) they involve difficult trade-offs between product features (known as “utility balance”; Huber & Zwerina, 1996). The product sets do not contain dominant product alternatives that clearly outperform the other products and will be selected by all respondents. Each set contains (1) low-priced products that score low on energy efficiency and low on performance/quality, (2) medium-priced products that score low on energy efficiency and high on performance/quality or vice versa, and (3) high-priced products that score high on energy efficiency and high on performance/quality. Thus, the products in a set are assumed to be of comparable utility given the specific purchase goal.

Energy efficiency levels

Available energy efficiency classes vary across product categories. For washing machines and refrigerators, the energy efficiency scale runs from A+++ to D, whereas for light bulbs the scale runs from A++ to E. The television category is a special case. Here, the current standard is a scale that runs from A+ to F, but there are already A++ televisions available which carry labels with a scale that runs from A++ to E. For the current study, this would mean that both A++ and A+ televisions should be displayed with the same dark green coloured arrow. Because this might confuse respondents and undermine the effectiveness of the label, we have used the A++ to E scale – which will become the new standard in the near-future – for all televisions in the product set.

Energy efficiency levels of the products in the consideration experiment are selected after desk research, and mimic (more or less) the actual distribution of energy efficiency levels in the specific market (see Table 3.3). In the choice experiment, each product set contains two products with relatively low energy efficiency and two products with relatively high energy efficiency. The energy efficiency classes used vary across product categories, but the difference between high and low energy efficiency products within a set is always two classes (see Table 3.4).

Table 3.3 Energy efficiency classes of products in the consideration experiment

	Energy efficiency score	Number of products			
		Washing machines	Refrigerators	Televisions	Light bulbs
A+++	*7*	5	2	-	-
A++	*6*	4	5	2	0
A+	*5*	2	3	4	0
A	*4*	1	2	3	8
B	*3*	0	0	2	0
C	*2*	0	0	1	2
D	*1*	0	0	0	2
E	*0*	-	-	0	0
F	*0*	-	-	-	-
Avg. energy efficiency level of product set		7.08	6.58	5.33	4.17

Table 3.4 Energy efficiency classes of products in the choice experiment

	Energy efficiency Score	Number of products			
		Washing machines	Refrigerators	Televisions	Light bulbs
A+++	*7*	2	2	-	-
A++	*6*	0	0	2	0
A+	*5*	2	2	0	0
A	*4*	0	0	2	2
B	*3*	0	0	0	0
C	*2*	0	0	0	2
D	*1*	0	0	0	0
E	*0*	-	-	0	0
F	*0*	-	-	-	-
Avg. energy efficiency level of product set		7	7	6	4

In the consideration experiment, the average price increase for a one-unit increase in energy efficiency is €194 for washing machines, €129 for refrigerators, €138 for televisions, and €3,38 for light bulbs. In the choice experiment, the average price increase for a one-unit increase in energy efficiency is €118 for washing machines, €126 for refrigerators, €69 for televisions, and €5,35 for light bulbs. Note that these price changes are not independent of changes in other product attributes.

Controlling for potential confounds: order and brand effects

We control for order effects in both subexperiments by using two different order conditions (see Figure 3.3) and randomly assigning respondents to these conditions. The main aim of the order manipulation is to control for potential order effects, that is, to make sure that responses are not driven by the specific (single) order in which the products are displayed. However, in the consideration experiment, differences in responses between the two order conditions are informative as well, for the following reason. In the consideration experiment, respondents are exposed to a relatively large number of products with relatively high variability in energy efficiency classes. By design, energy efficiency levels of products presented at the top of the web page (first row of products) differ from the energy efficiency levels of products presented at the bottom of the web page (last row).[12] This allows us to test hypothesis 7, which predicts that consumers are more likely to choose energy efficient products if they are presented at the top compared to the bottom of the web page. In contrast, in the choice experiment, we only use products with two different levels of energy efficiency (e.g., Product 1 = A+, Product 2 = A+++, Product 3 = A+++, Product 4 = A+). As a result, energy efficiency levels of products presented first (first two products) are generally similar to the energy efficiency levels of products presented last (last two products). It should be noted, therefore, that examining differences in responses to the different order conditions (i.e., the "order effect") in the choice experiment does not constitute a proper test of hypothesis 7.

[12] For product display order 1, the energy efficiency of products presented at the top of the web page was higher, on average, than the energy efficiency of products presented at the bottom of the page. For display order 2, the energy efficiency of products presented at the top of the web page was lower, on average, than the energy efficiency of products presented at the bottom of the page. See table below.

Product display order:	Products at the:	Avg. energy efficiency level	Avg. number of most efficient products	Avg. number of (2nd) most efficient products	Avg. number of least efficient products	Avg. number of (2nd) least efficient products
1	top	5.25	2.50	3.00	0.25	0.50
	bottom	4.19	0.75	2.00	1.25	2.50
2	top	4.56	0.75	2.50	0.50	1.75
	bottom	4.88	1.25	3.00	0.25	0.75

Hypothesis testing

The product order manipulation enables us to test (albeit with caution[13]) hypothesis 7 (order effect) in the consideration experiment.

Note that potential confounding effects of the brands used in this study are ruled out by design. Product information (including the brands) is kept constant across the conditions of the experimental design. That is, each respondent (in a subexperiment) is exposed to the *exact same* product information; only the specific energy label used varies between respondents. Since respondents are randomly assigned to the experimental conditions, ensuring that responses come from comparable groups, any differences in product choices that we observe can be attributed to the energy labels, and not to the brands.

Using real brands in this study would only be problematic if a certain brand is so popular that all respondents (in a specific country, for example) choose the same brand. Although highly unlikely, this might happen in the choice experiment where only four product alternatives are shown. To mitigate this risk, we have not only varied product order but also brand names in the website images of the choice experiment (see Figure 3.3). Note, in Figure 3.3, how the same brand (e.g. Siemens) is paired with different product information in order condition 1 and 2. This reduces the probability that the specific brand is a dominant option in both conditions.

Table 3.5 Controlling for order and brand effects

Order 1	Order 2
	

Country-specific differences

Extensive desk research was conducted to examine if the product sets required country-specific adaptations. Differences between countries in terms of major brands, prices and other product attributes for the selected product categories turned out to be surprisingly small. Therefore, ensuring optimal comparability of outcomes across countries, we have used the same product sets (with the same product information) in each country, with two exceptions:

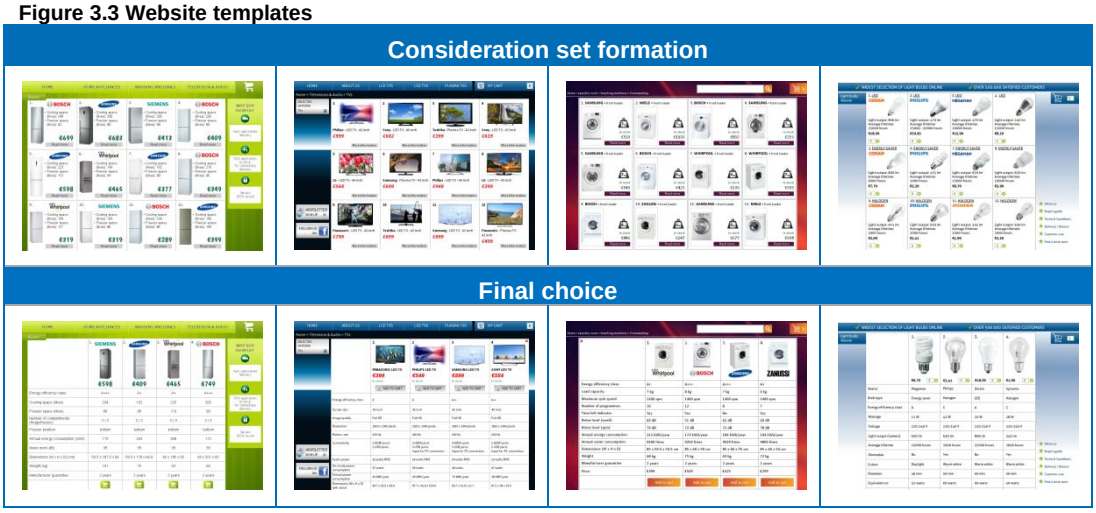
[13] A significant order effect should be interpreted with caution. Order effects may also be observed as a result of low respondent involvement or fatigue rather than position-based beliefs. These are common problems in online surveys and difficult to completely rule out.

1. Poland (złoty), Romania (leu), and Sweden (krona) have non-Euro prices. We have (1) converted Euro prices into the currencies of these countries (e.g., €359 is 1509zł), and (2) used rounding that is common in the specific country (e.g., 1509zł is changed into 1499zł);
2. Product prices for washing machines and refrigerators are substantially higher in Sweden than in the other countries. Washing machine prices were increased with 15% (of the average price), and refrigerator prices were increased with 25% (of the average price) to reflect actual price ranges in Sweden.

Website image development

The stimuli used in the experiment are static website images. The images were developed by the TiU team in Photoshop to look like real web stores. First, four website templates were created for each of the two subexperiments (consideration and choice; Figure 3.3), and for each of the ten countries. Five energy label variants were developed (class-only, meaning, frame of reference, meaning + frame of reference, full label) and inserted in the website images to create the full set of images. The energy label was the only element that varied across the images of a particular product category: everything else was kept constant. In total, 880 website images were created: 11 (energy label conditions) x 2 (product display orders) x 4 (product categories) x 10 (countries).

Figure 3.3 Website templates



3.5 Procedure and measures

The experimental procedure is as follows. First, respondents answer several screening questions related to Internet usage and socio-demographic characteristics (gender, age, and region). Based on the answers to these questions, respondents are selected to take part in the experiment.

The experiment starts with an introduction. Respondents are informed that they are going to visit four online stores and asked to imagine that they are planning to make purchases in each of these stores. Depending on the subexperiment (consideration or choice), subsequent instructions are as follows:

Consideration

"Online stores often have so many products on offer that not all product information can be shown at once. Therefore, online stores often provide the possibility for you to get more information about products that are of interest to you."

"By clicking on a product, you will obtain more detailed information about that product. Please select the products that you would seriously consider and that you would like to receive more information about in order to make your final choice."

Choice

"Imagine that you have already made a pre-selection from the wide range of products in the online store. There are currently four products that you are seriously considering to buy. Please indicate which of the four products you would choose."

Then, they are exposed to the image of the first web store which sells refrigerators. Respondents in the consideration experiment are asked to indicate which refrigerators "*you would seriously consider and about which you would like to receive more information if you were looking today for a refrigerator with a freezer compartment for your kitchen*". They can select a maximum of six products from the product set. Respondents in the choice experiment are asked to indicate "*which refrigerator you would prefer if you were looking today for a refrigerator with a freezer compartment for your kitchen*". The way energy-related information is presented on the web page varies between-subjects.

After selecting the product(s), respondents indicate on 7-point scales (1) how easy or difficult they found it to make the selection, and (2) how easy or difficult it was to understand the information on the website. Finally, they indicated where they would most likely buy (one of) the product(s) if they would actually plan to do so: in an online store or in a regular store. And, if they were most likely to buy the product in an online store, which device they would most likely use to make the purchase: a PC or laptop, a tablet, or a smartphone.

Then, a new screen appeared and respondents read that they were going to visit the next web store. The procedure is repeated for the remaining three web stores. An detailed overview of the experimental set-up is presented in Appendix II, also containing the exact instructions and measures.

3.6 Post-experiment questionnaire

After the experiment, respondents answer a 10-minute questionnaire. The questionnaire has two main goals, namely:

- To collect relevant background information of consumers for segmentation and filtering purposes.
- To measure factors that can explain differences between consumers in their likelihood to buy energy efficient products.

Next, we will describe the constructs that are measured in the questionnaire. The full questionnaire is in Appendix III. We have used existing valid and reliable scales (or subscales) whenever possible, and adapted them to the context of this specific study if necessary.

Online and offline purchasing and search behaviour (background information)

Consumers differ in their use of online and offline channels. The first part of the questionnaire assesses aspects of consumers' online and offline purchasing behaviour (e.g., frequency, type of products).

Importance of energy efficiency and label familiarity (background information)

In the second part of the questionnaire, respondents are asked to indicate how important several attributes are to them when purchasing washing machines, refrigerators, televisions, and light bulbs, respectively (cf. Gaspar & Antunes, 2011). For each of the product categories, a number of attributes are listed (e.g., price, brand, energy consumption, design, etc.) and respondents are asked to distribute 100 points among them. Then, respondents indicate on a 4-point scale from (1) *not important at all* to (4) *very important* how important energy efficiency is to them when buying household products. Finally, the energy label is shown and respondents are asked whether they have ever seen it before participating in the study.

Note that we measure self-reported importance of product attributes *before* measuring environmental attitudes and sustainability behaviour. If importance would be measured after assessing environmental attitudes, people may report finding energy-related information more important than they actually do because they believe it to be a socially desirable response or due to mere measurement effects.

Sustainability attitudes, subjective norms and perceived control (explanatory factors)

The third part of the questionnaire aims to gain insight into consumers' sustainability attitudes, subjective norms and perceived control. It captures the constructs of the Theory of Planned Behaviour and (most of) the model in Figure 2.3. The scale items used in this part of the questionnaire are adapted from existing scales found in the literature (e.g., Dunlap et al., 1999; Kim & Choi, 2005). Specifically, it measures:

1. **Environmental concern**: five items from the commonly used New Ecological Paradigm (NEP) Scale, e.g. "The earth has plenty of natural resources if we just learn how to develop them".
2. **Product-specific beliefs**: three items, e.g. "It is generally a good idea to choose energy efficient household products".
3. **Descriptive norms**: two items, e.g. "Nowadays it is just normal to take into account the energy efficiency of household products".
4. **Injunctive norms**: one item, "Most of my family and friends expect me to purchase energy efficient products".
5. **Individual psychological barriers**: two items, e.g. "I cannot afford to choose energy efficient products".
6. **Perceived individual efficacy**: one item, "There is not much that I can do about the environment".
7. **Behavioural intentions**: two items, e.g. "When buying a new household product, I intend to purchase an energy efficient alternative".

Sustainability behaviours across various domains (explanatory factors)

The next items tap into respondents' sustainability behaviours in other fields, such as organic foods, not accepting plastic bags, turn off stand-by modes, etc. The scale items, which are adapted from Gaspar & Antunes (2011), present a number of sustainable behaviours across various domains. Respondents then indicate on 5-point scales how often they engage in these different behaviours.

Socio-demographic and other personal information (background information)

Finally, the questionnaire assesses several socio-demographic and other personal characteristics of the respondents, namely:

- education;
- income;
- occupational status;
- household size;
- house ownership.

Note that age, gender, region and level of urbanisation are already measured at the start of the study for screening purposes. Finally, respondents are asked to indicate the device on which they had completed the survey.

Hypothesis testing

By combining data from the experiment and post-experiment questionnaire we can test:

- Hypothesis 8 (consumer groups)

4 Sample description

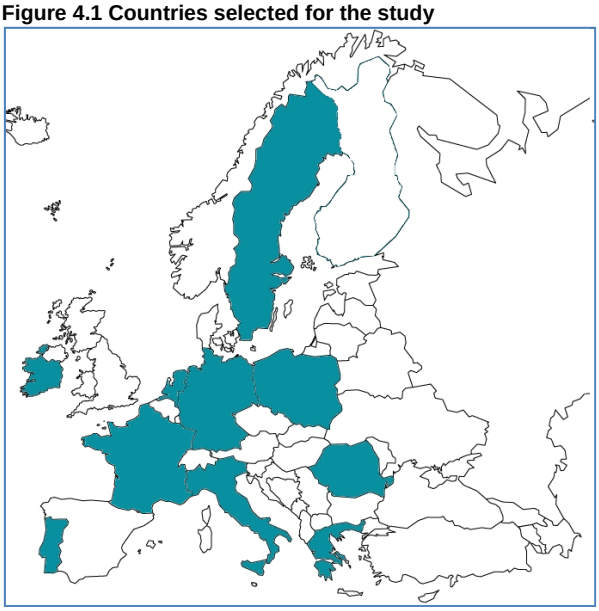
This chapter (1) explains the sampling procedure, including country, respondent and product category selection, and (2) describes the actual sample in terms of response rate and socio-demographic characteristics.

4.1 Sampling

4.1.1 Country selection

We have conducted online surveys in **ten EU member states** which have been selected according to their ability to reflect the EU in terms of region, with countries from Central, Eastern, and Mediterranean Europe, and Scandinavia (see Figure 4.1).

Figure 4.1 Countries selected for the study



The countries selected consists of larger as well as smaller EU-countries. Together they represent 63.5% of the EU's total population (Table 4.1). Relatively large countries are Germany (81.8 million inhabitants, 16.3% of EU-27), France (65.3 million, 13.0%), and Italy (59.4 million, 11.8%). Relatively small countries are Ireland (4.6 million), Sweden (9.5 million), Portugal (10.5 million), and Greece (11.3 million).

Given the content of the study, internet access is an important country characteristic to consider. This will reflect national differences in consumer attitudes and behaviour when searching for information or purchasing online. In countries with low internet penetration, online stores may be less developed and consumers using the internet for online purchasing may be atypical (innovative) compared to the rest of the population. In EU-27, more than two third of the population (67%) had internet access at home in 2011[14]. The countries selected reflect a range of different levels of internet access compared to the EU average (Table 4.2), with three countries with below average internet access (Greece, Portugal, and Romania), three countries with internet access somewhat

[14] European Commission, 2011. E-communications Household Survey. Special Eurobarometer 362.

above average (France, Italy, Poland), and four countries with access far above average (Ireland, Germany, Netherlands, Sweden).

Table 4.1 Population of selected countries

	Country	Population	% of EU-population
1	France	65,327,724	13.0%
2	Germany	81,843,743	16.3%
3	Greece	11,290,067	2.2%
4	Ireland	4,582,769	0.9%
5	Italy	59,394,207	11.8%
6	Netherlands	16,730,348	3.3%
7	Poland	38,538,447	7.7%
8	Portugal	10,542,398	2.1%
9	Romania	21,355,849	4.3%
10	Sweden	9,482,855	1.9%
	EU (27 countries)	502,467,790	Sample countries: 63.5%

Source: Eurostat, 2012.

Table 4.2 Selected countries and internet access

	Country	Internet Access at home	Relative penetration (compared to EU average)
1	France	73%	Above average
2	Germany	81%	Far above average
3	Greece	60%	Below average
4	Ireland	89%	Far above average
5	Italy	70%	Above average
6	Netherlands	92%	Far above average
7	Poland	77%	Above average
8	Portugal	63%	Below average
9	Romania	62%	Below average
10	Sweden	89%	Far above average
	EU (27 countries)	67%	

Source: Eurostat, 2011.

Given the current crisis, economic growth is another relevant country characteristic to consider. Table 4.3 illustrates the economic situation in 2012 by depicting unemployment (under 25 and 25+) and economic growth. Most relevant for consumption patterns is probably consumer confidence (measured with the index of consumers sentiment) (Table 4.4). The overall picture is that the economic situation is relatively good in Germany and Sweden, and relatively weak in Greece, Italy, and Portugal.

Table 4.3 Selected countries and unemployment

	Country	Unemployment		Economic growth
		Age < 25	25-74	
1	France	24,3%	8,7%	0,0%
2	Germany	8,1%	5,2%	0,7%
3	Greece	55,3%	22,2%	-6,4%
4	Ireland	30,4%	12,9%	0,9%
5	Italy	35,3%	8,9%	-2,4%
6	Netherlands	9,5%	4,5%	-1,0%
7	Poland	26,5%	8,5%	1,9%
8	Portugal	37,7%	14%	-3,2%
9	Romania	22,7%	5,6%	0,7%
10	Sweden	23,7%	5,7%	0,7%
	EU (27 countries)	22,8%	9,1%	-0,3%

Source: Eurostat, 2012.

Table 4.4 Selected countries and consumer confidence

	Country	Consumer confidence
1	France	-28.0
2	Germany	-7.6
3	Greece	-71.9
4	Ireland	-16.9
5	Italy	-37.2
6	Netherlands	-21.7
7	Poland	-31.7
8	Portugal	-56.5
9	Romania	-32.0
10	Sweden	3.7
	EU (27 countries)	-12,9

Source: Eurostat, 2013 (January).

4.1.2 Respondent selection

The online survey is administered to samples from GfK's online panels, which are actively managed, leading to highly committed and deeply profiled members. GfK's panels continuously grow and are refreshed using balanced recruitment methods. This ensures that the panels are dynamic in nature and reflect any changes in the population. The panels are deeply profiled to allow to draw nationally representative samples but also to access minorities or specific groups, which are pre-screened using proprietary techniques. The entire participation history of every panellist is registered which, coupled with a flexible panel management software, enables the exclusion of people who have completed any type of survey that one wishes. It is also possible to apply bespoke panel rules if this is required. Respondents will be incentivised as part of their membership of an online panel, where they receive 'points', which can then be converted into shopping vouchers, as reward for taking part in surveys. Through the use of managed panels and incentives, GfK is able to achieve high levels of response and respondents who engage with the survey.

Target population and screening criteria

The target population of the study is members of the general public who are Internet users. Therefore, potential respondents need to have used the Internet within the last 3 months in order to be eligible to take part in the survey. Considering that this survey is using online panel

methodology, respondents are asked a screening question of whether they internet have used the internet for purposes other than online panel research within the past three months. Those who have done so are eligible to take part.

Quota

It is important that the samples which are drawn at random from the GfK Online Panels are also nationally representative. GfK's panels are sufficiently large and consist of panellists from a wide range of socio-demographic backgrounds. Therefore, we are able to provide samples that are representative for the country's online population. Soft quotas have been set on age, gender and region, in order to obtain the opinions of a breadth of respondent types.

Sample size

The size of the respondent sample is important for the reliability of the data. It also needs to be sufficiently large to distinguish subgroups, such as consumers from a range of socio-demographic backgrounds, or with differing experiences of online purchasing. For this reason we aimed to conducted approximately 1000 online interviews in each of the ten countries, making 10,000 online interviews overall.

4.1.3 Product category selection

Each participant is confronted with four purchase situations during the simulated online shopping trip. These purchase situations involve different product categories within the domain of ho8usehold products. We have selected four out of the seven household product categories that currently have energy labels: (1) refrigerators/freezers, (2) washing machines/dryers, (3) dishwashers, (4) air conditioners, (5) TVs, (6) (microwave) ovens, and (7) light bulbs.

Product categories are selected based on the following criteria:

- **High penetration**, to make the product choices in the experiment realistic for a large number of respondents, and make sure that the economic contribution (relevance) of the products tested is considerable.
- **Variation in purchase price** between categories to guarantee that we study both the impact of energy labels on small and large purchases (this may also help us to understand the impact of labels in other industries, such as food or clothing).
- Including **household and non-household goods** and **functional and hedonic products.**

Based on these considerations, we have included the following four product categories in the study:

- **washing machines;**
- **refrigerators** (with freezer compartment);
- **televisions** (flat screen, full HD);
- **light bulbs.**

Penetration

The penetration in the selected countries is high for these product categories. The penetration of air conditioners is low, at least in northern countries, and the penetration of dishwashers is relatively low in less prosperous countries.

Purchase price

For standard washing machines, prices vary between €300 and €1200. Prices increase with increased loading capacity and spinning speed. Refrigerators with freezing compartment cost, strongly depending on size, between about €250 and €1000. Typical flat screen full HD televisions range between €300 and €1000, strongly depending on screen size. Light bulbs are an interesting

product category to include. First, they represent a much smaller purchase amount than the other product categories. Second, energy efficiency and price are strongly dependent on the specific type of bulb, with relatively energy inefficient halogen bulbs being relatively cheap (€3) and relatively efficient LED light bulbs being relatively expensive (up to €40), and saving light bulbs taking a position in between (around €7).

Product type

Finally the product set contains two housekeeping related products (washing machine and refrigerator) and two products which are not housekeeping related (television and light bulb).

4.2 Response

The survey is administered in September 2013 (weeks 37 and 38). In total, 11,764 respondents completed the fieldwork completely (experiment and questionnaire), Box 4.1 provides a description. The vast majority of the respondents completed the survey on a PC or laptop (89.6%). 5.6% completed the survey on a tablet and 4.8% on a smartphone.

Box 4.1 Response description

Gross Sample: 11,780 respondents who have completed the online survey

16 respondents were excluded from the analysis:

- 4 respondents did not provide complete answers in the choice task;
- 7 respondents did not provide complete answers in the consideration set formation task;
- 5 respondents participated in both experiments (because of a programming mistake).

Net Sample: 11,764, number of respondents in analysis:

- 5,847 respondents in consideration experiment;
- 5,917 respondents in choice experiment.

The tables and figures below provide an overview of the response in the different countries. Table 4.5 shows the total response per country, and decomposes by gender. In total 49.4% of the respondent were male and 50.6% female. The percentage of men was lowest in Ireland (44.4%) and highest in Romania (53.6%).

Table 4.5 Response per country and gender

		Total response	Gender	
	Country		Male	Female
1	France	1,259	48.4%	51.6%
2	Germany	1,364	50.4%	49.6%
3	Greece	973	43.8%	56.2%
4	Ireland	1,095	44.4%	55.6%
5	Italy	1,280	52.5%	47.5%
6	Netherlands	1,241	50.6%	49.4%
7	Poland	1,275	50.0%	50.0%
8	Portugal	1,000	49.3%	50.7%
9	Romania	1,057	53.6%	46.4%
10	Sweden	1,220	49.8%	50.2%
	Total	11,764	49.4%	50.6%

The average age of the respondent is 40.1 (*SD* = 12.8). Overall 16.8% of the respondents are between 18-25 years, 23.4% between 26-35, 23.6% between 36-45, 21.5% between 46-55 years, and 14.8% between 56-65 years old. The age distribution per country is depicted in Figure 4.2.

Because especially the oldest age groups are somewhat underrepresented, country-specific weights per age-group and gender are calculated. The weighted sample (representing the internet population) includes 15.5% between 18-25 years, 21.7% between 26-35 years, 22.2% between 36-45 years, 23.7% between 46-55 years and 16.9% between 56-65 years. We will use weighted results when we present descriptive statistics in Chapter 5 (especially sections 5.1-5.3). In general the differences between weighted and unweighted results turned out to be small. Because of this and because of the random assignments of the experimental treatments and the use of advanced models, we will work with unweighted results for the analysis of the experimental data (5.4-5.6).

Figure 4.2 Age distribution

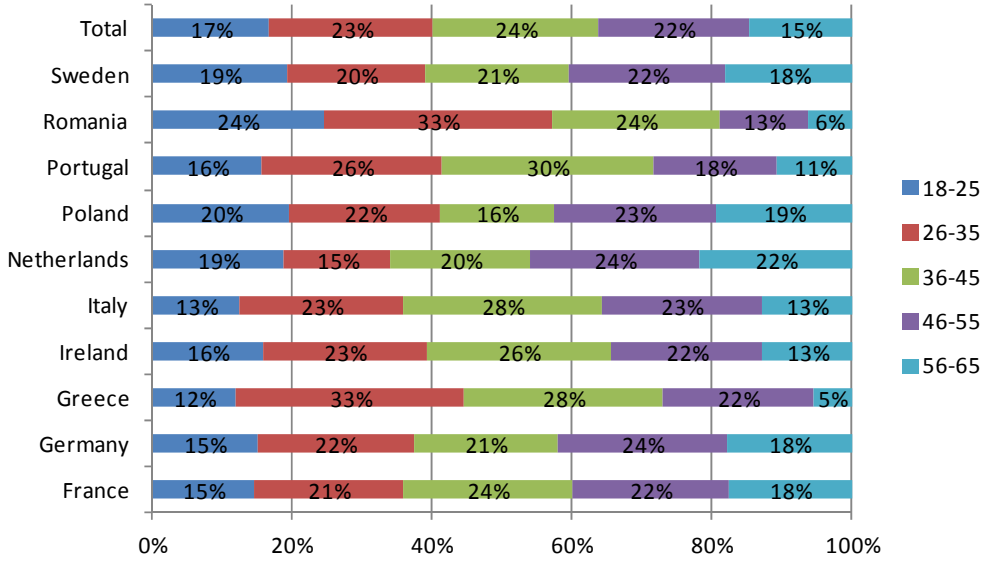
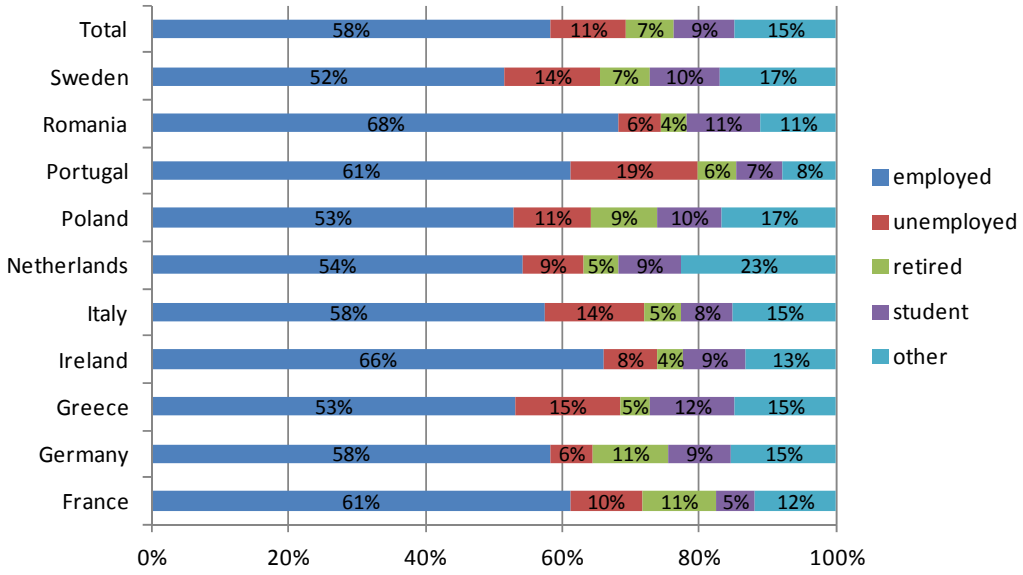


Figure 4.3 shows the occupational status of the sample. Overall, 58.2% is employed either as employee, self-employed or in a family-business. Next, 11.1% is unemployed; the percentage employed is relatively high in Greece (15.2%) and Italy (14.4%). Finally 6.9% is retired, 9.0% is student and 14.8% has another daily occupation (such as homemaker, disabled, etc.).

Figure 4.3 Occupational status



Some other descriptive figures of the sample:

- 15.0% lives in one-person household, whereas the majority (85.0%) of the respondents make part of a more-persons household. The percentage of one-person households is lowest (≤ 10%) in Italy, Portugal, and Romania. The average household size is 2.9 (*SD* = 1.4).
- In terms of education, the sample exists of 11.6% respondents who completed at most the first stage of secondary education, 46.1% completed secondary education, whereas 42.3% completed tertiary education.
- 60.6% of the respondents is house-owner, 39.4% rents or lives in free accommodation.
- Income-information is available for 85.5% of the sample, whereas 14.5% was unable or unwilling to provide this information. For the subsample of which income information is available, 30.9% has a low income (< €900 net per month), 44.0% has a monthly net income between €900 and €1950, and 25.2% has a high income (≥ €1950).
- Roughly one-third (32.5%) of the respondents live in densely populated area, 41.2% in an intermediate density area, and 26.3% in a thinly populated area.

5 Data-analysis

This chapter describes the results of the experiment and survey.

Sections 5.1-5.3 discuss the results of the survey part of the empirical study. Section 5.1 provides background information on the role of the online channel for household products in the EU, and section 5.2 provides information on the importance of energy efficiency in consumers' purchases of household products (based on self-reports). Section 5.3 tests a model of sustainable behaviour based on the theory of planned behaviour, as was developed in Chapter 2 (see Figure 2.2).

Sections 5.4-5.6 provide the experimental results. Section 5.4 examines differences in effectiveness between the energy label variants, and how label effectiveness differs between decision stages and product categories (defined as **result 1** in Chapter 1). Section 5.5 digs deeper into the results and provides the results of statistical models that enable us to test our hypotheses related to the impact of the specific content and display of information in online settings (**hypotheses 1-7**). This enables us not only to show *how* to optimally provide energy-related information, but also *why* this is most optimal (**result 2**) and to what extent the content and display of information may overcome pre-identified barriers to energy efficient product purchasing behaviour (**result 4**). Section 5.6 examines differences in label effectiveness between consumer segments (**hypothesis 8**). It provides insight into how different consumer segments are influenced differently by the content and display of energy-related information (**result 3**).

The chapter concludes with an overview of the key results.

5.1 The role of online channels for household products

Table 5.1 provides information on the use of the online channel for product purchase and search activities. It reveals that the vast majority of the internet population, 90.2%, has made an online purchase in the past year, whereas 9.8% did not make any purchase online. Almost 40% of the consumers made an online purchase at least once per month, 11.5% purchased online biweekly and 5.2% even weekly. Furthermore, 89.5% uses the Internet to search for information before making an offline purchase. Almost half of the internet population (48.3%) does this at least monthly. Overall, almost all internet users (97.6%) used the Internet in the past year for either searching or purchasing products. Online information search before making an offline purchase is very common, but the opposite around occurs as well, although less frequently. Approximately two-third (66.5%) conducted offline search before purchasing online in the past 12 months. About a quarter of the consumers (25.1%) did this at least monthly.

Table 5.1 Use of online channel for purchasing and information search in the past 12 months

	Online purchase	Online search, Offline purchase	Online purchase, offline search
Once every week or more often	5.2%	16.2%	5.8%
Once every two weeks	11.5%	12.5%	6.7%
Once a month	22.9%	19.6%	12.6%
Once every two months	13.4%	10.5%	8.1%
Once every three months	16.4%	12.6%	9.5%
Two times	12.4%	10.9%	11.6%
Once	8.4%	7.2%	12.2%
Never	9.8%	10.5%	33.5%
Total	**100%**	**100%**	**100%**

Table 5.2 provides information on the use of the online and offline retail channel for the different countries. It reveals that more than 90% of the online population in France, Greece, Ireland, Poland, and Sweden engages in online purchasing. Interestingly, in countries for which online purchase percentages are relatively low (e.g. Portugal, Germany, Romania), online information search before offline purchases occurs relatively frequently. Finally, online purchases are preceded by offline search relatively often in Poland (72.8%), but this is relatively uncommon in the Netherlands (47.6%) and Portugal (42.0%).

Table 5.2 Use of online channel in the past 12 months per country

	Total online purchase	Online search, Offline purchase	Online purchase, offline search
France	97.5%	82.7%	69.1%
Germany	84.2%	94.4%	62.2%
Greece	93.9%	91.6%	64.6%
Ireland	94.8%	86.8%	59.0%
Italy	88.6%	84.5%	58.3%
Netherlands	88.9%	83.8%	47.6%
Poland	92.7%	96.4%	72.8%
Portugal	78.1%	93.2%	42.0%
Romania	85.0%	95.3%	61.0%
Sweden	90.2%	87.5%	53.6%
Total	**90.2%**	**89.5%**	**66.5%**

Consumers who made an online purchase in the past year were asked to indicate which devices they used for their purchases (Table 5.3). Almost all consumers used a computer or laptop to purchase online (92.1%). Furthermore, more than one-out-of-ten used their tablet (12.6%) or smartphone (12.2%) to make online purchases. Smartphones are relatively frequently used for online purchases in Ireland (22.0%) and Sweden (16.4%), while tablets are relatively popular in Ireland (23.3%) and the Netherlands (20.2%). The use of tablets and smartphones for online purchases is relatively uncommon in Poland, Romania, Greece, Portugal, and Germany (≤ 10%).

Table 5.3 Device used for online purchasing (multiple answers possible, in % of online purchasers)

	Computer/laptop	Tablet	Smartphone
France	95.2%	12.3%	16.2%
Germany	95.6%	6.8%	8.3%
Greece	95.2%	9.1%	7.2%
Ireland	90.0%	23.3%	22.0%
Italy	92.3%	14.0%	13.4%
Netherlands	86.2%	20.2%	12.8%
Poland	94.8%	5.6%	5.6%
Portugal	94.1%	8.3%	8.5%
Romania	91.6%	8.0%	10.2%
Sweden	86.3%	16.7%	16.4%
Total	**92.1%**	**12.6%**	**12.2%**

Table 5.4 provides information on the importance of price comparison websites. It appears that 85.6% of the population visited a price comparison website in the past 12 months (87.8% of online buyers). About half of the consumers (49.5%) visits price comparison websites at least monthly (51.9% of online buyers) and 15.6% even weekly (16.3% of online buyers).

Table 5.4 Use of price comparison websites

	Total	Online buyers
Once every week or more often	15.6%	16.3%
Once every two weeks	14.5%	15.4%
Once a month	19.4%	20.2%
Once every two months	9.1%	9.5%
Once every three months	11.3%	11.4%
Two times	9.4%	9.1%
Once	6.4%	6.0%
Never	14.4%	12.2%

Table 5.5 illustrates the popularity of the online channel, which is for some products categories at least as important as the offline channel. The relative importance of the channels is best understood by comparing the percentages of online versus offline purchases within one product category (consideration per row). We observe that for three product categories (electric equipment, books, CD's, DVD's, and computer games), the percentage of consumers who made at least one purchase in the past year is higher online as compared to offline. Electric household appliances (the most relevant category for this study) were bought online by 22.8% and offline by 31.0% of the respondents. The offline channel is still relatively dominant for food, clothes, shoes and jewellery, and furniture.

Table 5.5 Channel use per product category: online versus offline

Product category	% of consumers that made a purchase (> €30) in the past year	
	Online	Offline
Electric equipment (incl. computer, phone, camera)	36.9%	33.8%
Clothes, shoes, and jewellery	47.3%	63.4%
Books	30.8%	29.0%
CD's, DVD's, and computer games	24.8%	19.9%
Electrical household appliance	22.8%	31.0%
Furniture	8.6%	21.8%
Sport and outdoor equipment	16.7%	23.8%
Food	11.4%	61.9%

To gain insight into the extent to which consumers use the various devices for the online purchase of *household products* specifically (refrigerators, televisions, washing machines, and light bulbs), we also measured consumers' intended use of channel (online or offline) and device (computer/laptop, tablet, or smartphone) for each purchase situation in the experiment. Overall, in 29% of the situations, respondents reported that they would buy the product online. The intention to buy online was somewhat higher for televisions (31.3%) and light bulbs (31.0%) than for washing machines (27.6%) and refrigerators (24.1%). Of those who intended to purchase online, 90.4% would use a computer or laptop, 6.8% would use a tablet or iPad, and only 2.8% would use a smartphone to make the purchase.

Together, our findings reveal that even though household appliances are bought somewhat more frequently offline than online, the gap is not very large. The online channel plays a substantial role in the sales of household appliances, which emphasizes the importance of optimising energy efficiency information in online settings. The online channel plays an important role for offline buyers as well, for searching and price comparison purposes. Thus, clear and easily recognisable energy efficiency information provided online may also promote more energy-efficient product choices in offline settings as well. Finally, the findings show that a computer/laptop is by far the most preferred device to purchase household products online.

5.2 The role of energy efficiency in purchasing household products

Respondents were asked how important they considered several products attributes including energy efficiency when buying household products. Table 5.6 shows the importance of brand, price, energy efficiency and two other relevant performance attributes for the four product categories that were used in the experiment according to consumer self-reports. Overall, price is the most important product attribute to consumers, for all products except for light bulbs where energy efficiency is slightly more important. Energy efficiency is reported to be the second-most important attribute to consumers when buying washing machines and refrigerators. For televisions, size and energy efficiency are considered equally important after price.

Table 5.6 Self-reported attribute importance

Attribute	Washing machine	Refrigerator	Television	Light bulbs
Brand	13.6%	13.3%	15.0%	8.3%
Energy efficiency	25.1%	26.2%	19.2%	27.2%
Price	29.9%	30.1%	30.2%	25.8%
Loading/spinning capacity	19.1%	-	-	-
Number of programs	12.3%	-	-	-
Size	-	18.2%	19.3%	-
Design	-	12.2%	-	-
Functional possibilities	-	-	16.2%	-
Light clarity	-	-	-	18.5%
Expected lifetime	-	-	-	20.1%
Total	**100%**	**100%**	**100%**	**100%**

Scale 0-100: 0% irrelevant attribute, 100% full weight (i.e., the only relevant attribute).

We also asked consumers directly how important energy efficiency was to them when buying household products (on a scale from (1) *not important* to (4) *very important*). 29.8% of the respondents considers energy efficiency somewhat important, 35.7% considers it important and 31.3% very important. Only 3.3% of the respondents considers energy efficiency not important at all. Differences between countries in self-reported importance of energy efficiency are relatively small (Table 5.7). We will include this variable in our analysis of the experiments to study consumer differences and understand label effectiveness (5.6).

Table 5.7 Self-reported importance of energy efficiency and label awareness per country

	Importance of energy efficiency	Awareness of energy label
France	3.0	93.1%
Germany	3.1	83.7%
Greece	2.8	93.7%
Ireland	2.9	94.6%
Italy	3.0	94.6%
Netherlands	2.7	91.3%
Poland	3.1	85.2%
Portugal	3.3	92.2%
Romania	3.0	96.4%
Sweden	2.7	81.2%
Average	3.0	93.1%

Importance: 1 = not important at all, 4 = very important.

This section shows that European consumers care about energy efficiency of household products, though they care about the price of household products somewhat more. We also find that almost all consumers (93.1%) know the energy label as currently used offline. This illustrates the need to obtain energy information in online settings as well.

5.3 Model of sustainable buying behaviour

In this section, we investigate consumers' intentions to buy energy efficient products, and how these are determined by their attitudes towards energy efficient products, social pressure to buy energy efficient products, and perceived behavioural control.

5.3.1 Country differences in attitudes, social pressure, perceived control, and behavioural intentions described

Table 5.8 provides descriptive results per country. The results reveal (statistically) significant differences between countries in consumers' environmental concern and attitudes towards energy efficient products, social pressure, perceived control and behavioural intentions (*p*s < .001), but these are small in absolute sense. Portuguese consumers report to be most concerned about the environment. In contrast, environmental concern is lowest among Dutch and Polish consumers, who also hold the least favourable beliefs regarding energy efficient household products. Social pressure to buy energy efficient products is most strongly experienced by Portuguese and Romanian consumers and least strongly by consumers in the Netherlands and Sweden. Perceived behavioural control is relatively low when consumers experience personal barriers to buy energy efficient products (that is, when they find it difficult to understand which products are most energy efficient and/or when they face budget constraints) or when they hold pessimistic beliefs about the impact of their own actions. Perceived behavioural control is relatively high in Portugal and relatively low in France and the Netherlands. Finally, consumers in Germany, Portugal, and Romania report the strongest intentions to buy energy efficient products. These intentions are weakest in France, Italy, and the Netherlands.

Table 5.8 Attitudes, social pressure, perceived control and behavioural intentions per country

	Environmental concern	Product-specific beliefs	Social norms	Perceived control	Behavioural intentions
France	4.14	3.80	3.58	3.22	3.24
Germany	4.24	3.97	3.57	3.49	4.05
Greece	4.21	3.93	3.47	3.44	3.82
Ireland	3.99	3.79	3.43	3.43	3.74
Italy	4.19	3.73	3.57	3.40	3.46
Netherlands	3.78	3.64	3.27	3.21	3.56
Poland	3.90	3.62	3.56	3.40	3.84
Portugal	4.37	3.90	3.70	3.71	4.03
Romania	4.14	3.90	3.69	3.33	4.00
Sweden	3.99	3.82	3.27	3.42	3.68
Average	4.08	3.80	3.50	3.39	3.72
Sig.	$p < .001$	$p < .001$	$p < .001$	$p < .001$	$p < .001$

Country differences considered

The descriptive statistics in this section present country differences that may seem somewhat counterintuitive. Countries such as the Netherlands and Sweden score low on variables such as self-reported importance of energy efficiency, environmental concern, and sustainable behaviour in other domains. However, these results may well be driven by differences in internet penetration. In countries with low internet penetration, the internet population is relatively innovative (innovators, early adopters and early majority segments) and deviates substantially from the national population as a whole. In most of these countries (Portugal, Romania, and Italy) we find that environmental

concern, and sustainable behaviours score high. For Greece, which also has low internet penetration, the effects are less prominent. On the other hand, in countries with high internet penetration the internet population almost resembles the population as a whole and also contains more conservative consumers, which can be characterized as the late majority or even laggards. Especially in these countries (the Netherlands, Ireland, Sweden) we find that environmental concern, and environmental concern score low. As such part of the country differences found are driven by differences in internet penetration, and as such will probably decrease or disappear over time.

5.3.2 *Testing the theory of planned behaviour*

Next, we examine how attitudes, social norms, and perceived control determine intentions to buy energy efficient products and actual sustainable behaviour. Actual sustainable behaviour is measured by respondents' product choices in the experiment. More specifically, it is a dichotomous variable which indicates whether or not the respondent selected the product with the highest energy efficiency class (more specific results of the experiment are presented in Section 5.4). Model details are in Appendix IV. Table 5.9 shows the model results.

Table 5.9 Theory of planned behaviour: model results

	DV: Behavioural intentions			DV: Behaviour (Selection of most efficient product in experiment)		
	Coef.	*z*		Coef.	*z*	
TPB variables:						
Behavioural intentions				.23	9.32	**
General environmental concern	.10	12.27	**	-.03	-1.42	
Product-specific beliefs	.40	39.09	**	.05	1.68	*
Social norms	.38	37.47	**	.12	4.38	**
Perceived control	.06	8.01	**	.30	15.83	**
Constant	.27	4.77	**	-1.77	-14.42	**

* $p < .05$; ** $p < .01$.

In line with the theory of planned behaviour, general environmental concern, product-specific beliefs (beliefs about energy efficient products), social pressure, and perceived control all have a positive effect on consumers' intentions to purchase energy efficient household products (first column of Table 5.9). Favourable product-specific beliefs and social norms contribute most strongly to positive behavioural intentions. These intentions in turn influence actual choices (second column of Table 5.9). In addition, perceived control over the behaviour (i.e., low personal barriers and high self-efficacy) has a relatively strong positive influence on actual sustainable behaviour. General environmental concern has an indirect effect on behaviour via behavioural intentions, but no direct effect ($p > .05$).

Table 5.10 reveals how socio-demographic characteristics influence behavioural intentions and energy efficient buying behaviour. Interestingly, we find for several characteristics that the effects on intentions are in the opposite direction as the effects on behaviour. Female consumers have stronger intentions to buy energy efficient household products than male consumers, but do not purchase them more often than male consumers. Older consumers have stronger intentions than younger consumers, but younger consumers make more energy efficient product choices in the experiment than older consumers. Similarly, intentions to buy energy efficient products are weaker for consumers with higher income, but higher income groups show more sustainable behaviour in the experiment than lower income groups. Most likely, differences in perceived control play a role

here. For example, consumers with low income are more likely to be put off by the higher purchase price of energy efficient alternatives, even though their incentives to reduce energy expenses are higher.

Employed consumers have stronger intentions to buy energy efficient products compared to students (p = .08), unemployed consumers (p < .01) and retired consumers (p < .05). In line with this, unemployed and retired consumers engage in less environmentally friendly behaviour in the experiment compared to employed consumers (p < .001 and p < .01, respectively). Consumers living in low density regions have lower intentions to buy energy efficient products, but their choice behaviour in the experiment does not deviate from groups living in areas with moderate or high population density. Furthermore, larger households have weaker intentions to buy energy efficient products, but actual energy efficient product choices are positively affected by household size. Finally, house-owners have stronger intentions to purchase energy efficient products and also show more sustainable behaviour than non-house-owners.

Table 5.10 Theory of planned behaviour: socio-demographic model results

	DV: Behavioural intentions			DV: Behaviour (Selection of most efficient product in experiment)		
	Coef.	*z*		Coef.	*z*	
Gender	-.15	-9.96	**	-.02	-.60	
Age	.01	9.68	**	-.00	-3.40	**
Low education	-.08	-3.12	**	-.12	-2.51	*
High education	.05	2.84	**	-.01	-.38	
Income unknown	-.02	-.88		-.14	-2.62	**
Low income	.03	1.34		-.21	-5.12	**
High income	-.06	-2.98	**	.15	3.56	**
Occ. status: Employed	.10	4.18	**	-.01	-.26	
Occ. status: Unemployed	.02	0.77		-.18	-3.10	**
Occ. status: Student	.04	1.27		-.09	-1.35	
Occ. status: Retired	.01	.32		-.18	-2.54	*
Low population density	-.12	-6.37	**	-.03	-.75	
High population density	-.02	-1.29		-.01	-.16	
Household size	-.01	-2.42	*	.05	4.52	**
House owner	.10	6.16	**	.26	7.91	**
Constant	3.48	77.55	**	.56	5.14	**

* p < .05; ** p < .01.

5.3.3 *Sustainable behaviour in other domains*

Table 5.11 shows the extent to which European consumers engage in environmentally friendly behaviour in various domains other than the purchase of energy efficient household products (on a scale from (1) *never* to (5) *always*). The majority of consumers always turn off the lights when leaving the room, and about half of the consumers always re-use plastic bags. The other sustainable behaviours are less ubiquitous. About one third of the consumers always turn off standby modes of appliances, about one in five always use rechargeable batteries, about one in ten always purchase products that are or can be recycled, and about 6% of consumers always purchase organic or fair trade items. On the other hand, the percentage of consumers who never engage in these behaviours is relatively low as well (< 15% for all behaviours).

Table 5.11 Sustainable behaviours in other domains

	% Never	% Always	Avg. score	St.dev.
Turn lights off when leaving the room	1.6%	57.8%	4.3	0.9
Re-use plastic bags	4.0%	48.5%	4.1	1.1
Use the washing machine at low temperatures	3.3%	25.9%	3.7	1.0
Turn off standby modes on the TV and other appliances	11.1%	32.1%	3.5	1.4
Purchase products from materials that are or can be recycled	4.3%	10.2%	3.3	1.0
Use rechargeable batteries	11.2%	19.3%	3.3	1.2
Purchase organic or fair trade food items	12.2%	6.4%	2.8	1.1

Table 5.12 shows differences between countries in sustainable behaviour (i.e., averaged across the seven environmentally friendly behaviours). Portuguese and Italian consumers report to engage most frequently in the sustainable behaviours and consumers from Sweden least frequently, but differences between countries are small in absolute sense.

Table 5.12 Sustainable behaviours in other domains

	Avg. score
France	3.61
Germany	3.70
Greece	3.60
Ireland	3.64
Italy	3.77
Netherlands	3.50
Poland	3.50
Portugal	3.78
Romania	3.54
Sweden	3.31
Total	**3.59**
Sig.	$p < .001$

5.4 Energy label effects: descriptive results

This section provides a descriptive analysis of the experimental data. It examines differences in effectiveness between the energy label variants, and how label effectiveness differs between decision stages and product categories.

Statistical testing

In this and the next sections, we describe the results based on statistical analyses. Analysis details are described in Appendix IV. In general, we estimate multilevel (logistic) regression models with energy efficiency of the selected product(s) as dependent variable and the labels as predictors (dummy variables with the control condition as baseline). Our models improve over standard ANOVAs and single-level regression models in that they properly take into account the multilevel structure of the data, that is, the fact that responses to purchase situations are “nested” within individuals, which are “nested” within countries. We test for the overall effect of energy labels (i.e., are there *any* differences in effectiveness between conditions?) by means of a Wald test which tests the joint significance of the parameters for the label dummies (for readers more familiar with the ANOVA technique, note that this test is comparable to the

ANOVA *F*-test). If the overall effect is significant, pairwise label comparisons are performed by means of Wald tests which test the (non)equality of parameters corresponding to the specific pair of labels (these are comparable to pairwise comparisons as ANOVA follow-up analysis).

If we report that there are "significant differences" in label effectiveness, we mean "statistical significance at the .05 level". That is, the difference in means (reported in the tables) that we find between the label conditions that are being compared are extremely unlikely to be due to chance alone. If the variability of responses *within* conditions is low, even small absolute differences in means *between* conditions can be statistically significant. Therefore, we also examine effect sizes in addition to statistical significance. As such, we may for example report that "differences are (statistically) significant, but small in absolute sense".

5.4.1 *Consideration set formation*

Four energy label variants were tested in the consideration subexperiment, namely:

- label 1: class-only label;
- label 2: textual meaning label;
- label 3: frame of reference label;
- label 4: pictogram label (which includes a frame of reference and visual meaning).

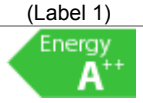
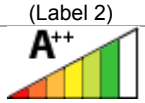
In this subexperiment, respondents selected a maximum of six products that they would seriously consider and about which they would like to receive more information. We use several measures to assess the energy efficiency of the selected set of products, namely:

- The average energy efficiency level of the products in the selected set[15].
- Whether a product with the highest energy efficiency class is selected (yes/no).
- Whether a product with the highest or second-highest energy efficiency class is selected (yes/no).
- Whether a product with the lowest energy efficiency class is selected (yes/no).
- Whether a product with the lowest or second-lowest energy efficiency class is selected (yes/no).

We examine how the different energy labels affect the response pattern across these five measures, which provides a more comprehensive picture than can be obtained with any single measure. On average the respondents selected 2.50 (*SD* =1.49) different products in their consideration set, with a minimum of one and maximum of six products.

[15] Energy efficiency scores: A+++=7, A++=6, A+=5, A=4, B=3, C=2, D=1 (see Table 3.3). Average energy efficiency level of consideration is set is the sum of the products' energy efficiency scores divided by the number of products in the consideration set.

Table 5.13 Effect of energy label variants on consideration set formation (all categories)

Energy label:	Average energy efficiency level	% most efficient product selected	% (2nd) most efficient product selected	% least efficient product selected	% (2nd) least efficient product selected
No information (control)	4.72[d]	51%[d]	78%[d]	29%[c]	55%[d]
 (Label 1)	4.95[b]	58%[b]	83%[ab]	20%[b]	40%[b]
 (Label 2)	4.94[bc]	56%[bc]	82%[bc]	20%[b]	40%[b]
 (Label 3)	**5.03[a]**	**61%[a]**	**85%[a]**	**17%[a]**	**37%[a]**
 (Label 4)	4.89[c]	55%[c]	80%[c]	21%[b]	44%[c]
Average	4.90	56%	81%	21%	43%
Overall label effect:					
Wald χ^2 (4)	143.38	64.07	55.64	127.10	210.89
p	< .001	< .001	< .001	< .001	< .001

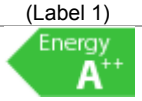
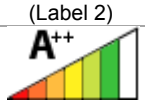
* Means with different superscripts (column-wise) are statistically significantly different from each other ($p < 0.05$).

Table 5.13 provides the descriptive results for the five measures. The results show that there are statistically significant differences between the energy information conditions (overall label effect; $p < .001$ for all measures). Providing energy efficiency information in the form of a (reduced) label is effective: all four labels promote the selection of more energy efficient products compared to the control condition in which no energy-related information is provided (differences with the control condition are statistically significant for all labels and measures; *p*s < .05). In this and the next tables, means with different superscripts ([a], [b], [c], etc.) reflect statistically significant differences at the 5% level (thus, differences between means with the same character in superscript are statistically not significantly different from each other).

Label 3 (the frame of reference label) performs best across all measures, yielding the highest average energy efficiency level, the highest percentage of consideration sets that include the most energy efficient product, and the lowest percentage of consideration sets that include the least energy efficient product. More specifically, pairwise comparisons reveal that label 3 encourages consumers to choose consideration sets with higher average energy efficiency levels ($M = 5.03$) as compared to label 1 (class-only label; $M = 4.95$, $p < .01$), label 2 (textual meaning label; $M = 4.94$, $p < .001$), and label 4 (pictogram label; $M = 4.89$, $p < .001$). Likewise, the probability that a product with the highest energy efficiency class is selected is significantly higher for label 3 ($M = 61\%$) than for label 1 ($M = 58\%$, $p < .01$), label 2 ($M = 56\%$, $p < .01$), and label 4 ($M = 55\%$, $p < .001$). The probability that a product with the lowest energy efficiency class is selected is significantly lower for label 3 ($M = 17\%$) than for label 1 ($M = 20\%$, $p < .01$), label 2 ($M = 20\%$, $p < .01$), and label 4 ($M = 21\%$, $p < .001$). Of the four label variants, label 4 (pictogram label) seems to be least effective in increasing energy efficient product choices, but even this label outperforms the control condition in which no energy efficiency information is provided at all.

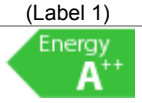
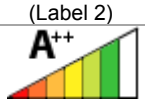
Tables 5.14-5.17 provide the descriptive results per product category. The findings are quite consistent across product categories. For each of the categories, we find that the energy label variants outperform the no-information condition. Furthermore, label 3 is clearly most effective overall in promoting energy efficient product selections, although for some specific measure-category combinations other labels perform equally well (but never significantly better) and the effects are somewhat less outspoken for light bulbs.

Table 5.14 Effect of energy label variants on consideration set formation (washing machines)

Energy label:	Average energy efficiency level	% most efficient product selected	% (2nd) most efficient product selected	% least efficient product selected	% (2nd) least efficient product selected
No information (control)	5.84^{c}	48%^{c}	81%^{c}	24%^{c}	57%^{c}
 (Label 1)	6.05^{b}	57%^{b}	85%^{b}	17%^{b}	42%^{b}
 (Label 2)	6.01^{b}	56%^{b}	83%^{bc}	19%^{b}	43%^{b}
 (Label 3)	**6.16^{a}**	**63%^{a}**	**88%^{a}**	**14%^{a}**	**37%^{a}**
 (Label 4)	6.01^{b}	54%^{b}	84%^{bc}	17%^{b}	44%^{b}
Average	6.02	56%	84%	18%	45%
Overall label effect:					
Wald χ^2 (4)	94.73	51.10	21.90	44.39	102.35
p	< .001	< .001	< .001	< .001	< .001

* Means with different superscripts (column-wise) are statistically significantly different from each other (p < 0.05).

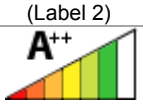
Table 5.15 Effect of energy label variants on consideration set formation (refrigerators)

Energy label:	Average energy efficiency level	% most efficient product selected	% (2nd) most efficient product selected	% least efficient product selected	% (2nd) least efficient product selected
No information (control)	5.43^{d}	37%^{c}	73%^{c}	48%^{c}	74%^{c}
 (Label 1)	5.75^{ab}	43%^{ab}	**83%^{a}**	31%^{b}	53%^{a}
 (Label 2)	5.71^{bc}	42%^{b}	82%^{a}	33%^{b}	55%^{a}
 (Label 3)	**5.81^{a}**	**46%^{a}**	**83%^{a}**	**26%^{a}**	**52%^{a}**
 (Label 4)	5.64^{c}	41%^{b}	78%^{b}	33%^{b}	61%^{b}

Energy label:	Average energy efficiency level	% most efficient product selected	% (2nd) most efficient product selected	% least efficient product selected	% (2nd) least efficient product selected
Average	5.67	42%	80%	35%	59%
Overall label effect:					
Wald χ^2 (4)	142.36	21.50	56.21	138.51	154.44
p	< .001	< .001	< .001	< .001	< .001

* Means with different superscripts (column-wise) are statistically significantly different from each other ($p < 0.05$).

Table 5.16 Effect of energy label variants on consideration set formation (televisions)

Energy label:	Average energy efficiency level	% most efficient product selected	% (2nd) most efficient product selected	% least efficient product selected	% (2nd) least efficient product selected
No information (control)	4.19^{d}	33%^{d}	60%^{c}	23%^{b}	48%^{c}
 (Label 1)	4.48^{ab}	41%^{ab}	68%^{a}	16%^{a}	34%^{a}
 (Label 2)	4.43^{bc}	37%^{bc}	66%^{ab}	16%^{a}	34%^{a}
 (Label 3)	**4.53^{a}**	**43%^{a}**	**70%^{a}**	**15%^{a}**	**33%^{a}**
 (Label 4)	4.35^{c}	36%^{c}	64%^{bc}	**15%^{a}**	40%^{b}
Average	4.40	38%	65%	17%	38%
Overall label effect:					
Wald χ^2 (4)	95.33	38.40	27.84	31.79	82.63
p	< .001	< .001	< .001	< .001	< .001

* Means with different superscripts (column-wise) are statistically significantly different from each other ($p < 0.05$).

Table 5.17 Effect of energy label variants on consideration set formation (light bulbs)

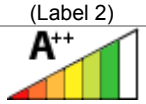
Energy label:	Average energy efficiency level	% most efficient product selected	% (2nd) most efficient product selected	% least efficient product selected	% (2nd) least efficient product selected
No information (control)	3.42^{c}	86%^{c}	96%^{a}	19%^{b}	39%^{c}
 (Label 1)	3.53^{b}	89%^{bc}	96%^{a}	15%^{a}	30%^{b}
 (Label 2)	3.59^{ab}	90%^{ab}	97%^{a}	**13%^{a}**	28%^{ab}

Energy label:	Average energy efficiency level	% most efficient product selected	% (2nd) most efficient product selected	% least efficient product selected	% (2nd) least efficient product selected
 (Label 3)	**3.60**[a]	**91%**[a]	97%[a]	14%[a]	**26%**[a]
 (Label 4)	3.54[ab]	89%[ab]	97%[a]	16%[a]	29%[ab]
Average	3.54	89%	97%	16%	30%
Overall label effect:					
Wald χ^2 (4)	36.85	16.43	3.07	18.61	55.61
p	< .001	< .010	.547	< .001	< .001

* Means with different superscripts (column-wise) are statistically significantly different from each other ($p < 0.05$).

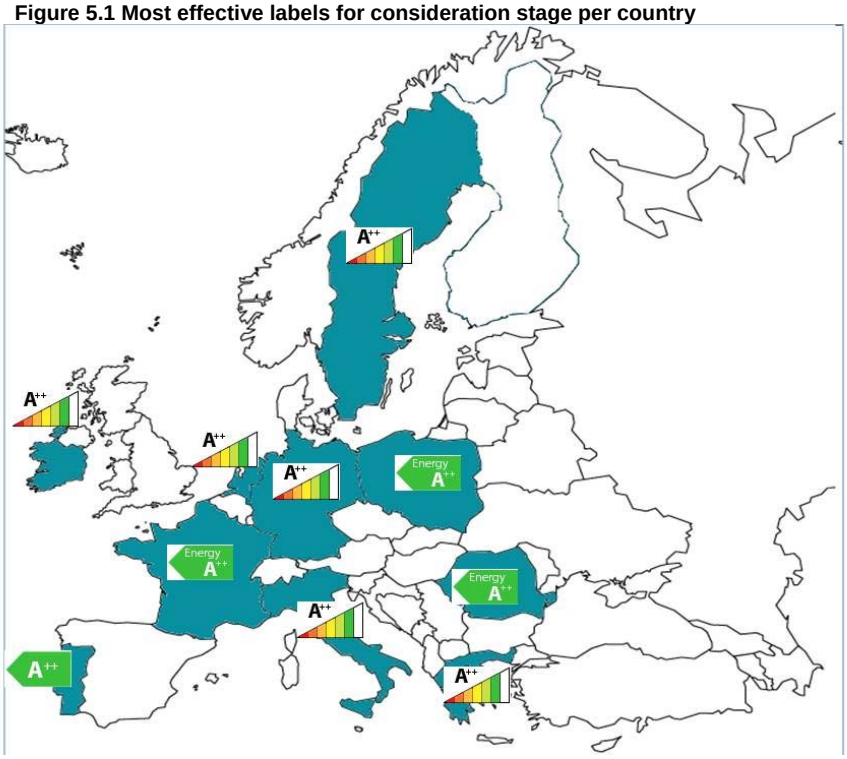
To investigate regional differences, Table 5.18 shows the average efficiency level of the consideration sets per country and per energy label variant. Label 3, the frame of reference label, promotes the selection of product sets with the highest average level of energy efficiency in six out of ten countries. For the remaining four countries, it is the second-best alternative. Label 3 performs better than the control (no information) condition in all ten countries, which does not hold for any of the other label variants. Label 1 is the most effective label in Portugal, and label 2 in France, Poland and Romania. In none of the countries is label 4 the most effective energy label. This label outperforms the control condition in only five out of ten countries (see Table 5.18).

Table 5.18 Effect of energy label variants on energy-efficiency level of consideration set per country

	Average energy efficiency level									
	FR	DE	EL	IE	IT	NL	PO	PT	RO	SW
No information (control)	4.66[b]	4.67[c]	4.81[b]	4.67[c]	4.81[c]	4.71[b]	4.74[c]	4.75[c]	4.64[c]	4.76[c]
 (Label 1)	4.88[a]	5.03[b]	4.95[ab]	4.90[ab]	4.96[b]	4.93[a]	4.94[ab]	**5.15**[a]	4.82[a]	4.99[ab]
 (Label 2)	**4.92**[a]	4.95[b]	4.94[ab]	4.80[bc]	4.99[ab]	4.81[ab]	**5.02**[a]	5.06[ab]	**4.95**[a]	4.91[bc]
 (Label 3)	4.91[a]	**5.20**[a]	**5.11**[a]	**4.97**[a]	**5.14**[a]	**4.93**[a]	4.95[ab]	5.10[ab]	4.84[a]	**5.10**[a]
 (Label 4)	4.79[ab]	4.91[b]	4.98[ab]	4.85[ab]	4.95[bc]	4.88[a]	4.82[bc]	4.96[b]	4.72[bc]	5.02[ab]
Average	4.83	4.95	4.96	4.84	4.97	4.85	4.89	5.00	4.79	4.96
Overall effect:										
Wald χ^2 (4)	13.51	42.55	10.73	13.75	17.88	9.43	15.25	24.90	14.12	17.79
p	<.01	<.001	<.05	<.01	<.01	.051	<.01	<.001	<.01	<.01

* Means with different superscripts (column-wise) are statistically significantly different from each other ($p < 0.05$).

Figure 5.1 Most effective labels for consideration stage per country



5.4.2 *Final choice*

In the choice subexperiment, respondents selected one product out of a set that included two products with the same high energy efficiency class and two products with the same low energy efficiency class. We tested the impact of the same four reduced labels as before as well as the full energy label. The control condition is a situation in which the energy-related information is provided in a non-prominent manner, that is, in the exact same way (font, font size, etc.) as other product information in the product-attribute matrix (table format in which details for the pre-selected products are displayed in parallel on the same page), which reflects the way energy-related information is typically presented online now. Choices are energy efficient to the extent that one of the two high energy efficiency products is selected (yes/no), which constitutes our dependent measure.

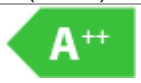
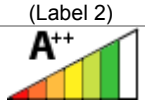
Table 5.19 provides the descriptive results across and within product categories. Products with the high energy efficiency level are selected in 65% of the cases when energy efficiency information is presented non-prominently. Overall, the percentage of respondents who have selected a product with high energy efficiency is again highest when label 3 is presented (68%), but the difference in effectiveness with the other labels is small in absolute sense and not always statistically significant. More specifically, label 3 (68%) is significantly more effective in promoting energy efficient choices than label 2 (with textual meaning; 65%, $p < .05$) and the full label (62%, $p < .001$), but not more effective than label 1 (67%, $p = .639$) and 4 (66%, $p = .262$). Label 3 is the only label variant that statistically significantly outperforms the control condition in which the same energy efficiency information is provided in a non-prominent manner (65%, $p < .05$). The full label is least effective overall ($M = 62\%$). It performs even significantly worse than the non-prominent information condition ($M = 65\%$; $p < .05$).

Thus, label 3 (68%) promotes more energy efficient product choices compared to non-prominent information (65%), label 2 (65%) and the full label (62%). Label 1 (67%) and 4 (66%) fall exactly in between: their effectiveness is not significantly different from that of label 3, but also not from that of label 2 and non-prominent information.

The differences between the reduced-form label variants are smaller in this final choice stage compared to first stage of consideration set formation. In the consideration experiment, the incremental effect of label 3 compared to the worst-performing reduced label was 10,9%: respondents who were exposed to label 3 selected products with the highest energy efficiency level 10,9% more often than respondents who were exposed to the worst-performing reduced label. In the choice experiment, the incremental effect of label 3 compared to the worst-performing reduced label is only 4,6%: respondents who were exposed to label 3 selected a product with the highest energy efficiency label 4,6% more often than respondents who were exposed to the worst-performing reduced label.

Furthermore, closer inspection of the differences in effectiveness between the energy label variants per product category provides a much less consistent picture than for the consideration stage of the decision-process. For each of the categories, a different label yields the most energy efficient product choices, with label 1 (class-only label) performing best for refrigerators, label 2 (textual meaning) performing best for light bulbs, label 3 (frame of reference label) performing best for washing machines, and label 4 (pictogram label) performing best for televisions. Yet, in contrast to the results of the consideration experiment, differences in effectiveness between the labels in the choice experiment are small in absolute sense and not always statistically significant (see Table 5.19; means with different superscripts reflect statistically significant differences).

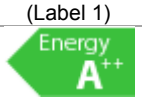
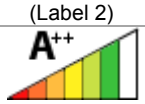
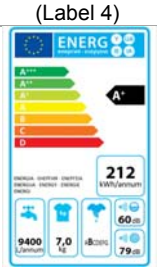
Table 5.19 Effect of energy label variants on choice

	% most efficient product selected				
Energy label:	**Average**	**Washing machines**	**Refrigerators**	**Televisions**	**Light bulbs**
Non-prominent information (control)	65%^{b}	67%^{ab}	61%^{ab}	60%^{b}	73%^{a}
 (Label 1)	67%^{ab}	67%^{ab}	**64%^{a}**	63%^{ab}	75%^{a}
 (Label 2)	65%^{b}	64%^{b}	59%^{bc}	62%^{ab}	**76%^{a}**
 (Label 3)	**68%^{a}**	**69%^{a}**	63%^{a}	65%^{a}	75%^{a}
 (Label 4)	66%^{ab}	66%^{ab}	58%^{bc}	**67%^{a}**	73%^{a}
 (Full label)	62%^{c}	57%^{c}	56%^{c}	61%^{b}	75%^{a}
Average	66%	65%	60%	63%	74%
Overall label effect:					
Wald χ^2 (5)	24.04	40.24	18.99	12.29	4.84
p	$p < .001$	$p < .001$	$p < .010$	$p < .050$	$p = .436$

* Means with different superscripts (column-wise) are statistically significantly different from each other (p < 0.05).

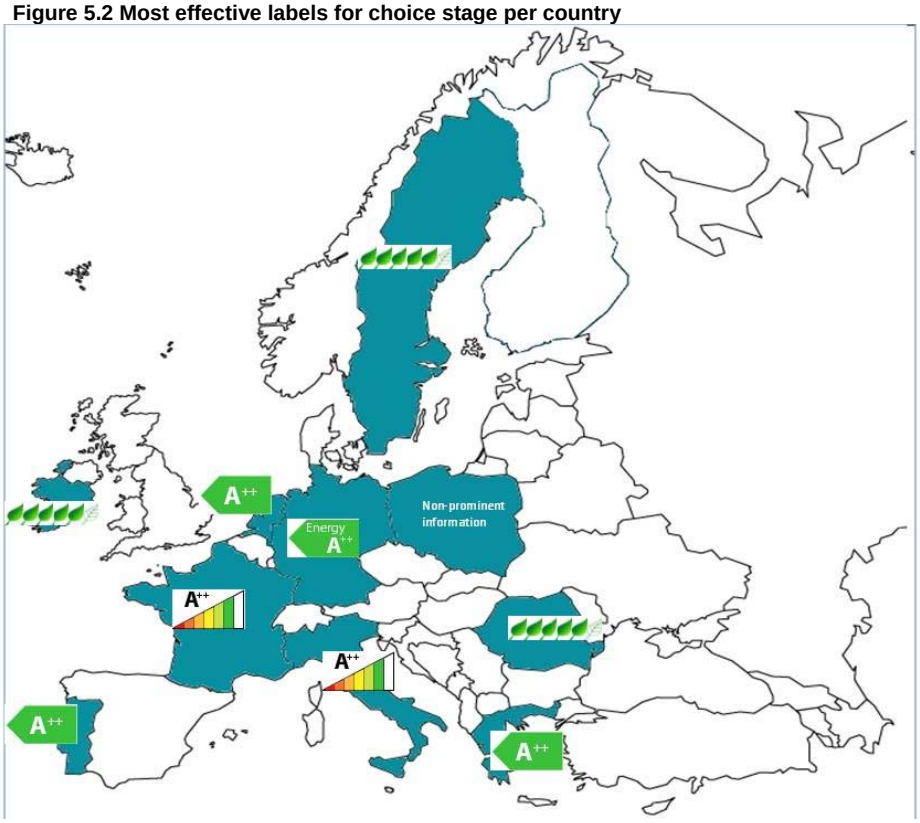
To investigate regional differences, Table 5.20 shows results per country. Which energy label variant is most effective in the choice stage differs between countries, but note that differences in effectiveness between the labels are often small in absolute sense and not always statistically significant (only means with different superscripts in Table 5.20 reflect significant differences). Overall, label 1 (class-only) is the most effective label variant in Greece, the Netherlands and Portugal, label 2 (textual meaning) in Germany, label 3 (frame of reference) in France and Italy, label 4 (pictogram) in Ireland, Romania and Sweden, and non-prominent energy efficiency information is most effective in Poland (see Figure 5.2). In none of the countries is the full energy label the most effective alternative.

Table 5.20 Effect of energy label variants on energy efficient product choices per country

	% most efficient product selected									
	FR	DE	EL	IE	IT	NL	PO	PT	RO	SW
Non-prominent information (control)	62%^{a}	68%^{ab}	67%^{a}	61%^{ab}	68%^{bc}	62%^{ab}	**66%^{a}**	75%^{ab}	65%^{ab}	63%^{a}
 (Label 1)	64%^{a}	66%^{ab}	**72%^{a}**	61%^{ab}	75%^{ab}	**67%^{a}**	65%^{a}	**78%^{a}**	58%^{b}	68%^{a}
 (Label 2)	60%^{a}	**72%^{a}**	67%^{a}	57%^{b}	71%^{ab}	62%^{ab}	63%^{a}	76%^{ab}	61%^{ab}	64%^{a}
 (Label 3)	**67%^{a}**	71%^{a}	67%^{a}	62%^{ab}	**76%^{a}**	66%^{a}	65%^{a}	76%^{ab}	65%^{ab}	65%^{a}
 (Label 4)	59%^{a}	65%^{ab}	68%^{a}	**67%^{a}**	66%^{c}	64%^{a}	64%^{a}	67%^{b}	**68%^{a}**	**71%^{a}**
 (Full label)	60%^{a}	63%^{b}	68%^{a}	59%^{ab}	71%^{ab}	55%^{b}	53%^{b}	69%^{b}	58%^{b}	65%^{a}
Average	4.83	4.95	4.96	4.84	4.97	4.85	4.89	5.00	4.79	4.96
Overall effect:										
Wald χ^2 (5)	4.88	7.82	2.31	6.85	9.68	9.21	12.91	9.69	8.38	4.94
p	.431	.166	.805	.232	.085	.101	< .05	.085	.137	.423

* Means with different superscripts (column-wise) are statistically significantly different from each other (p < 0.05).

Figure 5.2 Most effective labels for choice stage per country



5.4.3 *Comprehension difficulty and choice difficulty*

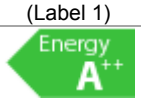
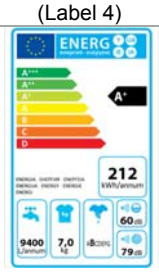
Table 5.21 provides information on how difficult consumers considered it to comprehend the product information (in general, not specifically the label itself) and how difficult they found it to select (a) product(s), both measured on a scale from (1) *very easy* to (7) *very difficult*.

Results show that the presence (versus absence) of energy efficiency information does not significantly influence comprehension and choice difficulty in the consideration stage. In other words, the addition of the reduced/simplified energy rating label to the product information in a long list of choices did not make it more difficult to understand the information or to choose. Nor did the labels make comprehension/choice easier; since the control was no information, the labels add an extra parameter to consider.

On the other hand, while there is no significant (overall) label effect on choice difficulty in the choice stage (overall label effect; $p = .304$, see Table 5.21), comprehension difficulty is significantly influenced by the way energy efficiency information is presented in this stage ($p < .001$). Specifically, we observe that the full label leads to higher levels of comprehension difficulty than each of the reduced labels ($ps < .05$) and non-prominent information ($p < .001$). Other differences between the conditions are not significant.

Together, these findings show that although providing reduced-form energy labels online does not simplify product choice, it does not hurt comprehension and does not make it harder to choose either. Only the full label raised comprehension difficulty compared to the control condition in the choice stage.

Table 5.21 Effect of energy label variants on comprehension difficulty and choice difficulty

Energy label:	Consideration set formation		Final choice	
	Comprehension difficulty	Choice difficulty	Comprehension difficulty	Choice difficulty
No information	2.35^{ab}	2.58^{a}	-	-
Non-prominent information	-	-	1.98^{b}	2.38^{ab}
 (Label 1)	2.30^{ab}	2.54^{a}	1.95^{b}	2.31^{b}
 (Label 2)	2.32^{ab}	2.55^{a}	2.02^{b}	2.41^{a}
 (Label 3)	2.28^{b}	2.52^{a}	1.96^{b}	2.34^{ab}
 (Label 4)	2.39^{a}	2.60^{a}	1.98^{b}	2.36^{ab}
 (Full label)	-	-	2.14^{a}	2.41^{ab}
Average	2.33	2.55	2.00	2.36
Overall label effect:				
Wald χ^2	6.02	3.05	21.19	6.02
p	.198	.549	< .001	.304

* Means with different superscripts (column-wise) are statistically significantly different from each other ($p < 0.05$).

5.4.4 Conclusion

Together, our findings provide insight into the influence of energy efficiency information on consumers' product choices (**result 1**). They show that providing energy efficiency information has a positive influence on the energy efficiency of consumers' product choices: if the information is present, consumers will use it in their decision-making process. Compared to the control condition in which no energy efficiency information was provided, *all* reduced label variants resulted in the formation of consideration sets with higher average energy efficiency levels. Label 3 was most effective in promoting energy efficient product choices during consideration set formation, followed by label 1 and label 2, with label 4 being least effective (though better than providing no information at all). This pattern of results was largely consistent across product categories and countries.

Whereas label 3 outperformed the other labels during consideration set formation, when relatively little other product information competes for the attention of the consumer, it did not significantly outperform all other labels in the choice stage, when consumers are confronted with information on a much larger amount of information on many more product features. In the choice stage, differences in effectiveness between the reduced label variants were much smaller, and although label 3 still performed well, it did not significantly outperform label 1 and 4 in this stage of the decision-making process. Furthermore, whereas the pattern of results was very consistent across product categories and countries in the consideration stage, the findings were much less clear-cut in the choice stage.

Thus, the key finding here is that differences in label effectiveness are generally large and consistent across product categories and countries in the consideration set formation stage (with label 3 outperforming the other labels), and generally small and inconsistent across product categories and countries in the final choice stage. This confirms **hypothesis 2**, which predicted that energy efficiency information would have a bigger impact in the consideration set formation stage than in the final choice stage. Energy efficient alternatives are less likely to be shortlisted for a final choice by a consumer shopping online if energy efficiency information is not immediately available in the first stage of the choice process when consumers are exposed to the full product assortment. Only giving energy information after a consumer has selected a product as potentially interesting (by clicking on mouse-over information or pre-selecting the product to study its details) seems to be too late, not only because some energy efficient alternatives may already be dropped by then, but also because the energy efficiency information competes with information on many more different product attributes in the choice stage. Finally, and importantly, our findings show that the reduced energy labels do not hurt information comprehension or increase choice difficulty compared to the full label or to the control conditions.

5.5 Influence of energy label characteristics related to display and content of information: hypothesis testing

The results in Section 5.4 provide insight into the effectiveness of the different label variants, but leave unexplained *why* certain energy label variants work better than others. This section aims to provide deeper insights into the underlying processes. We examine effects of information and label characteristics, such as whether a frame of reference is present or absent in the label, which enables us to test hypothesis 1 through 7.

In order to understand the effects of specific characteristics of the energy labels, we estimate a model with the same outcome measures as before, but with different predictors that enable direct hypothesis tests. That is, the model parameters corresponding to the predictor variables provide direct answers to the following questions:

- Does providing energy-related information (in whatever form) promote more sustainable product choices? (**Information effect**).
- Does providing a visual energy label (in whatever form) promote more sustainable product choices compared to non-prominent textual information? (**Label effect**).
- Does a reduced label promote as much (or more) sustainable product choices as a full label? (**Reduced label effect**).
- Does adding a frame of reference lead to more sustainable product choices? (**Frame of reference effect**).
- Does adding textual meaning to the reduced (class-only) label lead to more sustainable product choices? (**Textual meaning effect**).
- Does adding visual meaning (in the form of a pictogram) lead to more sustainable product choices (if a frame of reference is present)? (**Visual meaning effect**).
- Does the order in which the products are displayed influence product choices? (**Order effect**); note that this is not a label-related effect but a more general website display effect.

Hypothesis testing

To test hypothesis 1-7, we estimate multilevel (logistic) regression models with energy efficiency of the selected product(s) as dependent variable and label characteristics as predictors. In these models, specific label contrasts, i.e., variables that compare specific (sets of) labels against each other replace the dummy variables that were used as predictors in the previous models. The following contrasts are being used:

- **Information effect**: [label 1, label 2, label 3, label 4] vs. [no information] *
- **Label effect**: [label 1, label 2, label 3, label 4, label 5] vs. [non-prominent information] *
- **Reduced label effect**: [label 1, label 2, label 3, label 4] vs. [label 5] *
- **Frame of reference effect**: [label 3, label 4] vs. [label 1, label 2] **
- **Textual meaning effect**: [label 2] vs. [label 1] **
- **Visual meaning effect**: [label 4] vs. [label 3] **
- **Order effect**: [product display order 1] vs. [product display order 2]

Not only are these contrasts highly informative in that they directly test our hypotheses, another reason for selecting these specific contrasts is that they are *orthogonal* (in other words, the predictors in our model do not correlate with each other). This allows for independent and accurate estimation of all effects. Model details are provided in the technical appendix (Appendix IV).

* Note that due to different control conditions in each of the subexperiments, the information effect can only be tested in the consideration experiment and the label and reduced label effects can only be tested in the choice experiment. This explains the fact that some of the contrasts only include label 1 through label 4 (the labels tested in the consideration experiment), while other contrasts include label 1 through label 5 (the labels tested in the choice experiment).

** Note that our hypotheses regarding frame of reference and meaning effects predict that adding a frame of reference and/or meaning *to the reduced (class-only) label* increases its effectiveness. Therefore, these contrasts compare the effectiveness of *reduced* labels that include a frame of reference/meaning against the effectiveness of *reduced* labels that do not include a frame of reference/meaning. To make sure that the contrasts provide direct tests of our hypotheses, the full label is left out of the comparison here.

5.5.1 *Effects of energy label characteristics on consideration set formation*

Model results for consideration set formation are in Table 5.22. We observe that the heterogeneity in responses between consumers within countries is typically larger than the heterogeneity between countries. The findings are largely consistent across the five measures. There is a strong and positive information effect, which shows that providing energy-related information promotes the selection of more energy efficient and less energy inefficient products. Regarding the specific label characteristics, the results point to a significant visual meaning effect, but in unexpected direction. Adding visual meaning to the label by using a pictogram reduces rather than promotes the selection of energy efficient products and promotes rather than reduces the selection of energy inefficient products. The other label characteristics, textual meaning and frame of reference, do not have a significant impact on the energy efficiency of consumers' product choices. Finally, the results provide some evidence that the product display order influences consideration set formation. Consistent with our prediction, further analysis of the order effect reveals that the average energy efficiency of the consideration set and the probability that the most energy efficient product is selected are higher when the products are selected from an assortment that, on average, has more energy efficient products presented at the top of the web page as compared to the bottom of the web page.

The non-significant frame of reference effect may seem inconsistent with our previous finding that label 3 (the frame of reference label) works best, particularly in the consideration set formation stage, but in fact it is not. If the mere presence of a frame of reference would drive label effectiveness, label 4 – and actually the full label too – should have performed well too. However, these labels were the least effective ones. Therefore, the *average* effectiveness of labels with a frame of reference did not significantly differ from the *average* effectiveness of labels without a frame of reference. In other words, the effectiveness of label 3 does not seem to be driven by the mere presence of a frame of reference. We return to this issue in the conclusion section and study potential alternative explanations for the label effects in Section 5.5.

Table 5.22 Effects of label characteristics on consideration set formation

	Average energy efficiency level	Most efficient product selected (Prob.)	(2nd) Most efficient product selected (Prob.)	Least efficient product selected (Prob.)	(2nd) Least efficient product selected (Prob.)
Information effect	**.23**	**.33**	**.40**	**-.69**	**-.76**
Frame of reference effect	.01	.05	-.01	-.09	.02
Textual meaning effect	-.02	-.07	-.09	.01	.00
Visual meaning effect	**-.14**	**-.29**	**-.36**	**.30**	**.35**
Order effect	**.05**	**.20**	.10	-.05	-.06
Respondent heterogeneity (SD)	.00	1.06	1.32	1.39	1.23
Country heterogeneity (SD)	.06	.18	.20	.21	.21

Coefficients in shaded boxes are significant at the 5% level.

As before, the pattern of results for the consideration set formation stage is largely the same across product categories. Table 5.23 shows this. We observe a strong positive impact of providing energy efficiency information across all product categories. The negative visual meaning effect is present for all categories except for light bulbs. Textual meaning and frame of reference effects are mostly small and insignificant across the categories. Only for washing machines, we observe a frame of reference effect for two out of the five measures. Here, adding a frame of reference increases the average energy efficiency level of the consideration set and reduces the probability that the most energy inefficient product ends up in the consideration set, as predicted.

Table 5.23 Effects of label characteristics on consideration set formation per product category

	Average energy efficiency level			
	W*	R*	T*	L*
Information effect	**.22**	**.29**	**.26**	**.15**
Frame of reference effect	**.05**	-.00	-.01	.01
Textual meaning effect	-.04	-.04	-.05	.06
Visual meaning effect	**-.15**	**-.16**	**-.18**	-.06

* W = washing machine, R = refrigerator, T = TV, L = lightbulb

	Most efficient product selected (Prob.)				(2nd) Most efficient product selected (Prob.)			
	W	R	T	L	W	R	T	L
Information effect	**.38**	**.25**	**.33**	**.34**	**.29**	**.50**	**.29**	.14
Frame of reference effect	.07	.03	.03	.10	.13	-.13	-.00	.06
Textual meaning effect	-.07	-.06	**-.17**	.16	-.12	-.11	-.07	.24
Visual meaning effect	**-.35**	**-.22**	**-.29**	-.23	**.35**	**-.33**	**-.26**	-.28

	Least efficient product selected (Prob.)				(2nd) Least efficient product selected (Prob.)			
	W	R	T	L	W	R	T	L
Information effect	**-.47**	**-.75**	**-.44**	**-.33**	**-.63**	**-.84**	**-.55**	**-.49**
Frame of reference effect	**-.17**	-.12	-.01	.07	-.08	.11	.09	-.07
Textual meaning effect	.08	.08	-.03	-.18	.04	.09	-.01	-.13
Visual meaning effect	**.24**	**.31**	**.18**	.13	**.28**	**.36**	**.32**	.15

Coefficients in shaded boxes are significant at the 5% level.

5.5.2 *Effects of energy label characteristics on final choice*

Model results for final choice are in Table 5.24. To assess the label effect, the *average* effectiveness of label 1 through 5 is compared against the effectiveness of non-prominent energy efficiency information. To assess the reduced label effect, the *average* effectiveness of the reduced-form labels (label 1 through 4) is compared against the effectiveness of the full label (label 5).[16] The findings show that, on average, the labels do not promote more sustainable product choices compared to non-prominent textual information (the label effect is not significant). This seems to suggest that energy efficiency information is taken into account in consumers' product choices, even if it is not particularly salient and a relatively large amount of other product information is available as well. Closer inspection of the differences between the label variants reveals a significant reduced label effect: the reduced labels lead to more energy efficient choices on average in comparison to the full label. Thus, the absence of a label effect – that is, the *average* effectiveness of the labels is not different from the effectiveness of non-prominent information – is explained by the fact that the reduced-form labels generally outperform (or perform at least as good as) non-prominent energy efficiency information, while the full label performs significantly worse than non-prominent information. The significant reduced label effect shows that energy labels in condensed form with less information do not just perform as good as the full energy label that is currently used in offline settings, but are even *more* effective in promoting sustainable product choices. We do not observe the predicted effects of the characteristics related to the content of the

[16] Note that these effects have different control conditions: the "label effect" is the effect of all labels compared to the non-prominent information condition, and the "reduced label effect" is the effect of the reduced label variants compared to the full label. The effects are thus independent: one can be significant while the other is not.

labels, which suggests that the mere presence of a frame of reference and/or meaning is not sufficient to encourage more sustainable product choices.

Table 5.24 Effects of label characteristics on final choice

	Most efficient product selected (Prob.)
Label effect	.02
Reduced label effect	**.25**
Frame of reference effect	.03
Textual meaning effect	-.11
Visual meaning effect	-.12
Order effect	-.02
Respondent heterogeneity (SD)	1.06
Country heterogeneity (SD)	.22

Coefficients in shaded boxes are significant at the 5% level.

Table 5.26 presents the model results per product category. We find quite distinct patterns of results across the different product categories.

Table 5.25 Effects of label characteristics on final choice per product category

	Most efficient product selected (Prob.)			
	Washing machines	Refrigerators	Televisions	Light bulbs
Label effect	-.11	-.07	**.15**	.11
Reduced label effect	**.43**	**.20**	.14	.00
Frame of reference effect	.08	-.03	**.13**	-.09
Textual meaning effect	-.14	**-.20**	-.04	.03
Visual meaning effect	-.11	**-.21**	.07	-.12

Order effect = -.01 (SE = .03); Country heterogeneity SD = .18 (SE = .04). Coefficients in shaded boxes are significant at the 5% level.

5.5.3 *Effects of energy label characteristics on comprehension difficulty and choice difficulty*

This section examines how information and label characteristics influence comprehension difficulty and choice difficulty. The results in Table 5.26 show a significant influence of the decision-stage on comprehension and choice difficulty. Not surprisingly, consumers find it easier to comprehend the information and make choices when they are exposed to four rather than twelve products. Furthermore, we find a reduced label effect on comprehension difficulty; the product information is easier to comprehend when a reduced rather than a full label is presented. Other effects of information and label characteristics on comprehension and choice difficulty are not significant.

Table 5.26 Effects of label characteristics on comprehension and choice difficulty

	Comprehension difficulty	Choice difficulty
Information effect	-.00	-.02
Label effect	.04	-.00
Reduced label effect	**-.16**	-.05
Frame of reference effect	.01	.00
Textual meaning effect	.04	.05
Visual meaning effect	.07	.05
Decision-stage effect	**-.34**	**-.19**
Order effect	-.05	-.04
Respondent heterogeneity (SD)	1.05	1.08
Country heterogeneity (SD)	.25	.23

5.5.4 Conclusion

Section 5.5 described the results of statistical models that were used to test hypotheses 1 through 7, which related to the display as well as the content of energy-related information. Table 5.27 provides an overview of the findings. First of all, our findings clearly demonstrate that the provision of energy-related information promotes more energy efficient product choices, which confirms **hypothesis 1**. If energy efficiency information is presented in an online setting, people are likely to incorporate this information in their decision-making process, increasing the probability that energy efficient products end up in their consideration set and are finally chosen. In contrast to the idea that the visual salience of energy labels should increase the use of energy efficiency information in decision-making as compared to a situation in which the same information is presented non-prominently (in plain text), the average effectiveness of the labels did not significantly differ from the effectiveness of non-prominent energy efficiency information, which rejects **hypothesis 3**. Rather than a general label effect, our findings demonstrate that specific aspects of the energy labels determine label effectiveness. For example, and consistent with **hypothesis 4**, we find that the reduced-form labels are more effective in promoting energy efficient product choices than the full label.

In addition, we tested hypotheses related to the specific content of the energy-related information. Our findings do not confirm **hypothesis 5** (frame of reference effect) and **hypothesis 6** (meaning effect). First, the analysis revealed that it is not the mere presence of a frame of reference that contributes to more energy efficient choices, because in that case the pictogram (and the full label as well) should have performed relatively well too. Similarly, adding textual or visual meaning did not stimulate more energy efficient product choices. In fact, our findings seem to suggest that when it becomes more clear that the label informs consumers about the energy efficiency of the product, consumers make less rather than more sustainable choices. One reason may be that when the label lacks the explicit meaning of energy efficiency, consumers may interpret the label as some kind of overall product evaluation, and this may ironically increase product attractiveness more than energy efficiency does. If this is the case, we would expect label 3 to be particularly effective in comparison with label 2 (explicit textual meaning) and label 4 (explicit visual meaning) for consumers who are relatively unfamiliar with the label or who do not consider energy efficiency to be important. Section 5.6 provides more insight into this idea by examining differences in responses to the energy labels between different consumer groups.

We emphasize that it is not the goal of this study to come up with the best possible reduced-form energy label design (we only tested four reduced-form energy labels). Rather, the primary aim of the study is (1) to examine whether, in online settings, a reduced-form energy label can perform as

good as (or better than) the current full energy label, and (2) to better understand which *general* characteristics determine the effectiveness of reduced-form energy labels. More specifically, based on consumer information-processing theory, we identified the lack of a frame of reference and lack of meaning as two potential shortcomings of the reduced-form class-only label which could make the label more effective. However, our findings do not support the idea that adding a frame of reference and/or explicit meaning increases label effectiveness. Rather, they demonstrate that label effectiveness depends on more specific aspects of the label. For example, a label with a frame of reference may be effective (label 3) but may also perform quite poorly (label 4), which shows that that label effectiveness strongly depends on the specific way the frame of reference is implemented. Finally, our results demonstrate that website characteristics such as the order in which product alternatives are presented also matter. Consistent with **hypothesis 7**, our data provide some evidence that consumers are more likely to consider energy efficient products if these are presented at the top compared to at the bottom of the web page.

Table 5.27 Overview of results for hypothesis 1-7

	Consideration stage	Choice stage
Hypothesis 1 (information effect): Consumers are more likely to choose energy efficient products if energy information is available compared to when it is not.	Overall: confirmed Product categories: confirmed for all categories	-
Hypothesis 2 (decision-stage effect): Energy information has a stronger impact on choices in the consideration set formation stage than in the final choice stage.	Overall: confirmed	
Hypothesis 3 (label effect): Consumers are more likely to choose energy efficient products if energy information stands out from other product information (through a label) compared to when it does not (plain text).	-	Overall: not confirmed Product categories: confirmed for televisions
Hypothesis 4 (reduced label effect): Consumers are more likely to choose energy efficient products if energy information is displayed online in reduced as compared to full label form.	-	Overall: confirmed Product categories: confirmed for washing machines and refrigerators
Hypothesis 5a (Textual meaning effect): Adding textual meaning to the reduced (class-only) label increases its effectiveness.	Overall: not confirmed Product categories: not confirmed	Overall: not confirmed Product categories: negative effect of adding textual meaning for refrigerators
Hypothesis 5b (Visual meaning effect): Adding visual meaning to the reduced (class-only) label increases its effectiveness.	Overall: not confirmed, negative effect of adding visual meaning Product categories: negative effect for washing machines, refrigerators, and televisions	Overall: not confirmed Product categories: negative effect for refrigerators
Hypothesis 6 (Frame of reference effect): Adding a frame of reference to	Overall: not confirmed	Overall: not confirmed

	Consideration stage	Choice stage
the reduced (class-only) label increases its effectiveness, particularly in the final choice stage.	Product categories: confirmed for washing machines	Product categories: confirmed for televisions
Hypothesis 7 (Order effect): Consumers are more likely to choose energy efficient products if these are presented at the top of the web page compared to at the bottom of the web page, particularly in the consideration set formation stage.	Overall: confirmed	-

N.B. 'Confirmed' indicates that the experimental data provide empirical support for the hypothesis (i.e., differences/effects are statistically significant at $p < .05$).
N.B. The term 'overall' refers to the test across all countries and product categories. Next to the overall effects, we report the results per product category.

5.6 Energy label effects and consumer groups

Next, we examine the effectiveness of the energy label variants among various consumer groups. This allows us to test **hypothesis 8a** which predicts that the influence of energy efficiency information is stronger for consumers who (1) have relatively positive attitudes towards buying energy efficient products, (2) experience high social pressure to buy energy efficient products, and (3) have high perceived control over their behaviour (i.e., low personal barriers and high perceived individual efficacy), and **hypothesis 8b** which predicts that, compared to non-prominent energy efficiency information, the contribution of online energy labels to sustainable product choices is less strong for these consumer groups. In addition, the analyses may provide more insight into why label 3 seems to be most effective, particularly in the stage of consideration set formation.

Table 5.28 shows the results of spotlight analyses which compare the influence of energy information and energy labels between consumers with relatively high and low levels of energy efficiency attitudes, norm pressure, and perceived control. Attitudes towards energy efficiency are measured by respondents' self-reported importance of energy efficiency in buying household goods and their beliefs regarding energy efficient products (e.g., "Energy efficient household products perform at least as well as other alternatives" and "Energy efficient household products pay-off financially within a reasonable period of time"). Analysis details are in Appendix IV.

Consistent with hypothesis 8a, the presence of energy efficiency information promotes sustainable product choices more for consumers who find energy efficiency relatively important (rather than unimportant), have positive (rather than negative) beliefs regarding energy efficient household products, experience high (rather than low) levels of social pressure, and high (rather than low) levels of perceived control (Table 5.28, first column).

Table 5.28 Effectiveness of energy information and energy labels per consumer group

	Information effect	Label effect	Reduced label effect
Importance of energy efficiency: low	.12 (*CI* = .06, .17)	.09 (*CI* = -.04, .23)	.14 (*CI* = 0, .29)
Importance of energy efficiency: high	**.33 (*CI* = .27, .39)**	**-.07 (*CI* = -.22, .08)**	**.34 (*CI* = .19, .49)**
Product-specific beliefs: unfavourable	.16 (*CI* = .10, .22)	.10 (*CI* = -.05, .25)	.14 (*CI* = -.01, .29)

	Information effect	Label effect	Reduced label effect
Product-specific beliefs: favourable	**.30 (*CI* = .24, .36)**	**-.04 (*CI* = -.19, .11)**	**.33 (*CI* = .17, .49)**
Norm pressure: low	.17 (*CI* = .11, .23)	.17 (*CI* = .03, .32)	.18 (*CI* = .02, .34)
Norm pressure: high	**.30 (*CI* = .24, .36)**	**-.12 (*CI* = -.27, .04)**	**.31 (*CI* = .15, .47)**
Perceived control: low	.16 (*CI* = .10, .22)	.01 (*CI* = -.13, .15)	.26 (*CI* = .10, .41)
Perceived control: high	**.30 (*CI* = .24, .36)**	**.02 (*CI* = -.13, 17)**	**.22 (*CI* = .06, .38)**

Information and label effects at one standard deviation below and above the mean. CI = 5-95% confidence interval around the estimate.

The impact of a prominent energy label compared to non-prominent energy efficiency information (i.e., the label effect) is generally positive for consumers who have a relatively negative attitude towards buying energy efficient products (low importance and unfavourable product-specific beliefs) and who experience low levels of social pressure, and generally negative for consumers who have a relatively positive attitude and experience high levels of social pressure. These findings are in the expected direction, but the differences between consumer groups are not significant (Table 5.28, second column). Thus, hypothesis 8b is not supported.

Finally, we tested whether the effectiveness of reduced over full labels (i.e., the reduced label effect) differed across consumer groups. The results (Table 5.28, third column) show that this reduced label effect is stronger for consumers who attach high importance and hold favourable beliefs about energy efficient products and for consumers who experience relatively high social pressure to buy energy efficient alternatives.

5.6.1 Label effectiveness: potential explanations

As mentioned in Section 5.5.4, a potential explanation for the effectiveness of label 3 is that if a label does not explicitly communicate its meaning ("energy efficiency"), consumers may interpret the label as an overall product evaluation. This may increase the attractiveness of highly energy efficient products which are then seen as very "good" products. Consumers who place low value on energy efficiency are less likely to actively search for and use energy efficiency information in their decision-making, and are therefore more likely to misinterpret energy labels without explicit meaning. Ironically, misinterpretation of the label may increase rather than reduce energy efficient product choices among this group, because these consumer are more likely to attach value to a very "good" product than to a very "energy efficient" product. On the other hand, consumers who place high value on energy efficiency (1) are less likely to misinterpret the label, even if it lacks explicit meaning, because they are more likely to recognize the features that the reduced labels have in common with the current full label, and (2) will positively evaluate products that they perceive as highly energy efficient. From the tested set of labels, label 1 and 3 both do not explicitly communicate that they are about energy efficiency. However, since label 1 more clearly represents a familiar element of the current full label, this label is more likely to be accurately understood than label 3, even by consumers who place relatively low value on energy efficiency. Combining these insights, we make the following predictions:

1. All energy label variants should be more or less equally effective for consumers who find energy efficiency relatively important (because these consumers are actively interested in this type of information).

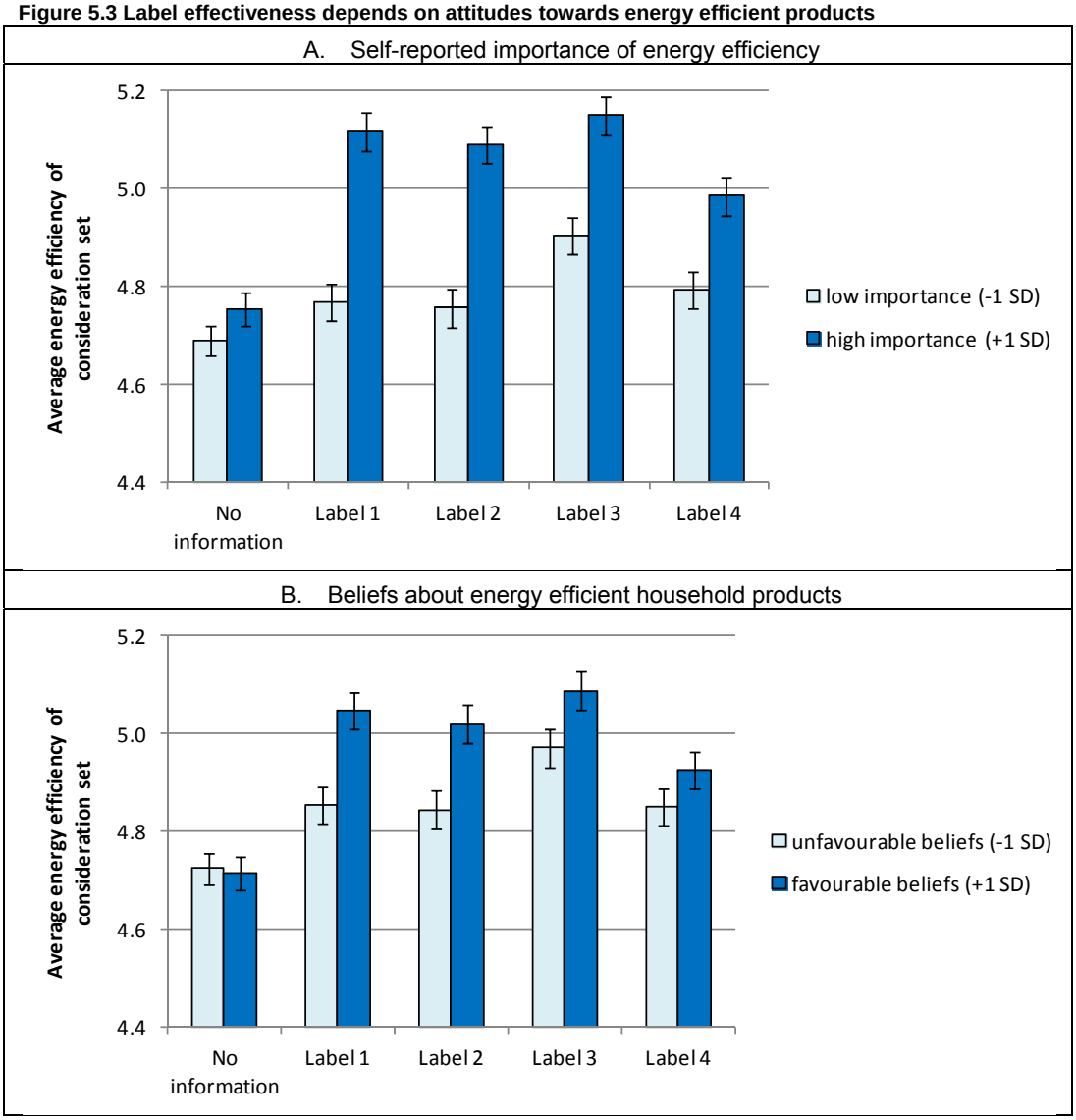
2. For consumers who find energy efficiency relatively unimportant, energy labels that do not explicitly communicate their meaning (label 1 and 3) should be more effective than energy labels that do so (label 2 and 4). However, since label 1 may be relatively easily recognised as energy label due to its similarity to the current label, we predict the effect to be stronger for label 3 than for label 1.

To test these predictions, we examine how the effectiveness of the energy label variants differs between consumers with relatively favourable and unfavourable energy efficiency attitudes (self-reported importance of energy efficiency and beliefs regarding energy efficient household products). Model details are in Appendix IV.

Consideration set formation

Moderation analyses reveal significant interactions between the energy information conditions and both consumer characteristics on the average energy efficiency of products in the consideration set (labels x energy efficiency importance, Wald $\chi^2(4) = 36.75$, $p < .001$; labels x beliefs, Wald $\chi^2(4) = 18.26$, $p < .01$).

Figure 5.3 Label effectiveness depends on attitudes towards energy efficient products



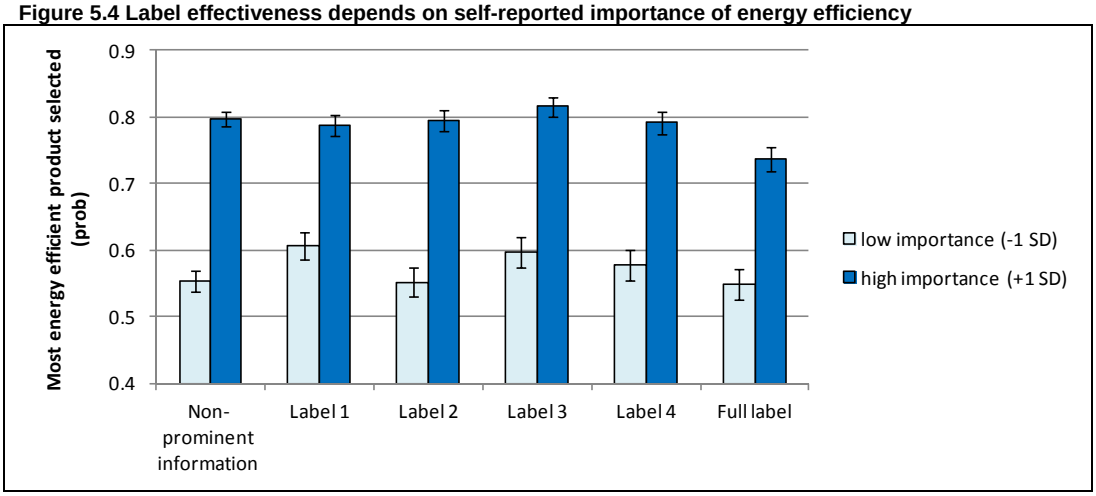
Consumers who place relatively low versus high importance on energy efficiency when buying household products do not only differ in their general response to energy efficiency information (as

established in the previous section), the two groups also respond differently to the specific energy label variants that were tested (Wald $\chi^2(4) = 11.40$, $p < .01$). For consumers who place relatively low importance on energy efficiency when buying household products, label 3 (frame of reference) is significantly more effective in promoting sustainable choices than label 1 (class-only, $p < .001$), label 2 (textual meaning, $p < .001$), and label 4 (pictogram, $p < .01$), which do not significantly differ from each other (ps > .31; see light bars in Figure 5.3.A). In contrast, for consumers who place relatively high importance on energy efficiency when buying household products, label 1, 2 and 3 are equally effective (ps > .11), and more so than label 4 (ps < .01; see dark bars in Figure 5.3.A). We observe a similar pattern of results for consumers with relatively favourable and unfavourable product-specific beliefs, i.e., beliefs about energy efficient household products (Wald $\chi^2(4) = 6.08$, $p = .11$; Figure 5.3.B). For consumers with relatively unfavourable beliefs about energy efficient household products, label 3 is most effective. This label outperforms labels 1, 2 and 4 (ps < .01), which do not differ from each other in terms of effectiveness (ps > .82). For consumers with relatively favourable beliefs about energy efficient household products, label 1, 2 and 3 are equally effective, and more so than label 4 (ps < .05).

Final choice

Moderation analyses reveal marginally significant differences in responses to the specific energy label variants for consumers with high versus low levels of energy efficiency importance (Wald $\chi^2(4) = 7.56$, $p = .109$), but not for consumers with high versus low levels of product-specific beliefs (Wald $\chi^2(4) = 6.27$, $p = .179$). Figure 5.4 shows the moderating role of energy efficiency importance in consumers' choices.

Figure 5.4 Label effectiveness depends on self-reported importance of energy efficiency



As predicted, for consumers who consider energy efficiency relatively unimportant, label 1 (class-only; $p < .05$) and label 3 (frame of reference; $p = .05$) are the only two labels that are more effective in promoting energy efficient product choices as compared to non-prominent energy efficiency information. These labels outperform label 2 (ps < .06) and the full label (ps < .05). For consumers who consider energy efficiency relatively important, there are no significant differences in effectiveness between the four reduced label variants (ps > .09). The full label performs significantly worse than each of the reduced label variants (ps > .01) and even worse than non-prominent information ($p < .001$).

Conclusion

Together, these findings support our predictions by showing that, for consumers who place low value on energy efficiency, the energy labels that do not explicitly communicate their meaning – and particularly label 3 – outperform the labels that do so. This supports the idea that these labels are being misinterpreted as an "overall" product evaluation, which ironically has positive

implications for product choices. In contrast, for consumers who place high value on energy efficiency, label 1 and 2 (and also label 4 in the final choice stage) are just as effective as label 3. This suggests that consumers who place high value on energy efficiency search for and use energy efficiency information in their decision-making process, regardless of the specific way the information is displayed, and even if it is presented in a non-prominent manner. The only exception is the full label, which performs poorly even within this consumer group. A potential explanation for the poor performance of the full label is that it does not efficiently use the (scarce) available space in online settings. That is, due to the fact that there is quite some "white space" in the label, the label occupies a fair amount of screen space for all the information in the full label to be properly readable. The full labels used in the study were designed such that all information in the label could be read, but due to space constraints the font size of information in the label was slightly smaller than that of the other product information (note that if the font size would have been the same, the labels would have occupied the full screen). Second, much of the additional product information in the label (such as the screen size of a TV or the load capacity of a washing machine) is logically part of the general product information, and hence presented in all conditions in the product-attribute matrix in the choice experiment.

While the pattern of results found for consumers who attach high versus low importance to energy efficiency in their choices is very consistent with our predictions based on the idea of label misinterpretation, there may be alternative explanations that cannot be ruled out by the present study. In this study, only four reduced-form label variants were tested and – although we tried to control for potential confounding factors as much as possible – the different labels may differ on other aspects than having a frame of reference and meaning. For example, differences in salience or in the extent to which the labels bear similarities to the full label (and hence feel familiar) might also play a role in label effectiveness. However, in contrast to our "misinterpretation" account, these factors cannot explain the complete pattern of results that we observe in Figure 5.3 and 5.4.

5.6.2 Consumer profiles

The previous section revealed that the effectiveness of the various energy labels investigated in this study depends on the importance consumers attribute to energy efficiency when buying household products. Table 5.29 provides insight into the attitudinal and socio-demographic profiles of the segments of consumers who attach relatively low (33% of the consumers), moderate (36%), and high importance (31%) to energy efficiency.

Not surprisingly, consumers who attach more rather than less importance to energy efficiency have more favourable product-specific beliefs, experience more social pressure to buy energy efficient products, have higher perceived control over their behaviour, stronger intentions to buy energy efficient products, and they engage in more environmentally sustainable behaviour in other domains (see Table 5.29, top). The consumer segments differ in their socio-demographic profiles, and most strongly in terms of gender and house ownership (Table 5.29, middle). There are relatively many male consumers (55%) in the low importance segment and relatively many female consumers (56%) in the high importance segment. Consumers in the high importance segment are more often house-owners (66%) than consumers in the moderate (61%) and low importance (55%) segments. Furthermore, there are more consumers with high education in the high (45%) as compared to the moderate (42%) and low importance (40%) segment. Employed consumers are somewhat underrepresented and students somewhat overrepresented in the low importance segment.

Table 5.29 Consumer profiles

	Segment 1 (33%): Low importance	Segment 2 (36%): Moderate importance	Segment 3 (31%): High importance	*Sig. (p)*
Attitudinal variables				
Product-specific beliefs*	3.50	3.84	4.08	<.001
Social norms*	3.20	3.53	3.80	<.001
Perceived control*	3.12	3.40	3.67	<.001
Behavioural intentions*	3.24	3.76	4.20	<.001
Sustainable behaviour in other domains**	3.31	3.60	3.87	<.001
* 1-5 scales; ** 1-7 behaviours.				
Socio-demographic profiles				
Gender (% male)	55%	49%	44%	<.001
Age	38	41	42	<.001
Low education	13%	11%	11%	.013
High education	40%	42%	45%	<.001
Low income	26%	26%	27%	.920
High income	38%	36%	35%	.041
Occ. status: Employed	56%	59%	59%	.016
Occ. status: Unemployed	12%	11%	10%	.142
Occ. status: Student	11%	9%	7%	<.001
Occ. status: Retired	6%	7%	8%	.001
Low population density	27%	27%	25%	.055
High population density	34%	33%	30%	.001
Household size	2.90	2.85	2.96	.001
House owner	55%	61%	66%	<.001
Distribution of consumer segments across countries				
Germany	11%	10%	14%	<.001
Greece	7%	8%	10%	<.001
France	12%	14%	6%	<.001
Ireland	10%	9%	9%	.057
Italy	11%	9%	13%	<.001
Netherlands	14%	12%	6%	<.001
Poland	8%	11%	14%	<.001
Portugal	5%	8%	13%	<.001
Romania	8%	10%	9%	.033
Sweden	14%	11%	6%	<.001
	100%	100%	100%	

Low = 1 (not important at all) or 2 (somewhat important), moderate = 3 (important), high = 4 (very important).

6 Spill-over effects

Having conducted the experiment and interpreted its result, we will now address to what extent these findings can be applied to other domains. We will call this application to other domains as spill-over effects.

There are two types of spill-over effects. The first refers to the tendency of people to adopt a similar mind set to a different situation. That is, as a consequence of seeing an energy efficiency label on one product, people also focus also on the energy efficiency of other products. The second type of spill-over effects is relevant for the policy maker. It refers to the extent to which effective elements in the label for one product can also be used in labels for another product.

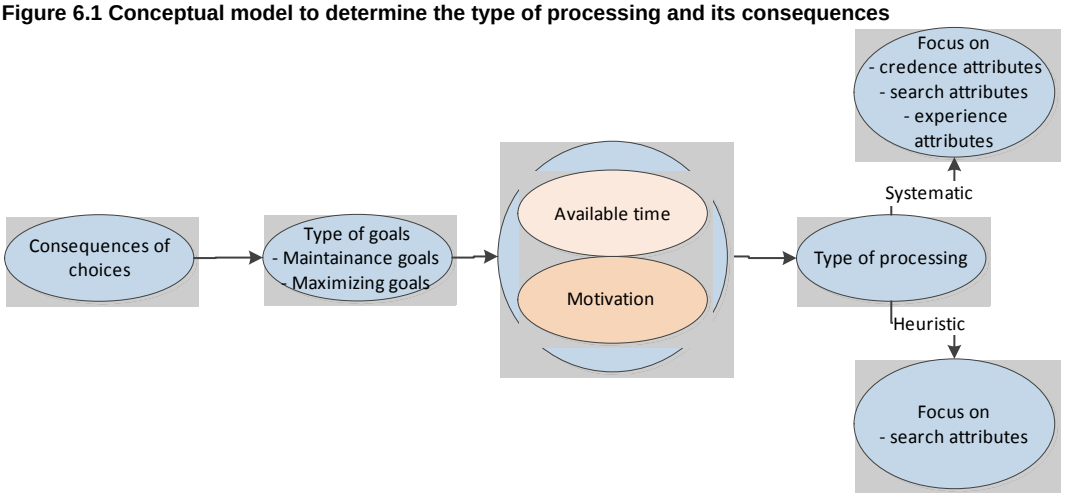
6.1 Spill-over effects to other products

To fully understand the level of spill-over, we need to further develop our understanding of the consumer choice processes for buying various types of goods and services. Therefore we first describe relevant theory from scientific literature. Next, combined with findings from the experiment, we apply this knowledge to explain the level of spill-over effects.

6.1.1 Scientific literature

The figure below summarizes the theory how people make choices between products or services. We further elaborate on this figure in the text below.

Figure 6.1 Conceptual model to determine the type of processing and its consequences



Types of processing

The process of choosing one product or service over the other involves weighing the pro's and con's of all the alternatives. According to the established dual processing model, evaluation of options can follow two different routes. [17] The first is the central or systematic route. Consumers evaluating through this route will extensively review and weigh all the aspects of the available options. They will focus on credence attributions, experience attributions and search attributions:

[17] Please note this theory complements the Theory of Planned behavior, described in Chapter 2. Depending on the route taken, the elements in the Theory of Planned Behaviour have a different weight.

Various attributes

Attributes are characteristics of the goods and services. We distinguish three types of attributes:

Search attributes are qualities that can be ascertained at the moment of purchase (e.g. colour, brand etc.).

Experience attributes are qualities that can only be ascertained after purchasing and consuming a product (e.g. taste, reliability, etc.). However, being in an online environment, consumers can often look for other consumers' experiences with the product or service.

Finally, **credence attributes** can never directly be ascertained by the average consumer. They involve characteristics of the product to a situation outside the consumer's view, or the effects are extremely small to such an extent that the (non-expert) consumer cannot judge the relationship between cause and affect (e.g. health or sustainability).

This is a relative intensive, time-consuming and difficult process. If consumers have the motivation (i.e. the choice is very personally important to them) and ability (e.g. no time constraints), they will most likely deliberately weigh all the information. However, consumers are usually not motivated and/or able to weight all available information. Therefore they often take the second route.

The second route, called the peripheral or heuristic route, processes information in a rather heuristic fashion, relying more on peripheral information. Consumers evaluating through this route will briefly review and weigh the most salient aspects of the available options, for instance price, colour, brand, and other search attributes. This process is quick and dirty.

What determines the route taken?

Ultimately, the consequences of making a right or wrong choice determine which route is taken to make a decision. The consequences are reflected in the kind of goals they pursue. We distinguish two types of end goals. People either adopt optimise satisfaction goals (i.e. maximizers) or maintenance goals (i.e. satisfizers). When the consequences are severe, people are more inclined to make the best possible decision. On the other hand, when the choice does not have a large impact, consumers will satisfy their needs, and stop putting efforts in the decision making process once the needs are (superficially) satisfied.

The adopted end goals are resulting in corresponding motivation levels and amount of time available for the choice. When a consumer is trying to maximize the outcome of his decision, he is more motivated, and makes more time available to make a decision. The opposite holds for when a maintenance goal is adopted.

Applying to labels

Labels represent information about characteristics of the product that is not readily available to consumers. Moreover, a label makes it easier for consumers to comprehend this information. This means that labels transform credence attributes (and possibly experience attributes) to search attributes. Therefore the credence information becomes accessible to more consumers, also to those consumers who make a decision through the heuristics route.

6.1.2 Combination of theory to experimental findings

In our experiment we found strong evidence that in large purchases where consumers are motivated to deliberately weigh all the information available (both search and credence attributes: e.g. buying a washing machine), using a label indeed increases the weight of sustainability in the

evaluation of the various household appliances. However, the more difficult labels (e.g. the off-line label) are less effective.

However, we also found indications that the less severe the impact is of a wrong or right choice (e.g. buying a light bulb), the less consistent our findings, indicating that choices with less impact render the label less effective. For the more expensive products, we did find strong and consistent effects of the label.[18]

Although we did not specifically study the effects of labels for other products, we argue that the effects of labels have the same effect for other products as found for household appliances. A label transforms a credence attribute to a search attribute, lowering the bar for consumers to pay attention to sustainability (or other credence) information. Consequently, this will influence the choices consumers make, as also found in our experiment.

Food labelling

When looking at how the findings of this study relate to food products, it is important to look at the existing European regulations in place on distance selling of these items. The European Parliament and the Council adopted regulation 1169/2011 on 25 October 2011 on the provision of Food Information to Consumers (hereinafter the FIC Regulation). The FIC Regulation modifies existing food labelling provisions in the Union to allow consumers to make informed choices and to make safe use of food, while at the same time ensuring the free movement of legally produced and marketed food. Art 14 requires mandatory food information to be provided also when food is offered for sale by means of distance selling.

Currently the regulation requires all information to be presented with words and numbers. The use of pictograms or symbols is only an additional means to express such particulars (Art 9). However, according to the regulation, the Commission has the authority to adopt delegated / implementing acts allowing one or more mandatory particulars to be expressed by means of pictograms or symbols instead of words or numbers if evidence of uniform consumer understanding is available.

Consumer decisions on food purchasing and food labelling

When shopping for daily groceries (e.g. food) consumer purchasing differs from those of household appliances. In shopping for daily groceries consumers face time constraints, limited motivation to carefully review every products and therefore act solely upon their goals in a heuristic fashion. Simply, consumers have mostly maintenance goals with a high level of time constraints and low motivation, and are therefore mainly focussed on search attributes. Consumers will usually not consider all the information available.

Therefore, a clear decision cue incorporated into the products' physical appearance indicating whether a specific product is "sustainable", would allow consumers to take also sustainability into account in their purchasing decision. A label that tells consumers immediately, with one simple look, whether a product is produced in an environmentally "(un)friendly" fashion will stimulate the desired purchasing.

Possible spill over effects on food products sold online

We conclude from the literature study that consumers, when purchasing food, usually base their purchases on search attributes such as colour or package design. However, other literature indicates that consumers prefer labels that provide them with extensive quantitative information on

[18] We find this explanation to be intuitively the best. Nevertheless, please note that also other factors could explain the results, such as habitual shopping, correlation between type of technology and energy consumption which is stronger for light bulbs or distribution of energy classes between the various products.

different factors concerning the product's quality. They want to make elaborate decision themselves based on specific characteristics they find important. Therefore, they prefer table labels (e.g. nutrition table) since these provide detailed and non-directive information (i.e. no statements of good/bad). Currently the FIC regulation allows information provision in the form of numbers and words and in the form of a table.

However, in energy related information the simplified label in form of colour scaling and letter identifying the energy class was found most effective. As currently the FIC regulation requires information to be displayed only in words and figures, we anticipate a stronger effect on consumers decision making if this information were to be displayed in a more visual format such as the designs of the labels we tested.

The existing European energy label is mainly related to environmental (sustainability) aspects of a product. Thus, a label that indicates clearly the environmental positive effect of food product (similarly to energy label) is likely to be effective for consumers. This label could indicate environmental impact of the food with similar colour and grading scale (A-G) as the energy label. Environmental impact can for instance result from the use of chemicals in the production process, extensive transportation and other energy consumption in the product.

However, when the label on the food product indicates other content than energy efficiency, or sustainability, one has to be very careful. Consumers came to understand that the labels, as investigated in our study, are related to energy consumption. Seeing the same label on food products, might lead consumers to erroneous assumptions about its meaning, when the meaning is actually something else than environmental impact. Thus, simply copying the same layout of label might lead to confusion or even mislead consumers.

6.2 Spill-over effects of exposure to energy labels

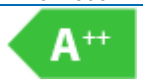
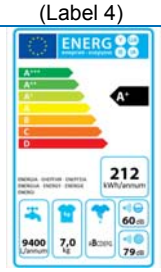
As mentioned in Chapter 5, on average participants in our experiments considered energy efficiency important in products with a 3.0 on a scale from 1 till 4. Also, participants were concerned about the environment with an average score of 4.08 out of 5.

Examining differences in respondents' general environmental concern as measured *after* exposure to energy information in the simulated shopping experiment may provide some initial insight into the presence of spill-over effects of the labels to environmental concern. Because respondents were randomly assigned to the experimental conditions, it can be assumed that respondents in different conditions had the same level of environmental concern before taking part in the experiment. Therefore, any differences in environmental concern measured after the experiment reflect the differential impact of the specific way energy information was presented (since all other information was held constant).

A multilevel regression analysis of general environmental concern on the energy information conditions (across the two subexperiments) yielded a marginally significant effect of energy information on general environmental concern (Wald $\chi^2(5) = 10.40$, $p = .06$). The descriptive results are in Table 6.1. Overall, consumers who were exposed to label 1 ($M = 4.10$) and 2 ($M = 4.11$) in the experiment reported significantly higher general environmental concern after the experiment as compared to consumers who were exposed to label 3 ($M = 4.05$; label 1 vs. 3, $p < .05$; label 2 vs. 3, $p < .01$) and 4 ($M = 4.06$; label 1 vs. 4, $p = .09$; label 2 vs. 4, $p < .05$). Reported environmental concern of respondents who were not exposed to energy information ($M = 4.08$), to non-prominent energy information ($M = 4.09$), or to the full label ($M = 4.07$) fell in between and did not significantly

differ from general environmental concern of respondents who were exposed to label 1, 2, 3, and 4 (*p*s > .09). Exposure to the energy labels did not impact consumers' *specific* attitudes towards energy efficient products (Wald $\chi^2(5) = 6.72$, $p = .242$), perceived social pressure (Wald $\chi^2(5) = 8.12$, $p = .150$), or perceived behavioural control (Wald $\chi^2(5) = 6.05$, $p = .302$).

Table 6.1 Effect of energy information on general environmental concern

	General environmental concern		
Energy label:	Consideration set formation	Final choice	Average
No information	4.08	-	4.08
Non-prominent information	-	4.09	4.09
 (Label 1)	4.12	4.08	4.10
 (Label 2)	4.10	4.13	4.11
 (Label 3)	4.03	4.08	4.05
 (Label 4)	4.07	4.05	4.06
 (Full label)	-	4.07	4.07
Average	4.08	4.09	4.08
Sig.	$p < .05$	$p = .301$	$p = .064$

Note: general environmental concern is measured by three items on a scale from 1 to 5.

Thus, whereas the experimental results in chapter 5 demonstrate that label 3 is most effective in promoting energy efficient product choices, these findings show that this label may not be very effective in building more favourable *general* attitudes towards the environment. That is, general environmental concern is (statistically) significantly lower after exposure to label 3 as compared to label 1 and 2. Interestingly, this seems to provide further support for the idea that the effectiveness of label 3 in promoting energy efficient product choices may be driven by the fact that consumers do *not* strongly associate this label with energy efficiency. In other words, due to lack of explicit meaning, this label may not prompt consumers to think about the environment as much as other labels.

We emphasize that because our study was not specifically designed to accurately measure spill-over effects, these findings only show crude, initial insights into potential spill-overs of exposure to online energy labelling. These findings can demonstrate an *immediate* effect of exposure to energy

labels on general environmental concern and that the direction of the effect is critically dependent on the specific energy label variant. However, they do not provide insight into the long-term impact on sustainability attitudes of exposure to online energy labelling.

Based on this, we judge the spill-over effects from the labels to the environmental concern as minimal. The differences between labels are very small, and effects are (although not tested) unlikely to last for a longer period.

7 Conclusions and policy implications

In Chapter 1, we described seven outcomes of our study. In this chapter, we revisit those expected results and present our findings. The recommendations provided in this chapter (and report) are provided by the project team and do not reflect any commitment from the European Commission.

Result 1: Putting energy labelling on the Internet has a significant impact on consumers' product choice

We examined two phases in the shopping process in the online environment where consumers could be influenced by an energy label. The first phase is when consumers face all the available products and narrow down their choice to a smaller set which they would like to consider in more detail (the consideration stage). In the second stage, consumers examine the smaller set of pre-selected products and make their final decision on which product to buy (the choice stage).

In the first decision stage (consideration), we find very strong and consistent evidence that the display of an energy label ensures that consumers are more likely to select more energy efficient household appliances**,** compared to no information on the energy efficiency rating of a product. This means that the energy label ensures that the shortlist from which consumers will ultimately make their final choice is more energy efficient. This finding is consistent for all examined products, in all examined countries, for all types of labels used in the experiment.

In the second stage of the online decision process (final choice of product), we studied the effect of having the energy information present through a label (prominent information) as compared to energy rating given as text among other product details (non-prominent), which mirrors the way energy ratings are often provided in online shops. We found that a label (i.e. making the energy rating more visible) does not contribute to more energy efficient choices of consumers in this stage. At this stage consumers are exposed to large amount of other information which effectively competes with the energy efficiency information. However, we did find that displaying the full offline label in the online environment at this stage can even have a negative effect: it gives worse results than showing the energy rating in a simplified form, either as simple text (e.g. A+) or as a simplified label.

Combining these two findings, we conclude that having a label present results in more energy efficient choices. Seeing an energy label in the consideration stage induces consumers to select a more energy efficient set of candidates from which they will choose their final product. This naturally leads to more energy efficient final decisions, despite the fact that labels do not work as well in the choice stage.

Policy recommendation 1 – Use labels in the online environment

Energy labels have a key role in providing buyers online with information on energy efficiency of the products and in influencing their choices in favour of products that consume less energy. If an energy label is displayed, especially in the early stage of choice-making, it is more likely that consumers choose energy efficient products.

Furthermore, as the online markets are rapidly growing and online information is increasingly used by end-users, it is important to level the playing field for online and offline retail environments in order for information about energy labels to reach the end-user regardless of where they make the

purchase (see also Result 5). The findings of the study thus support the mandatory requirement for energy class information to be presented in the online setting.

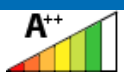
Result 2: In the future labels need to be designed specifically for the internet channel – not just "mimic" the off-line environment

In the experiments we tested five different labels, depicted in the table below. For the consideration stage, where many products are listed with only a few key parameters (brand, picture, price), we tested four designs of labels that aimed to convey the energy rating in a more compact format than the full energy label that is currently used in offline retail. For the choice stage, where the buyer has already narrowed down the choice and examines a few products in more detail, we tested the same four labels as well as the full label. The labels differed in terms of presentation of frame of reference, textual meaning and visual meaning. This allowed us to test the effectiveness of those three aspects of labels. We contrasted those against control conditions, which are representative of the current situation in online sales environments, namely 1) no energy rating information in the consideration stage, 2) energy rating listed as text in the product details (choice stage).

For both the consideration set stage and the final choice stage, we found that Label 3 (Frame of reference) outperformed the other labels, compared to the control condition. Label 3 led to the highest increase in selecting the most energy efficient product during the first selection stage of the decision process and made it less likely energy inefficient products were selected. Moreover, the label made it more likely that in the final choice a more energy efficient product was chosen. The second best label is Label 1 (Class-only label). Label 2 (Meaning) and Label 4 (Meaning + Frame of reference) perform less well. Finally, the full label (Label 5) shows the worst results, rendering it unsuitable for the online environment.

The results are summarized in Table 7.1 which shows the order of strength of the various tested labels, with the label providing the strongest performance on top. The ranking is based on statistical testing. This means that labels with the same rank perform statistically equally well. Thus, it shows that in the consideration experiment, all labels perform better than the control condition. Simultaneously, in the choice experiment, Label 3, 1 and 4 outperform the control condition, while Label 2 does not perform better than the control condition, and Label 6 performs worse than the control condition.19.

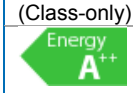
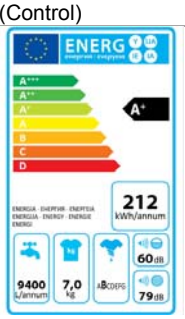
Table 7.1 Table with ranking of performance of the labels[20]

Consideration set experiment				Final choice experiment[21]	
Rank	**Label**	**Additional effect of label**		**Rank**	**Label**
1	 Label 3 (Frame of reference)	19.6%		1	 Label 3 (Frame of reference)

19 Please note, in the choice experiment, statistically, Label 3 shows the same performance as Label 1 and Label 4. But also, Label 2 performs the same as Label 1 and Label 4. Label 3 does perform statistically better than Label 2. Hence, we report the ranking as Label 1 and Label 4 in between Label 3 and Label 2.

20 The rankings are based on likelihood of selecting the most efficient product(s). Rankings are statistically tested. Labels with same rank do not statistically differ from each other.

21 Finding the additional effect of the labels in the choice stage is not possible, because the effects from the label in the selection stage will have an effect on the results in the final choice stage. In our experiment, participants participated in either of the two stages, which makes it impossible to derive realistic additional effects of the labels for the final choice stage.

Consideration set experiment				Final choice experiment[21]	
Rank	Label	Additional effect of label		Rank	Label
2	 Label 1 (Class-only)	13.7%		2[22]	 Label 1 (Class-only)
	 Label 2 (Meaning)	9.8%			 Label 4 (Visual meaning + Frame of reference)
3	 Label 4 (Visual meaning + Frame of reference)	7.8%		3	 Label 2 (Meaning)
4	No label (Control)				A++ (Control)
				4	 Label 5 (offline label)

These findings are relatively consistent for all products and countries. Only in a handful instances (products or countries) we found Label 1, or Label 2 to be most effective. However, in all those cases, Label 3 is always the second most effective label and never far behind the most effective label.

Label 1 and 2 (the arrow with the rating letter) are direct extracts from the full physical label. On the other hand, Label 3 was a preliminary attempt at an "internet-specific" design, which draws on the visual identity of the existing full label but seeks to "translate" it into the online environment by modifying the existing format.

The better performance of Label 3 points toward the need to take into account also the online sales environment, rather than just the brick and mortar stores in the design stage of a label. One can opt for two different labels, one for the online environment and one for the offline environment. However, this could result in confusion for the consumers who may not be able to distinguish the exact meaning of the label for instance by mistakenly assuming the online label means something different than the offline label. This reduces the comparability between offline and online products.

Therefore, we recommend designing separate labels for the online and offline environment and further test which label is the most effective in both environments.

What exactly makes the tested labels more or less effective is difficult to identify. When we looked in more detail at the different elements of the label we could not readily identify the successful

[22] The score for Label 1 is statistically not different from Label 3 or Label 2.

generic elements of it. Adding a meaning (visual or textual) to the label does not produce a positive effect. Also a frame of reference in the label does not produce positive effects in itself, as shown by the reduced performance of Label 4. Thus, it could be the case that other elements of the labels (the shape of the frame of reference, the colours of the labels etc) either reinforced or reduced the effect of the frame of reference effect. Due to the limited number of labels tested, we are unable to discern with certainty whether there is an interaction between frame of reference and other elements or that adding a frame of reference does not improve the performance of the label.

Remarkable for the frame of reference effect is also the strong performance of Label 3. It is relatively common that a higher score for a product (as indicated by for instance stars) is representative for better products. In the original offline label (Label 5) shorter horizontal bars represent higher energy efficiency score. However, for Label 3 that draws on that visual identity, longer (vertical) bars (and more of them) stand for higher efficiency score. Yet, people seem to understand this. Although not tested, there likely also is an interaction effect with the colouring scheme, whereby green is seen as a generally better score than a red score, and green is also associated with greater energy efficiency. Thus, the colour is compatible with its meaning.

The low score of the offline label (Label 6) in the online environment is also relatively prominent. The label is relatively large, and therefore it is not best fitted for the online environment. Although we ensured good visibility of all the elements of the label, we found that the label performed worse than simply providing the energy class without a label. However, this study cannot formulate any definitive conclusions on the reasons why this is the case. One explanation could be that the label was too complex for consumers to understand, particularly in the online environment where consumers are less willing to spend time reviewing the available information. This could have caused consumers to ignore the energy class more often than when just the energy class was provided. Nevertheless, it is clear that the offline label decreases the selection of energy efficient products, compared to the current situation where only the energy class is depicted.

Policy recommendation 2 – Research further the ways to optimise the energy efficiency label by exploring designs specific for the online environment

Our experiment showed that smaller, simpler labels functioned better and the energy efficiency label that is currently used in offline retail was least effective or even counter effective in increasing energy efficient product choices in the online environment. We therefore recommend revising the design and content of the current energy label in case of using it in online setting. Given the rising importance of the online channel not just for buying, but also for finding information and making choices before offline purchases, we recommend designing the energy label specifically with the internet channel in mind.

Result 3: Individual differences between consumers are more important than differences between member states.

Consistent with our predictions, the presence of energy efficiency information promotes energy efficient choices more for consumers who find energy efficiency relatively important, have positive beliefs regarding energy efficient household products, experience high levels of social pressure, and high sense that their actions matter.

Further analyses show that environmental concern (most important factor) is more likely to be found among consumers who are female, older, higher educated, likely to be employed, live in a more populated area, and are more likely to own their houses.

For consumers who place high value on energy efficiency, labels 1, 2 and 3 were equally effective in the early stage of decision making. Also in the final choice stage, consumers who place high value on energy efficiency pay attention to and use energy efficiency information in their decision-making process, regardless of the specific way the information is displayed, and even if it is presented in a non-prominent manner. The only exception is the full label, which performs poorly even within this consumer group.

On the other hand, when consumers were less inclined to consider energy efficient products, Label 3 proved to be most effective in encouraging consumers to consider the more energy efficient products. Other labels were on average equally successful in nudging disinclined consumers to consider more energy efficient products. In the final choice, the labels with no visual or textual meaning attached to them (Labels 3 and 1) performed best for these consumers. As in the consideration set formation stage, this may suggest that these labels are interpreted as an “overall” product evaluation with positive implications for product choices.

Based on these findings we conclude that on average Label 3 is more effective than the other labels, because it is better able to nudge consumers who are in general less inclined to focus on the energy efficiency when making decisions on what household appliance to buy. These consumers are mostly male, younger, lower educated, less likely to be employed, live in a low densely populated area, and are less likely to own their house.

Finally, we find that the most important factors determining the energy efficiency of the chosen products is at individual level, rather than at Member State level. Moreover, differences between Member States on what labels work best are very small. In other words, the findings are consistent across Europe. Based on this we conclude that a framework for the harmonisation of national measures on end-user information on the consumption of energy concerning energy-related products is best done at European level in order to provide energy related information of products in consistent and comparable way across Europe.

Policy recommendation 3 – to increase attention to energy efficiency, target groups with low environmental concern

For consumers for whom energy efficiency has low importance in their purchasing decision, education and awareness raising measures regarding energy efficiency will increase the effectiveness of the labels. As shown earlier, increased environmental concern improves the performance of all labels. In that sense, it may be most efficient to target those groups with low environmental concern, where the largest gains are possible. Specifically, the target group could be males, house renters and people with lower education, because those are the people that on average are relatively less concerned about the environment, according to our survey. Also, some Member States may be more relevant than others to target that show a lower environmental

concern (see table 5.7). In our study we found Netherlands, Poland, Ireland, Sweden to have a relative low environmental concern.

Result 4: Online labels need to simplify information for the consumer, but they also need to be interpreted correctly

When information is hard to acquire, it is less likely to play a role in the decision process. A label makes it a lot easier for consumers to assess a characteristic or attribute of a product that is otherwise hard to understand or to find information on. Thus, an energy efficiency label in itself makes it more likely consumers act upon their preference for more energy efficient household appliances. In addition to being present, labels must be noticed, before consumers can take into account the energy efficiency information. Secondly, the labels should be easy to understand, be trustworthy and help to attain a goal. Easier labels make it more likely that consumers understand what the label says, and consequently act upon it. Also, simpler labels are more likely to be taken into account when consumers are less motivated to spend a time and effort in making the best decision.

In our experiment we find that our labels are indeed taken into account by online buyers. With the exception of the full label, all tested labels result in more energy efficient choices by consumers compared to the control conditions. The effect of the labels was strongest for consumers with strong environmental concern or other motivations to include the energy efficiency of the products in their decision making process.

Regarding how easy to understand the labels were, the evidence is less clear. On average, the participants in the experiment, found Label 3 easiest to understand, followed by Label 1. Those labels were also most effective at encouraging more energy efficient choices. Label 2 (i.e. Label 1 accompanied by textual meaning "Energy") was rated as less easy to understand (an unexpected result), as was the pictogram (Label 4) and the full offline label (Label 5).[23] We conclude that consumers may indeed find it easier to understand Label 3 (and Label 1), but we cannot rule out miscomprehension, as some participants may have interpreted these labels as some overall quality rating of the product.

Finally, labels should be compatible with the ultimate goal consumers wish to accomplish, being either energy savings or life cycle cost savings. All our tested labels satisfy the first need, namely convey information about energy efficiency, although some more explicitly than others. Life cycle cost are not covered by the labels thus making them less attractive to consumers who have these as a priority.

Policy recommendation 4 – Conduct further research into consumer understanding of online labels

Further research is required to gain a better knowledge of consumers' understanding of online labels as we find some indications that consumers may misinterpret some of the tested labels. It is important to ensure that consumers do understand that the label is about energy efficiency of the product, and not an overall performance measure. In addition, more research is required to determine the optimal trade-off between the need to make the information easy to understand, and the need to be comprehensive in the information label communicates.

[23] Participants in the experiment did not compare the labels: each person only saw one label throughout the experiment and rated the overall ease/difficulty of understanding the information. Since the information for the participants differed only by label (other aspects being randomised), we were able to infer the relative 'easiness to understand' of the labels.

Result 5: The majority of consumers search online for product information before buying online or offline. Order of product search results matters.

Our data shows that the online environment is very important for purchases: 71.4% of the people search for products online on a regular basis, followed by an offline purchase. This means that those people will make their decision for a product in the online environment. Moreover, the majority of the consumers in the study (85,6%) visited a price comparison website. We also found that almost all consumers knew the energy label as currently used offline. Displaying energy labels in the online environment will therefore have an influence on the offline purchases. Thus, with respect to energy efficiency, online energy efficiency labels have a positive influence on the products people buy, both online and offline.

In searching for products, besides the energy labels, the order in which the products are depicted is also relevant for selecting energy efficient products. In the study we found that depicting energy efficient products on the top left, rather than the bottom right of the screen, makes it more likely that consumers select the energy efficient products.[24]
Although not studied, this effect might be related to the limited time consumers allow themselves in the online environment to select the right product, inducing them to select the first product they see. Studies involving eye tracking measurements could provide definitive answer whether this assumption is true.

Policy recommendation 5 – Promote availability of listing/sorting products by energy efficiency
It would be interesting to encourage online shops and price comparison websites to make available product sorting by energy efficiency, just like by other criteria such as price, newest to oldest, etc. The strongest effects are expected when by default the products are sorted from most to least energy efficient.

Result 6: Given the growing importance of the online channel and increased requirement of displaying labels online in other sectors, it is recommended to take the online environment into account when designing the label.

Findings from this study show that the offline label's performance in the online environment is particularly ineffective. Rather, other labels that were specifically designed for the online environment proved to be far more effective. Given that the online environment is increasing in prominence for consumers when shopping for products both on-line and off-line, also the labels in the online environment are becoming increasingly important. Therefore, we recommend to take explicitly also the online environment into account when designing new or other labels for consumer goods in general and household appliances specifically.

More broadly, as more economic and social activity moves into the online environment, it will become necessary to rethink information provision to consumers. A "label" is a physical world term. How do we best provide consumers with online data? Insights from behavioural analysis are already applied by business in the online environment and this is an important emerging area for the public sector to get to grips with.

The findings in this study are relatively consistent over countries and type of products. Therefore, we are very confident about reliability of the conclusions. We are also fairly confident about the generalizability of our results to other consumers and other countries as the participants in our study constitute a representative sample of the (online) population.

[24] At least in the consideration stage of the decision making process.

Appendix I: Product-specific labels

The Directive 2010/30/EU is a framework directive that acts as an umbrella under which fall currently nine delegated regulations and directives, for each product group one. These products are:

1. air conditioners;
2. dish washers;
3. lamps;
4. ovens;
5. refrigerators;
6. televisions;
7. tumble driers;
8. washer driers;
9. washing machines.

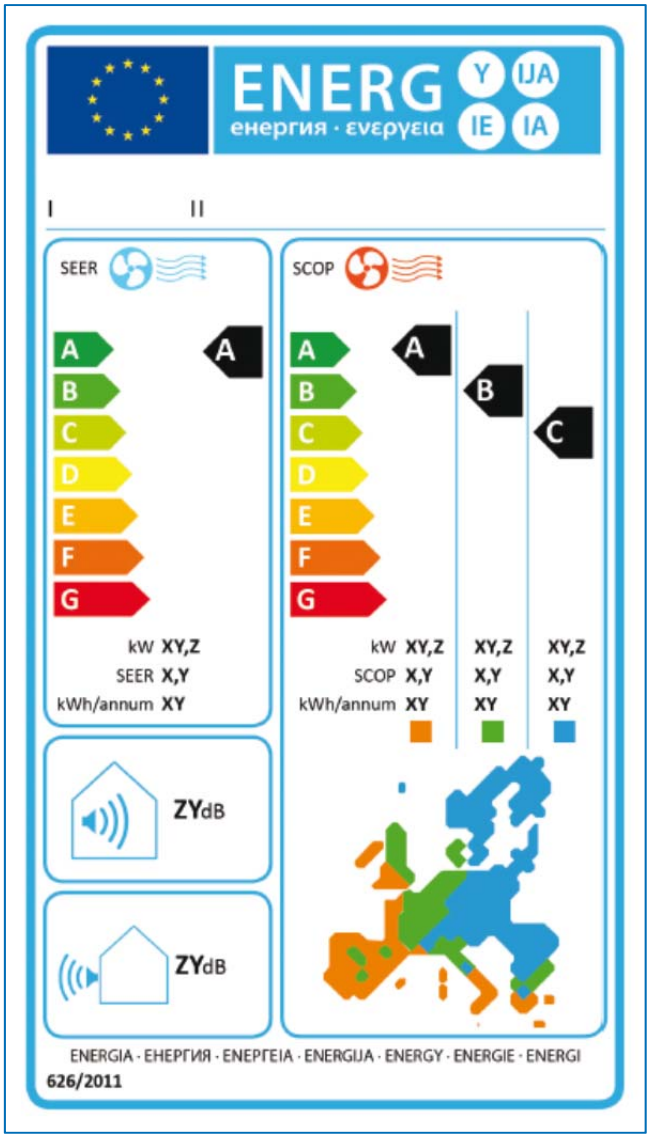
For each of these products, certain parts of the label are similar and others differ. In this Appendix we briefly describe the energy efficiency label per product.

Air conditioners

According to the delegated regulation 626/2011, Air conditioners should be labelled since 1 January 2013 with the label depicted below. There is no transition period.

The label consists of two energy efficiency labels: one for the cooling function, one for the heating function. There are also two values for the noise levels, one for inside and one for outside units. Finally, one key part of this label is the difference in energy efficiency depending on the region (climate), as indicated by the coloured map. For instance, in the label below, the energy efficiency of the heating function is lower in colder regions.

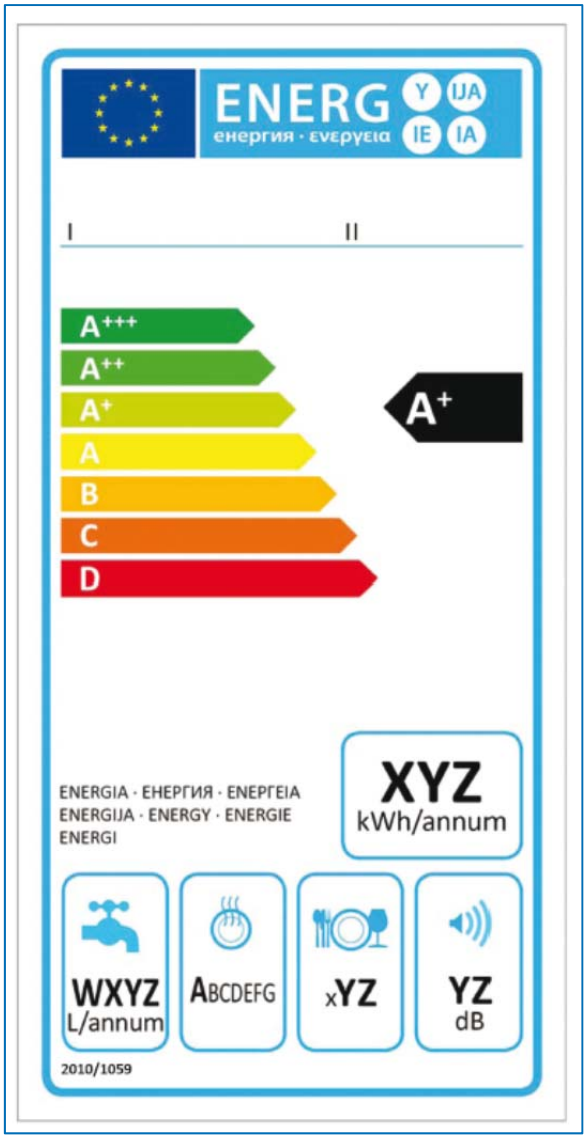
Besides the climate factor and the extra label regarding noise, the new regulation reclassified the A-G label, and allow for extra more efficient categorizations (A+ - A+++) for the years to come.



Dish Washers

According to the delegated regulation 1059/2010, dish washers should be labelled since 20 December 2011 with the label below. There is however, a transition period till 20 April 2012 in which both the old and the new label are acceptable for advertisements and distance selling.

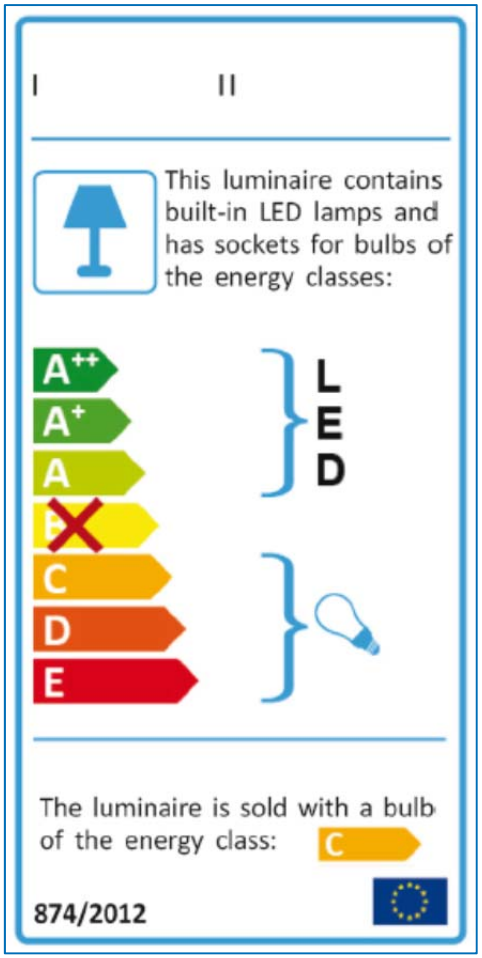
The label includes an energy classification that runs from A+++ to D. It also contains a symbol with the standardized amount of energy consumption, the annual standardized water consumption, the energy classification of the drying function, the capacity of the device, and finally a logo containing information on the noise level.

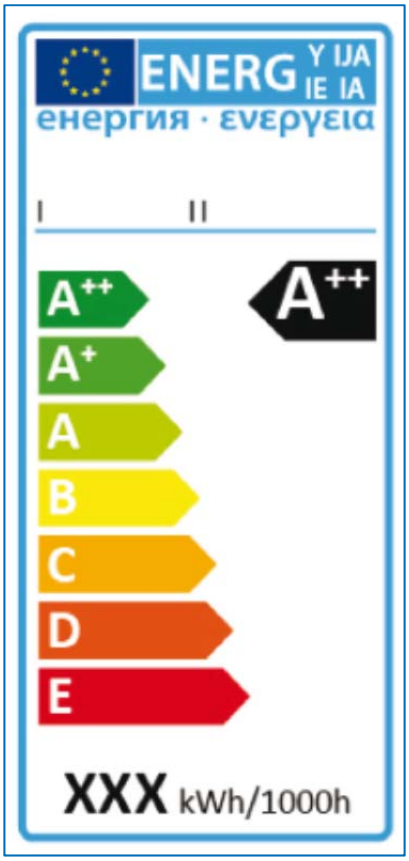


Lamps

According to the delegated regulation 1059/2010, lamps and luminaires should be labelled since 1 September 2013 with the new label, one of which is depicted below. There is however a transition period with exceptions running till 1 March 2014. The label consist of an energy efficiency class notification, and an annual standardized power consumption for the lamps. Only the energy efficiency class is depicted on the label for luminaires.

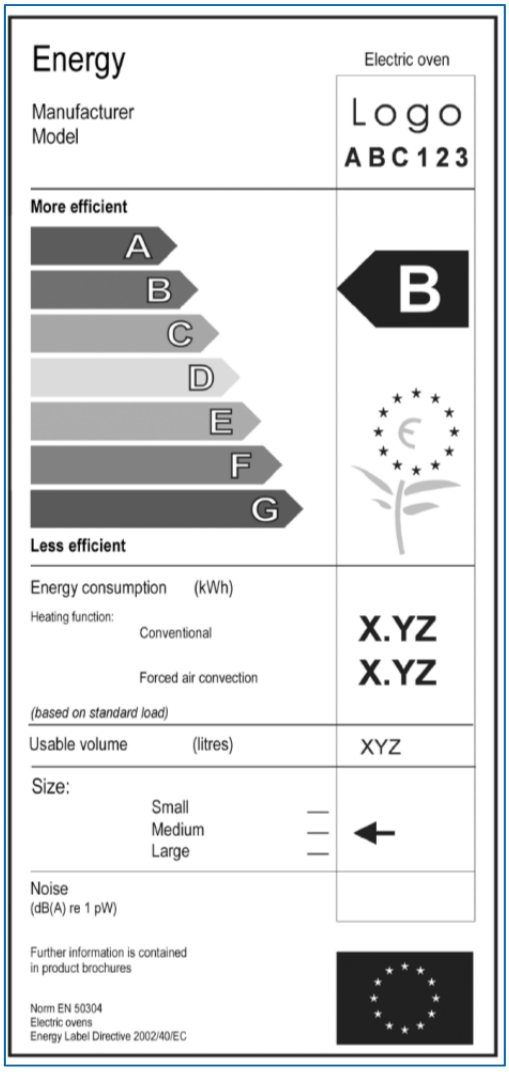
Noteworthy is the fact that different labels exist for different type of luminaires. For instance LED lamps will never have the energy classification lower than A, while ordinary bulbs will never have a classification higher than C. This is depicted with the red cross through B till E for LED lamps, and a red cross through A++ to B for the ordinary bulbs. A combination of these are depicted.





Ovens

The label for ovens is still regulated via the delegated directive published under the previous framework directive, (Directive 2002/40/EC), so the label still has the old lay-out. It specifies the energy labels attached to ovens, as depicted below. It consists of information on the energy class, specified for the normal and air heating, the volume of the oven and the noise it produces. It entered into force on 1 January 2003 with a transition period till 30 June 2003.

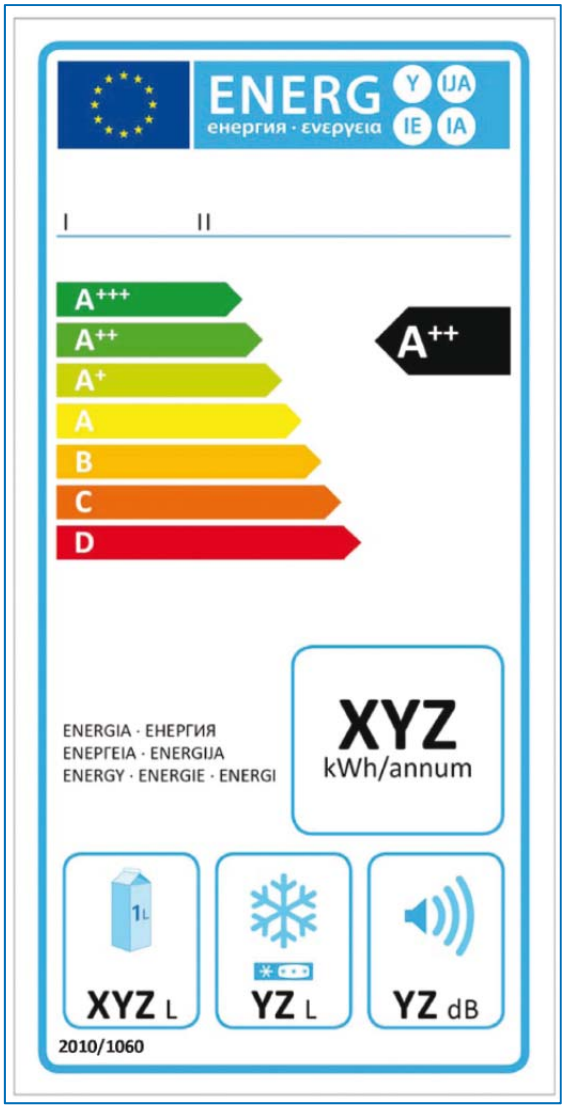


Refrigerators and wine storages

According to the delegated regulation 1060/2010, refrigerators and cooled wine storages should be labelled since 30 November 2011 with the new label, one of which is depicted below. There is however a transition period with exceptions running till 30 March 2012.

Depending on the energy efficiency classification, there are either 7 categories from A+++ to D (when classification falls inside this range), or 10 categories from A+++ to G (when classification is lower than D). The label consists of symbols indicating the annual standardized power consumption, its volume, the volume of the freezing compartment and the noise level in decibels.

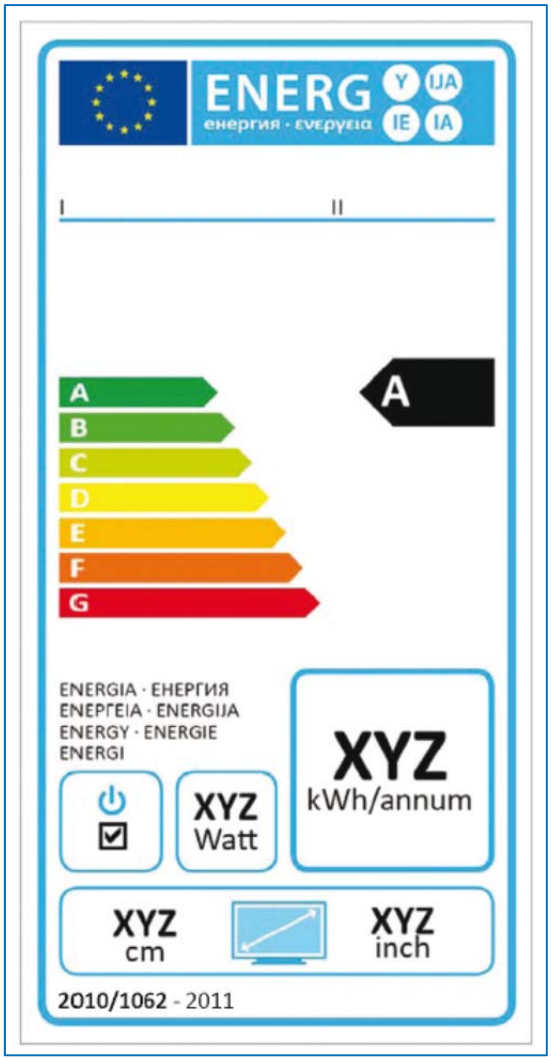
For the wine storages, a similar scheme holds for the energy efficiency classification, but less symbols are required. Only information on the energy consumption, volume and noise is required.



Televisions

According to the delegated regulation 1062/2010, televisions should be labelled since 30 November 2011 with the new label, one of which is depicted below. There is however a transition period with exceptions running till 30 March 2012. Interesting to note is that this product group was not subject to mandatory labelling before. The label consists of the energy efficiency classification and symbols for the standardized annual power consumption, the power of the television expressed in Watt, whether it consumes less than 0.01 Watts when switched off, and the visible screen diagonal in both centimetres and inches.

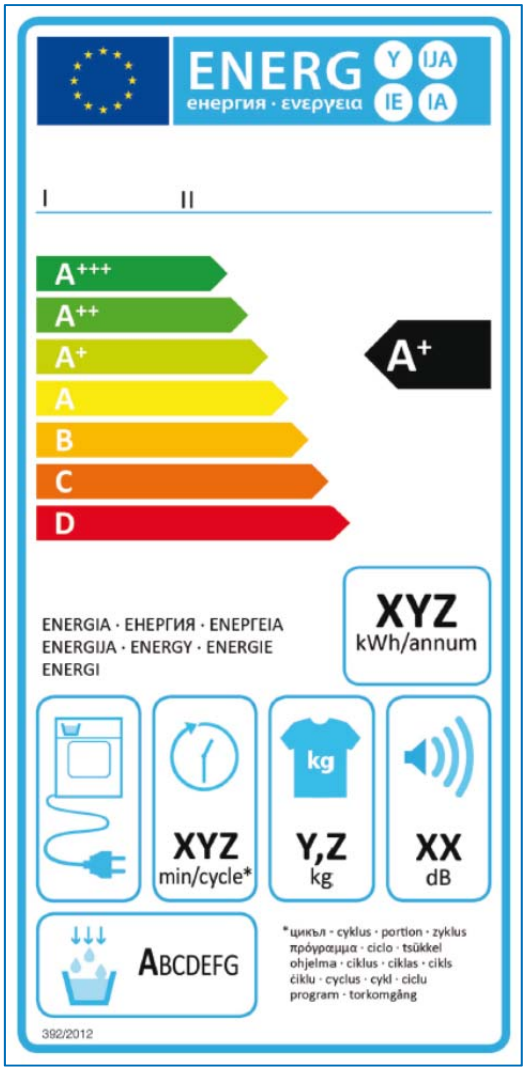
The energy efficiency classification scale runs from A till G, but every three years there is one higher classification included (A+ etc.) and one lower classification excluded, until the classification scheme runs from A+++ till D in 2020.



Tumble driers

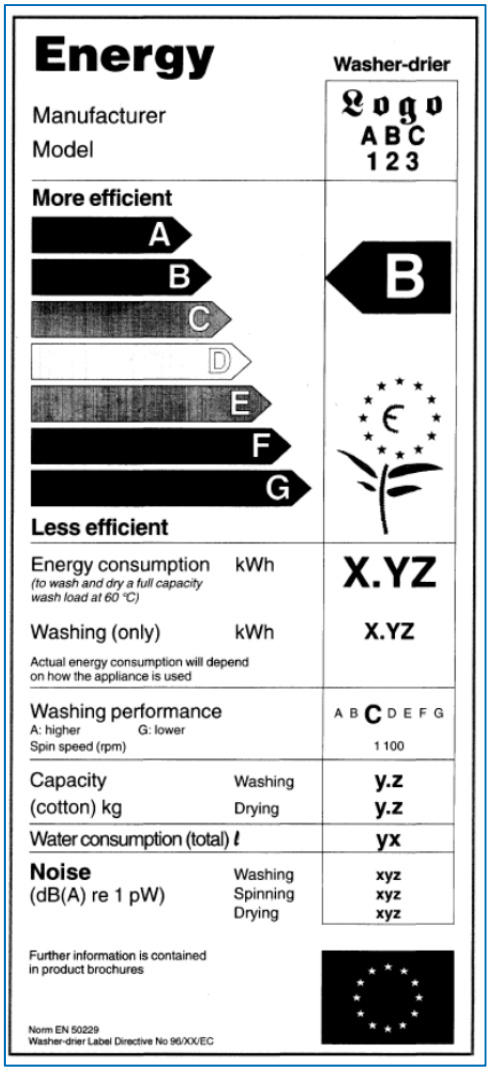
According to the delegated regulation 392/2012, tumble driers should be labelled since 29 May 2012 with the new label, one of which is depicted below. There is however a transition period with exceptions running till 29 September 2012.

There are different labels for different tumble driers. The regulation distinguishes between an air-vented drier, a condensation drier and a gas-fired drier. Depending on the type of tumble driers, some small differences exist in the number and content of symbols depicted. All labels for this product group, however, consists of the energy efficiency classification and symbols for the standardized annual power consumption, the duration of a standard cycle, the maximum loading capacity and the noise level. There is also a symbol indicating whether the machine runs on electricity or gas. Finally, in case of a condensing drier, the energy classification of this specific function is provided.



Washer driers

Commission Directive 96/60/EC, regulating the label for washer driers, was published under the previous framework directive, namely, so the label still has the old lay-out. It specifies the energy labels attached to washer driers, as depicted below. It consists of information on the energy class, the standardized energy consumption overall and for washing only, the washing performance, the capacity of washing and drying, total water consumption and the noise level for washing, spinning and drying. It entered into force on 1 February 1998 with a transition period till 30 June 2003.



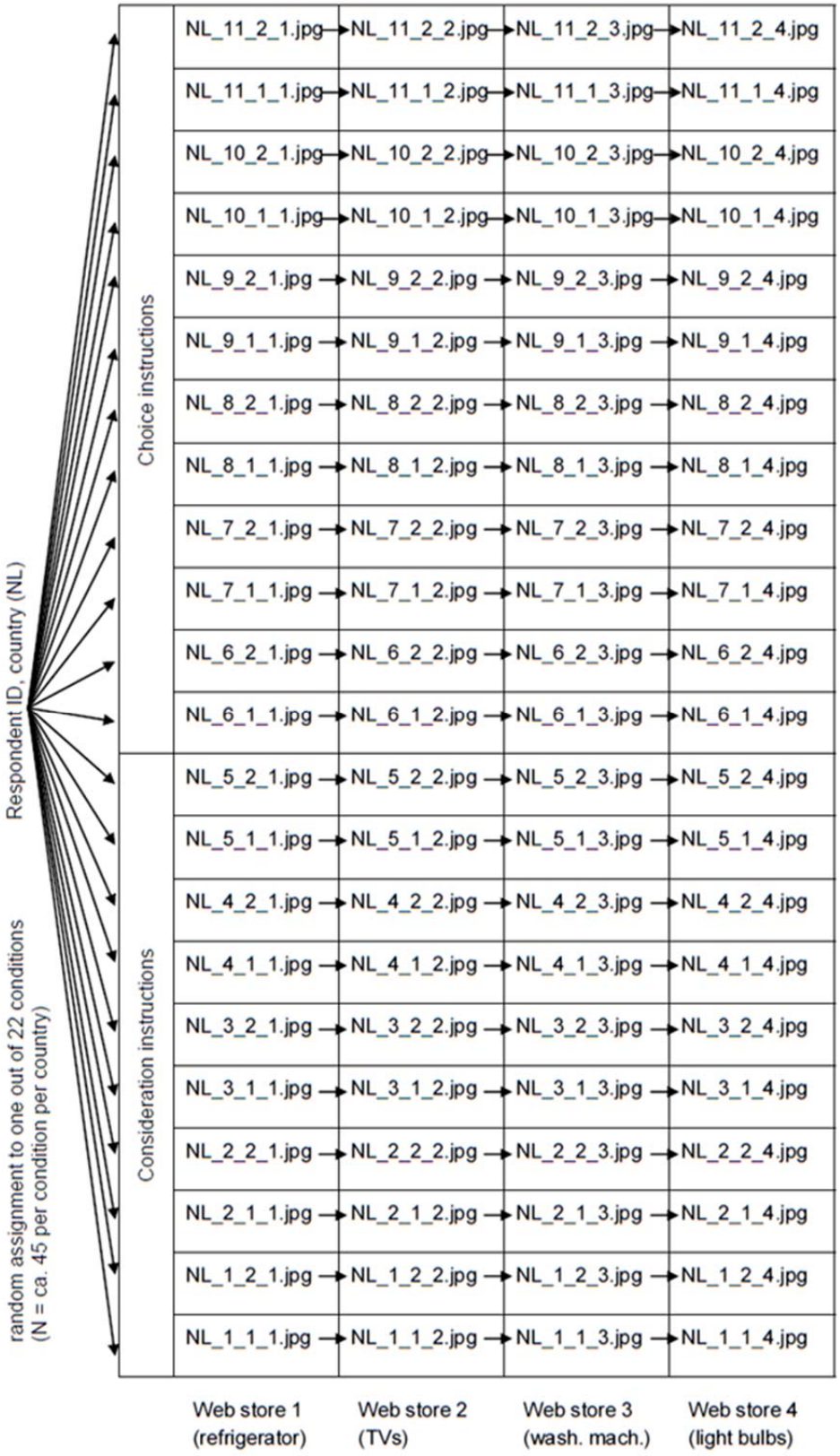
Washing machines

According to the delegated regulation 1061/2010, washing machines should be labelled since 20 December 2011 with the new label, one of which is depicted below. There is however a transition period with exceptions running till 20 April 2012.

The label consists of the energy efficiency classification from A+++ to D and symbols for the standardized annual power and water consumption, the loading capacity, the energy efficiency classification of the spinning procedure, and the noise level of the washing and spinning procedure separately.


ENERG
енергия · ενεργεια
Y
IJA
IE
IA
I
II
A+++
A++
A+
A
B
C
D
A+
XYZ
kWh/annum
ENERGIA · ЕНЕРГИЯ · ENEPГEIA
ENERGIJA · ENERGY · ENERGIE
ENERGI
kg
VWXYZ
L/annum
Y,Z
kg
ABCDEFG
YZdB
YZdB
2010/1061

Appendix II: Set-up of the experiment



AII.1 Examples of mock-up websites

AII.1.1 Fridges (Ireland)

C0_1: Consideration set - Control condition (order 1)

C1_1: Consideration set – Label1 (order 1)

C2_2: Consideration set – Label 2 (order 2)

C3_1: Consideration set – Label 3 (order 1)

C3_1: Consideration set – Label4 (order 1)

Ch0_1: Choice set – Control condition (order 1)

Ch1_1: Choice set – Label 1 (order 1)

Ch2_2: Choice set – Label 2 (order 2)

Ch3_1: Choice set – Label 3 (order 1)

Ch4_1: Choice set – Label 4 (order 1)

Ch5_1: Choice set – Label 5 (order 1)

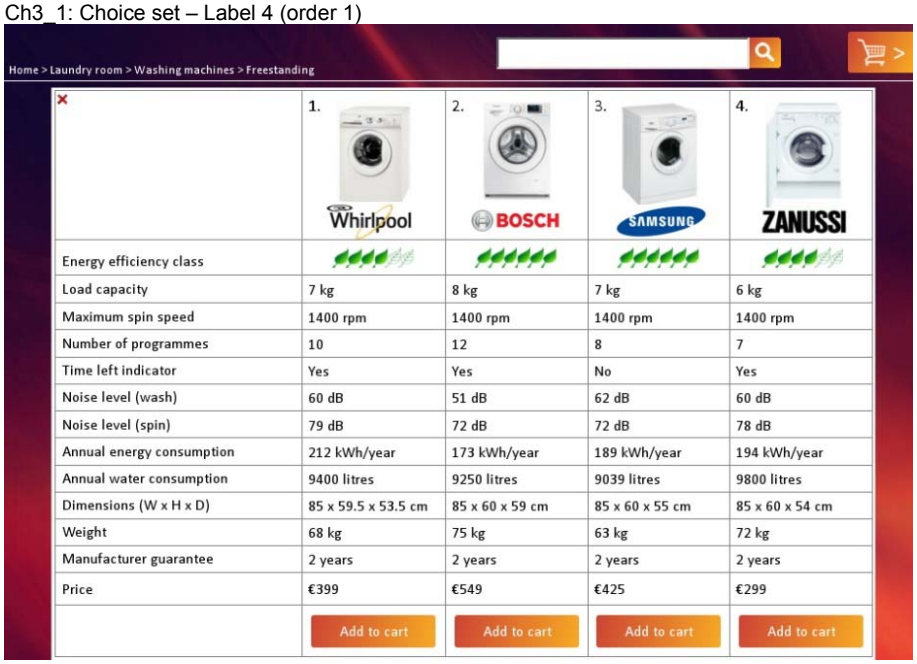
AII.1.2 Examples of other product categories

Light bulbs

C1_1: Consideration set – Label 1 (order 1)

Washing machines

Ch3_1: Choice set – Label 4 (order 1)



	1. Whirlpool	2. BOSCH	3. SAMSUNG	4. ZANUSSI
Energy efficiency class				
Load capacity	7 kg	8 kg	7 kg	6 kg
Maximum spin speed	1400 rpm	1400 rpm	1400 rpm	1400 rpm
Number of programmes	10	12	8	7
Time left indicator	Yes	Yes	No	Yes
Noise level (wash)	60 dB	51 dB	62 dB	60 dB
Noise level (spin)	79 dB	72 dB	72 dB	78 dB
Annual energy consumption	212 kWh/year	173 kWh/year	189 kWh/year	194 kWh/year
Annual water consumption	9400 litres	9250 litres	9039 litres	9800 litres
Dimensions (W x H x D)	85 x 59.5 x 53.5 cm	85 x 60 x 59 cm	85 x 60 x 55 cm	85 x 60 x 54 cm
Weight	68 kg	75 kg	63 kg	72 kg
Manufacturer guarantee	2 years	2 years	2 years	2 years
Price	€399	€549	€425	€299
	Add to cart	Add to cart	Add to cart	Add to cart

Televisions

Ch3_1: Choice set – Label 3 (order 1)

	1 SONY LED TV €899 In stock ADD TO CART	2 SAMSUNG LED TV €554 In stock ADD TO CART	3 PHILIPS LED TV €399 In stock ADD TO CART	4 PANASONIC LED TV €549 In stock ADD TO CART
Energy efficiency class	A++	A++	A	A
Screen size	42 inch	40 inch	40 inch	42 inch
Image quality	Full HD	Full HD	Full HD	Full HD
Resolution	1920 x 1080 pixels	1920 x 1080 pixels	1920 x 1080 pixels	1920 x 1080 pixels
Motion rate	500 Hz	200 Hz	200 Hz	400 Hz
Connectivity	4 HDMI ports 3 USB ports Input for PC connection	2 HDMI ports 2 USB ports Input for PC connection	3 HDMI ports 2 USB ports	3 HDMI ports 3 USB ports Input for PC connection
Audio power	24 watts RMS	20 watts RMS	20 watts RMS	24 watts RMS
On-mode power consumption	48 watts	47 watts	57 watts	58 watts
Annual power consumption	70 kWh/year	69 kWh/year	83 kWh/year	85 kWh/year
Dimensions (W x H x D) with stand	95.7 x 61.9 x 21.7	97.2 x 64 x 26.5	95.7 x 63.5 x 29.4	97.7 x 62.9 x X24.0

AII.1.3 Examples of non-English websites

Poland, Refrigerators

C2_1 Consideration set – Label 2 (order 1)

Greece, Televisions

C4_2: Consideration set – Label 2 (order2)

Netherlands, Light bulbs

Ch2_1: Choice set – Label 2

Appendix III: Questionnaire

English Master Questionnaire

S1. Gender

(1) Male

(2) Female

S2. Age

S3a. Region

S3b. Level of urbanisation

Intro Screen

This questionnaire asks about purchases in various stores. The questionnaire consists of two parts. In the first part, you shall make some imaginary purchases in online stores. In the second part, you shall answer some general questions about buying goods in online stores and in ordinary shops.

Intro Screen: Consideration test

You shall visit four online stores. There are different types of products sold in these online stores, namely washing machines, refrigerators, televisions and lightbulbs.

Imagine that you are planning to make purchases in each of these online stores. Online stores often have so many products on offer that not all product information can be shown at once. Therefore, online stores often provide the possibility for you to get more information about products that are of interest to you.

By clicking on a product, you will obtain more detailed information about that product. Please select which products you would seriously consider and that you would like to receive more information about in order to make your final choice.

Intro Screen: Consideration test - Refrigerators

The first online store offers a wide range of refrigerators. Imagine that you are looking for a refrigerator with a freezer compartment for your kitchen. On the next screen you will see the online store. Please indicate which refrigerators you would seriously consider and about which you would like to receive more information if you were looking today for a refrigerator with a freezer compartment for your kitchen.

1. Select the refrigerators that you would seriously consider and about which you would like to receive more information if you were looking today for a refrigerator with a freezer compartment. The maximum number of answers is six.

Product 1	Product 2	Product 3	Product 4
Product 5	Product 6	Product 7	Product 8
Product 9	Product 10	Product 11	Product 12

1. I found making this selection to be...
   (1) Very easy
   (2)
   (3)
   (4)
   (5)
   (6)
   (7) Very difficult

2. I found the information on this website to be...
   (1) Very easy to understand
   (2)
   (3)
   (4)
   (5)
   (6)
   (7) Very difficult to understand

3. If you were to actually buy one of the refrigerators, where would you be most likely to do this?
   (1) In an online store
   (2) In a regular store

4. If you were to actually buy one of the refrigerators in an online store, which device would you be most likely to use?
   (1) PC or laptop
   (2) tablet
   (3) smartphone

Intro Screen: Consideration test - Televisions

You now go on to the second online store. This online store offers a wide range of televisions. Imagine that you are looking for a flat screen television for your living room. On the next screen you will see the online store. Please indicate which televisions you would seriously consider and about which you would like to receive more information if you were looking today for a flat screen television for your living room.

1. Select the televisions that you would seriously consider and about which you would like to receive more information if you were looking today for a flat screen television. The maximum number of answers is six.

Product 1	Product 2	Product 3	Product 4
Product 5	Product 6	Product 7	Product 8
Product 9	Product 10	Product 11	Product 12

2. I found making this selection to be...
   (1) Very easy
   (2)
   (3)

(4)
(5)
(6)
(7) Very difficult

3. I found the information on this website to be...
   (1) Very easy to understand
   (2)
   (3)
   (4)
   (5)
   (6)
   (7) Very difficult to understand

4. If you were to actually buy one of the televisions, where would you be most likely to do this?
   (1) In an online store
   (2) In a regular store

(IF CODE 1 AT Q4, PLEASE ANSWER Q5)

5. If you were to actually buy one of the televisions in an online store, which device would you be most likely to use?
   (1) PC or laptop
   (2) tablet
   (3) smartphone

Intro Screen: Consideration test – Washing machines

The third online store offers a wide range of washing machines. Imagine that you are looking for a new washing machine. On the next screen you will see the online store. Please indicate which washing machines you would seriously consider and about which you would like to receive more information if you were looking today for a new washing machine.

1. Select the washing machines that you would seriously consider and about which you would like to receive more information if you were looking today for a new washing machine. The maximum number of answers is six.

Product 1	Product 2	Product 3	Product 4
Product 5	Product 6	Product 7	Product 8
Product 9	Product 10	Product 11	Product 12

2. I found making this selection to be...
   (1) Very easy
   (2)
   (3)
   (4)
   (5)
   (6)
   (7) Very difficult

3. I found the information on this website to be...
   (1) Very easy to understand
   (2)
   (3)
   (4)
   (5)
   (6)
   (7) Very difficult to understand

4. If you were to actually buy one of the washing machines, where would you be most likely to do this?
   (1) In an online store
   (2) In a regular store

(IF CODE 1 AT Q4, PLEASE ANSWER Q5)

5. If you were to actually buy one of the washing machines in an online store, which device would you be most likely to use?
   (1) PC or laptop
   (2) tablet
   (3) smartphone

Intro Screen: Consideration test - Lightbulbs

The last online store sells all kinds of lightbulbs. Imagine that you are looking for a new lightbulb for your hall. On the next screen you will see the online store. Please indicate which lightbulbs you would seriously consider and about which you would like to receive more information if you were looking today for a lightbulb for your hall.

1. Select the lightbulbs that you would seriously consider and about which you would like to receive more information if you were looking today for a lightbulb. The maximum number of answers is six.

Product 1	Product 2	Product 3	Product 4
Product 5	Product 6	Product 7	Product 8
Product 9	Product 10	Product 11	Product 12

2. I found making this selection to be...
   (1) Very easy
   (2)
   (3)
   (4)
   (5)
   (6)
   (7) Very difficult

3. I found the information on this website to be...
   (1) Very easy to understand
   (2)
   (3)
   (4)
   (5)
   (6)
   (7) Very difficult to understand

4. If you were to actually buy one of the lightbulbs, where would you be most likely to do this?
   (1) In an online store
   (2) In a regular store

(IF CODE 1 AT Q4, PLEASE ANSWER Q5)

5. If you were to actually buy one of the lightbulbs in an online store, which device would you be most likely to use?
   (1) PC or laptop
   (2) tablet
   (3) smartphone

Intro Screen: Choice test

You shall visit four online stores. There are different types of products sold in these online stores, namely washing machines, refrigerators, televisions and lightbulbs. Imagine that you are planning to make purchases in each of these online stores.

Imagine that you have already made a pre-selection from the wide range of products on the online store. There are currently four products that you seriously considering to buy. Please indicate which of the four products you would choose.

Intro Screen: Choice test - Refrigerators

In the first online store, you are looking for a refrigerator. Imagine that you are planning to buy a refrigerator with a freezer compartment for your kitchen. On the next screen you will see the online store. Please indicate which refrigerator you would prefer if you were looking today for a refrigerator with a freezer compartment for your kitchen.

1. Which refrigerator would you choose if you were looking today for a refrigerator with a freezer compartment. Please select the refrigerator that you would prefer.

Product 1	Product 2	Product 3	Product 4

2. I found making this choice to be...
   (1) Very easy
   (2)
   (3)
   (4)
   (5)
   (6)
   (7) Very difficult

3. I found the information on this website to be...
   (1) Very easy to understand
   (2)
   (3)
   (4)
   (5)
   (6)
   (7) Very difficult to understand

4. If you were to actually buy the refrigerator, where would you be most likely to do this?
   (1) In an online store
   (2) In a regular store

(IF CODE 1 AT Q4, PLEASE ANSWER Q5)

5. If you were to actually buy the refrigerator in an online store, which device would you be most likely to use?
   (1) PC or laptop
   (2) tablet
   (3) smartphone

Intro Screen: Choice test - Televisions

You now go on to the second online store. This online store offers a wide range of televisions. Imagine that you are looking for a flat screen television for your living room. On the next screen you will see the online store. Please indicate which television you would prefer if you were looking today for a flat screen television for your living room.

1. Which television would you choose if you were looking today for a flat screen television. Please select the television that you would prefer.

Product 1	Product 2	Product 3	Product 4

2. I found making this choice to be...
   (1) Very easy
   (2)
   (3)
   (4)
   (5)
   (6)
   (7) Very difficult

3. I found the information on this website to be...
   (1) Very easy to understand
   (2)
   (3)
   (4)
   (5)
   (6)
   (7) Very difficult to understand

4. If you were to actually buy the television, where would you be most likely to do this?
   (1) In an online store
   (2) In a regular store

(IF CODE 1 AT Q4, PLEASE ANSWER Q5)

5. If you were to actually buy the television in an online store, which device would you be most likely to use?
   (1) PC or laptop
   (2) tablet
   (3) smartphone

Intro Screen: Choice test – Washing machines

The third online store offers a wide range of washing machines. Imagine that you are looking for a new washing machine. On the next screen you will see the online store. Please indicate which washing machine you would prefer if you were looking today for a new washing machine.

1. Which washing machine would you choose if you were looking today for a new washing machine. Please select the washing machine that you would prefer.

Product 1	Product 2	Product 3	Product 4

2. I found making this choice to be...
   (1) Very easy
   (2)
   (3)
   (4)
   (5)
   (6)
   (7) Very difficult

3. I found the information on this website to be...
   (1) Very easy to understand
   (2)
   (3)
   (4)
   (5)
   (6)
   (7) Very difficult to understand

4. If you were to actually buy the refrigerator, where would you be most likely to do this?
   (1) In an online store
   (2) In a regular store

(IF CODE 1 AT Q4, PLEASE ANSWER Q5)

5. If you were to actually buy the refrigerator in an online store, which device would you be most likely to use?
   (1) PC or laptop
   (2) tablet
   (3) smartphone

Intro Screen: Choice test - Lightbulbs

The last online store sells all kinds of lightbulbs. Imagine that you are looking for a new lightbulb for your hall. On the next screen you will see the online store. Please indicate which lightbulb you would prefer if you were looking today for a lightbulb for your hall.

1. Which lightbulb would you choose if you were looking today for a lightbulb. Please select the lightbulb that you would prefer.

Product 1	Product 2	Product 3	Product 4

2. I found making this choice to be...
   (1) Very easy
   (2)
   (3)
   (4)
   (5)
   (6)
   (7) Very difficult

3. I found the information on this website to be...
   (8) Very easy to understand
   (9)
   (10)
   (11)
   (12)
   (13)
   (14) Very difficult to understand

4. If you were to actually buy the lightbulb, where would you be most likely to do this?
   (1) In an online store
   (2) In a regular store

(IF CODE 1 AT Q4, PLEASE ANSWER Q5)

5. If you were to actually buy the lightbulb in an online store, which device would you be most likely to use?
   (1) PC or laptop
   (2) tablet
   (3) smartphone

Intro Screen

Now we follow with a series of questions about purchasing products online and offline.

6. Over the last 12 months, how often on average have you bought products online?
   (1) Once every week or more often;
   (2) Once every two weeks;
   (3) Once a month;
   (4) Once every two months;
   (5) Once every three months;
   (6) Two times;
   (7) Once;
   (8) Never.

(IF CODE 1-7 AT Q6, PLEASE ANSWER Q7)

7. Over the last 12 months, which devices have you used to make online purchases?
   Multiple answers possible, indicate which devices you use at least now and then to make online purchases.
   (1) computer/laptop
   (2) tablet
   (3) smartphone

8. Over the last 12 months, how often have you searched for information about a product online after which you bought it in a brick-and-mortar store?
   (1) Once every week or more often;
   (2) Once every two weeks;
   (3) Once a month;
   (4) Once every two months;
   (5) Once every three months;
   (6) Two times;
   (7) Once;
   (8) Never.

9. Over the last 12 months, how many times have you searched for information in a brick-and-mortar store after which you bought it online?
   (1) Once every week or more often;
   (2) Once every two weeks;
   (3) Once a month;
   (4) Once every two months;
   (5) Once every three months;
   (6) Two times;
   (7) Once;
   (8) Never.

10. Thinking only about occasions when you spend €30 or more, what type of products did you purchase online in the last 12 months? Multiple answers possible
   (1) Electric equipment (incl. Computer, phone, camera);
   (2) Clothes, shoes, and jewellery;
   (3) Books;
   (4) CD's/DVD's/computer games;
   (5) Electrical household appliance;
   (6) Furniture;
   (7) Sports and outdoor equipment;
   (8) Food.

11. Thinking only about occasions when you spend €30 or more, what type of products did you purchase in a brick-and-mortar store in the last 12 months? Multiple answers possible
   (1) Electric equipment (incl. computer, phone, camera);
   (2) Clothes, shoes, and jewellery;
   (3) Books;
   (4) CD's/DVD's/computer games;
   (5) Electrical household appliance;
   (6) Furniture;
   (7) Sports and outdoor equipment;
   (8) Food.

12. How often did you visit a price comparison website in the last 12 months?
   A price comparison website is a website that compares prices of specific products across various (web)stores.
   (1) Once every week or more often;
   (2) Once every two weeks;
   (3) Once a month;
   (4) Once every two months;
   (5) Once every three months;
   (6) Two times;
   (7) Once;
   (8) Never.

13. Suppose you are going to purchase a washing machine. How important would the following factors be to you when making your choice?
    Please distribute 100 points among the product attributes:
    a) Brand;
    b) Energy efficiency;
    c) Loading and spinning capacity;
    d) Number of different programs;
    e) Price.

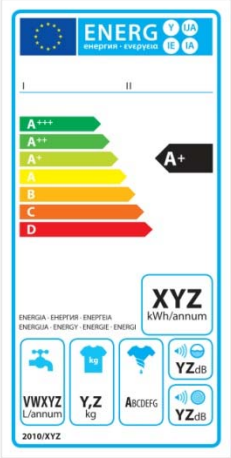
14. Suppose you are going to purchase a refrigerator. How important would the following factors be to you when making your choice?
    Please distribute 100 points among the product attributes:
    a) Brand;
    b) Energy efficiency;
    c) Size;
    d) Design
    e) Price.

15. Suppose you are going to purchase a television. How important would the following factors be to you when making your choice?
    Please distribute 100 points among the product attributes:
    a) Brand;
    b) Energy efficiency;
    c) Size;
    d) Functional possibilities;
    e) Price.

16. Suppose you are going to purchase a light bulb. How important would the following factors be to you when making your choice?
    Please distribute 100 points among the product attributes:
    a) Brand;
    b) Energy efficiency;
    c) Light clarity;
    d) Expected lifetime;
    e) Price.

17. How important is energy efficiency to you when you buy household products?
    (1) Not important at all;
    (2) Somewhat important;
    (3) Important;
    (4) Very important.

18. Before participating in this study, did you ever see the energy efficiency label?



(1) Yes
(2) No

19. Now we are showing you a number of statements. Please indicate to what extent you agree or disagree with them?

- The earth has plenty of natural resources if we just learn how to develop them.
- The balance of nature is very delicate and easily upset.
- Humans are severely abusing the environment.
- Humans have the right to modify the natural environment to suit their needs.
- Despite our special abilities humans are still subject to the laws of nature.

(1) Totally disagree;
(2) Disagree;
(3) Neither agree nor disagree;
(4) Agree;
(5) Strongly agree.

20. The following statements are about household products. Please indicate to what extent you agree or disagree with them?

With the term "household products" we mean energy-using devices such as washing machines, refrigerators, air conditioners, vacuum cleaners, light bulbs, televisions, etc.

- It is generally a good idea to choose energy-efficient household products.
- Energy-efficient household products perform at least as well as other alternatives.
- Energy-efficient household products pay-off financially within a reasonable period of time.
- Nowadays it is just normal to take into account the energy-efficiency of household products.
- Most of my family and friends possess energy-efficient household products.
- Most of my family and friends expect me to purchase energy-efficient products.
- I cannot afford to choose energy-efficient products.
- It is difficult to understand which household products are the most energy-efficient.
- There is not much that I can do about the environment.
- When buying a new household product, I pay close attention to the energy-efficiency of the product.
- When buying a new household product, I intend to purchase an energy-efficient alternative.

(1) Totally disagree;
(2) Disagree;
(3) Neither agree not disagree;
(4) Agree;
(5) Strongly agree.

21. How often do you do each of the following?
- Purchase organic or fair trade food items.
- Re-use plastic bags.
- Turn off 'standby' modes on the TV and other appliances.
- Purchase products from materials that are or can be recycled.
- Use rechargeable batteries.
- Turn lights off when leaving the room.
- Use the washing machine at low temperatures.

(1) Never;
(2)
(3)
(4)
(5) Always.

Intro Screen

Finally, we are asking you some general questions.

22. What is the highest level of education you completed? Is this …?

Unique code list per country

23. What letter best matches your household's total net income?

Use the part of the show card that you know best: weekly, monthly or annual income.

	WEEKLY	MONTHLY	YEARLY
A	Less than €45	Less than €199	Less than €2399
B	€ 46 to €79	€ 200 to € 349	€ 2.400 to €4.199
C	€ 80 to €129	€ 350 to €599	€ 4.200 to €7.199
D	€ 130 to €209	€ 600 to € 899	€ 7.200 to € 10.799
E	€ 210 to €309	€ 900 to € 1.349	€ 10.800 to € 16.199
F	€ 310 to €449	€ 1.350 to € 1.949	€ 16.200 to € 23.399
G	€ 450 to € 624	€ 1.950 to €2.699	€ 23.400 to € 32.399
H	€ 625 to € 824	€ 2.700 to € 3.599	€ 32.400 to € 43.199
I	€ 825 to € 1.024	€ 3.600 to € 4.499	€ 43.200 to € 53.999
J	€ 1.025 or more	€ 4.500 or more	€ 54.000 or more
K	Don't know / Would rather not say		

24. Occupational status:

25. Including yourself, can you please tell me how many people live in this household?

(1) one person;
(2) two persons;
(3) three persons;
(4) four persons;
(5) five persons;
(6) six persons;
(7) seven persons;
(8) eight or more persons.

26. Which of the following best describes your accommodation?

(1) Own without mortgage (i.e. without any loans)
(2) Own with mortgage
(3) Tenant, paying rent to private landlord
(4) Tenant, paying rent in social/voluntary/municipal housing
(5) Accommodation is provided rent free

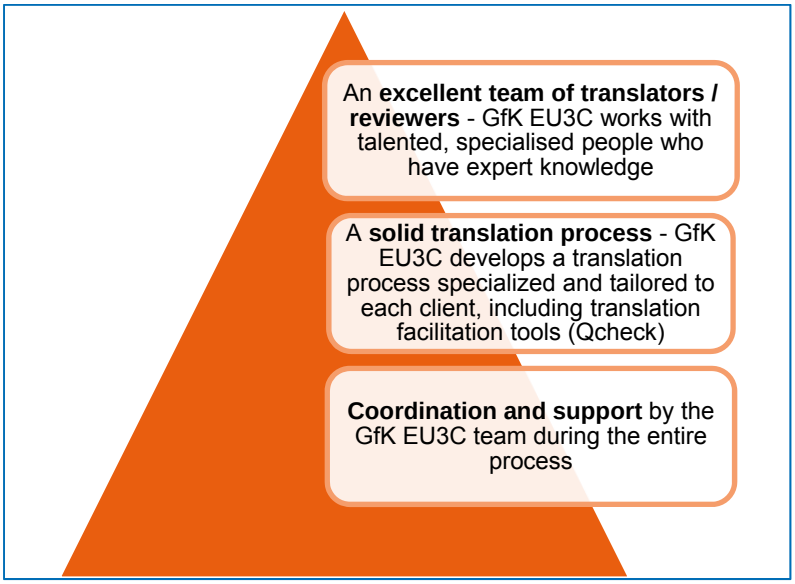
27. Device on which survey was completed.

(1) Desktop
(2) Tablet/I-Pad
(3) Smartphone

Translation

The experiment and questionnaire will be made available to respondents in the national languages of ten countries surveyed. GfK's European Custom Research and Coordination Centre (EU3C) will take care of the translation process. The questionnaire will be finalised in English, and then translated into the other survey languages. High quality translations will improve the "flow" of the survey, which will help keep respondents engaged and complete the survey. Our translation approach for surveys is to conduct a first translation (translator) of the questionnaire, followed by a reviewing session (reviewer).

To ensure effective and high quality translations, we consider the following pillars to be crucial:



After translation, the experimental stimuli will be adapted, ensuring that the visual appearance of the web stores is the same across countries. This is important for making cross-country comparisons of the impact of information provision on choices.

Note that through the use of the centralised scripting method, there is no need to test each language version of the survey, thus providing a high quality and efficient scripting process.

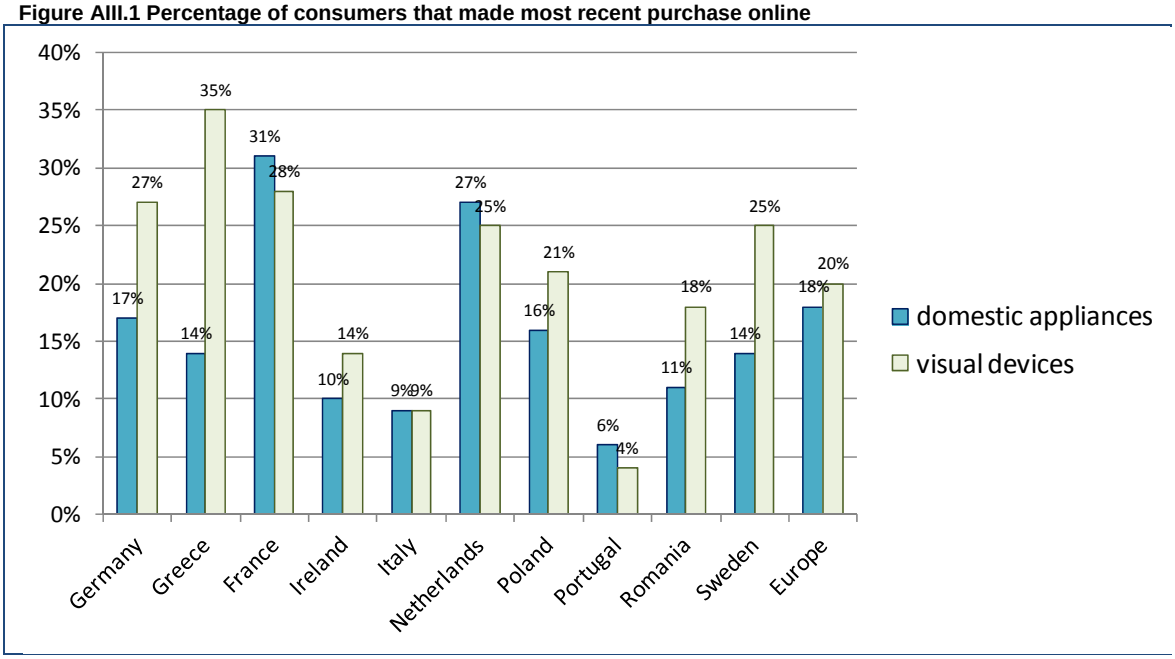
Use of online and offline channels in Europe

To provide some insight into the importance of the online channel to the household appliances (e.g., refrigerators, washing machines) and television industries, this section describes data from the Consumer Barometer for Europe. The Consumer Barometer is a global effort by IAB Europe in partnership with TNS Infratest and Google to quantify the role of online environments in the consumer decision process from research to purchase. To better understand this process, the Consumer Barometer provides insight into past purchase behaviours and a perspective on how consumers interact with the internet as a source of information for informing purchase decisions (see www.consumerbarometer.com for more information).

Consumers were asked to indicate which channel they used for their most recent purchase of domestic appliances and visual devices. The results are depicted in Figure 2.5 (numbers also include non-EU countries such as Russia and Turkey). It shows that 18% of the European consumers made their most recent purchase of domestic appliances online, and 20% of European

consumers did so for their last purchase of visual devices.[25] Furthermore, Figure 2.5 shows considerable differences between European countries. The use of the online channel for the purchase of domestic appliances and visual devices is still uncommon in Portugal (6% and 4%, respectively) and Italy (9% for both). In contrast, French (31% and 28%) and Dutch (27% and 25%) consumers show above-average use of online channels for the purchase of these types of products.

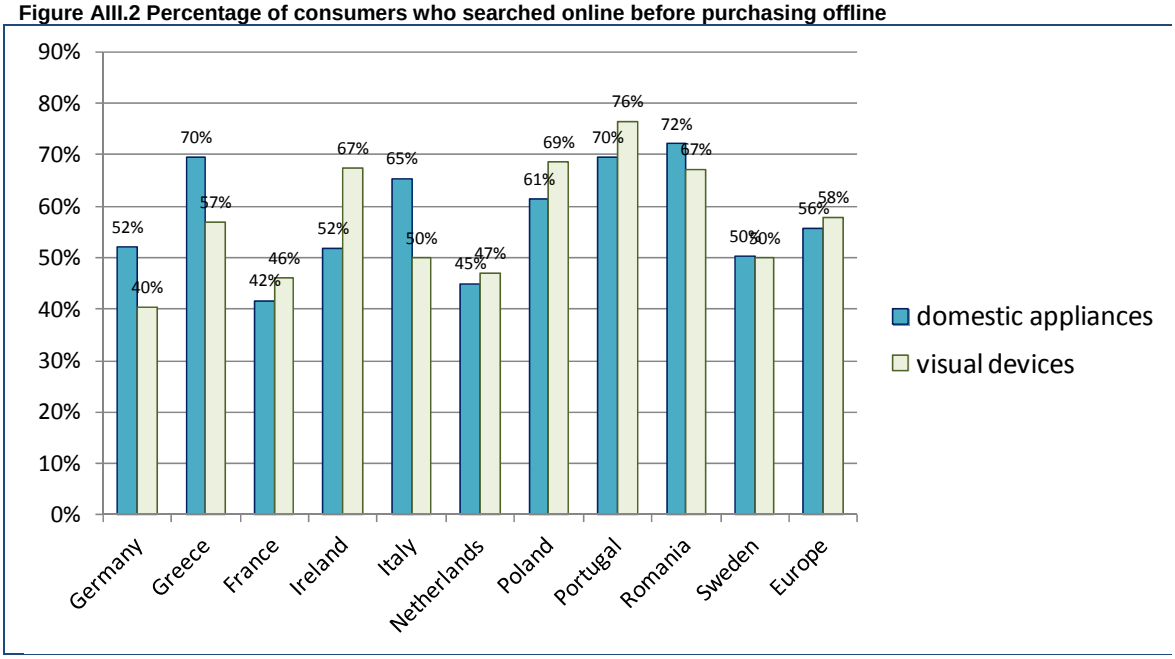
Figure AIII.1 Percentage of consumers that made most recent purchase online



The actual importance of the online channel is higher than these numbers suggest, because many consumers who purchase offline first do research online, as depicted in Figure 2.6. It turns out that more than half of the offline-buyers in Europe engaged in online searching before purchasing domestic appliances (56%) and visual devices (58%). Figure 2.6 shows that online searching is substantial for all countries. Even in countries with low online purchase percentages, the percentage of offline buyers who used the internet to search for product information is substantial.

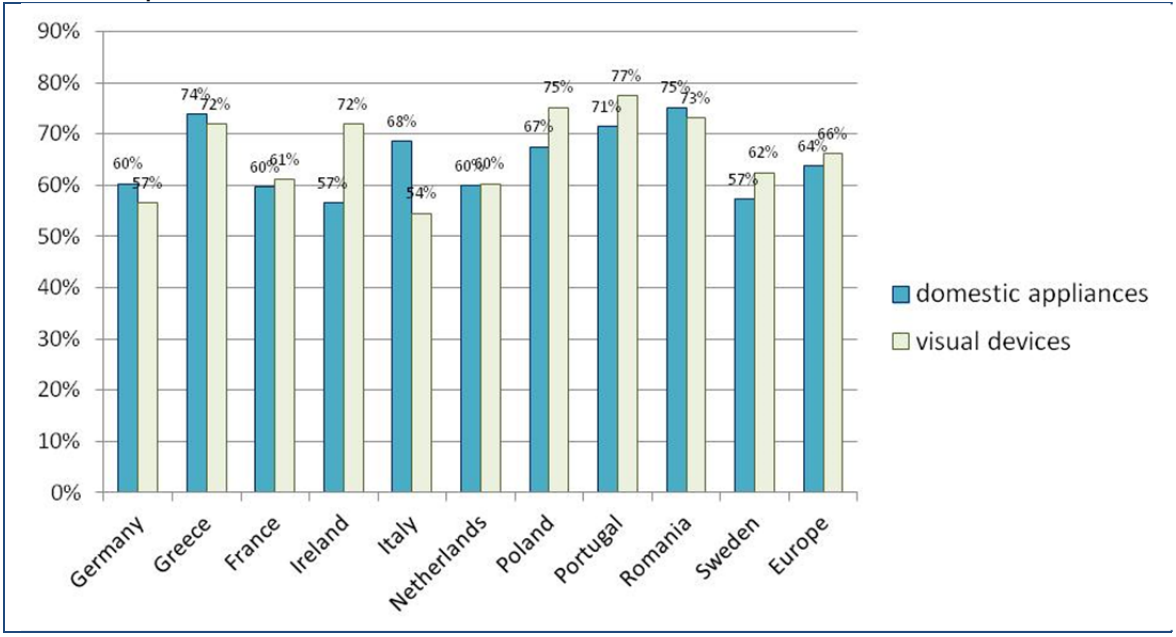
[25] Note that the current share of online purchases is probably higher, because the most recent purchase could easily be a few years ago.

Figure AIII.2 Percentage of consumers who searched online before purchasing offline



Overall, in Europe, about two-third of the consumers used the internet in some way for their most recent purchase of domestic appliances (64%) or visual devices (66%; Figure 2.7). In all countries, these percentages are above 50%, and the differences between countries are not very large. As such, we can conclude that the online channel plays an important role in domestic appliances and visual devices markets in all European countries.

Figure AIII.3 Percentage of consumers that used the internet (for searching and/or purchasing) for their most recent purchase



These data show that consumers often do not choose to use one channel exclusively, but rather use them both as complementary channels. The intensity of use differs between product categories, consumers, and countries. Because we think this is a very relevant observation, we add specific questions on the use of retail channels by European consumers in the post-experimental questionnaire.

Appendix IV: Technical Appendix

AIV.1 Testing the Theory of Planned Behaviour: Scale development and model description

AIV.1.1 Scale development

General environment concern consists of five items from the commonly used NEP-scale (Dunlap et al. 1999; q17 in the post-experiment questionnaire). Items q17_1, q17_2, q17_3 and q17_5 loaded on a single factor (factor loadings > .74). However, item q17_1 ("The earth has plenty of resources if we just learn how to develop them") correlated in unexpected direction with the other scale items and hence seems to be a poor item. Item q17_4 did not load on the same factor and was dropped as well. The Cronbach's alpha for the three remaining items (q17_2, q17_3 and q17_5) was .75.

A factor analysis of the items of q18, measuring product-specific beliefs, social norms, perceived control, revealed two factors with eigen value > 1. The items assessing product-specific beliefs and social norms all load highly on the first factor (loadings > .58). Yet, based on theoretical considerations, we decided to construct two scales. The first three items (q18_1-q18_3) capture product specific beliefs, with Cronbach's alpha equal to .66. The second three items (q18_4-q18_6) capture social norms, with Cronbach's alpha equal to .65. The correlation between the two scales is .59, which seems acceptable for further multivariate analyses. The perceived control items (q18_7-q18_9) all load highly on the second factor (loadings > .72). The Cronbach's alpha of this three-item perceived control scale is 0.61. Behavioural intentions were measured by two items (q18_10 and q18_11) that load on the same factor (loadings > .60). Cronbach's alpha of this scale is equal to .58.

Finally, the seven items assessing environmentally friendly behaviour in other domains (q19_1-q19_7) have an adequate level of internal consistency as well: Cronbach's alpha equals .71 for this scale.

Table A.IV.1 shows the correlations between the TPB scales.

Table AIV.1 Correlations between TPB scales

	Environmental concern	Product-specific beliefs	Social norms	Perceived control	Behavioural intentions	Sustainable behaviour in other domains
Environmental concern	1					
Product-specific beliefs	.47	1				
Social norms	.38	.59	1			
Perceived control	.10	.14	.07	1		
Behavioural intentions	.37	.59	.55	.15	1	
Sustainable behaviour in other domains	.35	.38	.41	.12	.38	1

AIV.1.2 Model description

The models that were used to test the theory of planned behaviour are multilevel regression models. The dependent variables were (1) the behavioural intentions scale, and (2) "actual" sustainable behaviour as measured by respondents' product choices in the experiment. Actual

sustainable behaviour is a dichotomous variable which equals “1” if the respondent selected the product with the highest energy efficiency class within the product set in the experiment, and “0” otherwise. As predictors, we used the scales as described in the previous section and socio-demographic characteristics (see Table IV.2 for the specific coding). We estimated four separate regression models:

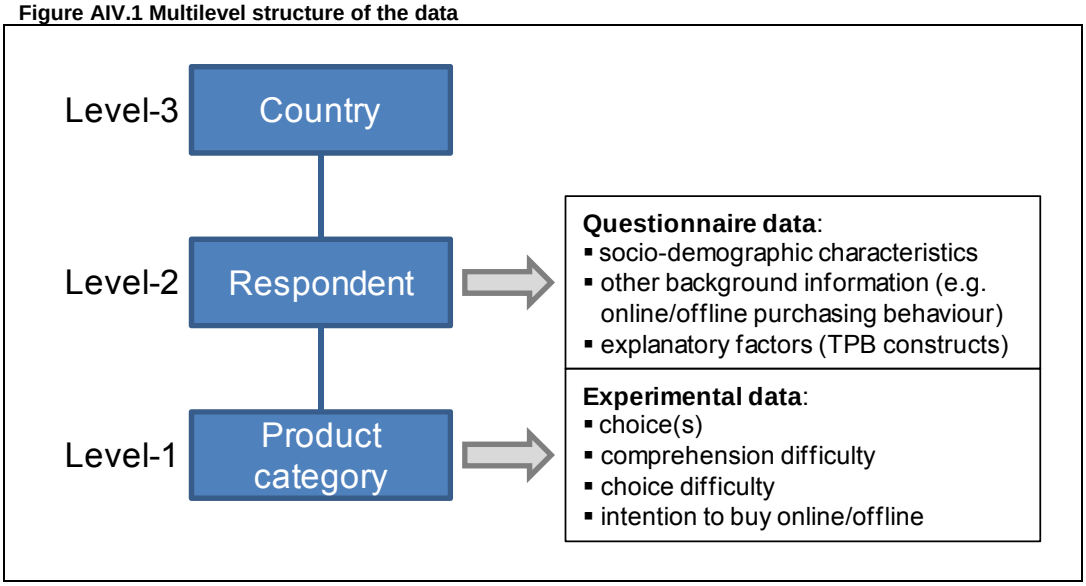
- Regression of behavioural intentions on general environmental concern, product-specific beliefs, social norms, and perceived control (results are in Table 5.9).
- Regression of actual sustainable behaviour on general environmental concern, product-specific beliefs, social norms, and perceived control (results are in Table 5.9).
- Regression of behavioural intentions on socio-demographic characteristics (results are in Table 5.10).
- Regression of actual sustainable behaviour on socio-demographic characteristics (results are in Table 5.10).

TPB constructs and socio-demographic characteristics are measured at the respondent level, while actual sustainable behaviour is measured at the product category level (each respondent provided responses for multiple product categories; see Figure AIV.1). To properly account for the multilevel structure of the data, the models with behavioural intentions as dependent variable are two-level random-intercept models with individuals within countries, and the models with actual sustainable behaviour as dependent variable are three-level random-intercept models with product categories within individuals within countries.

Table AIV.2 Coding of socio-demographic characteristics

	Type of variable	Coding
Gender	Dichotomous	1 = male; 0 = female
Age	Continuous	
Low education	Dichotomous	1 = pre-primary education / primary education or first stage of basic education / lower secondary or second stage of basic education; 0 = other
High education	Dichotomous	1 = first/second stage of tertiary education; 0 = other
Income unknown	Dichotomous	1 = don’t know/would rather not say; 0 = other
Low income	Dichotomous	1 = €10.799 per year or less; 0 = other
High income	Dichotomous	1 = €32.400 per year or more; 0 = other
Occ. status: Employed	Dichotomous	1 = at work as employee or employer/self-employed / employed, on child-care leave or other leave / at work as relative assisting on family farm or business; 0 = other
Occ. status: Unemployed	Dichotomous	1 = unemployed less than 12 months / unemployed 12 months or more; 0 = other
Occ. status: Student	Dichotomous	1 = in education (at school, university, etc. / student; 0 = other
Occ. status: Retired	Dichotomous	1 = retired; 0 = other
Low population density	Dichotomous	1 = thinly populated area (GfK coding of specific country area); 0 = other
High population density	Dichotomous	1 = densely populated area (GfK coding of specific country area); 0 = other
Household size	Continuous	
House owner	Dichotomous	1 = own without mortgage (i.e., without any loans) / own with mortgage; 0 = other

Figure AIV.1 Multilevel structure of the data



AIV.2 Energy label effects: model description

In order to test for differences in effectiveness between the various energy labels, multilevel (logistic) regression models are estimated with energy efficiency of the selected product(s) as dependent variable and the label conditions as predictors (i.e., dummy variables with the control condition as baseline). These models improve over standard ANOVAs and single-level regression models in that they properly take into account the multilevel structure of the data, that is, the fact that responses to purchase situations are "nested" within individuals, which are "nested" within countries. More specifically, we estimated *three-level random-intercept models* which account for baseline heterogeneity in energy efficient product choices between countries as well as between individuals within countries.

Model for consideration set formation

In the consideration experiment, we have five measures that reflect the energy efficiency of the products that were selected for further consideration. Average energy efficiency level of the consideration set (y^a_{ijk}, with i = 1,…,4 product categories, j = 1,…,N and k = 1,…,10 countries) is continuous, and selection of most (y^b_{ijk}), most and second most (y^c_{ijk}), least (y^d_{ijk}), and least and second least (y^e_{ijk}) energy efficient products are binary (yes, no, with probability(yes) = π^m_{ij} for m = {b,…,e}). To accommodate these measurement scales, a random-intercept linear regression model is used for average energy efficiency level, and random-intercept logit models for the remaining dependent variables. The model (for m = {a,…,e}) is:

$$\eta^m_{ijk} = \beta^m_0 + \beta^m_1 Label\_1_{jk} + \beta^m_2 Label\_2_{jk} + \beta^m_3 Label\_3_{jk} + \beta^m_4 Label\_4_{jk} + \zeta^m_{jk} + \zeta^m_k + \varepsilon^m_{ijk}$$

The independent variables in the model (*Label_1* through *Label_4*) are dummy variables representing the different label conditions (the "no information" condition is the baseline). In the model with average energy efficiency level (which is continuous) as dependent variable: $y^a_{ijk} = \eta^a_{ijk}$. For the remaining (binary) dependent variables, a logit link is used: $\text{logit}(\pi^m_{ij}) = \eta^m_{ij}$. We make the following assumptions regarding the random intercepts and the residual error term: $\zeta^m_{jk} \sim \text{N}(0, \psi^{(2)})$, $\zeta^m_k \sim \text{N}(0, \psi^{(3)})$, and $\varepsilon^m_{ijk} \sim \text{N}(0, \theta)$.

Interpretation of the model parameters is as follows:

- β_1^m represents the difference in effectiveness between label 1 and the control condition (no information), β_2^m represents the difference in effectiveness between label 2 and the control condition, and so on.
- $\psi^{(2)}$ represents the variance in responses between individuals within countries and $\psi^{(3)}$ represents the variance in responses between countries.

The parameters for the dummy variables in the main model represent the effect of each energy label variant compared to the control condition. To test for the overall effect of energy labels – that is, are there *any* differences in effectiveness between conditions? – we use a Wald test which tests the joint significance of the parameters for the label dummies. The statistical null hypothesis of this test is that $\beta_1^m = \beta_2^m = \beta_3^m = \beta_4^m = 0$, in other words, that there are no differences in effectiveness between the label variants. (For readers more familiar with ANOVA techniques, note that this test is comparable to the ANOVA *F*-test.)

If the overall label effect is significant, pairwise label comparisons are performed by means of Wald tests which test the (non)equality of parameters corresponding to the specific pair of labels (e.g., $\beta_2^m = \beta_3^m$ for label 2 versus label 3). (These tests are comparable to pairwise comparisons as ANOVA follow-up analysis.)

Model for final choice

In the choice experiment, the dependent variable (y_{ijk}^f, with success probability π_{ij}^f) is a binary variable that has value "1" if the selected product has the highest energy efficiency class, and "0" otherwise. We estimated a three-level random-intercept logit model, which is similar to the model for the consideration experiment, but with an additional dummy variable to represent to full label condition (here, the baseline is non-prominent information). The model is as follows:

$$\text{logit}\left(\pi_{ij}^f\right) = \beta_0^f + \beta_1^f Label\_1_{jk} + \beta_2^f Label\_2_{jk} + \beta_3^f Label\_3_{jk} + \beta_4^f Label\_4_{jk} + \beta_5^f Label\_5_{jk} + \zeta_{jk}^f + \zeta_k^f + \varepsilon_{ijk}^f$$

The independent variables in the model (*Label_1* through *Label_5*) are dummy variables representing the different label conditions (the non-prominent information condition is the baseline). We assume $\zeta_{jk}^f \sim \mathrm{N}(0, \psi^{(2)})$, $\zeta_k^f \sim \mathrm{N}(0, \psi^{(3)})$, and $\varepsilon_{ijk}^m \sim \mathrm{N}(0, \theta)$. As before, in order to test the overall label effect, the coefficients corresponding to the label dummies are tested for joint significance (with statistical null hypothesis $\beta_1^f = \beta_2^f = \beta_3^f = \beta_4^f = \beta_5^f = 0$) and pairwise comparisons are conducted by means of Wald chi square tests (e.g., $\beta_1^f = \beta_5^f$ for label 1 versus the full label).

Follow-up analyses

As a follow-up, the models described above are estimated per country (taking into account respondent heterogeneity) and per product category (taking into account country heterogeneity). The models for the other measures in the experiment (comprehension difficulty, choice difficulty, intention to purchase online/offline) are similar to the models described above, but with different dependent variables.

AIV.3 Energy label effects: deeper insights

The results in Section 5.5 are based on three-level random-intercept models similar to the models described above, but with different predictors. In these models, the label dummy variables are replaced with variables that reflect the generic label characteristics (frame of reference, visual and

textual meaning). Proper orthogonal contrast-coding of these variables enables direct hypothesis testing. The following contrasts are being used:

- **Information effect**: [label 1, label 2, label 3, label 4] vs. [no information].
- **Label effect**: [label 1, label 2, label 3, label 4, label 5] vs. [non-prominent information].
- **Reduced label effect**: [label 1, label 2, label 3, label 4] vs. [label 5].
- **Frame of reference effect**: [label 3, label 4] vs. [label 1, label 2].
- **Textual meaning effect**: [label 2] vs. [label 1].
- **Visual meaning effect**: [label 4] vs. [label 3].
- **Order effect**: [product display order 1] vs. [product display order 2].

Due to different control conditions in each of the subexperiments, the information effect can only be tested in the consideration experiment and the label and reduced label effects can only be tested in the choice experiment. This explains the fact that some of the contrasts only include label 1 through label 4 (the labels tested in the consideration experiment), while other contrasts include label 1 through label 5 (the labels tested in the choice experiment).

The exact coding of the label contrasts can be found in Table AIV.3 (for the consideration experiment) and Table AIV.4 (for the choice experiment). Furthermore, we included the display order of the products (first order condition = 0.5; second order condition = -0.5) as an additional predictor to account for order effects. Not only are the selected contrasts highly informative in that they directly test hypotheses 1 through 7, another reason for selecting these specific contrasts is that they are *orthogonal* (in other words, the predictors in our model do not correlate with each other). This allows for independent and accurate estimation of all effects.

Table AIV.3 Orthogonal contrast-coding of label variants (consideration experiment)

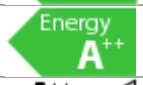
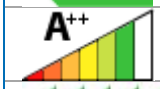
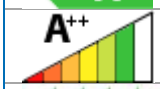
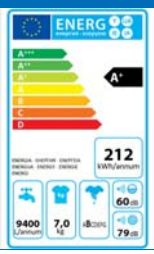
Energy information		Information effect	Frame of reference effect	Textual meaning effect	Visual meaning effect
No information	Co_0	-4/5	0	0	0
	Co_1	1/5	-1/2	-1/2	0
	Co_2	1/5	-1/2	1/2	0
	Co_3	1/5	1/2	0	-1/2
	Co_4	1/5	1/2	0	1/2

Table AIV.4 Orthogonal contrast-coding of label variants (choice experiment)

Energy information		Label effect	Reduced label effect	Frame of reference effect	Textual meaning effect	Visual meaning effect
A++	Ch_0	-5/6	0	0	0	0
	Ch_1	1/6	1/5	-1/2	-1/2	0
	Ch_2	1/6	1/5	-1/2	1/2	0
	Ch_3	1/6	1/5	1/2	0	-1/2
	Ch_4	1/6	1/5	1/2	0	1/2

Energy information		Label effect	Reduced label effect	Frame of reference effect	Textual meaning effect	Visual meaning effect
	Ch_5	1/6	-4/5	0	0	0

Models for consideration set formation and final choice

The model for the five dependent measures (m = {a,…,e}) in the consideration experiment is:

$$\eta_{ijk}^{m} = \beta_0^m + \beta_1^m \text{Information}_{jk} + \beta_2^m \text{Frame of reference}_{jk} + \beta_3^m \text{Textual meaning}_{jk} + \beta_4^m \text{Visual meaning}_{jk} + \beta_5^m \text{Position}_{jk} + \zeta_{jk}^m + \zeta_k^m + \varepsilon_{ijk}^m$$

Logit links are used for all binary dependent measures ($\text{logit}(\pi_{ij}^m) = \eta_{ij}^m$). We assume $\zeta_{jk}^m \sim \text{N}(0, \psi^{(2)})$, $\zeta_k^m \sim \text{N}(0, \psi^{(3)})$, and $\varepsilon_{ijk}^m \sim \text{N}(0, \theta)$. Interpretation of the model parameters is as follows:

- β_1^m represents the "information effect", i.e. the difference in effectiveness between the energy labels (averaged across all labels) and no information, β_2^m represents the "frame of reference effect", i.e. the difference in effectiveness between labels with a frame of reference and labels without a frame of reference, β_3^m represents the "textual meaning" effect, i.e., the difference in effectiveness between the label with textual meaning (label 2) and the same label without textual meaning (label 1), and so on.
- $\psi^{(2)}$ represents the variance in responses between individuals within countries and $\psi^{(3)}$ represents the variance in responses between countries.

The model for the dependent measure in the choice experiment is:

$$\text{logit}\left(\pi_{ij}^f\right) = \beta_0^f + \beta_1^f \text{Label}_{jk} + \beta_2^f \text{Reduced label}_{jk} + \beta_3^f \text{Frame of reference}_{jk} + \beta_4^f \text{Textual meaning}_{jk} + \beta_5^f \text{Visual meaning}_{jk} + \beta_6^f \text{Position}_{jk} + \zeta_{jk}^f + \zeta_k^f + \varepsilon_{ijk}^f$$

Follow-up analyses

A follow-up model estimated the effects of the label characteristics per product category, but simultaneously. The general model was the same as before, but with different predictors. For example, for the consideration experiment (with m measures) the model is:

$$\begin{aligned}\eta_{ijk}^{m} = {} & \beta_0^m + \beta_1^m \text{TVs}_{ijk} + \beta_2^m \text{Washing machines}_{ijk} + \beta_3^m \text{Light bulbs}_{ijk} + \\ & \beta_4^m \text{Info} * \text{Refrig}_{ijk} + \beta_5^m \text{FoR} * \text{Refrig}_{ijk} + \beta_6^m \text{Text\_mean} * \text{Refrig}_{ijk} + \beta_7^m \text{Vis\_mean} * \text{Refrig}_{ijk} + \\ & \beta_8^m \text{Info} * \text{TVs}_{ijk} + \beta_9^m \text{FoR} * \text{TVs}_{ijk} + \beta_{10}^m \text{Text\_mean} * \text{TVs}_{ijk} + \beta_{11}^m \text{Vis\_mean} * \text{TVs}_{ijk} + \\ & \beta_{12}^m \text{Info} * \text{Wash}_{ijk} + \beta_{13}^m \text{FoR} * \text{Wash}_{ijk} + \beta_{14}^m \text{Text\_mean} * \text{Wash}_{ijk} + \beta_{15}^m \text{Vis\_mean} * \text{Wash}_{ijk} + \\ & \beta_{16}^m \text{Info} * \text{Light}_{ijk} + \beta_{17}^m \text{FoR} * \text{Light}_{ijk} + \beta_{18}^m \text{Text\_mean} * \text{Light}_{ijk} + \beta_{19}^m \text{Vis\_mean} * \text{Light}_{ijk} + \\ & \beta_{20}^m \text{Position}_{jk} + \zeta_{jk}^m + \zeta_k^m + \varepsilon_{ijk}^m\end{aligned}$$

As predictors, we included three product category dummies (with refrigerators as baseline category) to account for different a priori probabilities of choosing energy efficient products across the product categories. These different a priori probabilities of choosing energy efficient products are due to the fact that the product sets used in the consideration experiment do not have the same

distribution of energy efficiency classes across the different product categories (see Table AIV.5). In addition, we included the interactions between the label contrast and four product category dummies, which – by leaving out the main effects of the label characteristics – represented the simple effects of the label characteristics for each product category. For example, β_4^m represents the "information effect" (that is, the difference in effectiveness between the energy labels (averaged across all labels) and no information) for the refrigerator category, β_8^m represents the "information effect" for TVs, β_{12}^m represents the "information effect" for washing machines, and β_{16}^m represents the "information effect" for light bulbs. The model results are in Table 5.22 (for consideration) and Table 5.24 (for choice).

Table AIV.5 Prior probabilities of consideration of most and least energy efficient products

	Most	Most or second most
Washing machines	42%	75%
Refrigerators	17%	58%
Televisions	17%	50%
Light bulbs	67%	83%
	Least	**Least or second least**
Washing machines	8%	25%
Refrigerators	17%	42%
Televisions	8%	25%
Light bulbs	17%	33%

The models for the other measures in the experiment (comprehension difficulty, choice difficulty, intention to purchase online/offline) are similar to the general model described above. Since these measures are the same across the two subexperiments, we estimated the model on the complete data set, and included a contrast for the decision-stage (consideration = -0.5; choice = 0.5) as additional predictor in the analysis.

AIV.4 Energy label effects and consumer groups

The moderation models estimated and described in Section 5.6 were three-level random-intercept models with the same dependent measures as before. Predictors in the models were the energy label dummies (*Label_1* through *Label_4* and *Label_5* for the consideration and choice experiment, respectively), the moderator variable (that is, self-rated importance of energy efficiency, product-specific beliefs, norm pressure, or perceived control), and their interactions. Wald chi square tests were conducted to test the joint significance of the interaction terms, which revealed whether the relative effectiveness of the labels significantly differed across consumer groups with respectively high and low levels of self-rated importance, product-specific beliefs, norm pressure, and perceived control.

If the overall analysis established that effects of the energy labels were different across consumer groups, a spotlight analysis (Spiller et al. 2012) was conducted to gain more insight into *how* label effectiveness was different between the groups. In the spotlight analysis, we tested the effects of the energy label dummies at one standard deviation below the mean of the moderator variable (low level) and at one standard deviation above the mean of the moderator variable (high level). We tested for joint significance of the energy label dummies at each level (low vs. high) of the moderator variable by means of Wald chi square tests (i.e., we tested the null hypothesis $\beta_1^m = \beta_2^m = \beta_3^m = \beta_4^m = 0$ at one standard deviation below and above the mean). If the simple effect of energy labels was significant, pairwise comparisons were conducted to gain insight into the relative

effectiveness of the various energy labels at each level of the moderator. Model results are shown in Figure 5.3 - 5.4.

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