CONSumer Energy Efficiency Decision making

CONSUMER'S ENERGY EFFICIENCY CHOICES FOR DIFFERENT CONSUMER GROUPS AND GEOGRAPHICAL LOCATIONS: SURVEY RESULTS

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Executive summary

The general aim of the CONSEED Project is to examine how different consumer groups interact with existing EE policies that aim to influence consumer investment decisions, and to make policy recommendations based on the empirical evidence collected. This deliverable presents the survey results implemented in work package 3 (WP3). The specific objectives of WP3 are to:

- Identify the factors that are most relevant in determining consumption investment decisions for appliances, machinery, transport and/or properties across different consumer groups (households, services, agricultural and industrial sectors) and geographical locations (Ireland, Greece, Norway, Slovenia and Spain)

- Advance the current knowledge on how different consumer groups (with special attention to gender) make energy efficiency investment decisions across different geographical locations

- Identify the most important barriers (financial and non-financial) to energy efficiency investments for different consumer groups and geographical locations

- Estimate the impact of the EU labelling schemes on energy efficient investments and barriers.

We carried out eleven surveys in five countries spread across four sectors. Each survey concerned one of eight combinations of product categories and sectors: household appliances (Spain and Greece), residential properties (Ireland and Slovenia), personal vehicles (Norway), tractors (Ireland), heating and cooling systems in the services sector (Greece and Spain), commercial properties (Ireland), and industrial machinery (Slovenia and Norway). The surveys were designed based on the focus groups and in-depth interviews conducted in work package 2 (see Deliverable 2.1) as well as the literature review conducted in work package 1 (see Deliverable 1.1). We developed a common questionnaire and adapted it to each case study. The questionnaire has 4 main common sections:

a) The attributes of the purchasing decision
b) The energy efficiency attitudes to elicit potential barriers of EE investment
c) The understanding and use of existing labels and simulated monetary labels
d) The socio-demographic characteristics.

The statistical analysis shows that energy efficiency is generally not the most important attribute in the purchasing decision. Energy efficiency is, however, considered *very important* in almost all types of investment decisions, although some exceptions are observed.

We identify knowledge and information gaps in the different surveys, regarding both the labelling schemes and various elements of the investment decision. We also find that there is room for improvement to make more consumers aware of the labels, the price of energy, and the energy consumption of the products. The size of this knowledge and information gaps vary between countries and sectors. Awareness is the lowest in sectors where the EU labelling scheme is not compulsory, or is constrained by the product type: namely the vehicle directive (1999/94/CE) and the directives 2013/811/EU and 2013/812/EU for heating and cooling system.

The understanding of energy consumption varies considerably between product categories. Energy consumption is well understood for vehicles across all sectors, but less well understood for household appliances. The awareness of energy prices differs substantially across countries and product categories. Respondents express that highest degree of awareness for energy use for vehicles (i.e. gasoline, diesel or electricity). Consumers are much less aware of electricity prices is certain countries, such as Spain.

Filling the knowledge and information gaps regarding the labelling schemes would likely help boost EE investments, more particularly for appliances and heating and cooling systems as respondents who are aware of the labels declare that labels influence their final decision. For properties and vehicles, however, only a minority of consumers express the view that the labels influence their investment decision.

Financial barriers, and more specifically limited access to loans, is a potential impediment to investments in energy efficiency investment in some countries, particularly in Greece. Beliefs regarding technological progress are also another potential barrier for investing in energy efficiency. In almost all case studies, respondents who are willing to 'take a chance' on a new technology to reduce their energy consumption are more likely to consider energy efficiency in their investment decision.

To address information gaps we tested potential improvements of the labels in the surveys. We specifically tested the effects of displaying monetary cost information in addition to the current labelling schemes. Results show that households and firms of all sectors generally believe that this monetary information would make the information conveyed by the labels easier to understand in terms of energy consumption and running costs. The following table summarizes our findings:

Table 1: Key messages from consumers surveys

Market	Attribute	EE attitudes	Existing vs monetary labels
Household appliances	EE among top two factors, more than 70% rate it as very important.	Mixed results regarding understanding of energy use and financial constraints.	Large majority aware of existing label, and believe it influences. Monetary label more understandable, and helps understand operating cost. Not necessarily more trustworthy.
Residential properties	Price dominates, but 50-60% rate EE as a very important factor.	Good understanding of own property's energy use, but financial constraints matter.	High share aware of the label, but few believe it influences. Monetary labels helpful to understand operating costs, but not necessarily more trustworthy.
Commercial properties	Price dominates, EE very important for only 26%.	Majority aware of energy use, but financial constraints matter.	Very high level of awareness, but few believe it influences. Monetary labels help understand operating costs, but are more open to manipulation.
Personal cars	Reliability most important, EE ranked only 4th.	Majority aware of energy prices, financial constraints matter less than in other markets.	Large majority *not* aware of the current label. Believe monetary label is more understandable, but less trustworthy.
Tractors	Reliability most important, EE ranked only 4th.	Most report good understanding of energy use and costs, but financial constraints matter.	Only hypothetical label explored: Most think it would help them understand energy use and calculate cost.
Heating & cooling in hotels	Reliability ranked most important in Greece, EE in Spain	Mixed understanding of energy use, and financial constraints are a barrier to some.	More than half are aware and they believe the label influenced decision. Monetary labels help understand operating costs, other results are mixed.
Industrial machineries	Reliability most important factor, 40 to 50% rate EE as very important.	Agree EE investment would save money, yet still think government should support it.	Only hypothetical label explored: Well received. Agree it would be easy to understand, but not sure they would trust it.
General	**EE rated as relatively important across markets, most important for HH appliances.**	**Important to address financial constraints in quite a few markets.**	**Monetary labels would generally be more understandable, and help understand operating costs, but trustworthiness needs to be addressed.**

1 Introduction

This deliverable analyses the results of a set of surveys designed to provide a cross-sectoral and cross-product category overview of the role of energy efficiency in investment decisions. The survey design was based on the results of focus groups and in depth-interviews presented in Deliverable 2.1. The surveys aim to: (i) assess the weight given to energy efficiency in consumer decisions; (ii) identify the most common market and behavioural barriers that prevent different consumer groups from investing in energy efficiency (Gillingham et al., 2009; Linares and Labandeira, 2010), (iii) assess the impact of energy labelling schemes on energy efficiency choices; and (iv) obtain empirical evidence of the role of different factors such as behavioural and market barriers, socio-economic characteristics, attitudes, beliefs and perceptions on energy efficiency investments and others. We reviewed the role of these factors in previous studies in Deliverable 1.1 in CONSEED.

A total of eleven surveys were implemented in five countries (Greece, Ireland, Norway, Slovenia and Spain) and for four sectors (households, agriculture, services and industry). Moreover, these surveys concern six different product categories: appliances, heating and cooling systems, cars, properties, tractors and machinery (see Table 2).

Table 2: The survey breakdown in CONSEED

	Household			Agriculture	Service		Industry
	Appliances	**Property**	**Transport**	**Transport/ Machinery**	**Appliances**	**Property**	**Machinery**
Ireland		Residential property		Tractors		Commercial property	
Norway			Cars				Machinery
Spain	Washing machines				Heating and cooling systems		
Slovenia		Residential property					Machinery
Greece	Refrigerators				Heating and cooling systems		

We designed a common framework for the questionnaires in order to ensure consistency across sectors. The survey was structured according to four main sections, identified in the focus groups and in-depth interviews analysed in Deliverable 2.1 in CONSEED. These common sections are:

- The attribute of the purchasing decision
- The energy efficiency attitudes to elicit potential barriers of EE investment
- The understanding and use of existing labels and simulated monetary labels
- The socio-demographic characteristics.

This deliverable is organized as follows: Section 2 details the methodology followed to implement, collect and analyse the different surveys. Section 3 presents the results by sector and country and Section 4 concludes.

2 Methodology

Generally speaking, the aim of quantitative research, such as consumer surveys, is to address structured questions in order to uncover correlations or cause-effect relationships and identify similarities and differences in responses between subgroups (Bernard, 2012; Blaikie, 2000; Creswell, 2009; Newing, 2010; Starr, 2014). Consumer surveys questionnaires consist of a series of specific, usually short, questions which are either asked verbally by an interviewer, or answered by the respondent on their own (self-administered). Each question in the questionnaire elicits information on a particular and quantifiable variable defined carefully in advance and standardised (i.e., asked in the same way of each respondent). Using this method allows researchers to: (i) gather highly targeted data; (ii) compare the responses of different people directly; and (iii) carry out statistical analyses to look at patterns of variation in the data. However, designing a valid questionnaire is not an easy task and several steps ought to be carefully carried out (Bernard, 2012; Czaja and Blair, 2005; de Vaus, 2002; Fowler, 1995; Newing, 2010). All these recommendations were followed in this work.

Our elicitation of consumers' preferences and behaviours follow a stated preference approach. It relies on self-reported answers to carefully worded statements and questions. Answers are reported in our questionnaires on a Likert scale rating system. In this approach respondents are not incentivized, the reliability of their answers is based on trust and their ability to answer carefully (Brown 2003). As a consequence, policy implications should be taken carefully. Complementary methods such as fields

experiment methods and discrete choice experiments will be used in Work Package 4 in order to test empirically specific policy implementations.

2.1   Survey design and data collection

We designed a common research questionnaire template for all sectors, product categories and countries, in order to provide a comparable cross-sectoral and cross-product overview of the role of energy efficiency in different purchasing decisions.

The questionnaire was designed to address the following specific objectives: (i) to assess the weight of energy efficiency in the purchasing decision-making; (ii) to identify the most common market and behavioural barriers that prevent different consumer groups from investing in energy efficiency; (iii) to assess the impact of energy labelling schemes on energy efficiency choices; and (iv) to obtain empirical evidence of the role of factors such as behavioural and market barriers, socio-economics characteristics, attitudes, beliefs and perceptions on energy efficiency investments.

Almost all questions were designed in closed-format, including closed checklists and rating scales, to enable comparability of quantifiable data across different case-studies. Moreover, a common coding was used for each possible answer. See Table A 1 and Table A 2 for more detail.

Table 3 provides an overview of the surveys carried out by country, sector and product category, showing the sample size and administration method used for each survey. Sample sizes vary between sectors due to the difficulties of obtaining a larger number of respondents in certain sectors such as agriculture, services and industry. For the household sector, the sample size varies from 426 to 1093 observations and in the private sectors from 83 to 316 observations. The implementation phase lasted three months from November 2017 to January 2018. On-line, face-to-face and telephone interviews have been used to collect the data. Surveys have been diffused at the at the national level.

The relatively small sample size obtained in some sectors may affect the extrapolation of the results to a larger and broader population. Policy implications in these cases should be taken more carefully.

Table 3: Sampling details of the surveys

	Household			Agriculture	Services		Industry
	Appliances	**Property**	**Transport**	**Transport/ Machinery**	**Appliances**	**Property**	**Machinery**
Ireland		Sample size: 501. Level: national. Method: CAWI[b]		Sample size: 316. Level: national. Method: CAWI[b]		Sample size: 187. Level: national. Method: CATI[c]	
Norway			Sample size 1093. Method CAWI[b]. Level: national. Product. cars.				Sample size: 86. Method: CAWI[b]. Level: national. Product: machines.
Spain	Sample size: 500. Level: national. Method: CAPI[a]. Product: washing machines				Sample size: 200. Level: national Method: CATI[c]. Product: heating and cooling systems		
Slovenia		Sample size: 426. Level: national Method: CAWI[b]. Product: residential property					Sample size: 83. Level: national. Method: CAWI[b]. Product: machines
Greece	Sample size: 496. Level: national. Method: CAWI[b]. Product: refrigerators				Sample size: 102 hotel units Level: national. Method: CATI[c]. Product: heating and cooling systems		

[a]: CAPI stands for Computer Assisted Personal Interviewing
[b]: CAWI stands for Computer-Assisted Web Interviewing
[c]: CATI stands for Computer-Assisted Telephone Interviewing

2.2 Data analysis and model specification

Data analysis consisted of two tasks: (i) descriptive statistics; and (ii) econometric analysis. The first task aims at summarising the data, looking at common patterns and finding main tendencies and deviations. The qualitative variables are described using their relative frequency (percentage) and the 95% confidence interval. The objective of the second task (econometric analysis) is to explore the factors affecting the importance given to EE in the different sectors. For the second task we used a closed form format question asking respondent to value EE with the following range of importance: *Not at all important; Not very important; Fairly important; Very important*. In order to have a common framework of analysis between

the eleven case studies, we decided to analyse the probability of having answered v*ery important* to this question using binary response models[1]. Annex 6.2 presents the details of the statistical and econometric analysis. Note that for the industry sector, the number of cases reporting EE as a very important attribute is too small to allow for an econometric analysis.

3   Results

This section provides further details on each survey, organized by sector and product category.

3.1   Summary of findings

We present a brief summary of findings by sector, before providing further details by sector and product category in chapters 3.2 to 3.5.

3.1.1   Household sector summary

Household surveys in all five partner countries were implemented to analyse the role of energy efficiency and energy labelling in the investment decisions for a) household appliances in Greece and Spain, b) properties in Ireland and Slovenia, and c) cars in Norway.

Energy efficiency is seen as a *very important* attribute in the purchasing decision, and it is one of the primary attributes influencing the investment decision. The share of respondents that consider EE *very important* differs by product category. For refrigerators, the EE attribute has the highest share of *very important* responses; for property and washing machines, price is most important; for cars, reliability is more important than other attributes. A country effect regarding the valuation of attributes should not be discarded, but it could not be tested in all case studies as some product categories were studied in a single country.

Knowledge regarding some drivers of EE investment, such as the price of energy or the running costs, varies considerably across product categories and countries. Norwegian car buyers have a high awareness

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[1] An alternative specification would have consisted in estimating a model which would have accounted for the 4 different ranges of importance (a multinomial model). However, the multinomial approach would have implied different model specifications across case studies since some modalities are much less frequently selected by respondents in some case studies.

of vehicle energy prices. For property, energy price awareness is higher in Ireland than in Slovenia, and for appliances, awareness is higher in Greece than in Spain. However, in almost all countries, households have difficulty understanding the money saved if they bought a more energy efficient good (i.e., running costs).

We tested the add-on of monetary cost information to the existing label scheme in all five countries. In most countries, households believe a monetary indication of energy cost would be more understandable and make them more aware of energy consumption and running costs of the product. A high level of distrust in current labels is generally observed in the five countries: households believe that labels are potentially subject to manipulation. Results show that the introduction of monetary information would not change this distrust in labelling schemes.

The level of awareness is relatively high for appliances and properties, but not so for vehicles. In the case of the Building Energy Rating (BER) for properties, while the vast majority of households are aware of the label, a large share of them does not know the grade of their current property: about 50% in Ireland and 93% in Slovenia. However, this finding might be due to the timing of and exemptions relating to current labelling policies.

The influence of the label in the purchasing decision varies across sectors. For cars and appliances, most households said that the label did not influence their decision; for appliances, the label is much more influential (please check Figure 1).

Environmental and climate change concerns, as well as belief in new technologies, are significant drivers for the valuation of EE as a *very important* attribute of the purchasing decision. Households of the five countries generally believe in the role of energy efficiency in reducing their environmental impacts from energy consumption and are predominantly willing to take a chance on new technologies to reduce their energy consumption. The belief that new technology would help to reduce energy consumption is a significant determinant of EE valuation in the case of appliances and cars. Being concerned about climate change also has a significant impact in the case of properties. A gender effect is found in the five countries: women are more likely to rate EE as a *very important* attribute.
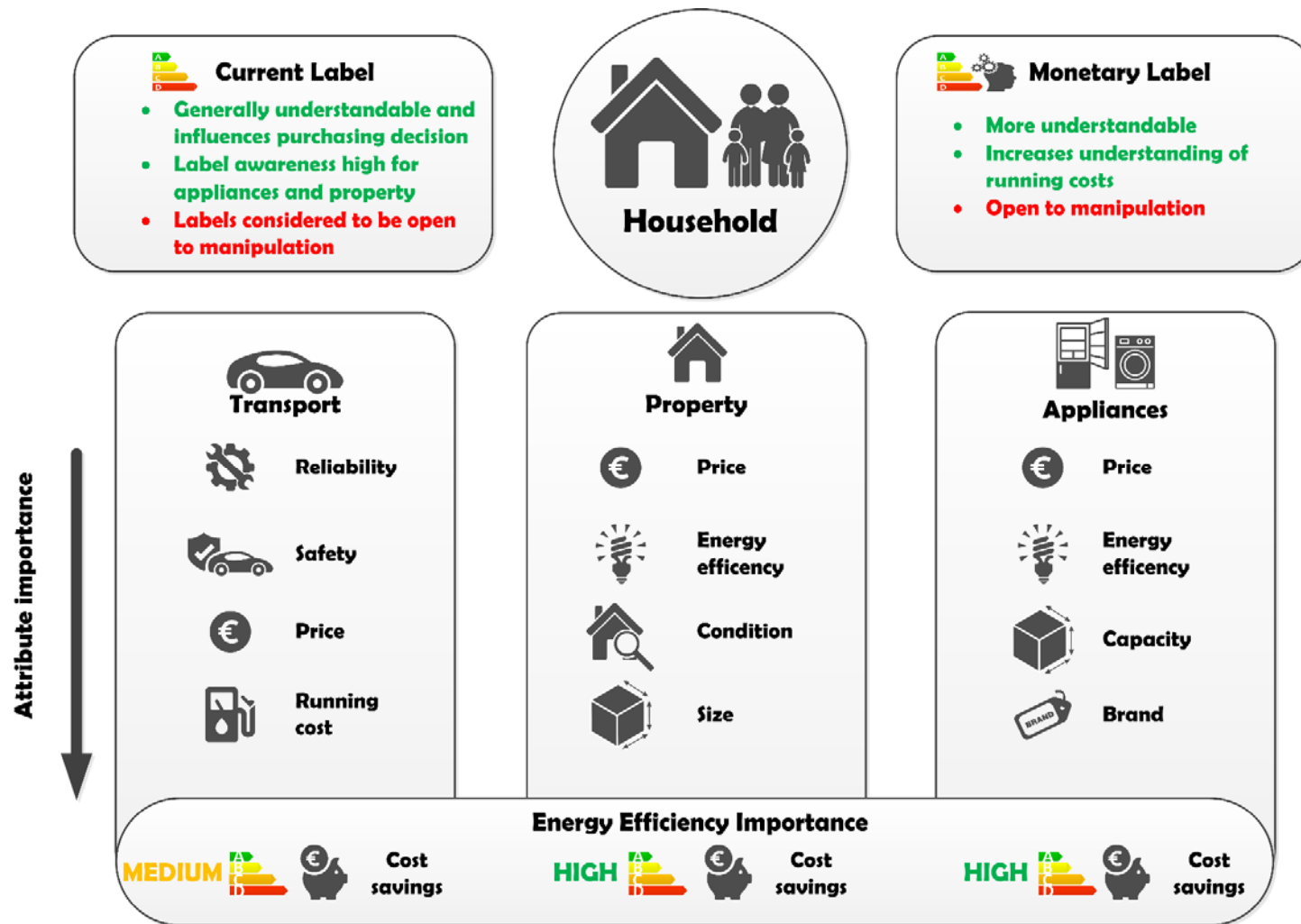
Figure 1: Infographics for the household sector

3.1.2 Services sector summary

The services sector is explored in Ireland (property), Spain and Greece (appliances: heating and cooling systems). There are significant differences in energy efficiency valuation and attitudes across countries and technologies. For appliances, 89% of firms in Greece consider energy efficiency to be *very important* when investing, compared to 67% in Spain. For property in Ireland, the share is just 26%. Our regression analysis show that environmental concern is strongly and significantly correlated with energy efficiency valuation in Spain only. Firms' willingness to take a chance on new technologies is found to be a determinant in Greece only (not included in Irish model). Females care more about energy efficiency in Greece (not included in other models).

Attitudes and knowledge differ across countries. Reduced environmental impact is considered a benefit of higher energy efficiency by most firms in Greece (over 90% *strongly agree*), but by far fewer in Ireland (54%) and in Spain (43%). Furthermore, Spanish and Irish firms are less likely to 'take a chance' on new technologies (to reduce energy consumption) than firms in Greece (based on *strongly agree* shares). However, in all countries, few firms express concern that more energy efficient technologies are less reliable. The size of the knowledge gap differs across countries – for appliances, knowledge of current energy consumption is considerably higher in Greece than in Spain (about 81% versus 38% *strongly agree*, respectively); for property in Ireland, knowledge is low at about 34%.

Regardless of the technology, finance and credit constraints are impediments to energy efficiency investment. The share of firms who cannot afford higher energy efficiency is 54% in Greece, 14% in Ireland and 7% in Spain (*strongly agree*). Loan access is also a concern – for 13% of firms in Ireland, credit constraints prevent investment in energy efficiency. However, the share in Spain and Greece is 31% and 67% respectively.

Awareness of energy labelling is high for firms in Greece and Ireland (above two thirds), but less so in Spain (about half). However, in Ireland, very few firms were influenced by the label (in relation to their current property) and only a quarter know the energy rating of their main business premises. For appliances in Spain and Greece, the label is considerably more influential.

We explore firm perception of existing energy labelling and an alternative monetary label. Both labels are, in general, considered understandable, influential and useful for understanding energy consumption and costs in all countries. However, the monetary label is considered more understandable and trustworthy in Spain, and better for understanding energy costs in all countries (please check Figure 2).
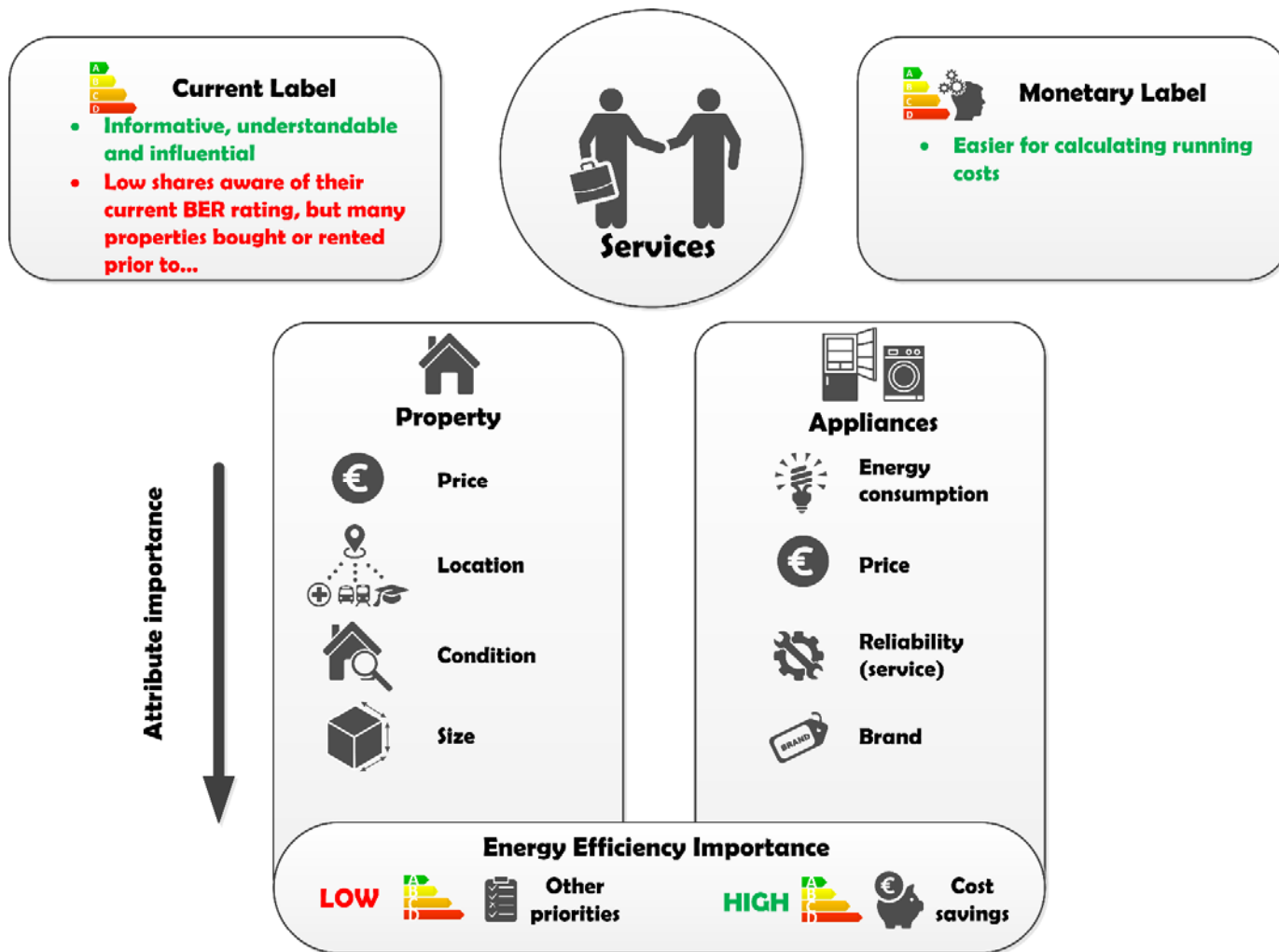
Figure 2: Infographics for the services sector

3.1.3   Agriculture sector summary

The agricultural sector is explored in Ireland (tillage farmers). Farmers have slightly different priorities than other sectors when investing in energy-consuming technologies. When buying tractors, price is less important than factors which may impact farm production, such as reliability, back-up service and horsepower. Fuel efficiency, while less important than these production-related attributes, is still a major concern for most farmers – 52% of farmers consider energy efficiency to be *very important* and an additional 38% find it *fairly important*

Regression analysis finds few factors that are significantly related to the importance of fuel efficiency. For example, farm size, age and education have no effect, nor does a farmer's concern for climate change (unlike in other sectors in Ireland). However, farmers who believe that all new tractors have similar fuel efficiency levels are less likely to value energy efficiency when investing. Such expectations are important, and if inaccurate, could be rectified through better information on fuel efficiency and comparisons. We also find that the 43% of farmers who understand the monetary savings of better fuel efficiency (*strongly agrees* share) are more likely to value this attribute when investing.

In terms of attitudes (this paragraph refers to the *strongly* and *slightly* agree shares combined), most farmers believe that higher fuel efficiency would reduce their farm's environmental impact. Furthermore, around 40% of farmers would be more likely to buy a more fuel-efficient tractor if other farmers did so first. Reliability concerns are an issue for some – about a quarter of farmers think that more fuel-efficient tractors are less reliable and 14% are not willing to invest in 'new technologies' to reduce their fuel consumption. We also find that most farmers have a very good understanding of their current fuel consumption (88%) and the monetary savings associated with better fuel efficiency (84%). Finance and credit constraint are also an issue – about half of farmers say they cannot afford more fuel-efficient tractors and that loan access is preventing them from making more energy efficient choices on the farm.

While there is no efficiency labelling for tractors in the EU, we explore the potential effects of two alternative labels (fuel consumption and monetary cost). Farmers would be generally supportive of both types of labelling for tractors, and most believe that labels would be understandable, influential, and would help them understand their fuel consumption and calculate their fuel costs. However, there are no significant differences in preferences for the two labelling types as shown in Figure 3.
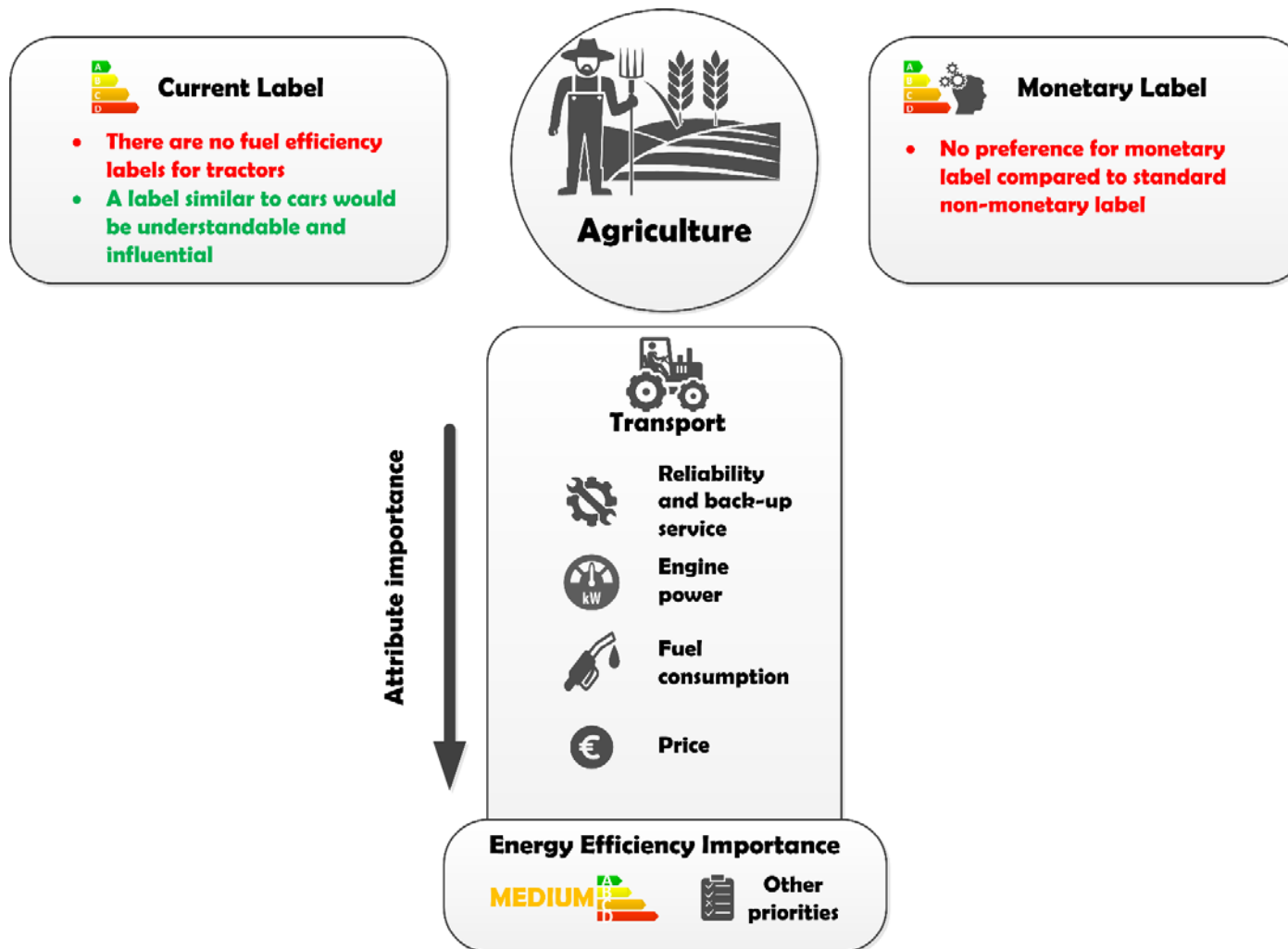
Figure 3: Infographics for agriculture sector

3.1.4 Industry sector summary

For the industry sector, machinery investment in Norway and Slovenia was explored through 169 online survey respondents in total. Reliability is the most important factor in the investment decisions followed by safety, while price and ease of operation are also important but not crucial factors in both countries. On the other hand, time to deliver and energy efficiency are less important factors. A similar picture is observed in Norway and Slovenia, general quality is the most important attribute and companies are ready to pay more in order to have top quality products.

Regarding attitudes towards energy efficiency, the majority of the respondents in both countries agree that government should provide support for companies to invest in energy efficiency and that such investments will save them money in the future. On the contrary, a high share of respondents in both countries disagreed that reduction of their energy consumption will negatively affect their profitability/efficiency and that more energy efficient machines perform poorly and are likely to break down sooner.

Since there is no mandatory EU-wide energy labelling scheme for machinery used in industry we have asked questions regarding the technical specifications currently provided, and the potential need for a cost labelling scheme. There were no clear preferences regarding the current technical documentation since around half of the respondents in Norway and Slovenia agreed that current technical specifications contain sufficient information needed to understand how much energy the machine will use. Regarding potential introduction of the label, the respondents in both countries were quite favourable and the majority agreed that information provided in monetary units would be easy to understand, would help them to understand how much energy the machine would use and more than half of the respondents believed that it might influence the choice of their purchase. Respondents were, however, somewhat less certain that the labels would be trustworthy and majority of them believe it could be easily manipulated by the sellers (please see Figure 4).
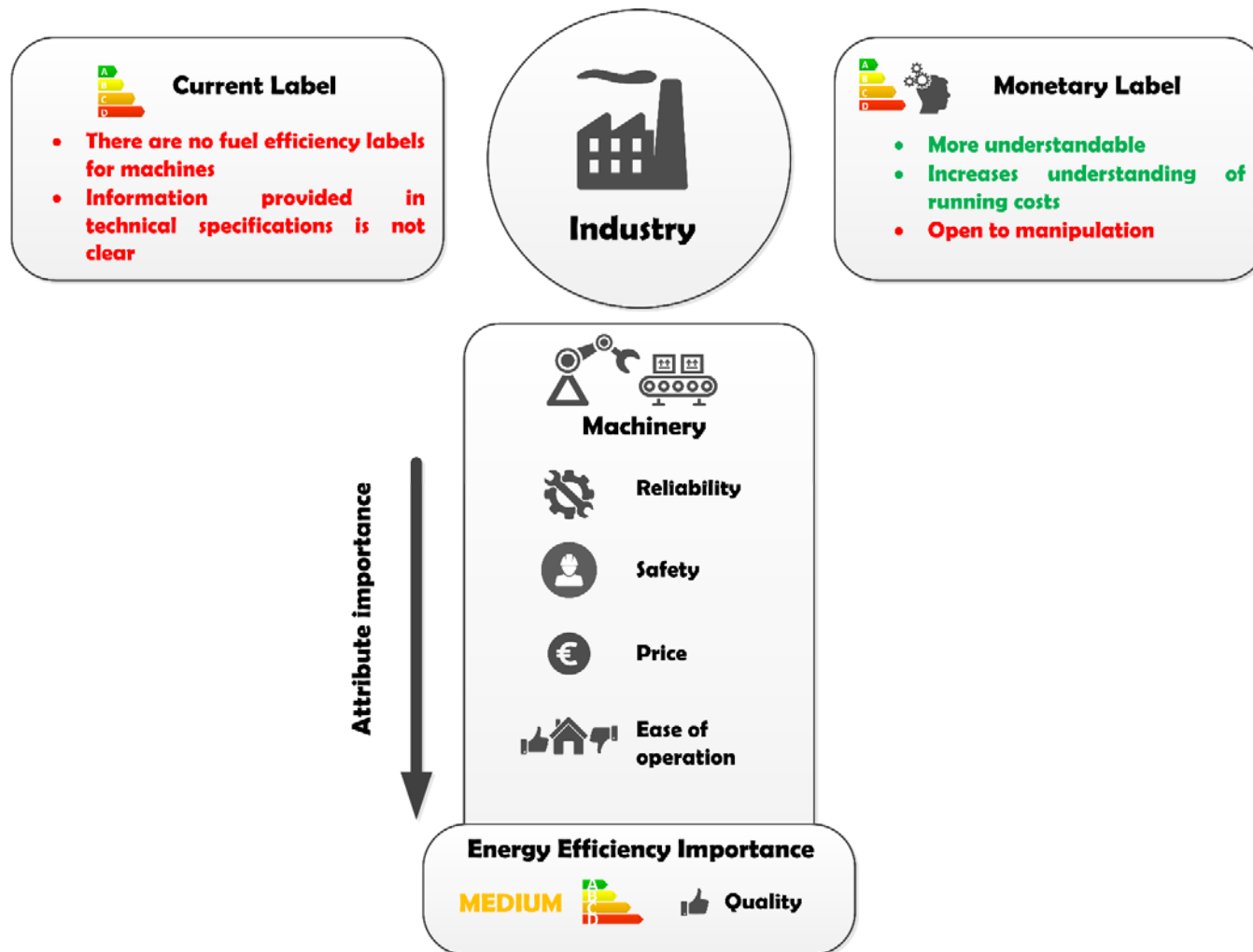
Figure 4: Infographics for the industry sector

3.2   Household sector

This section presents the results of the five surveys implemented in the household sector in CONSEED: appliances in Spain and Greece, properties in Slovenia and Ireland, cars in Norway.

3.2.1   Household: appliances in Spain and Greece

Washing machines in Spain and refrigerators in Greece were studied.

3.2.1.1   *The case of washing machines in Spain*

The survey targeted households who purchased a washing machine during the previous four years (i.e., during the period 2013-2017). The purchasing decision could have either been an individual decision or a shared decision for people living with a partner.

The data shows that nearly all purchases were made in hypermarkets or small shops. Internet purchases represent only about 5% of the products in this sample. However, the internet was used in about a third of the cases to gather information to inform the decision prior to purchasing. The retailers play a major role in guiding the decisions for about 60% of respondents. Interestingly, people that use the internet rely less on the retailers. In terms of finance, most washing-machines were paid with own funding (74%) and only 26% with shop or bank credit. Ten percent of the purchase received a subsidy for purchasing high EE level washing machines.[2]

The sample is representative in terms of gender and age intervals (55% female and ages range from 20 to 92 years, with an average of 46 years). Most of the households (i.e. the 95th percentile) are composed of 1 to 4 members. About 80% of respondents are employed. With respect to their income, 39% declare they are able to "cope with their income", 40% state they "live comfortably" or "very comfortably" and 20% say they find it "difficult or very difficult to live on current income".

- *The attributes of the purchasing decision*

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[2] Note that the subsidy program known as Plan Renove is not permanent but has been in place for short periods of time with little information with regards to when the scheme will be operative to reduce suppliers adjusting prices accordingly.

The attributes most frequently considered as *fairly or very important* are is price (88% of respondents scored it as *fairly* or *very important*), energy efficiency (87%), and loading capacity (83%). These attributes are followed in importance by water consumption (78%) and Services & Options[3] (76%). The brand and size attributes are similarly valued with close to 60% of respondents rating it a *fairly* or *very important* attribute. The aesthetic attributes (i.e., colours and design) is not an important attribute (see Figure 5).

The top three *very importantly* valued attributes are the price, the loading capacity and the energy efficiency (see Figure 6). However, the price is the attribute which is most frequently cited as a *very important*. Energy efficiency, loading capacity and water consumption, in this order, are most frequently cited as a *fairly* important attribute rather than a *very important* attribute.

Figure 5: Importance of the purchasing decision attributes of a washing machine in Spain

Figure 6: Percentage of Very Important scores for the purchasing decision attributes of a washing machine in Spain, with 95% confidence intervals

- *Attitudes towards Energy Efficiency*

Households predominantly believe that new technologies will reduce their environmental impacts from energy consumption (see Figure 7) as: 95% of them are willing to take a change on new technologies to reduce their energy consumption, 98% of them believe that EE investment would reduce their environmental impacts and only about 10% of them believe that more EE washing machines are less

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[3] Services and options refer to the number of programs, delay option, screen, counter, water use regulation, etc.

reliable. These beliefs are robust in the sense that most of households valued these statements strongly (see Figure 8).

The decision to invest in more energy-efficient washing machines would not seem to be limited by financial or search time constraints (see Figure 7): most respondents disagree with the statements that (i) they could not afford to upgrade the EE levels of the washing machine (83% of disagreement), (ii) their access to loans will limit their purchase (77% of disagreement).

Information relative to energy efficiency and to some determinants of EE investment seems to be rather poorly known. 28% of respondents understand the energy consumption of the washing machine, 21% knows the price they pay for electricity (€ per kWh) and 20% understand how much money they would save with a more energy-efficient washing machine. The source of this lack of information seems not to be disinterest in their energy bill since 76% of respondents pay attention to their electricity bill (see Figure 7).
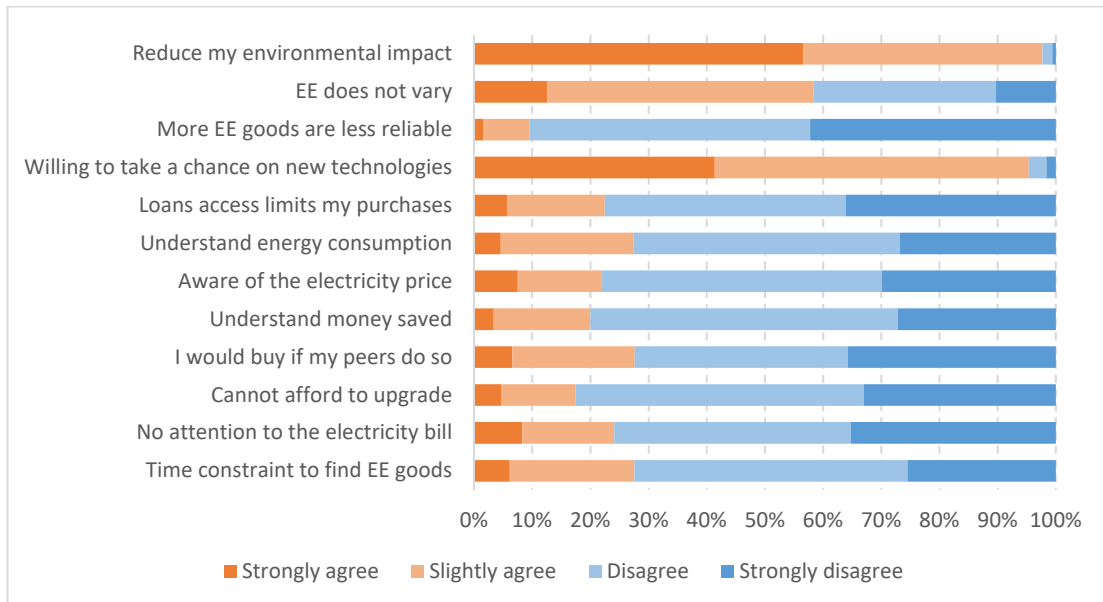
Figure 7: Agreement with behavioural statements on energy efficiency, case of a washing machine in Spain

Figure 8: Agreement with behavioural statements on energy efficiency, case of a washing machine in Spain: the Strongly Agree scores with 95% confidence intervals

- *Understanding of existing and future monetary labels*

Spanish households are predominantly aware of the existence of the label scheme for appliances and state that the label had an influence on their purchasing decision: 90 to 95% know the label and 67 to 76% expect to be influenced by the label (see Figure 9). Washing machines purchased during the period 2013-2017 are mostly from the top 3 grades of energy efficiency label: A+++, A++ and A+. It can be expected that 42 to 51% of the washing machines purchased in this period of time in Spain correspond to the highest grade, A+++ (see Figure 10). Also, 8 to 13% of respondents do not know the level of efficiency of their washing machine.
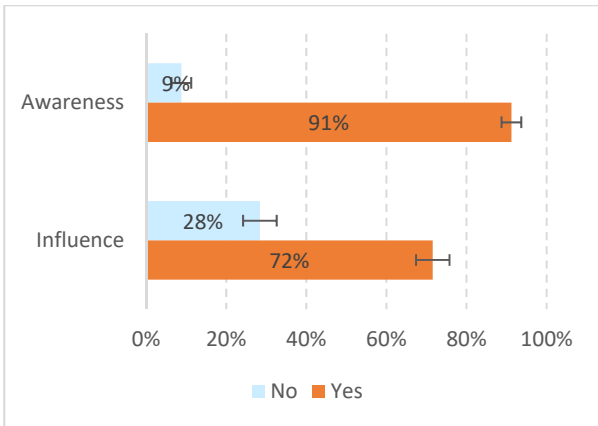
Figure 9: Awareness and influence of the appliances label: the case of washing machine scheme in Spain with 95% confidence intervals
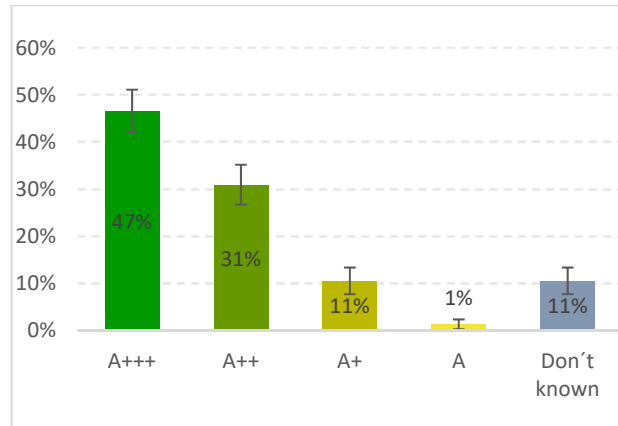
Figure 10: Grades of energy labels with 95% confidence intervals: the case washing machines in Spain

The introduction of monetary information (cost information during the useful life of the washing-machine as per Figure A 1 in annex 6.3) in the EE label for appliances would improve the performance score of the label. Respondents believe a monetary information would make the label more understandable and improve the understanding of both energy consumption and the running costs. Cost information would also increase the influence of the label in the purchasing decision. However, respondents are much less unanimous on the impact on trust and manipulation of label information. Given the confidence intervals of these two statements, a significant positive impact of monetary information on label trust and manipulation seems to be unlikely (see Figure 11).
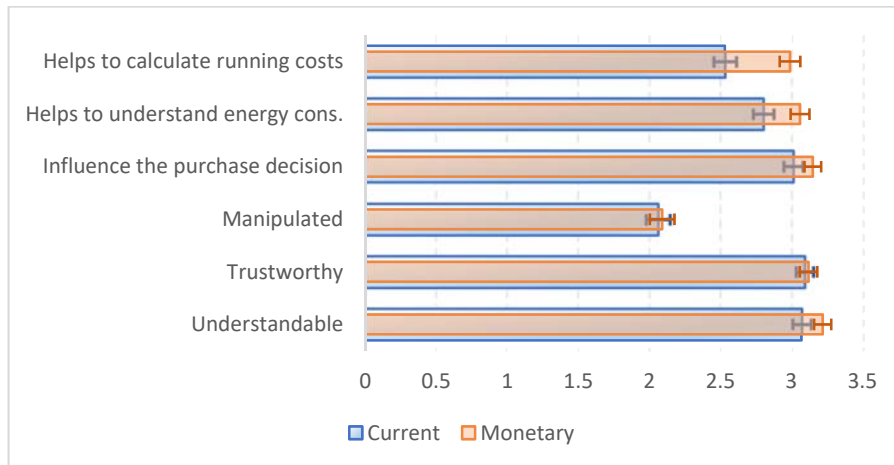
Figure 11: Testing label perceptions changes from current to monetary labels: the case of washing machines in Spain with 95%. Average scores of a scale of responses ranging from 1-Strongly disagree to 4 Strongly agree.

- *Exploring the factors affecting the valuation of EE*

We analysed the potential barriers or drivers explaining the valuation of energy efficiency as *Very Important* attributes of the purchasing decision (Table A 3). Respondents with strong beliefs regarding the potential environmental impact reduction from EE products and on the capacity of new technologies to reduce energy consumption are more likely to value EE as a *very important* attribute of their washing machine purchasing decision, 11% and 17% more likely respectively.

The likelihood to value EE increases with income. We have represented the level of income by its qualitative description. Those respondents "coping with income" and "living comfortably or vey comfortably" on their current income are, respectively, 17% and 24% more likely to value the EE attribute as *very important* than households "finding it very difficult to live with current income". Women who answered the survey are about 7% more likely to value EE as a *very important* attribute. No significant effect of subsidies for EE on EE attribute preference is observed. Some other socio-demographics and attitudinal variables were also tested but did not reveal a significant impact on the EE attribute valuation.

3.2.1.2 The case of refrigerator in Greece

- *Description of the socio-demographics of the sample and of the product*

In total, 496 questionnaires were successfully completed via CAWI (computer-assisted web interviewing)[4]. The questionnaire was related to the purchase of refrigerators, and the questions asked were practically the same as those used in the survey of Spanish households.

The sample is representative of the Greek population with respect to key characteristics, i.e. gender, age, household size, etc. More specifically, as regards the demographic characteristics of the respondents, 49.8% were women and 50.2% were men. In total, 22.3% of the respondents were less than 30 years old, 27.6% were between 30 and 40 years old, 22.6% were between 40 and 50 years old, 21.9% were between 50 and 60 years old and the rest were more than 60 years old. More than half (i.e. 51.2%) of the respondents have a monthly household income less than €1,100 (25.5% less than €750), 31% between €1,100 and €1,800, 7.9% between €1,800 and €2,200 and less than 10% more than €2,200. In connection with the above-

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[4] The survey was conducted by an experienced market research and opinion polling company, which is a member of the Association of Greek Market & Opinion Research Companies (AGMORC), the World Association for Public Opinion Research (WAPOR) and follows quality assurance procedures that have been certified by AGMORC's Data Collection Quality Control

described statistics, 14.6% of the respondents say that they find it very difficult to live on current income, 33.3% find it difficult to live on current income, 32.1% cope on current income and the rest (about 17.5%) declare that they live comfortably or very comfortably on current income.

- *The attributes of the purchasing decision*

As shown in Figure 12 and Figure 13, 72% of the respondents declare that energy consumption is a *very important* attribute when selecting a new refrigerator, followed by the energy class (68%), the price (64%) and the operating costs (62%). At the other end lie the design (only 23% say that it is a *very important* attribute and 34% believe that it's *not at all* or *slightly important*), the warranty (53% say that it is *very important* and 12% that it's *not at all* or *slightly important*) and the after sales service (56% say that it is *very important* and 12% that it's *not at all* or *slightly important*).
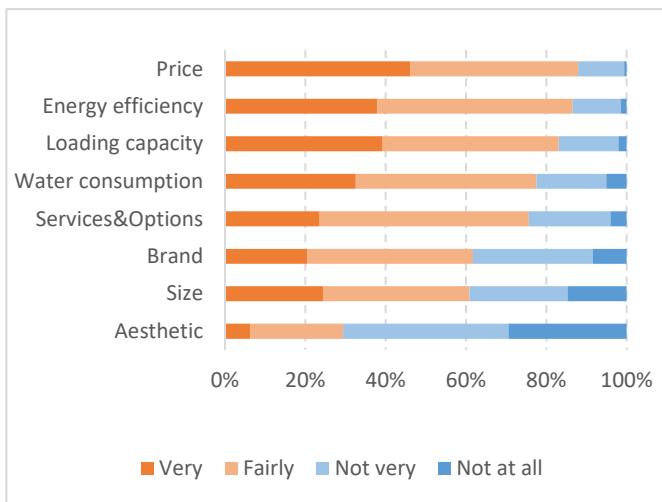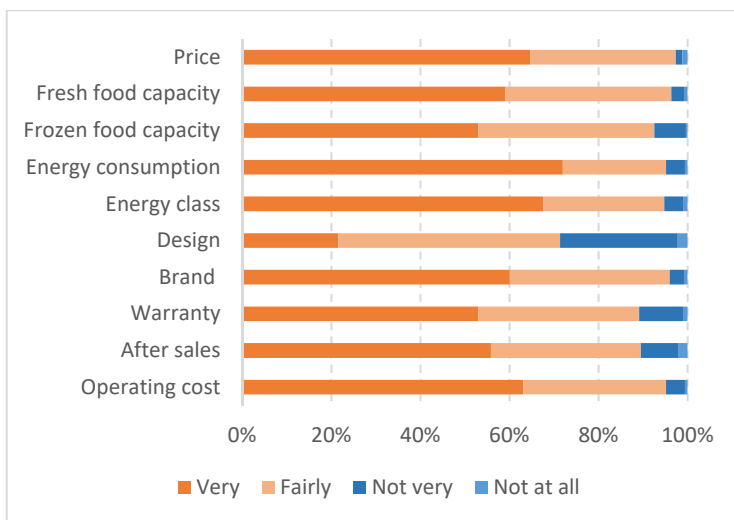

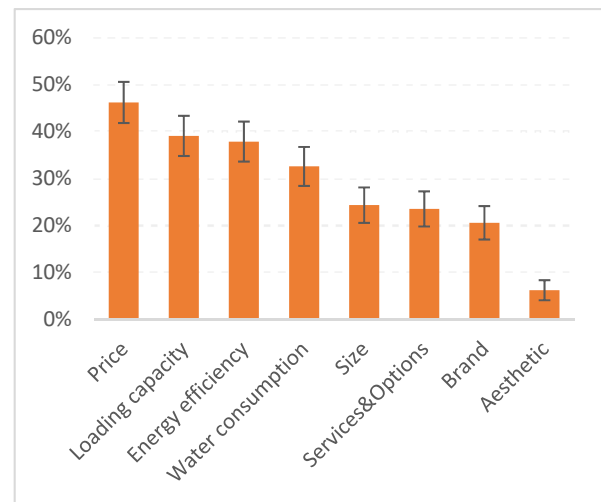Figure 12: Importance of the purchasing decision attributes of a refrigerator in Greece
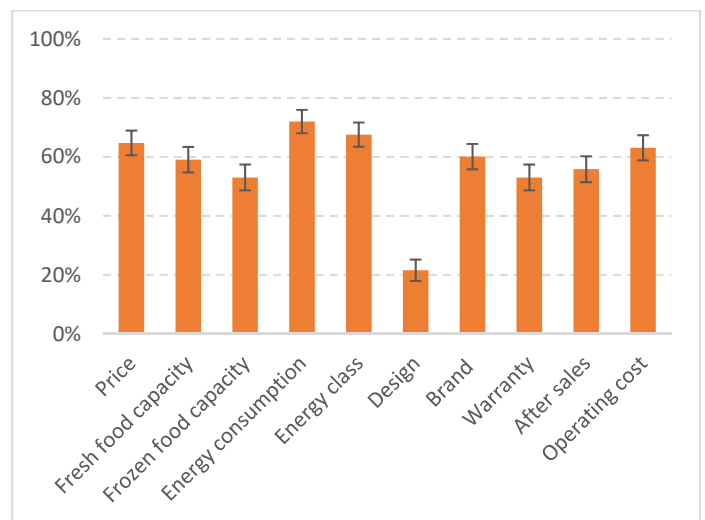
Figure 13: Percentage of Very Important scores for the purchasing decision attributes of a refrigerator in Greece with 95% confidence intervals

- *Attitudes towards Energy Efficiency*

As regards Greece (Figure 14 and Figure 15), more than 95% of the respondents *strongly* or *slightly agree* that buying a more energy efficient refrigerator would reduce the impact of their household on the environment and are willing to take a chance on new technologies to reduce their energy consumption. Further, almost 40% disagree with the statement that all new refrigerators have similar energy efficiency levels, and 80% do not accept that more energy efficient refrigerators are less reliable. Nevertheless, 63% of them declare that they cannot afford to buy an energy efficient refrigerator and, in addition, more than

80% say that the lack of financial incentives is an important barrier towards making more energy efficient choices.

According to the answers provided, about 65% of the respondents *strongly* or *slightly agree* that they a have a good understanding of the refrigerator's energy consumption, 85% *strongly* or *slightly agree* that they understand how much money they would save if they bought a more energy efficient refrigerator and 80% *strongly* or *slightly agree* that they are aware of electricity prices. Nevertheless, more than 60% of them declared that they don't know the amount of money paid to the electricity utility each year for the operation of their refrigerator, and, additionally, only 10% provided an answer within the 'typical' range of the energy cost of a refrigerator in Greece, i.e. between 20 € and 80 € per year.

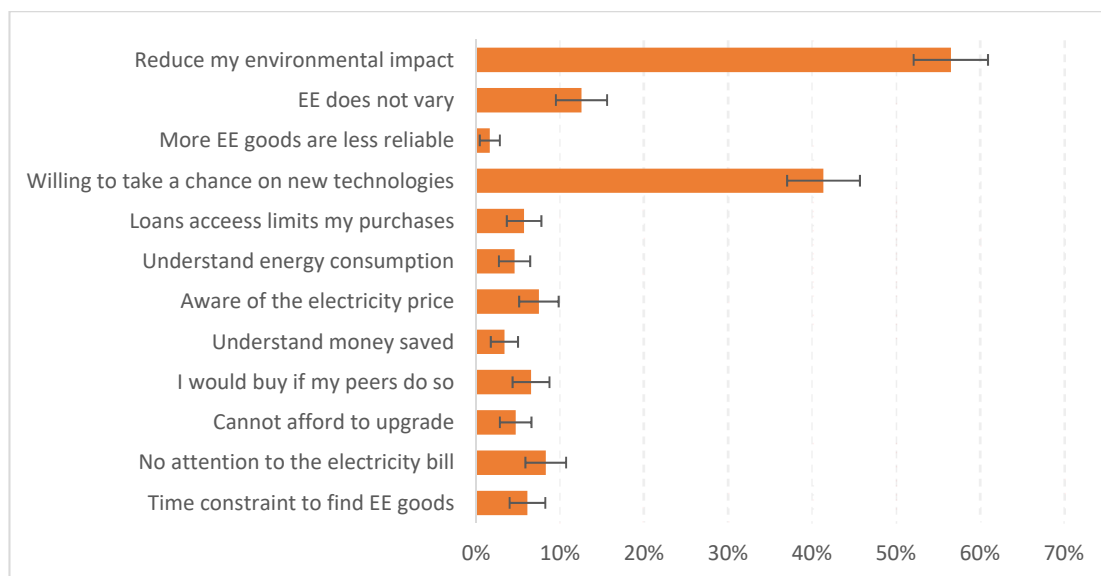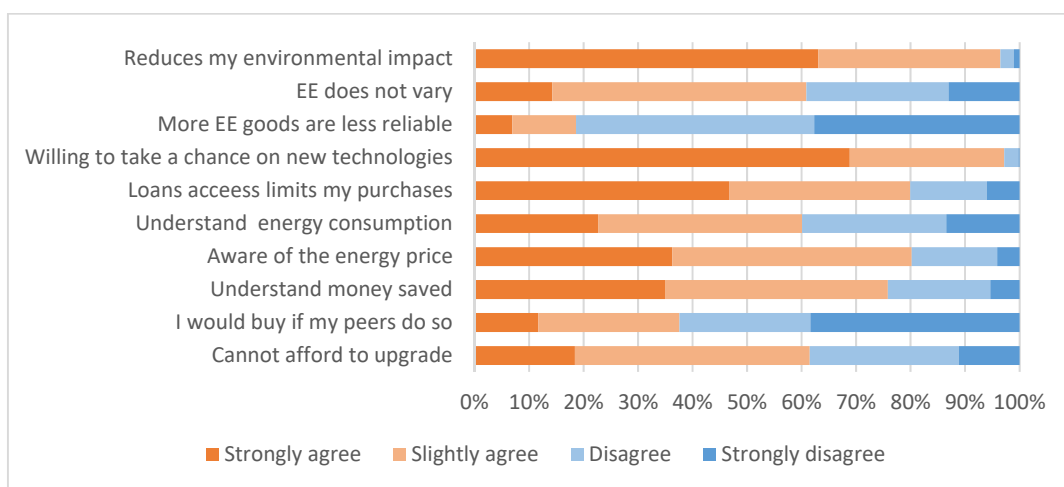*Figure 14: Agreement with behavioural statements on energy efficiency: the case of a refrigerator in Greece*
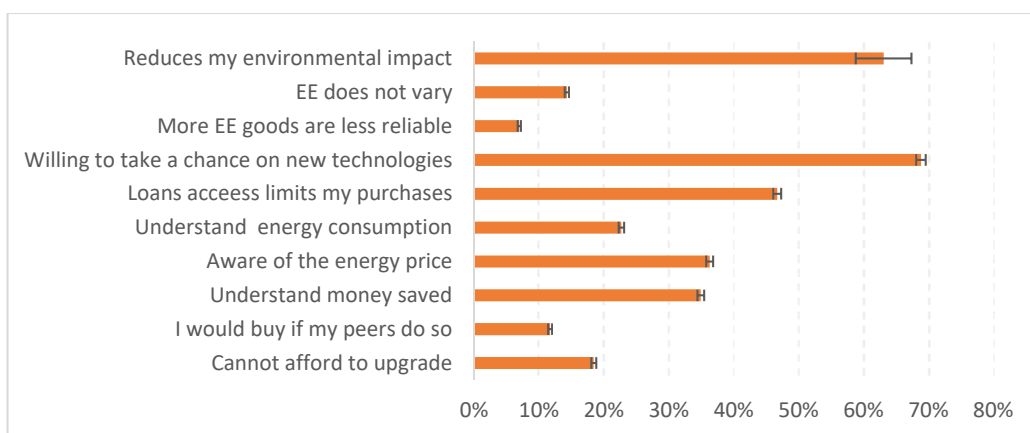
Figure 15: Agreement with behavioural statements on energy efficiency, case of a refrigerator in Greece: the Strongly Agree scores with 95% confidence intervals

- *Understanding of existing and future monetary labels*

As shown in Figure 16, almost two-thirds of the respondents state that they are aware of the existing energy labels. More importantly, 85% of the respondents claim that the energy label did affect the purchase of their refrigerator. According to the econometric models, which are presented in the next section, both parameters, i.e. the awareness of the energy label and its role in selecting a more energy efficient refrigerator, are dependent on a number of attitudinal and demographic factors including, for example, gender, age, beliefs about the reliability of energy efficient refrigerators, awareness of electricity prices, etc.
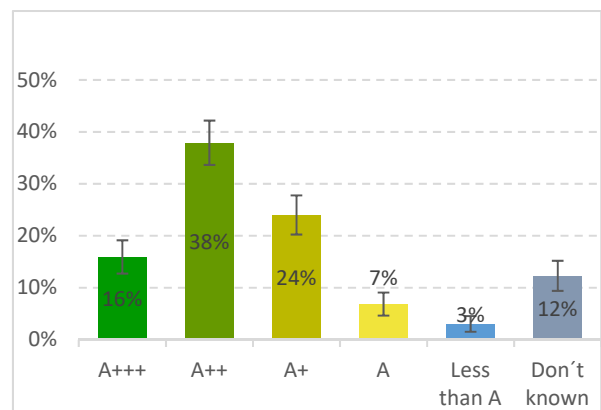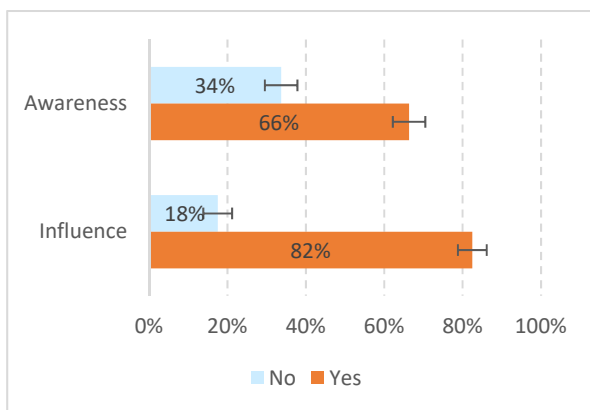
Figure 16: Awareness and influence of the appliances label scheme in Greece: the case of refrigerators with 95% confidence intervals

Figure 17: Grade of energy labels in Greece: the case of refrigerators with 95% confidence intervals

According to Figure 17, less than 20% of the existing refrigerators are of the A+++ class. The majority (i.e. 43%) are of A++ class, 27% are of A+ class, and the rest 12% are of A class or lower. Finally, 12% of the respondents stated that they didn't know the energy class of their refrigerator. The energy efficiency grade of the existing refrigerator is also associated with a number of demographic and attitudinal parameters, as detailed in the next section.

Respondents were also presented with a proposed energy label (Figure A 2 in annex 6.3) that contained monetary information (i.e. the total energy cost per year, calculated by the energy consumption and an average electricity price) and were asked to compare them with the existing ones. The results are given in Figure 18.
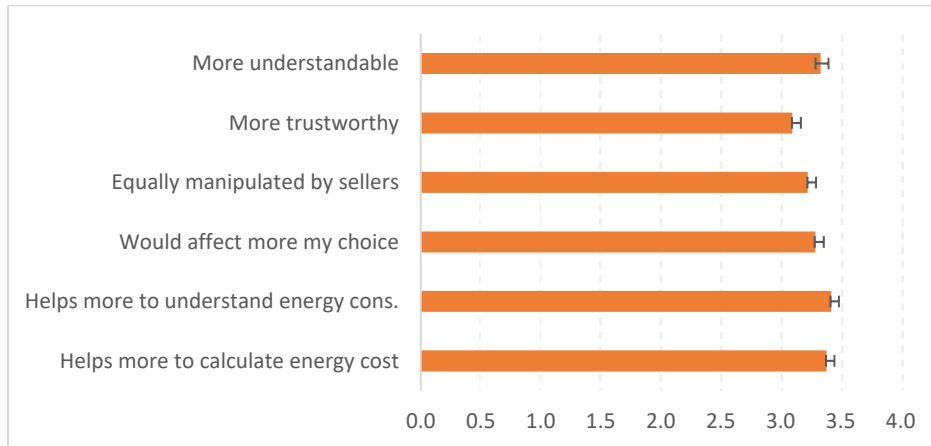
Figure 18: Comparison of monetary vs. existing energy labels (Greece)

Respondents believe that the proposed monetary labels are more helpful than the current labels for calculating how much it would cost to operate a refrigerator and for understanding how much energy is consumed by a refrigerator (the latter finding is a little bit unexpected given that existing labels provide the same piece of information as far as the electricity consumption is concerned). Furthermore, they believe that the proposed labels are more understandable and would influence more their decision. Finally, respondents support that the proposed labels would be equally manipulated by the sellers, although they find them more trustworthy.

- *Exploring the factors affecting the valuation of EE*

The quantitative data from the Greek consumer survey was analysed using standard econometric techniques (i.e. probit regression models) to explore how the decision-making process varies across different consumer groups in terms of age, gender, etc. The energy efficiency attribute (examined via the importance of the energy class of the refrigerator) was used as the dependent variable of the model (coded as: 1 = *Very important*; 0 = otherwise). Moreover, a number of attitudinal (i.e. 'Buying a more energy efficient refrigerator would reduce the impact of my household on the environment', 'All new refrigerators have similar energy efficiency levels', 'I'm willing to take a chance on new technologies so to reduce my energy consumption', 'I'm aware of electricity prices', 'The energy label would affect what refrigerator I'd choose', 'Lack of financial incentives prevents me from making more energy efficient choices', 'I'm willing to combat climate change by purchasing a more expensive yet more energy efficient refrigerator'), and demographic characteristics of the respondent (i.e. gender, age, number of households members and description of current income) were implemented as independent variables. The results in terms of marginal

effects at the means (MEMs) are reported in Table A 4. Annex 6.3 provides complementary analysis on the factors driving the influence of EE in the purchasing decision and the willingness to buy a new refrigerator.

According to the MEM measures, holding all variables at their mean, the probability of considering the energy efficiency as *very important* is higher for those who: *strongly agree* that buying a more energy efficient refrigerator would reduce the impact of their household (16.7%), are willing to take a chance on new technologies to reduce their energy consumption (13.5%), are aware of the electricity prices (15%), state that the energy label would affect what refrigerator they would choose (9.7%), and are willing to combat climate change by purchasing a more expensive yet more energy efficient refrigerator (13.2%). Moreover, having two otherwise-similar individuals, one male and one female, the female's probability of considering the energy efficiency as *very important* would be 9.4% higher. On the contrary, those who believe that all new refrigerators have similar energy efficiency levels are less likely to support this statement (by 22.6%). The age of the respondent and the household size (the latter is not statistically significant at p=0.05) are associated with an insignificant increase in the probability of considering the energy efficiency as *very important* (0.5% and 2.4%, respectively). Finally, the probability is negatively associated with the lack of financial incentives, and the income of the respondent. Nevertheless, the decrease in the probability is small (less than 5%) and the variables are not statistically significant.

3.2.1.3   *Conclusions*

The results of the surveys on washing machines in Spain and refrigerators in Greece show that energy efficiency is an important attribute in the purchasing decision. It is the most important in the case of refrigerators and the third most important for washing machines. Price and technical attributes such as capacity are also rated as important by households in both countries.

Households generally believe in the role of EE in reducing environmental impacts from energy consumption. In both countries they are willing to take a chance on new technologies to reduce their energy consumption, and respondents believe that buying a more EE product would help to reduce their environmental impact. However, differences regarding knowledge and financial barriers are observed between the two countries. In Spain, far fewer people declare being aware of the electricity price than in Greece (20% in Spain versus 80% in Greece). Financial barriers to upgrading the EE of the product are much more present in Greece than in Spain. In Greece 6 out of 10 respondents declare they could not afford an upgrade in EE, in Spain the proportion is close to 2 out of 10 respondents.

The appliances label scheme is rather well known in both countries. More than two thirds of households are aware of the existence of the label scheme. The awareness is, however, significantly different across the countries: 7 out of 10 respondents in Greece are aware of the refrigerator label versus 9 out 10 respondents in Spain. In both countries, the label is a significant selling argument that influences the purchasing decision: 7 to 8 persons out of 10 declare the label influences the decision. The distribution of energy efficiency grades of appliances is significantly different between countries. The most frequently observed grades are A+++ and A++ in Spain yet are A++ and A in Greece. If A+++ can represent 40 to 50% of washing machine installed in Spanish houses with a 95% confidence level, A+++ would represent 15 to 20% of the refrigerator installed in Greek houses. However, we cannot distinguish whether this difference is due to a product effect (washing machine versus refrigerator) or a country effect.

The addition of monetary information in the label would help buyers to better understand the label and the running costs of the product in order to take a rational purchasing decision. However, the monetary information would not significantly improve buyers' trust in the label or would not change the belief that labels are exposed to manipulation by manufacturers.

Common factors between countries explaining the valuation of EE as a *very important* attribute are related to the environmental footprint of the products, the willing to reduce energy consumption thanks to new technologies and gender. Women are about 8 to 9 % more likely than men to value EE very importantly. Pro technological progress people are about 13 to 17% more likely to *very important* value EE and people worried about environmental footprint of the product are about 11 to 17% more likely to very importantly value EE. More country or product specific determinants are the income, the age of respondents, the awareness of electricity price.

3.2.2   Household: properties in Ireland and Slovenia

Households' properties have been analysed both in Ireland and Slovenia with a common questionnaire.

3.2.2.1   *The case of properties in Ireland*

- *Description of the socio-demographics of the sample and of the product*

In Ireland, 501 respondents were asked about property purchasing decisions and the effects of labelling (The *Building Energy Rating* (BER)). The sampling, which was carried out by *Amárach Research*, set

quotas on age, gender, region and social class and is nationally representative.[5] A number of screening questions ensured that current homeowners, and those who plan to buy (next five years), were targeted. We also excluded respondents who are 'not involved' in the purchasing decision (51 respondents were slightly involved and 450 were *extremely* involved).

The sample is evenly split by gender (51% female) and the average age is 45.[6] The majority of respondents (69%) are living with a spouse/partner and 42% have children (currently living in the property). There is a wide spread of education, with 40% having a higher degree or above and 58% having only a secondary education or a lower degree (the remaining is below secondary). In terms of employment status, most are either employed (50%) or retired (18%) with the remainder either self-employed, house persons, carers, unemployed, students or unable to work. The majority are currently homeowners (75%).

- *The attributes of the purchasing decision*

Figure 19 presents responses for the evaluation of six property attributes – price, distance to work, neighbourhood crime rate, energy efficiency/consumption, condition and size – while Figure 20 presents the share of 'very important' responses only. While all attributes are considered *very* or *fairly important* by the majority, price is the most important consideration when buying a property in Ireland, rated as *very important* by 84% of respondents. This is followed by the area crime rate (74%), energy efficiency (57%), size (50%), distance to work (44%) and condition (38%). Figure 20 shows that differences in these shares are statistically different in most cases. Energy efficiency has a significantly lower share of *very important* responses than price and safety, but a higher share than distance to work and condition (no significant difference between energy efficiency and size).

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[5] *Amárach Research*, an Irish research company, were contracted to distribute the online survey. In order to determine the estimated sample size and quota controls, they first placed a question on a nationally representative survey with 1000 respondents. To ensure that the final sample is nationally representative, quotas were set for age, gender, region and social class based on the 2016 *Central Statistics Office* census data. The participants were selected from a pool of a respondents from Research Now, who have a pool of over 90,000 respondents from Ireland who are in the panel on a double opt-in basis.
[6] All sample statistics are weighted according to age, gender, region and social class based on the 2016 *Central Statistics Office* census data.
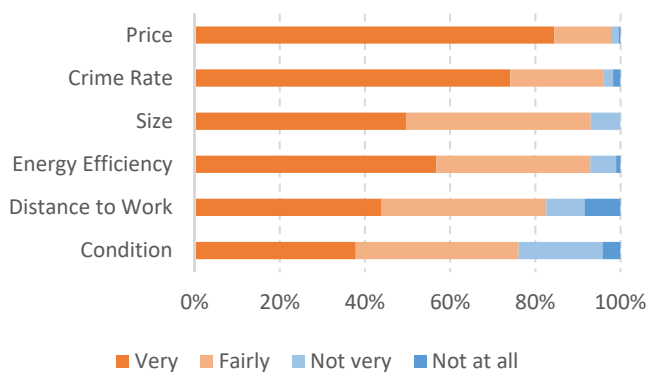
Figure 19: Importance of the purchasing decision attributes of a house in Ireland
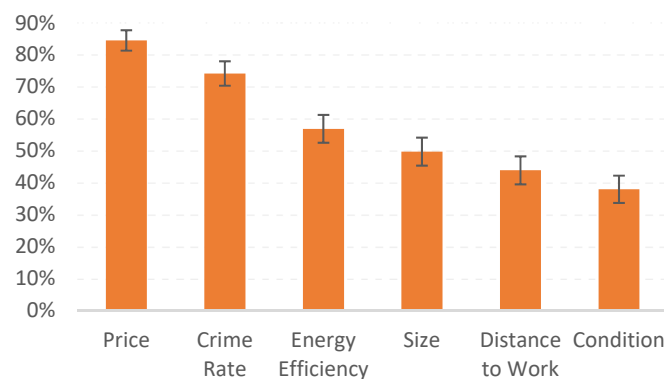
Figure 20: Percentage of Very Important scores for the purchasing decision attributes of a house in Ireland, with 95% confidence intervals

- *Attitudes towards Energy Efficiency*

Figure 21 presents response shares while Figure 22 presents the share of respondents who *strongly agree* with each statement used to explore attitudes towards energy efficiency. The vast majority of respondents believe that buying a more energy efficient property would reduce their household's environmental impact (62% '*strongly agree* and 33% *slightly agree*). Other possible motives for energy investment include comfort and asset appreciation – 95% agree (either *slightly* or *strongly*) that energy efficiency upgrades improve the comfort and value of a property.

Three statements deal specifically with household knowledge in relation to the factors which could affect the decision to invest in more energy efficient technologies.[7] Knowledge gaps are not particularly prevalent for Irish households – most households show a good understanding of property energy consumption, the energy savings associated with higher energy efficiency and energy prices (77%, 75%, and 86% agree with these knowledge statements, respectively).

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[7] The three statements are as follows: 1 - 'I have a good understanding of my property's energy consumption'; 2 – 'I understand how much money I would save if I bought a more energy efficient property'; 3 - 'I am aware of energy prices, that is the price of fuels such as gas, oil and electricity'.

We also explored the importance of a number of energy-related perceptions which could impact the uptake of energy efficient technologies. For example, most (65%) agree that all new properties have similar energy efficiency levels. Furthermore, a sizable 40% of respondents agreed with the statement that more energy efficiency appliances are less reliable. "Herd" effects may also be important – 48% would be more likely (agreed with the statement) to upgrade the energy efficiency of their home if friends, neighbours or colleagues also did so.

Poor household finances and credit constraints also appear to be major factors in household energy efficiency investment. For example, 75% agree that they cannot afford to upgrade the energy efficiency of their homes and 56% agree that lack of access to loans prevents them from making more energy efficient choices.
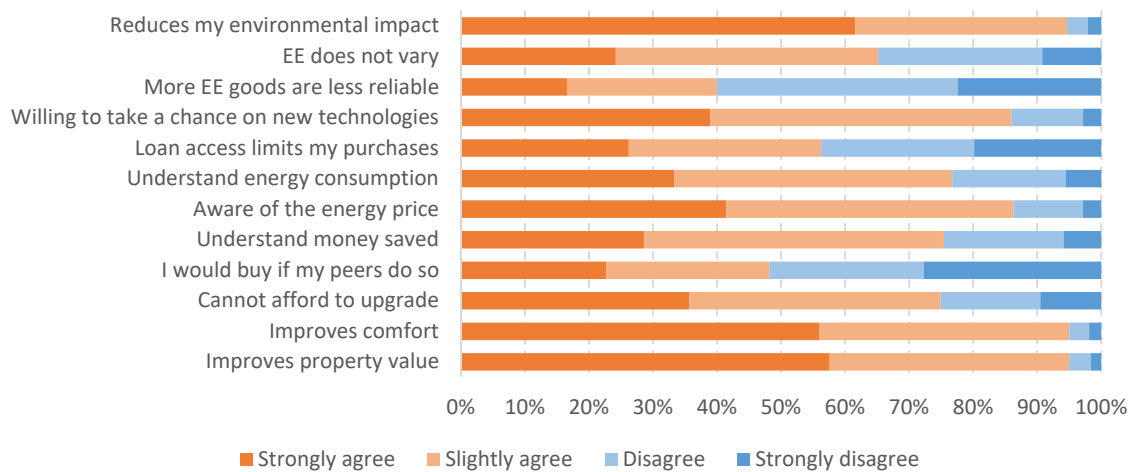
Figure 21: Agreement with behavioural statements on energy efficiency, case of a house in Ireland
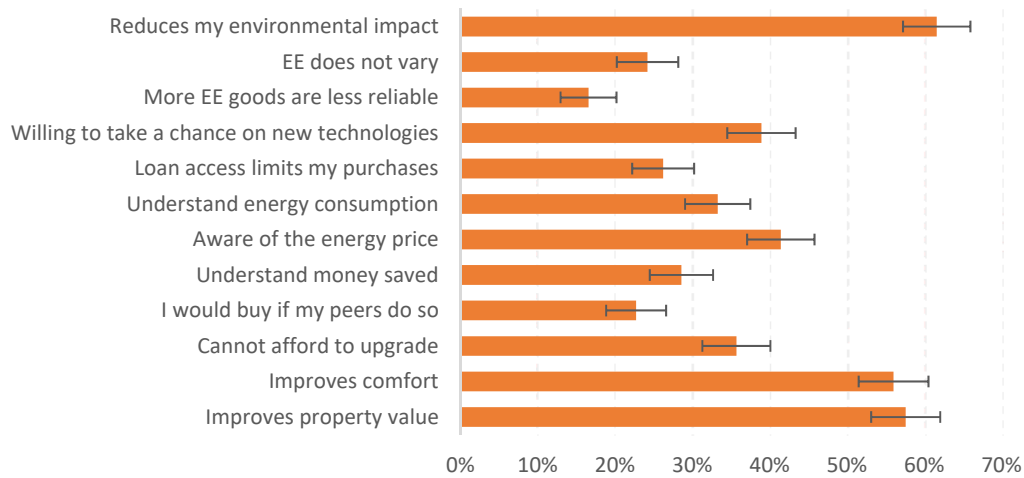
Figure 22: Agreement with behavioural statements on energy efficiency, case of a house in Ireland: the Strongly Agree scores with 95% confidence intervals

- *Understanding of existing and future monetary labels*

There is a high level of awareness of the BER labelling system in Ireland, and 72% said that they were aware of the scheme. However, only 30% said that the BER system influenced their decision to buy their current property and 49% are not aware of their current BER rating. Such low levels of awareness are, however, expected given that the sample includes households who bought before the BER system came into existence. Furthermore, it is only mandatory to acquire a BER certificate when selling a home.

To overcome such potential biases, we focus the analysis of these three indicators on 196 households who have occupied their current property since January 2009 (when the system came into force). BER awareness shows no major change (68% aware, from 72% in full sample). However, the share of households stating that the BER influenced their choice of property increases to 46% (from 30% in full sample) and the share who do not know their BER rating declines to 31% (from 49% in full sample).
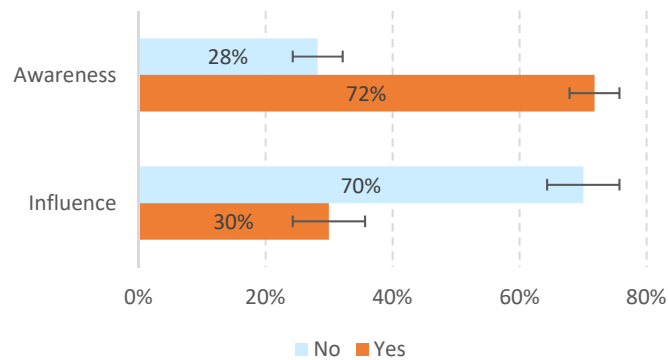
Figure 23: Awareness and influence of the BER label scheme in Ireland with 95% confidence intervals
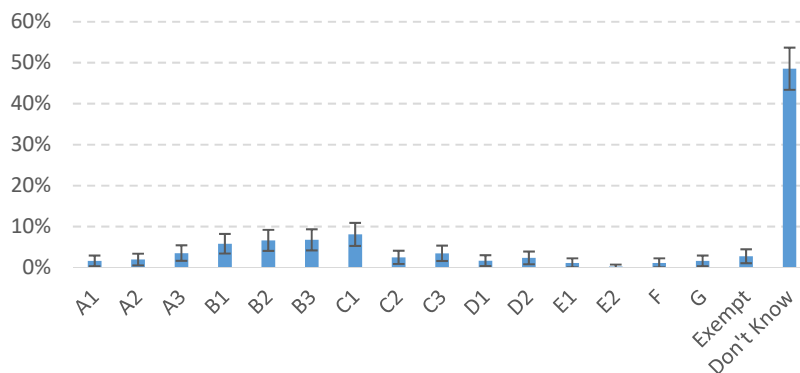
Figure 24: Grade of energy labels in Ireland property with 95% confidence intervals

Six survey statements explored household perception and understanding of both the current BER system and a hypothesised monetary labelling system. In both cases, households agreed or disagreed with statements regarding understanding, influence, trust and manipulation. In neither case did we show images of the labels but relied on memory (for the BER) and text descriptions (for monetary labels). The monetary label scenario is presented in annex 6.1.

Figure 25 presents the mean response for these six statements. These statistics are calculated for the 72% of households that are aware of the BER system (order of BER and monetary label was randomised). For all responses, the mean response is above 2.5, implying a general agreement – most households therefore agree that the BER is understandable, influences their decision, and helps them to understand their energy consumption and calculate their energy costs. However, there is potentially

conflicting responses for two statements – most believe that the system is trustworthy and most also believe that it is manipulated by sellers. For the monetary labels, very similar results are observed. However, three significant differences in responses between BER and monetary labels are apparent – while the monetary labels are more likely to help households estimate property running costs (mean of 3.3 versus 3.1), households also consider monetary labels to be more open to manipulation and less trustworthy. Analysis of households who moved since 2009 (year of policy) leads to identical conclusions.

Figure 25: Testing label perceptions changes from current to monetary labels: the case for Ireland property with 95% confidence intervals. Average scores of a scale of responses ranging from 1-Strongly disagree to 4 Strongly agree.

- *Exploring the factors affecting the valuation of EE*

Table A 7 presents results (marginal effects) from a logit model which explores the characteristics which are correlated with the energy efficiency attribute. The binary dependent variable equals 1 if the household considers energy efficiency to be *very important* when buying a property (simplified to 'value energy efficiency' below). The sample size reduces to 416 (from 501) due to a number of 'don't know/not relevant' responses in the independent variables. Overall, the independent variables are jointly significant.

A number of attitudinal statements are statistically correlated with energy efficiency valuation (mean 56.7%). For example, the belief that energy efficiency upgrades improve property value (responded with *strongly agrees* – 58% of households), increases the likelihood of valuing energy efficiency by 18.4 percentage points (PPs). Opinions regarding climate change appear to be particularly important –

households that are very concerned about the climate (33% of the sample) are 21.3 PPs more likely to value energy efficiency. We also explore two knowledge variables. While knowledge of property energy consumption has no effect, understanding of the money savings associated with energy efficiency improvements is significant – the 28.4% of households that understand monetary savings are 15.6 PPs more likely to value energy efficiency when choosing a new property.

We explore two personality traits: patience and riskiness (both ranging from 1 to 10). 33% of households consider themselves as very patient (responded with 8-10) and 20% consider themselves to be risk loving. However, neither traits have a statistically significant effect.

We also include a wide range of household characteristics. A number of age variables are statistically significant and suggest a non-linear relationship – both the youngest (less than 30 years) and oldest households (over 60 years) are more likely to value energy efficiency (18 and 27 PPs respectively) than the reference category (those aged 40 to 49 years). We also observe a significant gender effect – females are 12.9 PPs more likely to value energy efficiency than males. The results for house size (number of bedrooms) is counter to expectations, and it appears that those with larger houses (and higher energy bills) are less likely to value energy efficiency (each additional bedroom decreases likelihood by 4.9 PPs). A number of additional socio-economic variables have no effect on energy efficiency valuation. For example, income (self-reported perception), education, marital status and the presence of children have no significant effects.

3.2.2.2 The case of properties in Slovenia

- *Description of the socio-demographics of the sample and of the product*

The Slovenian survey was implemented in collaboration with the Slovenian company ARAGON; 426 surveys responses were collected in total. Two thirds of the respondents are female with an average age of 51 years. More than 57% of the respondents has university or PhD degree and less than 2% has primary school or less. 64% of the respondents own their current property, almost 27% of them are renting it, and 9,4% chose some other option (living with parents, living with mother-in-law, etc.). 40% of the owners acquired their property more than 5 years ago, 44% between 1-5 years ago and 16% less than 1 year ago. 77% respondents confirm they are planning to purchase house or apartment in next 3 years while 23% do not have such plans in near future.

- *The attributes of the purchasing decision*

Price is the most important factor in the investment decision with 77% of the respondents ranking it as *very important*, following by energy efficiency/consumption with 54% and condition (time since last renovation) with 52%. On the other hand, size and distance to work are less important factors while the distance to important infrastructure such as school, hospital, etc. is *fairly* or *very important* for more than 86% of the respondents.

As expected, the price of the property is the most important attribute of the purchasing decision followed by condition and consumption which are also *very important* since they are closely correlated with costs of the monthly renovation and future running costs. Distance to important buildings is more important than distance to work because in Slovenia employees receive subsidy for commuting to/from work and therefore work-home distance is not a crucial factor in the investment decisions.
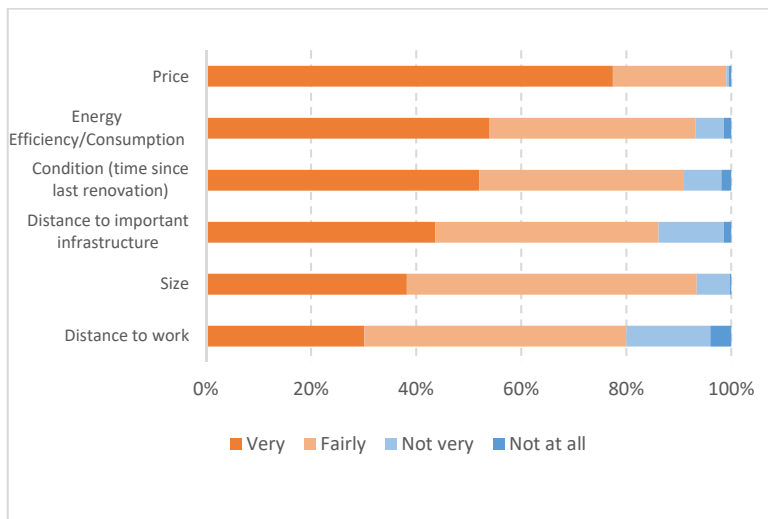
Figure 26: Importance of the purchasing decision attributes of a property in Slovenia
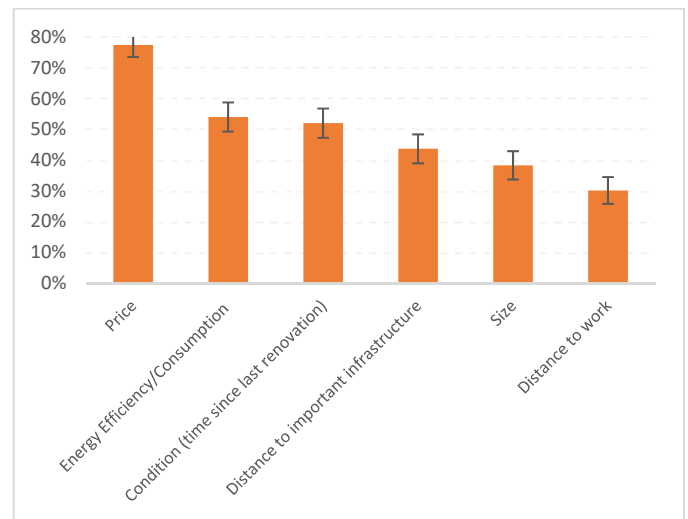
Figure 27: Percentage of Very Important scores for the purchasing decision attributes of a property in Slovenia with 95% confidence intervals

- *Attitudes towards Energy Efficiency*

More than 88% of respondents in Slovenia *strongly* or *slightly agree* that energy efficiency upgrades improve the value and comfort of the property. 87% of them believe that buying a more energy efficient property would reduce their property's environmental impact. 78% of the respondents *slightly* or *strongly agree* that they have a good understanding of property's energy consumption while even higher percentage of them (85%) understand how much money they would save if they would buy a more energy efficient

property. More than three quarters of respondents are aware of energy prices and are willing to take a chance on new technologies. The lack of access to loans for making more energy efficient choices was confirmed by almost 55% of the respondents, and exactly one half of the respondents answered that they cannot afford to upgrade the energy efficiency of their home. An interesting fact is that a similar percentage of the respondents (55% agree vs 45% disagree) think that all new properties have similar energy efficiency levels. At the end most of the respondents would not upgrade the energy efficiency of their property (for example, improving windows, insulation and heating system) if their friends, neighbours or colleagues also do so since more than 69% of the respondents disagree with this statement. Besides that, 4/5 of respondents disagree with that energy efficient appliances are less reliable.
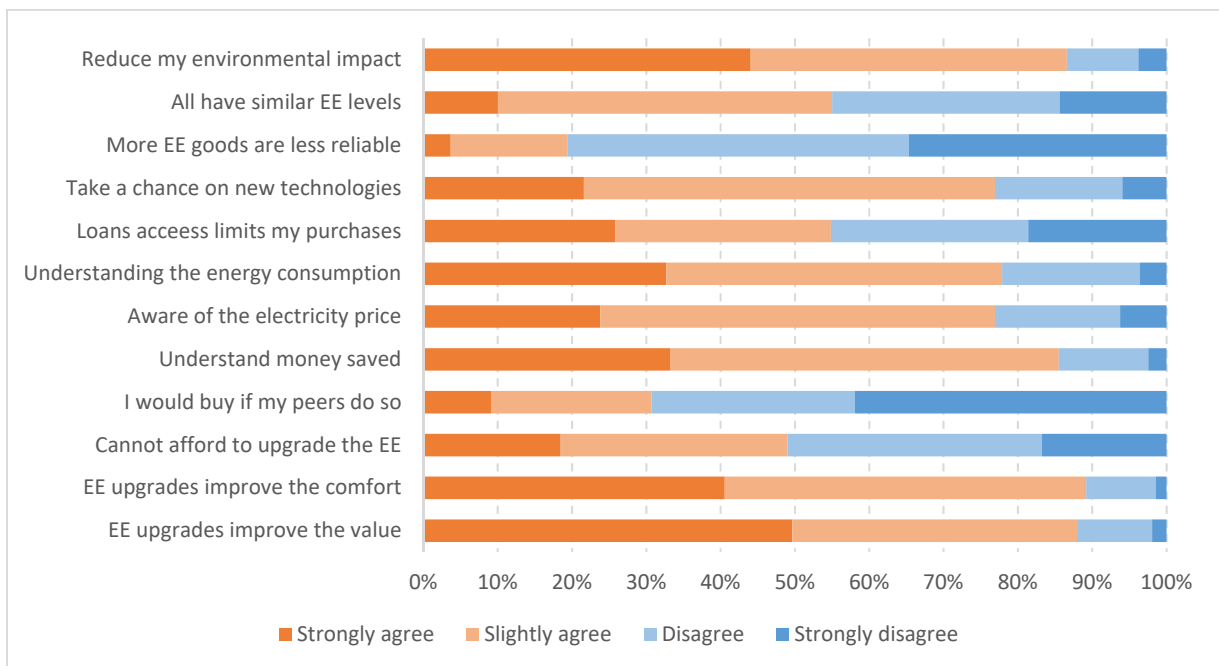
Figure 28: Agreement with behavioural statements on energy efficiency, case of a property in Slovenia
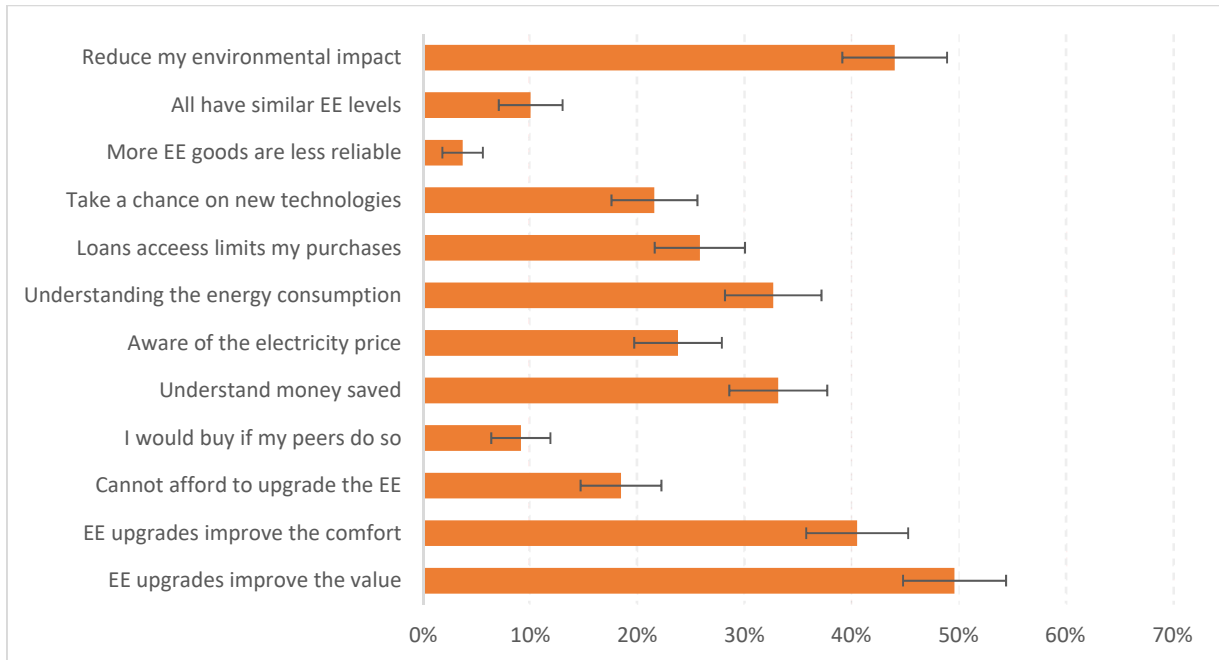
Figure 29: Agreement with behavioural statements on energy efficiency, case of a property in Slovenia: The Strongly Agree scores with 95% confidence intervals

- *Understanding of existing and future monetary labels*

80% of the respondents confirm they are familiar with the BER certificate scheme. The really interesting results came out from the question *"Did the BER affect the choice of your current property?"* where 62% of all respondents answered it is not applicable for them (has not heard of BER or does not own property). For the remaining respondents, 15% of them answered they did not have BER, 16% that it did not influence their choice and only 7% that BER has affected their choice. The result of the respondents who answered this question only with yes/no is shown in the Figure 30.
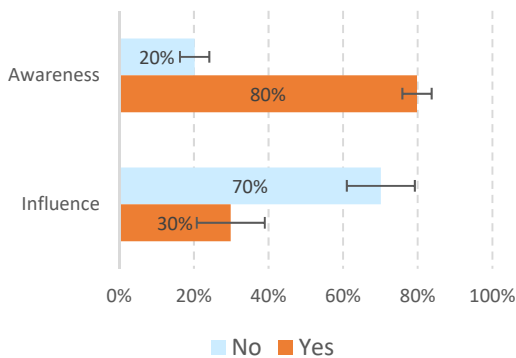
Figure 30: Awareness and influence of the Building Energy Rating (BER) certificate scheme for property in Slovenia, with 95% confidence intervals
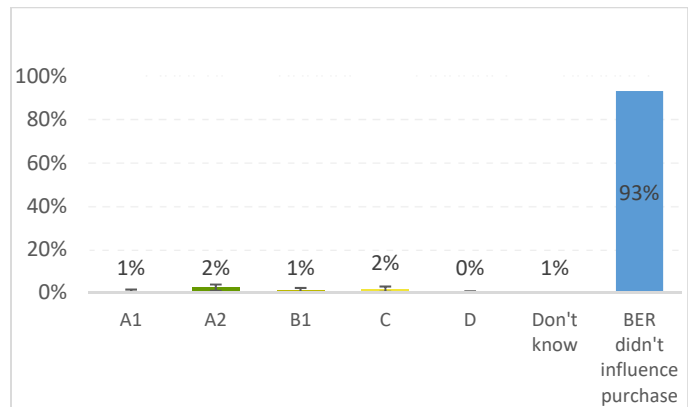
Figure 31: Grade of energy labels of properties in Slovenia with 95% confidence intervals

Even though the majority of the respondents were aware of the BERs only 6% of all respondents answered the question *"What is the BER of your current property"* and gave the answer from A to H. More than 93% of the respondents answered the question as "not applicable" since it did not influence the purchase.

The reason for that could be explained through details and legislation on the BER in Slovenia. Under the Slovenian Energy Act the BER is mandatory since 2014. In the case of buying/selling of the property the seller must submit a BER no later than the conclusion of the sales contract to the prospective buyer. In the case of a rental, the BER is not mandatory for a rent period shorter than one year.[8] Owners of the properties, who are legally obliged to obtain the BER for their properties at their own expense, are postponing the issuing of BER if it is not strictly necessary (in case of selling) and are renting their properties for less than 12 months. Moreover, they have found an exemption: they rent a property to a new tenant for a month and during that time the tenant registers a temporary residence in the property. After that, the first rental agreement is suspended, and the owner concludes a new rental agreement with an existing 'one-month' tenant for an indefinite period of time and with that avoid the need for acquisition of BER. All that resulted in many rentals shorter than one year and quite low number of issued BERs for properties. So far there have been 47.209 BERs issued (until February 2018) for more than one million properties what means less than 5% of the all properties have BER in Slovenia.[9] That answers the high number of respondents claiming that BER did not influence the purchase.

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[8] http://www.energetika-portal.si/podrocja/energetika/energetske-izkaznice-stavb/za-drzavljane/
[9] http://www.energetika-portal.si/fileadmin/dokumenti/podrocja/energetika/energetske_izkaznice/seznam_izdanih_ei_31-01-2018.pdf
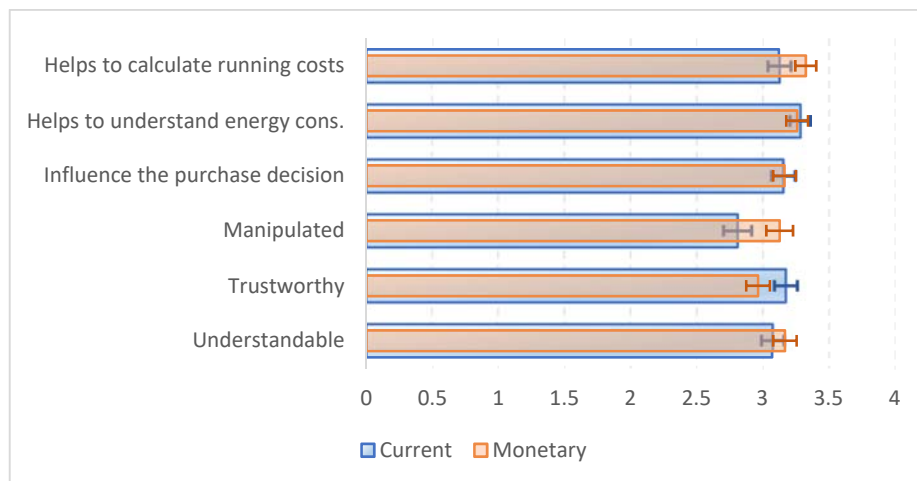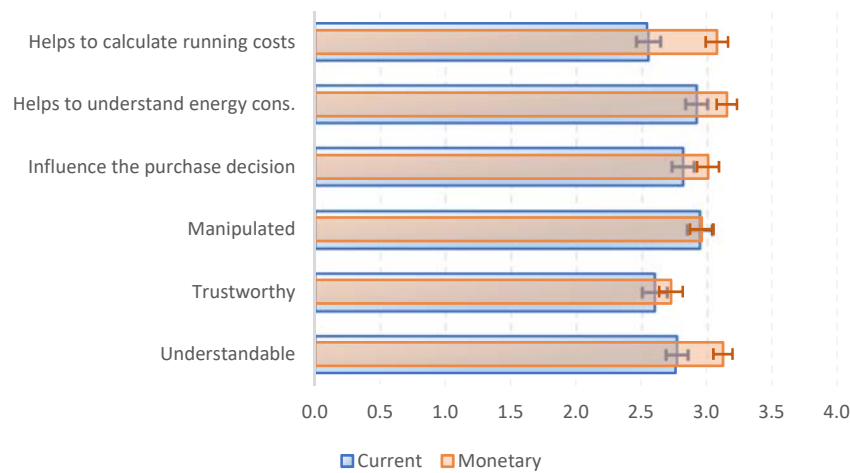
Figure 32: Testing label perceptions changes from current to monetary labels: the case of properties in Slovenia with 95% confidence intervals. Average scores of a scale of responses ranging from 1-Strongly disagree to 4 Strongly agree.

The potential introduction of monetary information would be generally well-received. The majority of respondents believed that it might help them to understand and calculate the energy costs and would influence their purchase decision. However, a high share of respondents in both surveys consider both labels untrustworthy.

- *Exploring the factors affecting the valuation of EE*

A logit model is employed to explore the factors which are correlated with energy efficiency valuation (Table A 8 presents results on marginal effects). The binary dependent variable equals 1 if the household considers energy efficiency to be *very important* when buying a property (simplified to '*values energy efficiency*' below for ease of interpretation), and zero otherwise. The sample size reduces to 363 (from 426) due to a number of '*don't know*' responses in the independent variables. Overall, the independent variables are jointly significant.

We include two attitudinal statements as dummy variables – the first captures perceptions relating to property value (*strongly agrees* that energy efficiency increases property value), and the second indicates that the household is '*very concerned*' about climate change. While there is no statistically significant effect for the first, the second has a positive effect – households who are very concerned about climate change (25% of the sample) are 14.1 percentage points (PPs) more likely to value energy efficiency when buying

a property. This effect is relatively large given the mean of the dependent variable (54%). We also include two knowledge variables which explore household understanding of energy consumption and savings. While both have the expected (positive) signs, neither are statistically significant.

Most additional household characteristics are insignificant, including income (perceptions), age, education, and the presence of children. Gender, however, has a significant effect – females are 15.6 PPs more likely to value energy efficiency than males. Furthermore, married/partnered respondents (this includes divorced, separated and widowed) are 24.2 PPs more likely to value energy efficiency than single individuals. The results for house size (number of bedrooms) is counter to expectations, and it appears that those with larger houses (and, we expect, higher energy bills) are less likely to value energy efficiency (each additional bedroom decreases likelihood by 4.4 PPs).

3.2.2.3 Conclusions

This section has explored the role of energy efficiency and energy labelling in household property decisions in Ireland and Slovenia. Different property attributes play slightly different roles in each country. While price is the most important factor in both countries, property condition seems to be more important in Slovenia, and area crime rate is among the most important factors in Ireland (not considered in Slovenia). The share of respondents who consider energy efficiency as *very important* is, however, the same in both countries (57% in Ireland and 54% in Slovenia – not statistically different).

Regression results (factors affecting high energy efficiency valuation) show some similarities between countries. For example, those "very concerned" about climate change are more likely to value energy efficiency, particularly in Ireland. A common gender effect is also observed across both countries – females are significantly more likely to value energy efficiency when buying a property. We also observe a counterintuitive house size effect – in both countries, those living in larger households (and higher energy bills) value energy efficiency less. This result may be due to a negative income/wealth effect. There are also results not common to both countries: in Ireland, there appears to be a non-linear age effect (not significant in Slovenia), with energy efficiency valued more by both the youngest and oldest households. There is also a correlation between the future property value motive and current energy upgrades (in Ireland only). In Slovenia, married/partnered individuals care more about energy efficiency.

There are also similarities in attitudes towards energy efficiency between countries (please note: the next two paragraphs refer to the *strongly agree* shares). For example, in both countries, most households believe that energy efficiency reduces their individual environmental impact, improves property comfort and improves property value, particularly so in Ireland, where shares are higher for the first two statements. In terms of financing, about a quarter of households in each country believe that credit constraints limit their investment in higher energy efficiency. However, fewer households in Slovenia believe that they cannot afford to upgrade the energy of their home (18% compared to 36% in Ireland).

We also explore three knowledge statements which may impact investment decisions relating to energy: understanding of energy prices, property consumption and energy upgrade savings. For the latter two statements, shares are very similar in both countries (both low and around a third), but knowledge of energy prices is higher in Ireland (41% compared to 24% in Slovenia). Furthermore, in Slovenia, fewer households are willing to "take a chance" on new technologies to reduce their energy consumption (22% compared to 39% in Ireland).

About two thirds of households in both countries are aware of existing energy efficiency labels. However, only about a third have been influenced by such labels when buying their current property. We also observe very high shares of households who are unaware of their current energy efficiency grade, particularly so in Slovenia. However, this is likely driven by the recent roll-out of the schemes and current exemptions.

We compare existing labels with a new monetary label. Slovenian households appeared to be largely in favour of the latter – in Slovenia, more households find that monetary labels are understandable, influential and helpful for understanding/calculating household energy consumption and costs. However, in Ireland, monetary labels only perform better for helping households to calculate energy costs. In both countries, there appears to be a high level of distrust in labels – most households think that labels (existing and monetary) are open to manipulation.

3.2.3   Household: transport in Norway

- *Description of the socio-demographics of the sample and of the product*

The survey was conducted in November 2017 by the professional survey company Opinion among members of the respondent data base panel.no. The target group was the adult Norwegian population who

have purchased a new car at some point or were planning to do so within the next 12 months. The survey received 1,093 completed responses. The response rate was 30%. 50.8% of respondents were male, 70.4% are living with a spouse or partner, 18.3% live alone, and the average age was 49. In terms of education and employment status 52.3% have a bachelor's degree or higher, 55.4% are employed, 24.6% retired, and 7.3% are students. Compared to the general population of Norway this makes our sample older, more likely to be retired, more highly educated and less likely to live alone. All of this is, however, broadly consistent with how the population of (new) car buyers might be expected to differ from the general population.

The focus was on the purchase of new cars, with questions focusing on factors that influence the purchasing decision (equivalent to all other household surveys), and their level of agreement with statements relating to the energy and environmental properties of cars, their awareness of the current labelling scheme, their response to an alternative label focusing on energy costs per month, and a range of standard socioeconomic questions (age, gender, education, household composition, employment status and income). 94.8% of respondents currently have access to a car in their household, and of those 32% have (access to) a gasoline car, 46.2% a diesel car, 9.2% a hybrid and 7.1% an electric car (for the car they use most frequently if they have more than one car)

- *The attributes of the purchasing decision*

The choice of attributes to include in the survey was determined by the results from the focus groups (as reported in Deliverable 2.1 from CONSEED). Compared to focus group results, and our own intuition, the most surprising result is that almost three quarters of respondents ranked "reliability" as a *very important* factor (see Figure 33 and Figure 34), making it the factor most frequently ranked as *very important* – ahead of safety and price.

44.5% of respondents ranked fuel consumption as a *very important* factor, and 48.0% ranked is as *fairly important*, leaving only 3.9% who ranked it as *not very important*, and 0.3% who think it is *not at all important*.
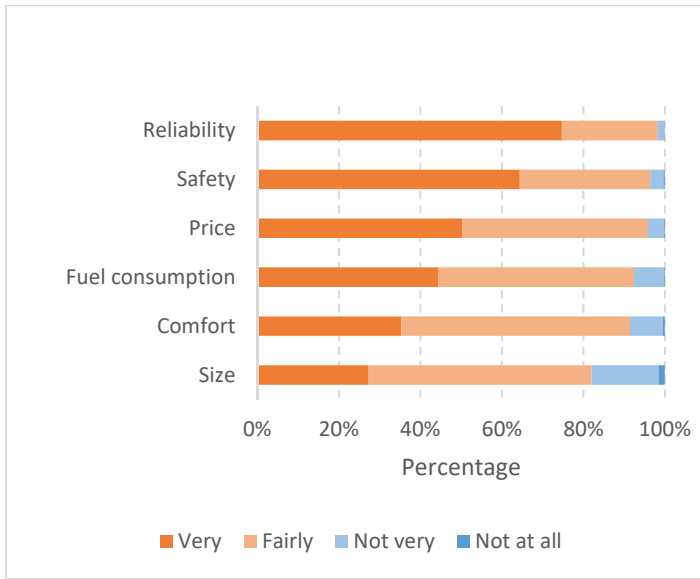
Figure 33: Importance of the purchasing decision attributes of a new car in Norway
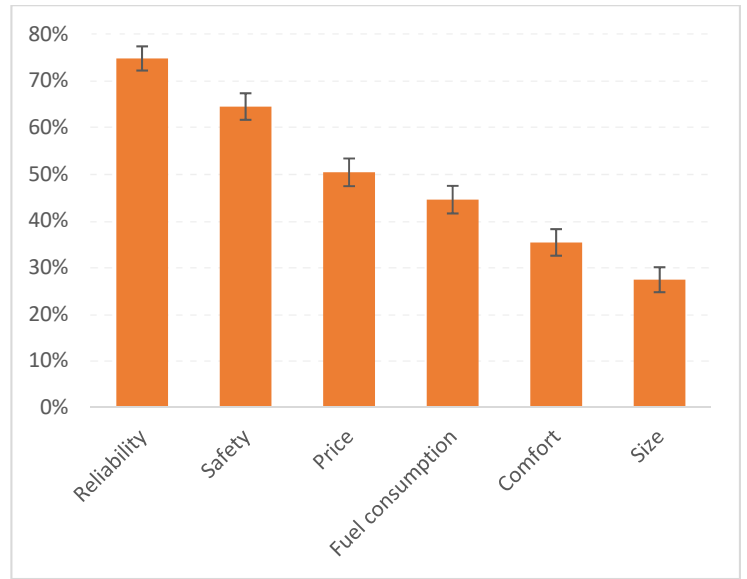
Figure 34: Percentage of "very important" scores for the purchasing decision attributes of a new car in Norway with 95% confidence intervals

- *Attitudes towards Energy Efficiency*

Respondents were asked to rate to what extent they agree with a range of statements relating to the energy efficiency of new cars. More than half of respondents *strongly agree* that they are aware of energy prices and of their own car's energy consumption. In some contrast to this, only 29% *strongly agree* that they understand how much energy they would save if they bought a more energy efficient car.

91% of all respondents *strongly* or *slightly agree* that buying a more energy efficient car would reduce the environmental impact of their household, and they are aware that energy efficiency levels vary between cars (58% *disagree* or *strongly disagree* that all new cars have similar energy efficiency levels).

In terms of possible barriers to buying more energy efficient cars, only 8% strongly agree that lack of access to loans prevent them from doing so, and 17% agree. Furthermore, only 10% *strongly agree* that electric and hybrid cars are less reliable, but a more sizeable 26% agree with this statement.
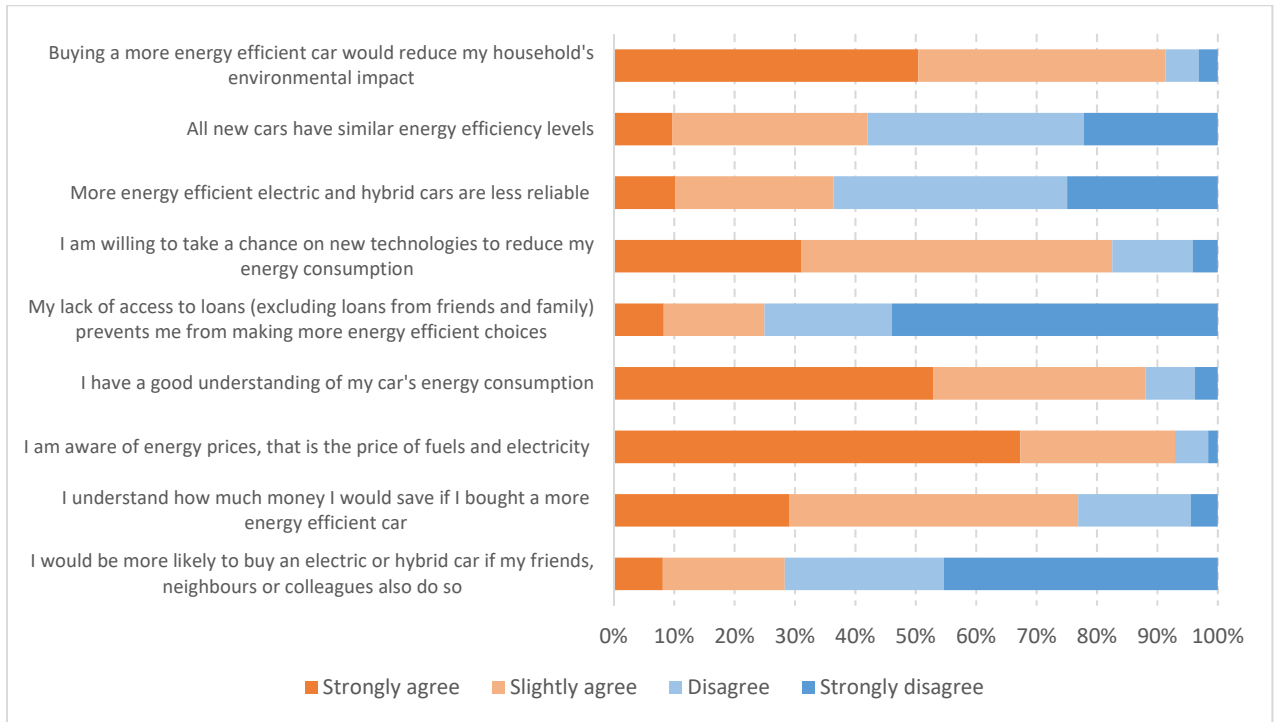
Figure 35: Agreement with behavioural statements relating to energy efficiency, case of new cars in Norway
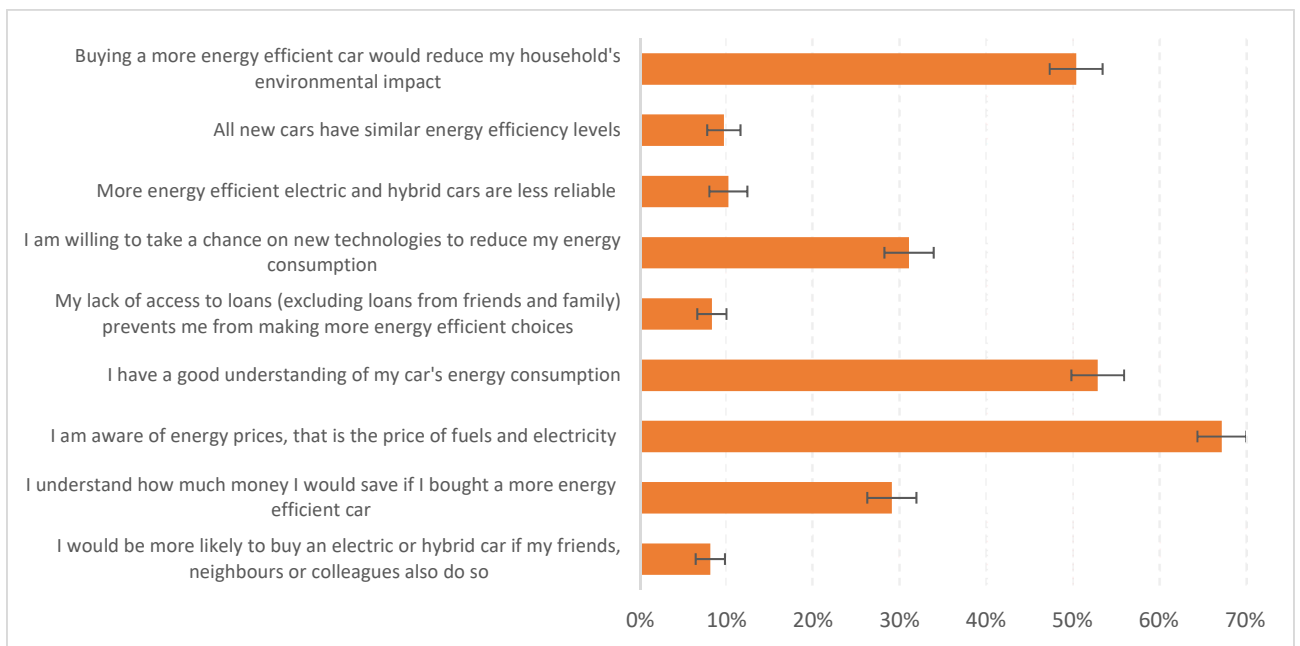
Figure 36: Agreement with behavioural statements on energy efficiency, case of a new cars in Norway: the Strongly Agree scores with 95% confidence intervals

- *Understanding of existing and future monetary labels*

The third section of the questionnaire asked a series of questions to explore the awareness of and attitudes towards the current energy labels for new cars. We showed an illustrative example of the current label (see Figure A 3 in annex 6.5) to respondents, followed by the questions relating to the current label. We displayed an alternative label (see Figure A 4), followed by equivalent questions relating to this alternative label.

Fully 82% of respondents said they were not aware of the current label (see Figure 37), which is a worryingly high number in terms of the potential effectiveness of the scheme. Of the 120 respondents who purchased a new car, recall that is was labelled, and have an opinion on the question, 72% do not think it influenced their decision. Of those that are aware of the label, 41% do not know they grade of their current car, 19% state that the car did not have a grading when they bought it, and the grades of those that recall the label and the grade of their car can be seen in Figure 38.
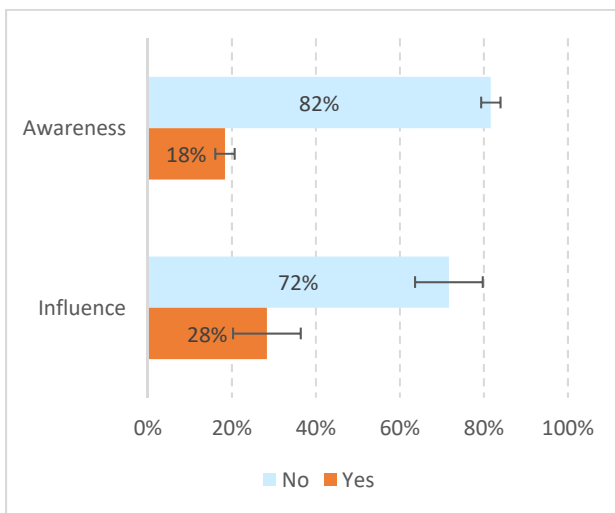
Figure 37:Awareness and influence of the car label scheme in Norway with 95% confidence intervals
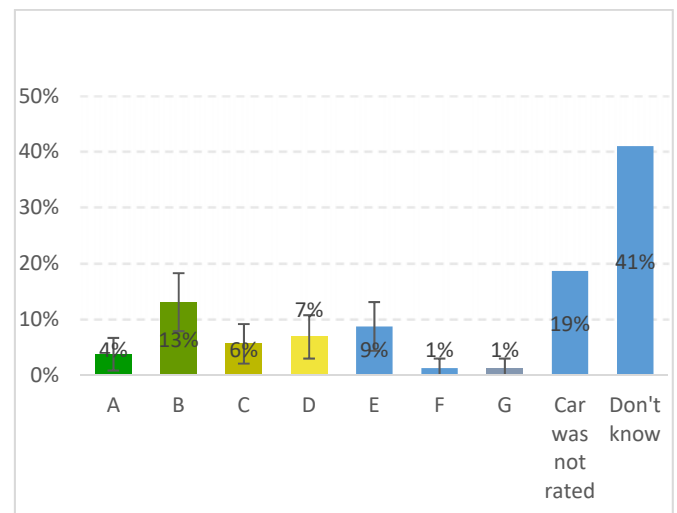
Figure 38: Grade of energy labels for the car purchased among respondents who recalled the label of their car in Norway.

Next, we compared attitudes toward the current label with attitudes toward the alternative label. Figure 39 below shows how attitudes differ between the current and alternative label. As Figure 39 below shows, differences in perceptions of the current and alternative label are relatively minor, and only two differences seem noteworthy: The alternative label is seen as easier to understand, but also as less trustworthy. The

reason for this does not appear to be that the alternative label would more likely be manipulated by producers, as respondents think this somewhat less likely than for the current label.
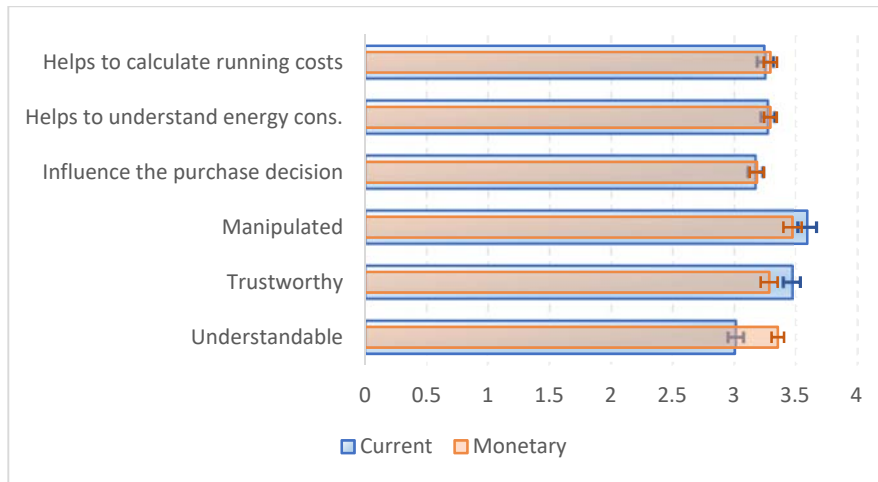
Figure 39: Testing label perception changes from current to monetary labels: The case of cars in Norway. Average scores of a scale of responses ranging from 1-Strongly disagree to 4 Strongly agree.

- *Exploring the factors affecting the valuation of EE*

We conducted a probit analysis to explain the probability of selecting energy efficiency as a *very important* attribute in the choice of a new car. The variables included are classified according to the section of the survey they belong to. Table A 9 below reports the marginal effects.

The marginal effect coefficients show how much the probability of the dependent variable (rating fuel consumption as a *very important* attribute) changes when the value of an independent variable changes by one unit, while holding all other independent variable constant:

- A positive sign for "Similar EE level" implies that people who agreed that all new cars have similar energy efficiency levels, are more likely to rate fuel consumption as a *very important* attribute compared to those who disagreed that all new cars have similar energy efficiency levels.

- A positive sign for "New technologies" implies that people, who agreed that they are willing to take a chance on new technologies, are more likely to rate fuel consumption as a *very important* characteristic compared to those, who are not willing to take a change on new technologies.

- A positive sign for "Money savings" implies that people, who agreed that they understand how much money they would save if they bought a more energy efficient car, are more likely to rate fuel consumption as a *very important* characteristic compared to those, who have less understanding on money savings related to car purchases.

- A positive sign for "Female" implies that females are more likely to rate fuel consumption as a *very important* characteristic.

- A positive sign for "Age" implies that older people are more likely to rate fuel consumption as a *very important* characteristic.

- By contrast, "Living comfortably or very comfortably on current income" has a negative sign, which implies that people, who stated that they are living comfortably on their current income, are less likely to rate fuel consumption as a *very important* characteristic compared to those who have lower income.

3.2.3.1   *Conclusions*

Fuel consumption (i.e. energy efficiency) is seen as a *very important* factor when choosing which new car to purchase by close to half of all respondents in our survey. Three other attributes (reliability, safety and price) are, however, rated as *very important* even more frequently, indicating that fuel consumption, while important, is not one of the primary considerations of buyers in the Norwegian car market. It is important to note that, whereas more than half of respondents *strongly agree* that they are aware of energy price and of their own car's energy consumption, only 29% *strongly agree* that they understand how much energy they would save if they bought a more energy efficient car. This might have been seen as an indication that a monetary label displaying the energy cost of operating different car models would be effective in influencing the choice of car model by making this information more readily available. However, the responses to the questions regarding such a potential new/additional label shows that they do not think it would help them calculate running costs, nor would it be more likely to influence their purchasing decision.

The household transport survey was conducted only in Norway, hence there are no cross-country comparison to make as there are for all other sectors.

3.3 Services sector

This section presents the results of the three surveys implemented in the services sector in CONSEED: appliances in the lodging sector in Spain and Greece and commercial properties in Ireland.

3.3.1 Services: appliances in Spain and Greece

Heating and cooling systems in the lodging sector have been studied both in Greece and Spain.

3.3.1.1 *The case of heating and cooling systems in Greece*

- *Description of the socio-demographics of the sample and of the product*

In total, 102 questionnaires were successfully completed from hotel owners/managers via CATI (computer-assisted telephone interviewing)[10]. The questionnaire was related to the heating and cooling system of the hotel units.

The sample is representative of the Greek hotel sector in terms of geographic dispersion and hotel characteristics (i.e. type of the unit, star ratings, capacity in bed-places, etc.). The majority of the hotels operate for 5 to 6 months per year (June to September), and 46% for 12 months. During high season, more than 50% of the respondents said that the hotel occupancy rate exceeds 90%.

As regards the heating and cooling system, 25.5% of the hotels have a central system, 63.7% have a distributed system and the rest (i.e. 10.8%) have both systems in operation. According to the answers given, the average energy cost per month is about 4,500 Euros (min: 100 Euros and max: 90,000 Euros). The average energy cost is strongly associated with the hotel rating and the hotel capacity. Finally, the average monthly cost for the hotels that have a central heating and cooling system is 2,700 Euros and for those having a distributed system is 3,000 Euros. The hotels that operate a mixed system appear to have the highest cost, i.e. 16,300 Euros per month.

- *The attributes of the purchasing decision*

As shown in Figure 40 and Figure 41, the hotel owners/managers state that the most important attributes when choosing a heating/cooling system for their unit are the energy consumption and the manufacturer's

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[10] The questionnaires were filled by an experienced market research and opinion polling company, a member of the Association of Greek Market & Opinion Research Companies (AGMORC), and the World Association for Public Opinion Research (WAPOR) and certified by the AGMORC's Data Collection Quality Control

reliability (89%), followed by the annual energy cost and the after sales service (81%), the capacity of the system (79%), the years of warranty (78%), and the price (75%). The CO_2 emissions are not an important parameter for the selection of the heating/cooling system, as 67% of the respondents say that it is a *very important* attribute and 10% believe that it's *not at all* or *slightly* important.
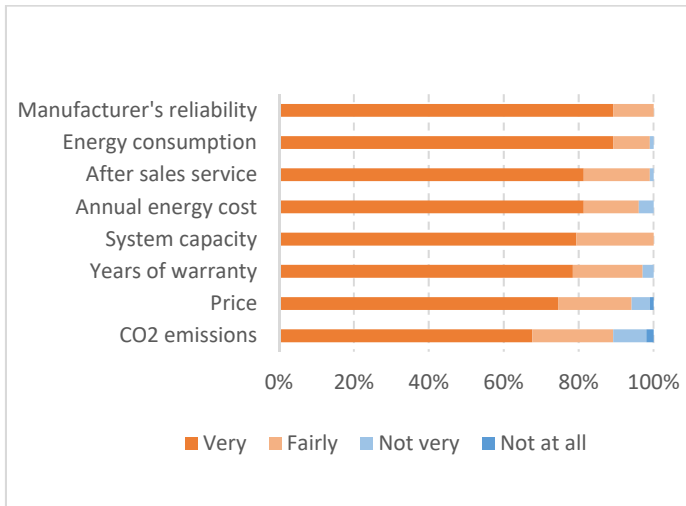
Figure 40: Importance of the purchasing decision attributes of a hotel heating/cooling system in Greece
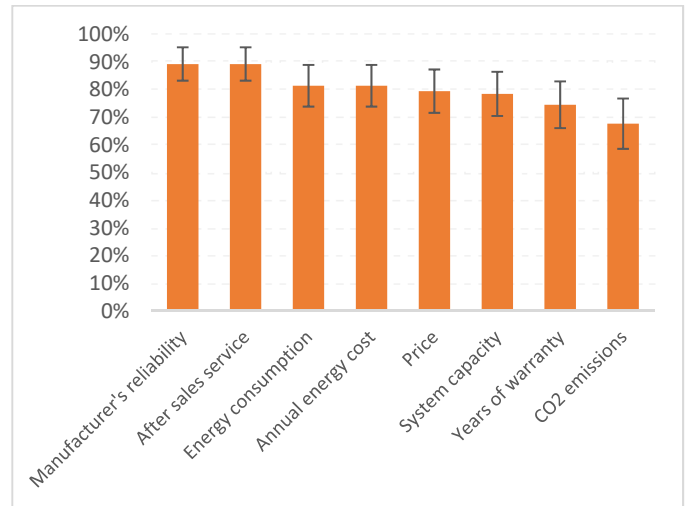
Figure 41: Percentage of Very Important scores for the purchasing decision attributes of a hotel heating/cooling system in Greece

- *Attitudes towards Energy Efficiency*

At the hotel sector in Greece (Figure 42 and Figure 43), more than 95% of the hotel owners/managers *strongly* or *slightly agree* that buying a more energy efficient refrigerator would reduce the impact of their unit on the environment and are willing to take a chance on new technologies to reduce their energy consumption. Further, almost 50% support that all new heating/cooling systems have similar energy efficiency levels and less than 20% believe that more energy efficient systems are less reliable. About 65% declare that they cannot afford to upgrade to a more energy efficient cooling/heating system and, additionally, 75% state that the lack of financial incentives is an important barrier towards making more energy efficient choices. And this, despite the fact that more than 90% of the respondents are convinced that upgrading the hotel heating/cooling system would improve the comfort and would increase the value of their unit.

As regards the information level of the respondents, about 90% of them *strongly* or *slightly agree* that they have a have a good understanding of the system's energy consumption and of the money savings by making their system more energy efficient and are aware of electricity prices. Nevertheless, approximately 90% of the participants said that they are not aware of their hotel energy consumption, and about 47% of the respondents didn't know or refused to state their energy costs. Further, more than 50% of the participants state that they don't know which systems are more energy-efficient.
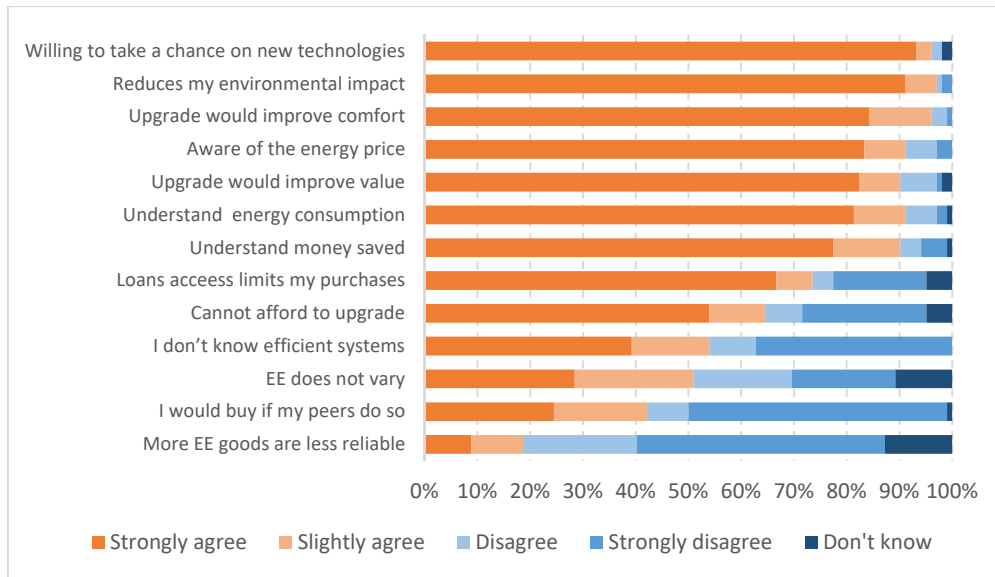
Figure 42: Agreement with behavioural statements on energy efficiency, case of heating/cooling systems at the hotel sector in Greece
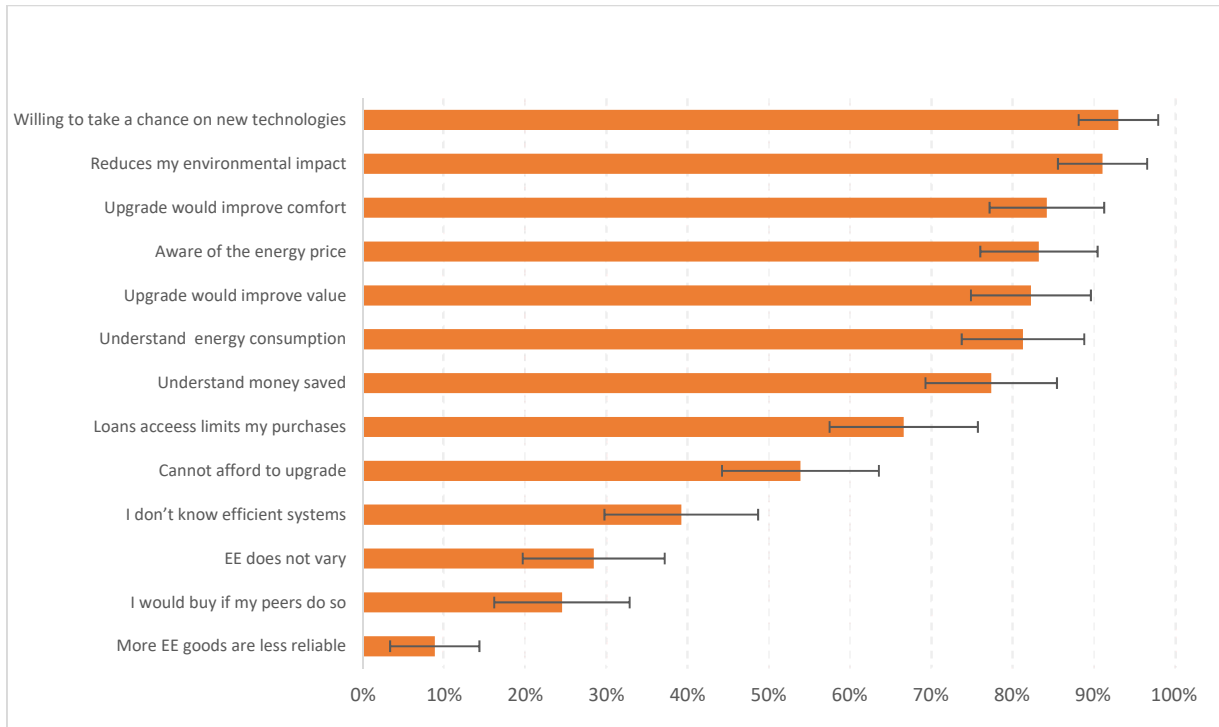
Figure 43: Agreement with behavioural statements on energy efficiency, case of heating/cooling systems at the hotel sector in Greece: the Strongly Agree scores

- *Understanding of existing and future monetary labels*

According to Figure 44, about two-thirds of the participants are aware of the existing energy labels and approximately 70% claim that the energy label did affect the purchase of their hotel heating/cooling system. Furthermore, as shown in Figure 45, more than 70% of the installed heating/cooling systems are of the A+++ class. Yet, 26% of the participants didn't know the energy class of the existing system.
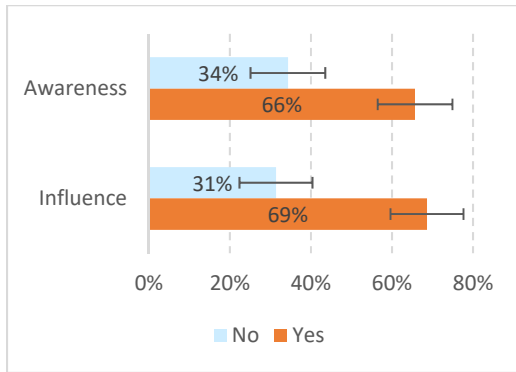
Figure 44: Awareness and influence of the energy label scheme in Greece: the case of hotel heating/cooling systems with 95% confidence intervals
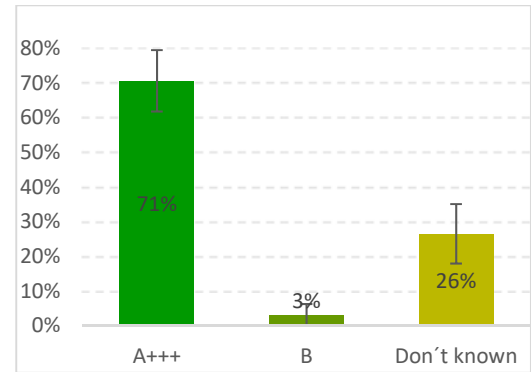
Figure 45: Grade of energy labels in Greece: the case of hotel heating/cooling systems with 95% confidence intervals

In general, according to Figure 46, Greek hotel owners/managers believe that the current energy labels are understandable (3.7/4), trustworthy (3.4/4), have an influence on the purchase decision (3.7/4), and help to understand the system's energy consumption and running costs (3.6/4). Further, they believe that the current labels are manipulated by the sellers (3.5/4). The proposed monetary labels are considered equally understandable and trustworthy with the current labels and perform better than the current ones as regards the understanding of the system's energy consumption and of the running costs. Further, it seems that they perform worse than the current labels as regards the influence on the purchase decision and the manipulation by the sellers (3.6/4 and 3.7/4, respectively). Nevertheless, the difference in the means is not statistically significant.
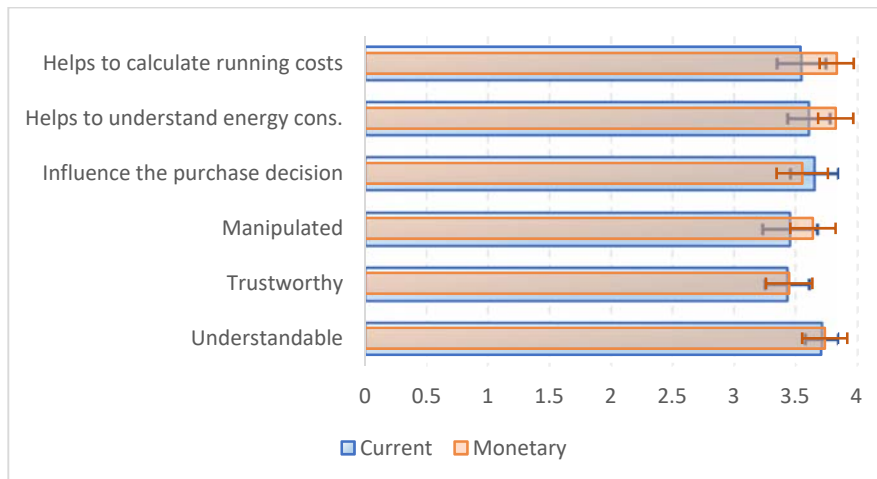
Figure 46: Testing label perceptions changes from current to monetary labels: the case of hotel heating/cooling systems in Greece with 95% confidence intervals. Average scores of a scale of responses ranging from 1-Strongly disagree to 4 Strongly agree.

- *Exploring the factors affecting the valuation of EE*

The quantitative data from the survey on the Greek hotel sector was analysed by means of econometric models to investigate the role of the attitudinal and demographic factors of the respondents on the selection of the hotel heating and cooling system.

The energy efficiency attribute was examined through the importance of the energy consumption of the heating/cooling system. To this end, a probit model was formed taking energy consumption as the dependent variable of the model (coded as: 1 = *Very important*; 0 = otherwise), and the variables 'I'm willing to take a chance on new technologies so to reduce my energy consumption', 'Lack of financial incentives prevents me from making more energy efficient choices', 'Hotel ownership type', 'Gender' and 'Age', as independent variables. Annex 6.6 provides a complementary analysis with the study of the drivers influencing the purchasing decision.

According to the MEM measures (Table A 10), the probability of considering the energy consumption as *very important* is higher for those who are willing to take a chance on new technologies so to reduce their energy consumption (13.4%) and are owners of the hotel unit (the probability in franchised hotels reduces by 50.6%). Moreover, the probability of considering the energy efficiency as *very important* is 9.3% higher for the women, and 0.3% for a one-year increase in the age. Finally, the probability is negatively associated with the lack of financial incentives, although the decrease is small (less than 6%) and the variable is not statistically significant.

3.3.1.2 *The case heating and cooling systems in Spain*

- *Description of the socio-demographics of the sample and of the product*

In Spain, two hundred telephone interviews were carried out with respondents from various types of lodgings (hotels, hostels and cottages) to explore their attitudes towards centralised heating and cooling systems. The targeted respondents were people who are in charge of the purchasing and investment decisions in the lodging. Seventy percent of the respondents were owners of the building and the remaining respondents had a lease contract.

The lodgings included in the survey are distributed along four main climatic regions (Mediterranean, Atlantic, Continental, Subtropical) and three geographical areas (coast, mountain and inland) and represent

different star ratings. They were operated on average for 17 years, with a range from 1 to 86 years. They have on average 26 rooms, but a large range is observed, from 1 to 434 rooms. The average occupancy rate of rooms was 80% during high season and 40% during low season. Most of the lodgings consider that their business has a good economic situation, and they don't see economic problems in the future. On a scale from 1 "*I am having very important economic difficulties*" to 10 "*My economic situation is very comfortable*", the average score is 6 for the present situation and 7 for the following 5 years.

Regarding their heating and cooling systems, 27% of lodgings have combined heating systems, and 72% have separate heating systems, and 18% also have a separate cooling system. The heating energy sources are oil for 33% of lodgings, electricity for 15% of them, biomass for 14%, and natural gas for 11%. Combined systems and separate cooling systems use electricity. On average heating and cooling system age were installed 16 years ago, with a range from 1 to 86 years.

- *The attributes of the purchasing decision*

Figure 47 and Figure 48 show that energy efficiency is the attribute most frequently valued as important for the choice of heating and cooling system. 67% of respondents value it as a *very important* attribute. Noise level (decibels) is the second most important attribute (64% rate is as *very important*), followed by price (62%). Brand reliability (i.e. durability and technical & maintenance support) and services and options (such as automatic control) are also rated as *very important* by at least 50% of respondents.
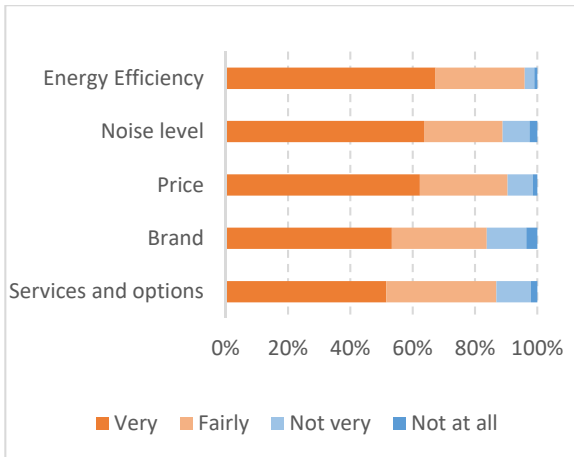
Figure 47: Importance of the purchasing decision attributes of a heating and cooling system for lodgings in Spain
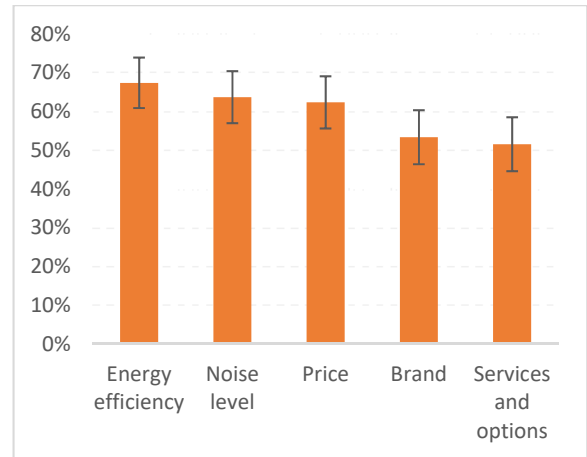
Figure 48: Percentage of Very Important scores for the purchasing decision attributes of a heating and cooling system for lodgings in Spain

- *Attitudes towards Energy Efficiency*

Various statements were used to evaluate and understand attitudes towards energy efficiency (Figure 49 and Figure 50). About 43% of respondents *strongly agreed* that buying a more energy efficient property would reduce their environmental impact (Figure 50). About 39% of respondents *strongly agree* that they are willing to take a chance on a new technology to reduce their energy consumption. The vast majority believe in the reliability of EE products: about 83% of respondents *disagree* or *strongly disagree* with the idea that more energy efficiency heating and cooling system are less reliable (Figure 49). It is also important to consider that about 38% of respondents know how much energy their products consume and 34% of respondents are aware of the energy price.
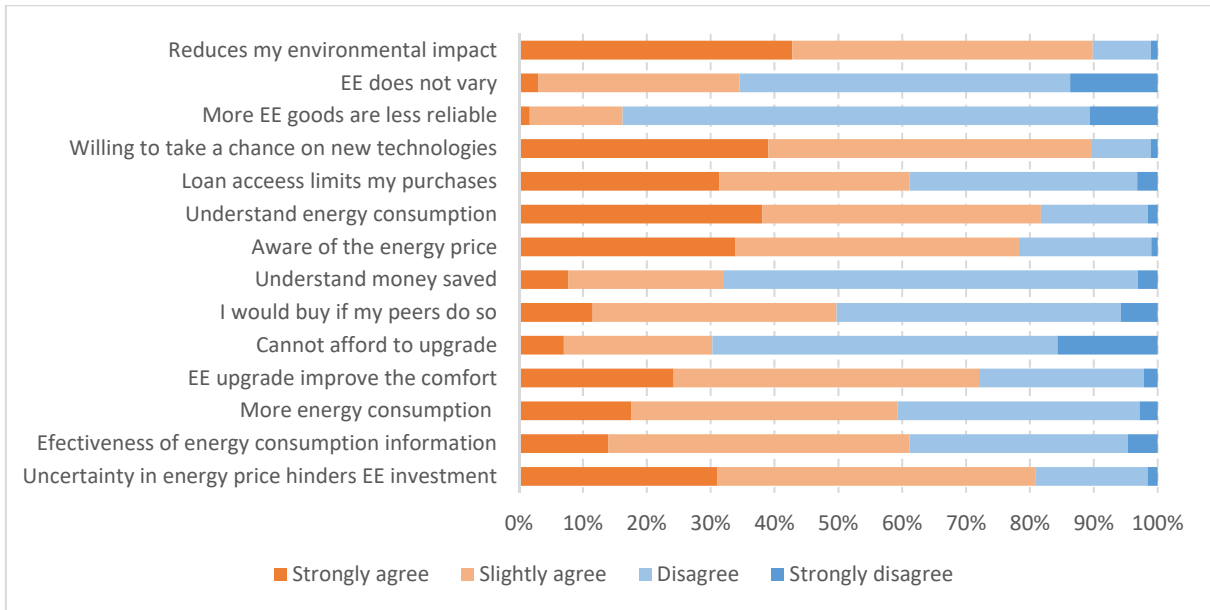
Figure 49: Agreement with behavioural statements on energy efficiency, case of a heating and cooling system for lodgings in Spain
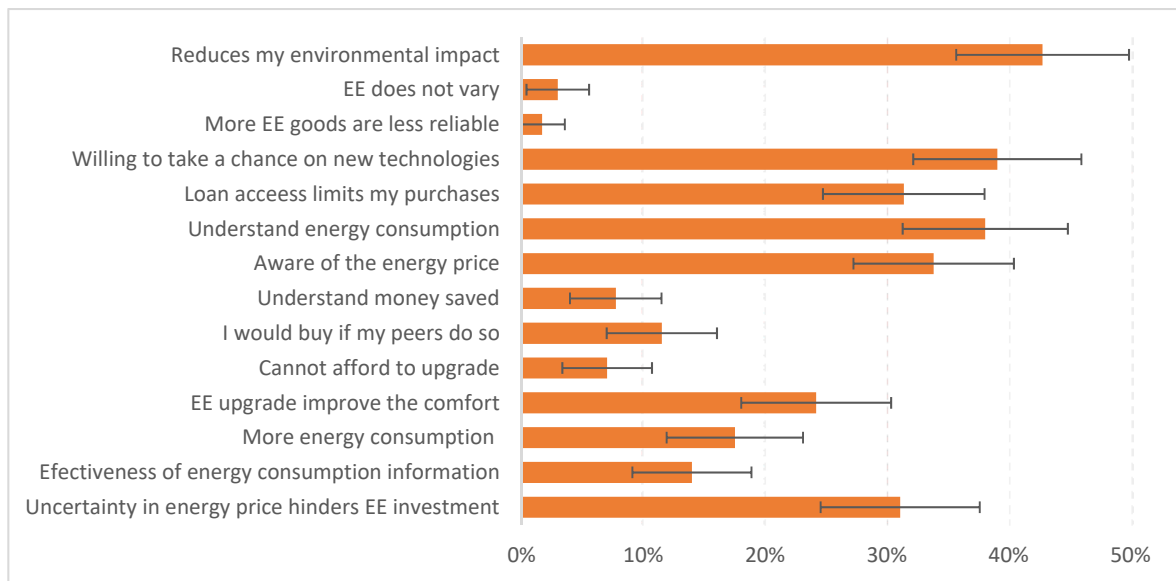
Figure 50: Agreement with behavioural statements on energy efficiency, case of a heating and cooling system for lodgings in Spain: the Strongly Agree scores with 95% confidence intervals

- *Understanding of existing and future monetary labels*

According to Figure 51 and Figure 52, both in the case of heating and the case of cooling, only half of the respondents are aware of the label. With a 95% confidence level, it can be expected that 40 to 60% of lodgings are aware of the label schemes. For those respondents who are aware of the label, 70 and 74% declared that the label would influence the purchase of heating systems and cooling systems, respectively. A potential reason explaining the low level of awareness could be that for heating system with a power higher than 70 kW there is no mandatory EU-wide energy labelling (coloured-based labelling), but heating and cooling systems have a data sheet with the environmental performance of systems.
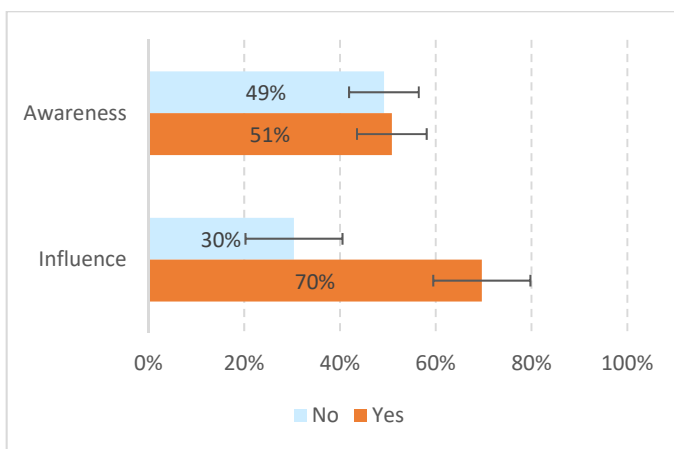
Figure 51: Awareness and influence of the heating label scheme with 95% confidence intervals for lodgings in Spain
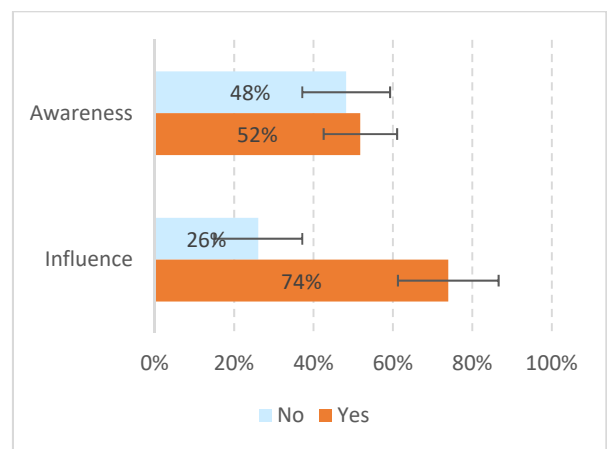
Figure 52: Awareness and influence of the cooling label scheme with 95% confidence intervals for lodgings in Spain

The use of monetary information on the label is perceived by respondents to make the label more understandable and more trustworthy. It would also have a greater influence in the purchasing decision although the variability in answers to this statement mitigates this finding (see confidence intervals). Respondents consider that current labels are manipulated by manufacturers and believe that monetary information would reduce the manipulation. Here also, the large confidence intervals (they cross each other) indicate that this finding should be taken with certain caution (Figure 53).
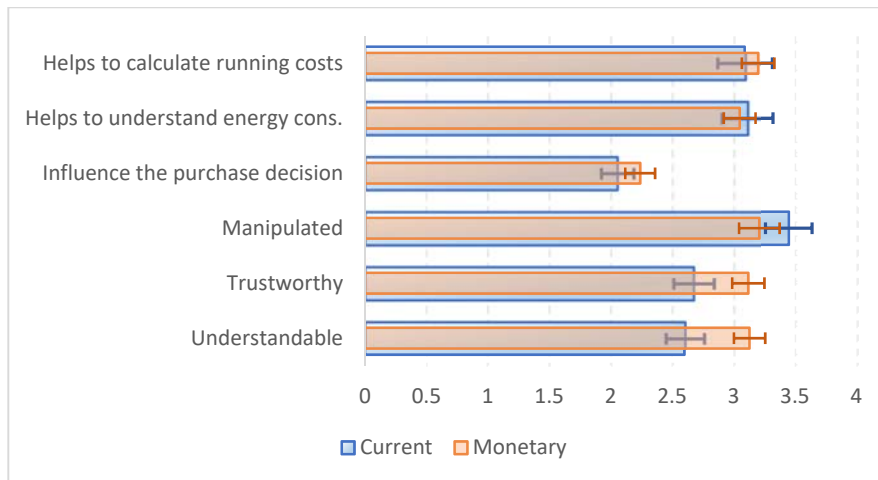
Figure 53: Testing label perceptions changes from current to monetary labels: the case of heating and cooling for lodgings in Spain with 95% confidence intervals. Average scores of a scale of responses ranging from 1-Strongly disagree to 4 Strongly agree.

- *Exploring the factors affecting the valuation of EE*

To explain the factors affecting energy efficiency investment of lodgings, we provide a Probit model to explain the probability that they value energy efficiency as a *very important* attribute. Results are given in Table A 12. Specific attitudes regarding energy efficiency contributes to explaining why EE is very importantly valued. Respondents that *strongly agree* with taking a chance with new technologies are 26% more likely to value energy efficiency as a *very important* attribute.

Climate is a significant determinant of energy efficiency. Lodgings located in continental and subtropical climates are respectively 22% and 28% more likely to value energy efficiency as a *very important* attribute than lodging located in Mediterranean climate. The type of lodging also plays a significant role. Hostels are 15% more likely to value energy efficiency as a *very important* attribute than hotels. The occupancy rate during the high season has a significant influence (but relatively small) on the valuation of energy efficiency as a *very important* attribute.

Some technical characteristics of the heating and cooling systems have a significant impact on valuation. Lodgings with heating systems using propane gas are 22% more likely to value energy efficiency as a *very important* attribute. And those having only a heating system installed (without cooling system) are 20% more likely to value energy efficiency as a *very important* attribute. Environmental concern is also a factor explaining energy efficiency in the lodging sector. Lodgings more worried about environment, are 23% more likely to value energy efficiency as a *very important* attribute.

3.3.1.3 *Conclusions*

The two samples share some common characteristics but there are also differences. Regarding the Greek sample (102 units), lodgings have on average 50 rooms (ranging from 1 up to more than 650). The average occupancy rate of rooms is 95% during high season and 55% during low season. On a scale from 1: "*I am having very important economic difficulties*" to 10: "*My economic situation is very comfortable*", the average score is 6.6 for the present situation. Finally, 90% are privately owned hotels units and the rest are leased. The Spanish sample comprises 200 units with an average of 26 rooms (range from 1 to 434 rooms). The occupancy rate is also lower compared to Greece (80% during high season and 40% during low season). Yet, the economic situation of businesses is similar, since on the same the average score is 6.

The results of the surveys show that in both countries the energy efficiency attribute is the most valued attribute of the hotel heating and cooling system, although in Greece the specific attribute seems to gain greater importance (89% of respondents in Greece and 67% of the respondents in Spain value it as a *very important* attribute; $z= 4.1447$, $p=0.000$). Brand reliability (i.e. durability and technical & maintenance support, years of warranty, etc.) and services and options are also important attributes when purchasing a heating and cooling system, according to the responses given.

As regards the attitudes and beliefs of the respondents towards energy efficiency, about 90% of the respondents in Greece and 43% of respondents consider that buying a more energy efficient property would reduce their environmental impact. Moreover, 93% of the respondents in Greece and 39% of respondents in Spain declare that they are willing to take a chance on new technologies to reduce their energy consumption. Again, the proportion of the respondents is significantly higher in Greece ($z= 7.8504$, $p=0.000$). The vast majority of the respondents from both countries believe in the reliability of EE products, i.e. about 80% of respondents reject the idea that more energy efficiency heating and cooling system are less reliable. It is also important to consider that about 38% of respondents know how much energy their products consume and 34% of respondents are aware of the energy price. In Greece, however, about 65% of the respondents declare that they cannot afford to upgrade to a more energy efficient cooling/heating system, while in Spain the corresponding proportion is much lower, i.e. 30% ($z= 5.8318$, $p=0.000$).

As regards the information level of the respondents, about two-thirds of them in Greece, in comparison to about half of them in Spain, say that they are aware of the energy label scheme. Again, the difference is statistically significant ($z= 2.4784$, $p=0.0132$). Nevertheless, for both countries about 70% of the

respondents who are aware of the energy label, declared that the energy label would influence the purchase of heating and cooling systems.

In Spain, the use of monetary information in the energy label is perceived by respondents as making the label more understandable and more trustworthy, whereas in Greece, existing and monetary labels are considered equally understandable and trustworthy. In both countries, the respondents agree that monetary labels would help them to better understand the running cost of the heating/cooling system. Moreover, according to the Spanish survey respondents consider that monetary information would reduce the manipulation by the sellers, while the Greek survey shows the opposite. Nevertheless, the difference in the means between the existing and the monetary labels is not statistically significant.

The probit models indicate some similarities and some differences between factor structures in the two countries. In both countries, the probability of valuing energy efficiency as a *very important* attribute is higher for those who are willing to take a chance on new technologies so to reduce their energy consumption. Moreover, the probability is negatively associated with the lack of financial incentives. In Greece, however, gender and age seem to play a role to the model, while this is not the case for Spain. Further, climate considerations and technical characteristics of the hotel units affect the value of the energy efficiency attribute, whereas in Greece these parameters did not affect the explanatory model.

3.3.2   Services: properties in Ireland

- *Description of the socio-demographics of the sample and of the product*

In Ireland, 176 services firms were asked about property purchasing decisions and the effects of labelling (The *Building Energy Rating* (BER)). The sampling and telephone interviews were carried out by *Amárach Research*. Our services sector sample consists of Micro and Small firms (up to 50 employees) and meets sampling quotas based on the population of Irish SMEs (proportions of firms by employee numbers based on Central Statistics Office population data). The final sample is weighted to reflect these population proportions.

We only included firms that either bought or rented a property in the past ten years and/or plan to buy or rent in the next five. We also only included respondents who are *extremely* or *slightly* involved in business

property decisions, however the majority were extremely involved (84%). Respondents were contacted using business telephone number lists provided by Bill Moss, a leading list provider in Ireland.[11]

The average (weighted) number of employees and annual turnover in our sample is 11.7 and €3,105,518 respectively (all statistics below exclude 'don't know' and 'refused'). Given the current economic climate in Ireland, the financial and trading situation of our sample is buoyant – firms gave an average financial situation score of 6.6 (scale from one to ten). Furthermore, 57% have increased their employee numbers in 2017 and 50% have acquired fixed assets over the past 12 months. 63% are currently renting their main business premises.

- *The attributes of the purchasing decision*

Respondents were asked to rate the importance of a number of attributes (four response options: *not at all important*, *not very important*, *fairly important* and *very important*). Figure 54 presents responses for six property attributes – price, location, access to public transport, energy efficiency/consumption, condition and size – while Figure 55 presents the share of 'very important' responses only. While all attributes are considered 'very' or 'fairly' important by the majority, price is the most important consideration for Irish businesses, rated as *very important* by 88% of respondents. This is followed by location (71%), condition (48%), size (39%), access to public transport (28%) and energy efficiency (26%). The share of *very important* energy efficiency responses is not statistically lower than public transport access (Figure 55).

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[11] *Amárach Research* attained a list of business telephone numbers from Bill Moss, a leading third-party business leads provider. The sample was split by employee size, as is standard for SME research.
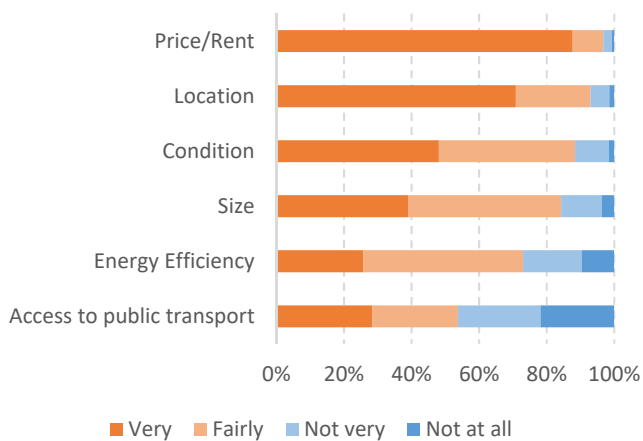
Figure 54: importance of the purchasing decision attributes of property in Ireland
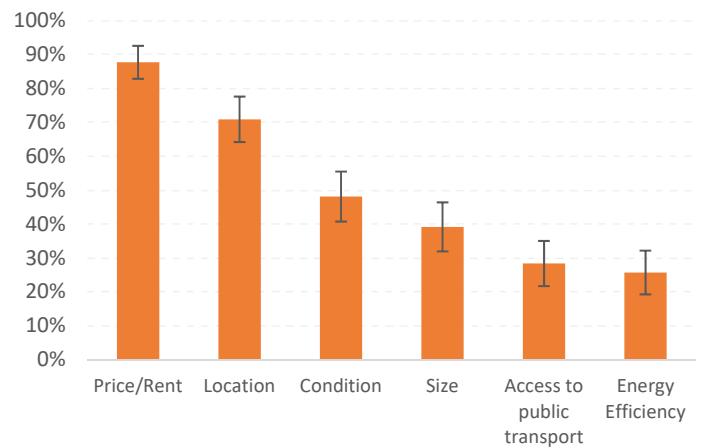
Figure 55: Percentage of Very Important scores for the purchasing decision attributes of property in Ireland with 95% confidence intervals

- *Attitudes towards Energy Efficiency*

Figure 56 presents response shares while Figure 57 presents the share of respondents who strongly agree with each statement used to explore attitudes towards energy efficiency. The vast majority of respondents believe that buying a more energy efficient property would reduce their environmental impact (54% *strongly agree* and 28% *slightly agree*). Comfort and asset appreciation are also possible potential motives – 90% agree (either *slightly* or *strongly*) that energy efficiency improves comfort and 91% agree that upgrades improve property value.

Three knowledge statements explore factors which could affect the decision to invest in more energy efficient technologies.[12] Knowledge gaps do not appear to be particularly prevalent for Irish services firms – most show a good understanding of property energy consumption, the energy savings associated with higher energy efficiency and energy prices (69%, 56%, and 78% agree with these knowledge statements, respectively).

Four statements explore energy-related perceptions. A sizeable 46% agree that all new properties have similar energy efficiency levels. This finding may help explain why so many firms are less unconcerned about energy efficiency than other attributes. Reliability concerns are not prevalent – only 21% of firms

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[12] The three statements are as follows: 1 - 'I have a good understanding of my property's energy consumption'; 2 – 'I understand how much money I would save if I bought a more energy efficient property'; 3 - 'I am aware of energy prices, that is, the price of fuels such as gas, oil and electricity'.

agreed that more energy efficient appliances are less reliable. Furthermore, firms do not appear to be concerned by the reliability of new technologies – the majority (84%) would be willing to take a chance on new technologies in order to reduce their energy consumption. We also find that "herd" effects could be an important driver of energy efficiency adoption – 44% would be more likely to upgrade if other businesses did so too.

Finance and credit constraints appear to be impediments for many. For example, 45% of firms say they cannot afford to upgrade the energy efficiency of their property and 36% agree that the lack of access to loans prevents them from making more energy efficient choices. This is somewhat consistent with attitudes towards finance in general – 26% of firms say that they would not be granted a €50,000 equipment loan.
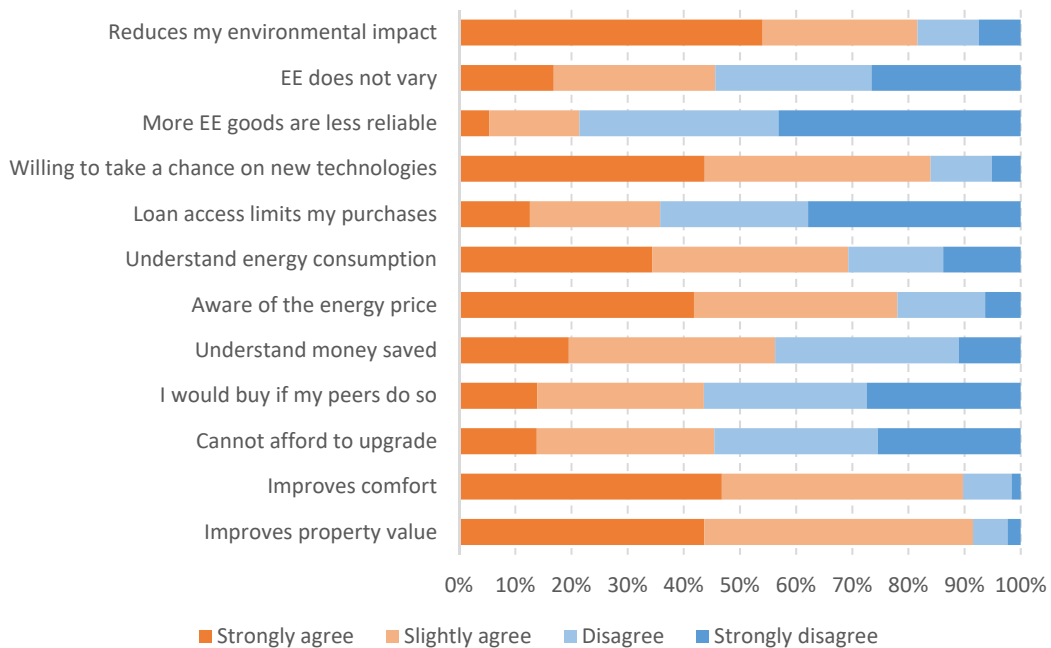
Figure 56: Agreement with behavioural statements on energy efficiency, case of property in Ireland
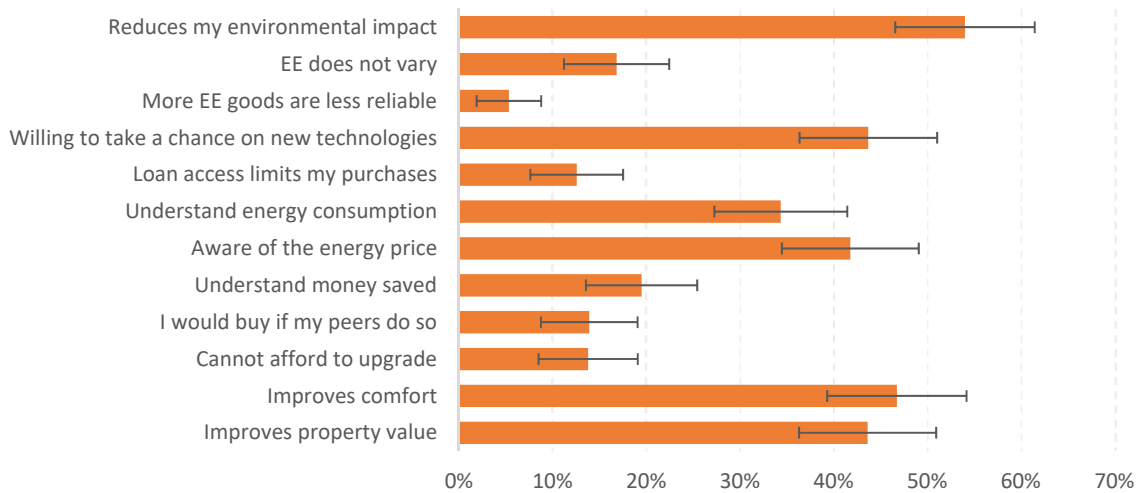
Figure 57: Agreement with behavioural statements on energy efficiency, case of property in Ireland: the Strongly Agree scores with 95% confidence intervals

- *Understanding of existing and future monetary labels*

There is a high level of awareness of the BER labelling system in Ireland – 90% said that they were aware of the scheme (Figure 58). However, only 16% said that the BER system influenced their decision to buy/rent their current property and 73% are not aware of their current BER rating (Figure 59). Such low levels of awareness are, however, expected given that the sample includes firms who bought/rented before the BER system came into existence.
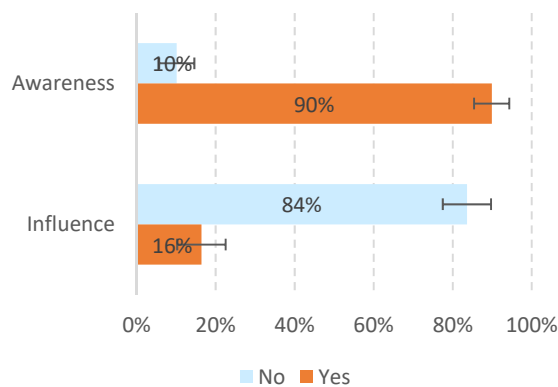
Figure 58: Awareness and influence of the BER label scheme in Ireland with 95% confidence intervals
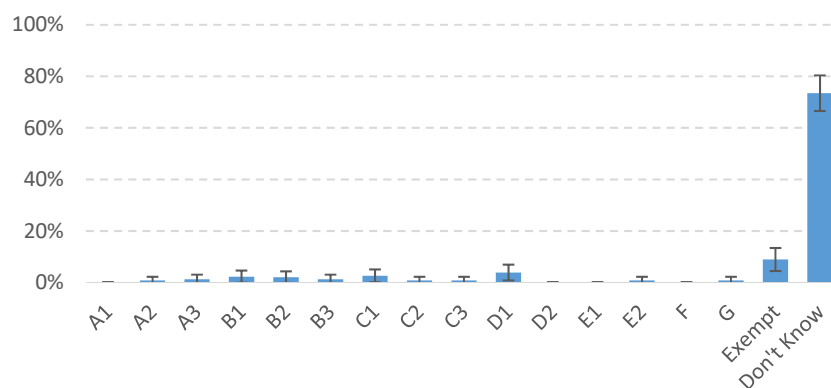
Figure 59: Grade of energy labels in Ireland property with 95% confidence intervals

Six survey statements explored perception and understanding of both the current BER system and a hypothesised monetary labelling system. In both cases, firms agreed or disagreed with statements regarding understanding, influence, trust and manipulation. In neither case did we show images of the labels but relied on memory (for the BER) and text descriptions (for monetary labels). The monetary label scenario is presented in annex 6.1.

Figure 60 presents the mean response for these six statements. These statistics are calculated for the 90% of firms that are aware of the BER system (order of BER and monetary label was randomised). Responses range from 1 *strongly disagree* to 4 *strongly agree*. For all statements except 'manipulated', the mean response is above 2.5, implying a general agreement – most firms therefore agree that the BER is understandable, influential, and helps them to understand their energy consumption and calculate their energy costs.

Very similar results are observed for the monetary label. However, two significant differences in responses between BER and monetary labels are apparent – while the monetary labels are more likely to help firms estimate property running costs (mean of 3.2 versus 2.8), firms also consider monetary labels to be more open to manipulation.
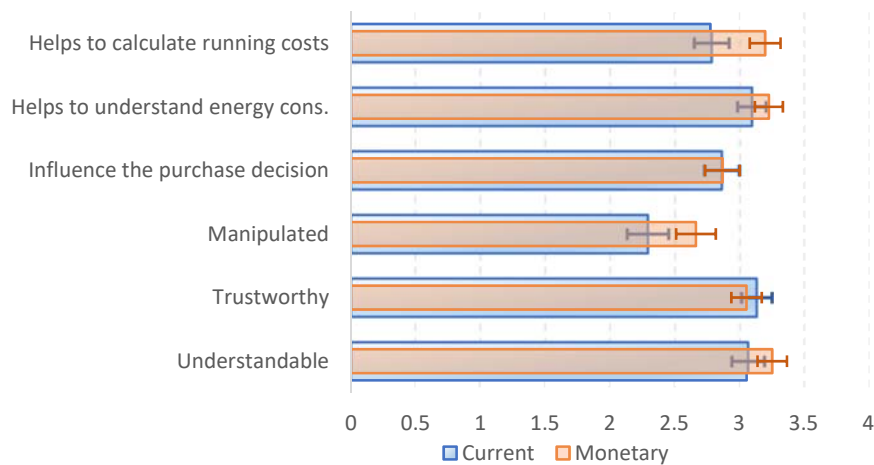
Figure 60: Testing label perceptions changes from current to monetary labels: the case for Ireland property with 95% confidence intervals Average scores of a scale of responses ranging from 1-Strongly disagree to 4 Strongly agree.

- *Exploring the factors affecting the valuation of EE*

A logit model is employed to explore the factors that are correlated with the importance of energy efficiency (Table A 13 presents marginal effects). The binary dependent variable equals 1 if the firm considers energy efficiency to be *very important* when buying or leasing a property (mean 0.256). For ease of interpretation, we have simplified this to 'values energy efficiency' below.

The majority of variables are insignificant. For example, energy efficiency valuation is unrelated to firm size (number of employees), current financial situation (scored 8 or above on a ten-point scale), concern for climate change, or to measures of risk aversion and patience. Only tenure appears to be an important driver, and renters are 20.8 percentage points (PPs) less likely to value energy efficiency. This is a very large decrease relative to the mean and an important finding given the high proportion of firms that rent in Ireland.

3.3.2.1 Conclusions

Services firms appear to value property energy efficiency very differently to households. In Ireland, 26% consider energy efficiency *very important* when buying or renting a property, a lower share than any other property attribute, and about half the share for households (in Ireland and Slovenia). Regression analysis shows very few factors which are related to energy efficiency valuation. Only renters are considerably less

likely to value energy efficiency when considering a new property. This result is important given the high share of renters in the business sector.

Firm attitudes towards and knowledge of energy efficiency are explored. Similar to households, reduced environmental impact, increased property value and improved property comfort are all considered to be the benefits of energy efficiency (this paragraph refers to the share of *strongly* or *slightly agree* responses). We also find that only 16% are not willing to 'take a chance' on new technologies and about a fifth have reliability concerns related to higher efficiency. 'Herd' effects could also be important – 44% of firms would be more likely to invest if other firms did so first. In terms of knowledge, 31% do not have a good understanding of property energy consumption, 44% do not understand monetary energy savings (of higher efficiency) and 22% are unaware of energy prices. Finance and credit constraint are also a concern – 45% cannot afford to upgrade the energy efficiency of their property and 36% agree that the lack of access to loans prevents them from making more energy efficient choices.

While the vast majority of firms are aware of the BER, only 16% said that it influenced their last property decision and only 27% know their current rating (main premises). Such low shares could be the result of properties being bought or rented prior to the system coming into force. However, the BER labelling system appears to be understandable and influential and helps firms to understand energy consumption and calculate energy costs (most agree). The proposed monetary label is equally valued but makes running costs easier to calculate.

3.4 Agriculture sector

For agriculture sector tractor investment decisions have been analysed in Ireland.

3.4.1 Agriculture: tractors in Ireland

- *Description of the socio-demographics of the sample and of the product*

In Ireland, 316 tillage farmers were asked about their tractor investment decisions. Farmers were invited to participate in the online survey by *Amárach Research* through an online link on the farming website *Agriland*, Ireland's largest farming news portal. The website is accessed across the country and we were therefore able to achieve a good regional spread. Respondents were screened out of the survey if they are

not extremely involved in decisions relating to farm machinery, do not own at least one tractor and/or have less than 50% of their land in tillage. As national tillage farmer population data were unavailable to our survey company, they were unable to apply quota sampling or provide weights for this analysis. The results below should therefore be interpreted given these shortcomings.

Tillage farmers would have a much higher use of tractors than other systems. 53% of our sample have one to three tractors, 40% have between four and seven and 7% have at least eight. The average number of acres is 327 and 63% of farms hire additional employees. Most respondents (69%) are full-time farmers and farming income accounts for above 70% of total income for about two thirds of respondents. 45% said their income in 2017 increased relative to 2016 and most are either coping (48%) or comfortable (29%) on their current income levels. 97% are male.

- *The attributes of the purchasing decision*

Figure 61 presents valuation responses for six attributes – price, horsepower, brand, fuel efficiency/consumption, back-up service and reliability. Figure 62 presents the share of *very important* responses only. All attributes are considered either *very* or *fairly important* by the vast majority of farmers. However, the share of *very important* responses is highest for reliability (93%), followed by back-up service (79%), horsepower (75%), fuel efficiency (52%), price (50%) and brand (36%). The share of *very important* fuel efficiency responses is statistically different to all other attributes except price).
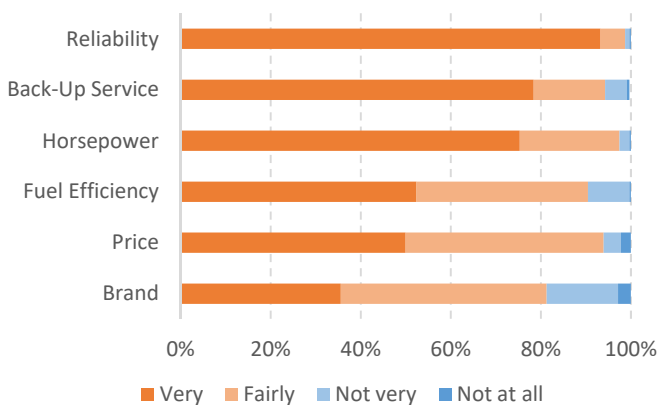
Figure 61: Importance of the purchasing decision attributes of tractors in Ireland
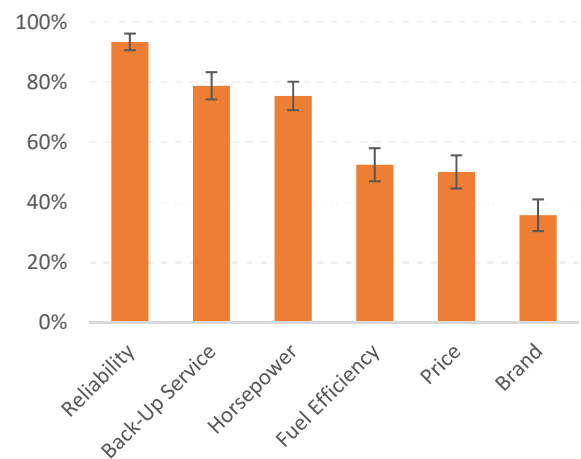
Figure 62: Percentage of Very Important scores for the purchasing decision attributes of property in Ireland with 95% confidence intervals

- *Attitudes towards Energy Efficiency*

Figure 63 presents response shares to farming attitudes towards tractor fuel efficiency while Figure 64 presents the share of respondents who *strongly agree* with each statement. Environmental impact is a potential driver of investments in energy efficiency – most believe that buying a more fuel efficient tractor would reduce their farm's environmental impact (56% *strongly agree* and 30% *slightly agree*).

Knowledge gaps may also affect the decision to invest in more energy efficient tractors. However, as with other sectors in Ireland, knowledge gaps are not particularly prevalent – most show a good understanding of the fuel efficiency of their current tractors, the energy savings associated with higher fuel efficiency and energy prices (88%, 84%, and 96% agree with these knowledge statements, respectively).[13]

Four statements explore energy-related perceptions. 41% agree that all new tractors have similar fuel efficiency levels. Such an expectation may lead farmers to disregard fuel efficiency when investing. "Herd" effects could also be an important driver of energy efficiency adoption – 38% agreed that they would be more likely to buy more fuel-efficient tractors if other farmers did so too. Reliability concerns are not prevalent – only 26% of farmers think that more fuel-efficient tractors are less reliable. Lastly, farmers do not appear to be averse to new technologies – the majority (86%) would be willing to take a chance on new technologies in order to reduce their energy consumption.

Finance and credit constraints appear to be impediments to energy efficiency adoption. 50% of farmers say they cannot afford more fuel-efficient tractors and 48% say that the lack of access to loans prevents them from making more energy efficient choices on the farm.

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[13] The three statements are as follows: 1 - 'I have a good understanding of my tractor's fuel consumption'; 2 – 'I understand how much money I would save if I bought a more energy efficient tractor'; 3 - 'I am aware of energy prices, that is, the price of diesel and electricity'.
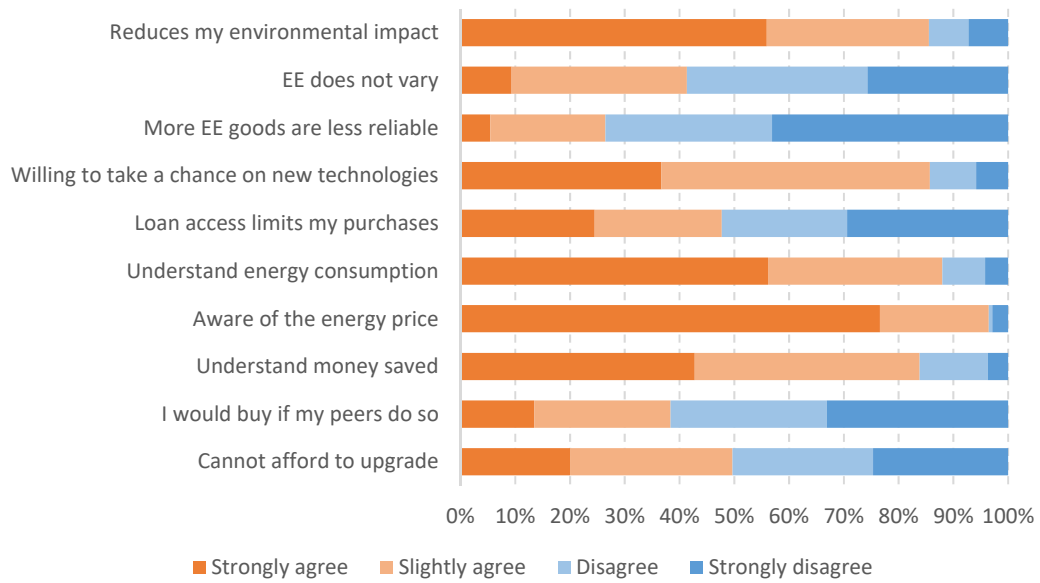
Figure 63: Agreement with behavioural statements on energy efficiency, case of tractors in Ireland
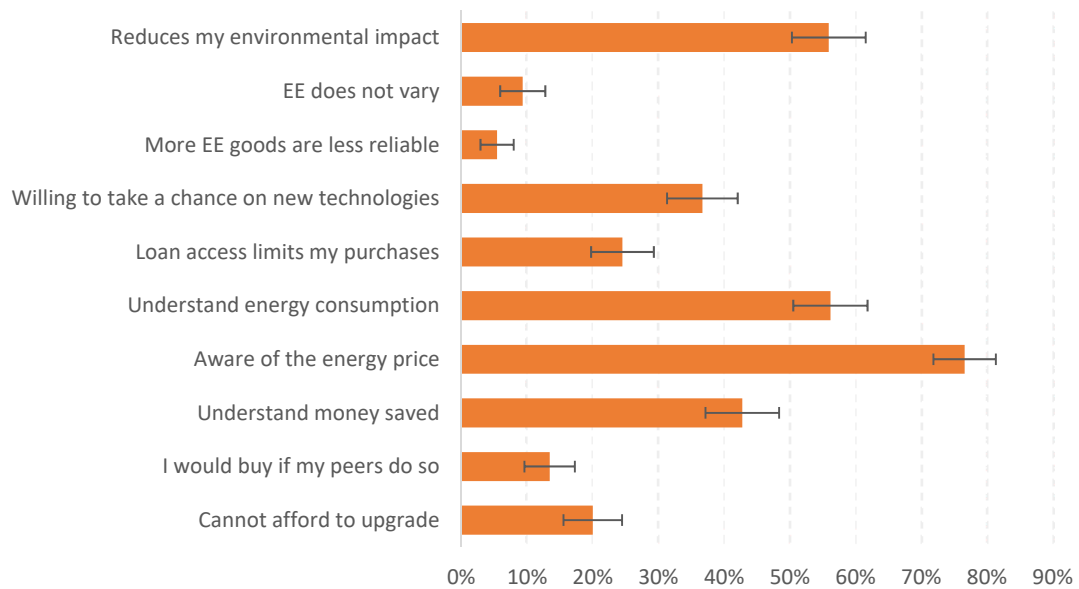
Figure 64: Agreement with behavioural statements on energy efficiency, case of tractors in Ireland: the Strongly Agree scores with 95% confidence intervals

- *Understanding of existing and future monetary labels*

There is no fuel efficiency labelling system for tractors in Ireland. We explored the perception and understanding of two hypothetical labelling options: labels similar to current EU labels for appliances and labels based on monetary information. For the first, we presented the following text:

'Imagine that the government is considering providing farmers with a new fuel efficiency label for new tractors. The label would show you where a certain tractor ranks in terms of its fuel efficiency and also how much diesel it consumes per hour under full load. In relation to this proposed information, please state whether you disagree or agree with the following statements:'

For the monetary label, we presented:

'Now imagine that the government is considering providing farmers with diesel cost information for new tractors: The label would tell you, for example, that "this tractor is expected to cost "X" on diesel per hour under full load". This new information would be based on standardised soil conditions and the fuel efficiency of the particular tractor. In relation to this proposed information, please state whether you disagree or agree with the following statements:'

Both labels were explored using six statements (Figure 65 presents the mean response for these six statements). For the EU-style label, the mean response is above 2.5 which implies a general agreement – most farmers agree that such labels would be understandable, influential, and would help them understand their energy consumption and calculate their energy costs. There is, however, no significant difference between the EU0style label and the monetary cost label for farmers.
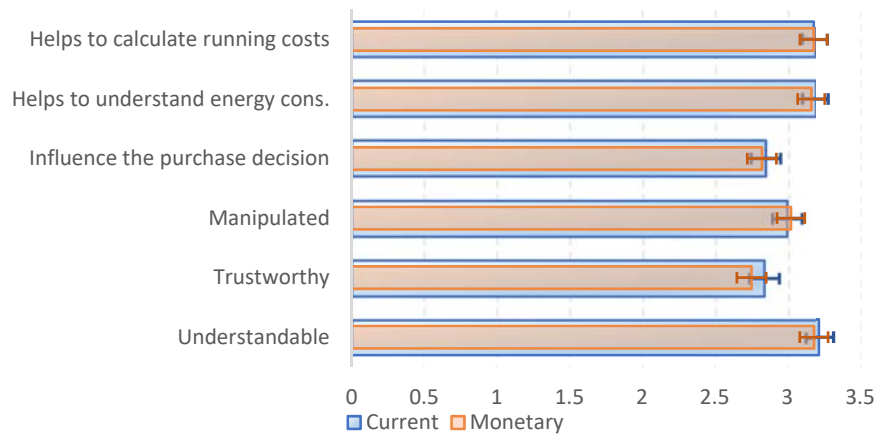
Figure 65: Testing label perceptions changes from current to monetary labels: the case for Ireland tractors with 95% confidence intervals Average scores of a scale of responses ranging from 1-Strongly disagree to 4 Strongly agree.

- *Exploring the factors affecting the valuation of EE*

A logit model is employed to explore the factors which are correlated with the importance of fuel efficiency (Table A 14 presents marginal effects). The binary dependent variable equals 1 if the farmer considers energy efficiency to be *very important* when buying a tractor (simplified to 'values fuel efficiency' below for ease of interpretation), and zero otherwise (mean 0.524). The sample size reduces to 255 (from 316) due to a number of 'don't know' or 'refused' responses in the independent variables.

While the independent variables are jointly significant, there are few individually significant effects. For example, there is no effect for farm size (proxied by the number of tractors, as acres had a high percentage of 'refused' responses), age, education or whether the farmer is full- or part-time.

We include two attitudinal statements as dummy variables – the first captures whether the farmer is 'very concerned' about climate change; the second indicates whether the farmer believes (*strongly agrees*) that all new tractors have similar fuel efficiency levels. Unlike other surveys in Ireland, concern for climate change is not correlated with energy efficiency valuation. However, the belief that all new tractors have similar fuel efficiency levels is important – the 9.3% of farmers with this expectation are 26.1 percentage points (PPs) less likely to value energy efficiency when buying a new tractor, a sizable effect relative to the mean. We also include two knowledge variables which explore farmer understanding of energy consumption and energy savings. Of these variables, only the latter is significant – farmers that have a good

understanding of potential energy savings (56% of farmers *strongly agree*) are 31.7 PPs more likely to value fuel efficiency.

Finally, we explore two personality traits: patience and riskiness (both ranging from 1 to 10). 26% of tillage farmers consider themselves as very patient (responded with 8-10) and 26% consider themselves to be risk loving (responded with 8-10). The regression results show that patient individuals are more likely to value energy efficiency.

3.4.1.1   Conclusions

Irish tillage farmers have slightly different priorities than other sectors when investing in energy-consuming technologies. When buying tractors, price is less important than factors which may impact farm production, such as reliability, back-up service and horsepower. Fuel efficiency, while less important than these attributes, is still a major concern for most farmers (52% of farmers find it *very important* and an additional 38% find it *fairly important*). There are few factors which are correlated with the importance of fuel efficiency. For example, farm size, age and education have no effect, nor does concern for climate change (unlike other sectors in Ireland) or understanding of existing tractor energy consumption (although few are unaware). There is, however, a negative relationship associated with the belief that all new tractors have the same fuel efficiency levels (9% of farmers *strongly agreed* with this statement and 32% *slightly agreed*). We also find that farmers who have a very good understanding of monetary energy savings (associated with energy efficiency improvements) are more likely to care about this attribute.

In terms of attitudes (this paragraph refers to the combined share of *strongly agrees* and *slightly agrees*), most farmers believe that higher fuel efficiency would reduce their farm's environmental impact. Furthermore, 38% would be more likely to buy a more fuel-efficient tractor if other farmers did so first. Reliability concerns are an issue for some – 26% of farmers think that more fuel-efficient tractors are less reliable and 14% would be unwilling to invest in new technologies to reduce their fuel consumption. We also find that most farmers have a very good understanding of their current fuel consumption (88%) and the monetary savings of associated with better fuel efficiency (84%). Finance and credit constraint are an issue – 50% of farmers say they cannot afford more fuel-efficient tractors and 47% say that loan access is preventing them from making more energy efficient choices on the farm.

There is no efficiency labelling for tractors in the EU. However, farmers are generally supportive of two proposed labelling systems (fuel consumption and monetary) – most tillage farmers believe that both labels

would be understandable, influential, and would help them understand their energy consumption and calculate their fuel costs. There are no significant differences between labelling types.

3.5 Industry sector

Industry' machines have been analysed both in Norway and Slovenia with a common questionnaire.

3.5.1 The case of machinery in Norway

- *Description of the socio-demographics of the sample and of the product*

For the Norwegian survey CICERO initially identified 110 companies to contact with the help of the Federation of Norwegian Industries (from given industry sub sectors and with fewer than 10 functionaries employed). Even with a very high response rate we did not expect this to give us a sufficient number of responses, so we used Bisnode (a marketing tool/data base) to add another 359 companies. The initial distribution of the survey on January 4th 2018 resulted in only 15 responses. We therefore added a further 1,910 companies by extending the range of sub-sectors explored and increasing the cut-off from 10 to 20 employees. Overall, we received 95 partial and 86 completed responses (and 342 automatic responses to the effect that the email invitation was undeliverable or the email address no longer in use). The final sample had an average of 23.6 employees, 42% of the companies had an annual turnover below 10 million NOK (approx. 1 million EUR), and 11% above 100 million NOK (approx. 104 million EUR). This means we succeeded relatively well in targeting small and medium enterprises, but apparently a few substantially larger companies also responded. This could either be due to errors in the database we used as a basis for defining which companies to contact, or – at least equally likely – when we contacted branches or subsidiaries, the respondents responded on behalf of the larger company to which they belong, rather than on behalf of the branch/subsidiary they work for.

- *The attributes of the purchasing decision*

Reliability is a *very important* factor in the purchasing/investment decision for fully 84% of the respondents from Norwegian companies. This is followed by safety, which more than two thirds rate as *very important*. Price is "only" ranked fourth among the attributes, and energy efficiency second to last – although almost 40% of respondents do agree this is a *very important* factor.

It is problematic to compare these hypothetical decisions for very different types of machinery across respondents, yet it does seem that a general trend for Norwegian respondents is that non-price concerns such as reliability and safety matter the most. This fits the general picture of Norwegian industry, in an international context, as not competing primarily on price, but on quality.
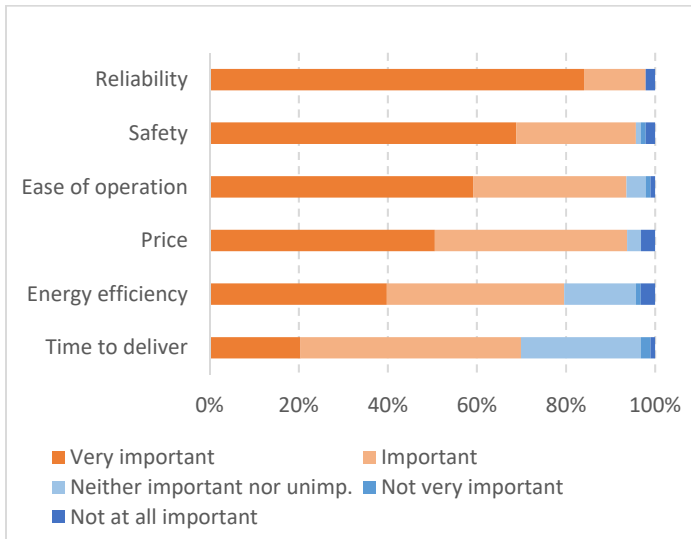
Figure 66: Importance of the purchasing decision attributes for industry sector – machinery in Norway
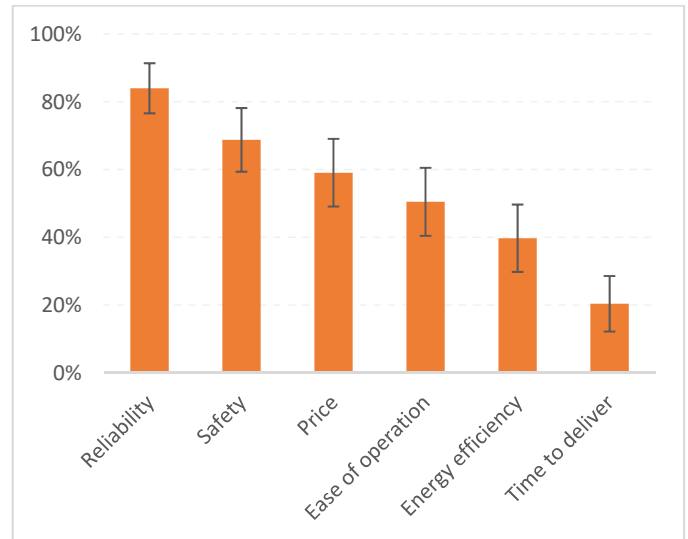
Figure 67: Percentage of Very Important scores for the purchasing decision attributes for industry sector – machinery in Norway with 95% confidence intervals

- *Attitudes towards Energy Efficiency*

A majority of Norwegian respondents *slightly* or *strongly agree* that the government should provide support for companies to invest in energy efficiency (79%), and that such investments will save them money in the future (75%). The expectation of government support seems a little at odds with the expectation that such investments will be profitable and does not seem to be explained by non-price factors either: a majority of respondents reject the idea that more energy efficient machines are more likely to break down, or that they perform poorly (not one single respondent agreed strongly with either statement).

Figure 68: Agreement with behavioural statements on energy efficiency, case of industry – machinery in Norway
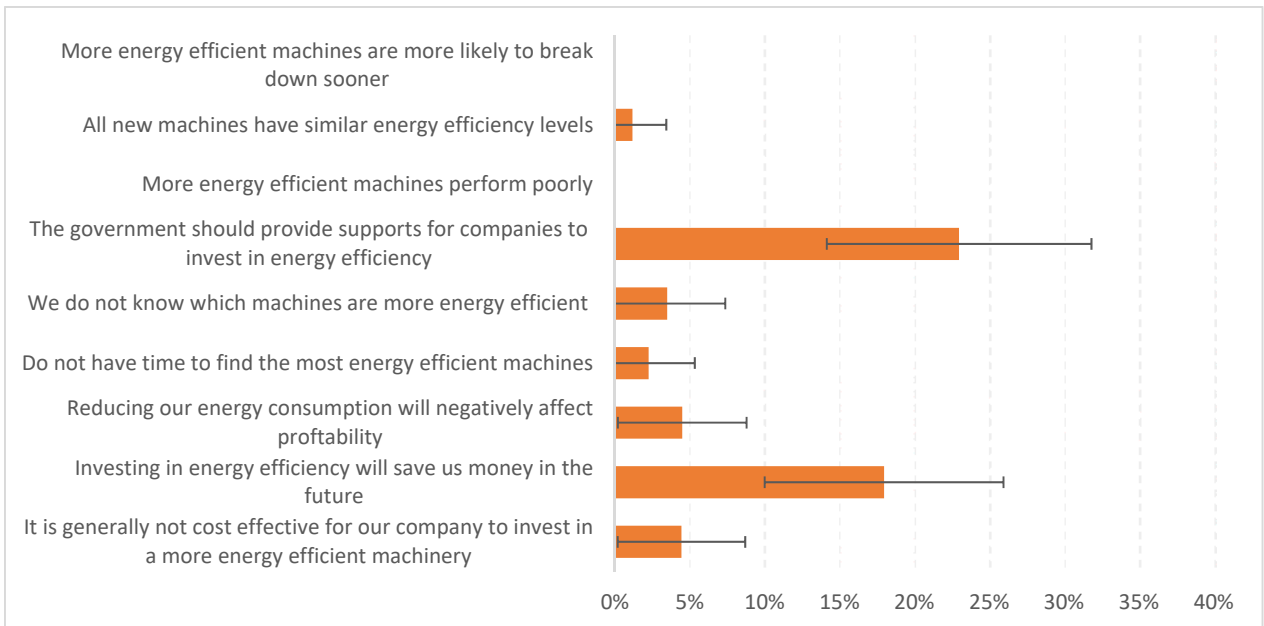
Figure 69: Agreement with behavioural statements on energy efficiency, case of industry – machinery in Norway: The Strongly Agree scores with 95% confidence intervals

- *Understanding of existing and future monetary labels*

There is no mandatory EU-wide energy labelling scheme for machinery used in industry. We could therefore not ask questions about current and alternative labels, as done for other sectors and products. Instead, we asked questions regarding the technical specifications already provided, and the potential for a cost labelling scheme.

There were no clear majority views regarding the current technical documentation, as seen in Figure 70 for Norway and Figure 76 for Slovenia. 54% of respondents in Norway disagree while in Slovenia 37% *slightly agree* and 12% *strongly agree* it contains the information needed to understand how much energy the machine will use.

We introduced the hypothetical label as follows: *"It would be possible to provide companies with energy cost labels for machinery. For example, "this machine is expected to cost €2,000 to operate per year". This new information would be based on typical usage patterns."*

Respondents in Norway received this quite favourably. 68% *agreed* or *strongly agreed* the labels would be easy to understand, and 64% *agreed* or *strongly agreed* the label might influence which machinery they chose to purchase. Respondents were, however, somewhat less certain that the labels would be trustworthy: Only 16% *agreed* or *strongly agreed*, 21% disagreed or strongly disagreed, and fully 61% did not *agree* nor *disagree*.
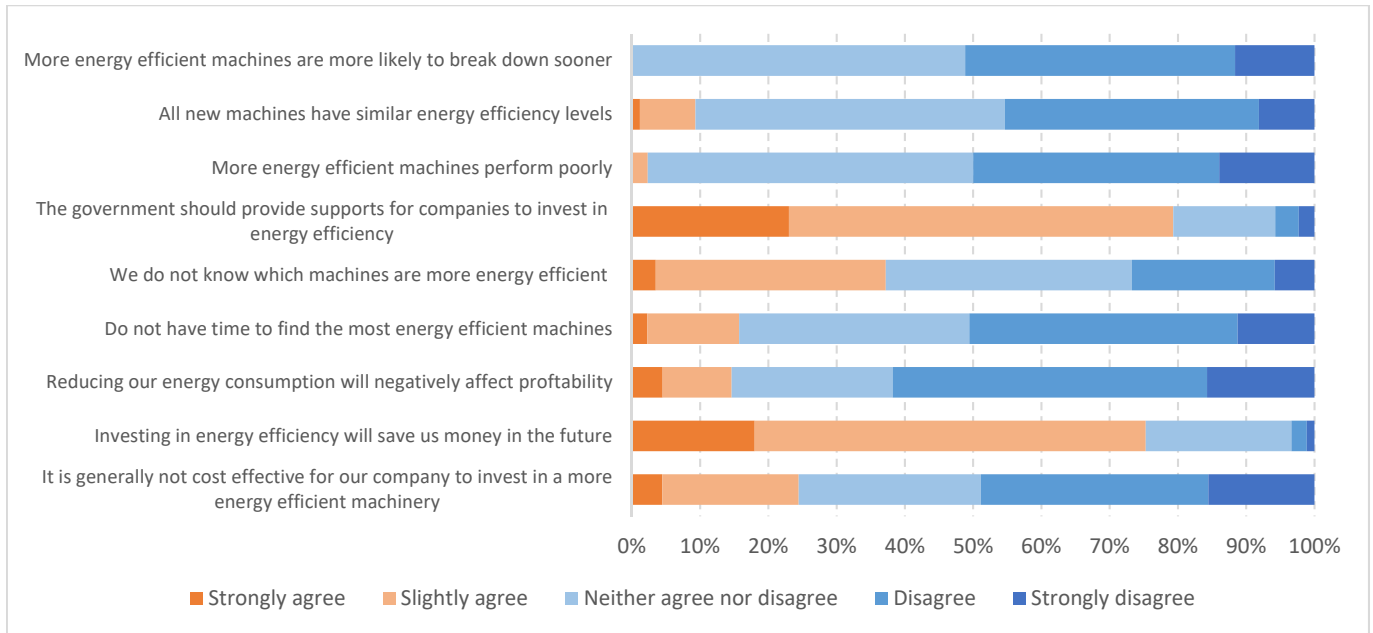
Figure 70: Understanding of technical documentation and potential monetary label with cost labelling scheme for industry sector – machinery in Norway
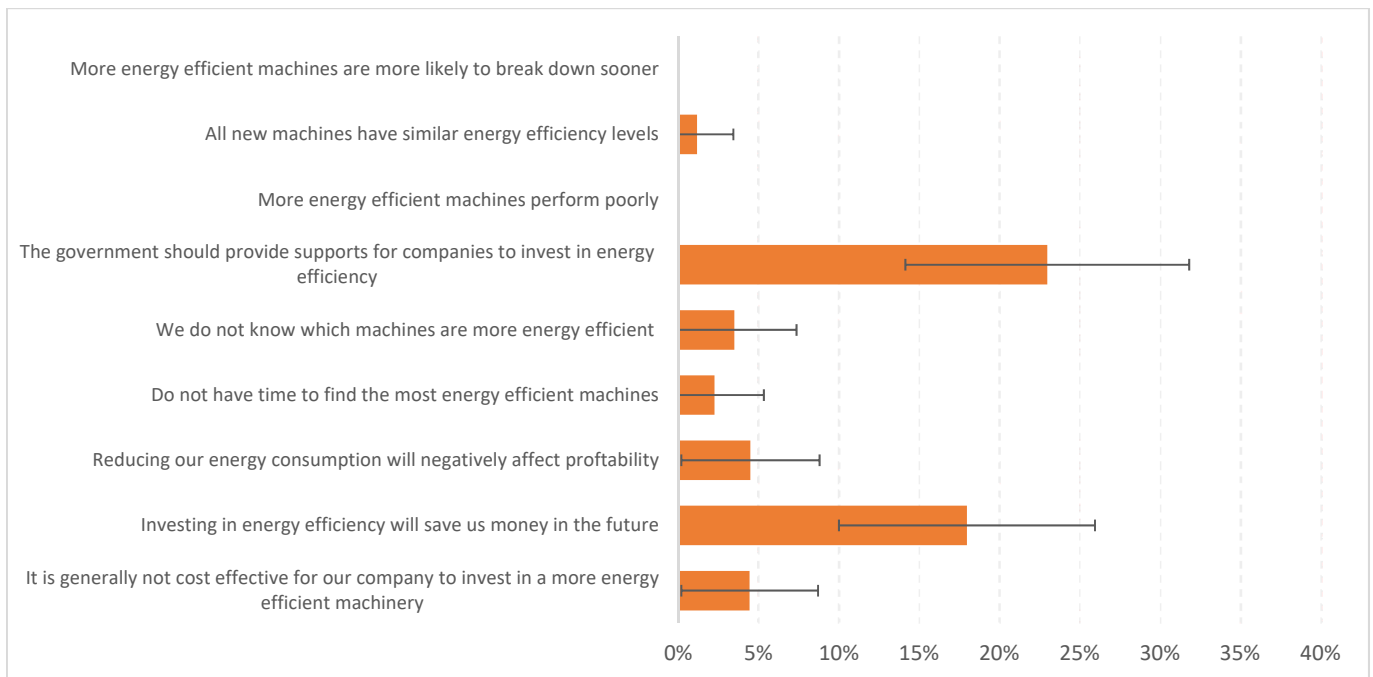
Figure 71: Understanding of technical documentation and potential monetary label with cost labelling scheme for industry sector – machinery in Norway: The Strongly Agree scores

3.5.2 The case of machinery in Slovenia

- *Description of the socio-demographics of the sample and of the product*

The Slovenian survey was done in cooperation with Slovenian company ARAGON but due to the limited financial budget we needed to identify the potential companies who would fill in the survey. We identified almost 200 companies and contacted them via email and telephone. In the first round we sent around 100 surveys, but only 15 of them completed the survey. The majority (more than 80%) closed the survey after opening the first question. So, in the second round we involved also other employees at the university in the company recruitment process, some colleagues and others who could give us some suggestions regarding who could be possible companies to target. Even though we contacted more than 150 companies (we also sent a reminder to the previously contacted companies who did not completed the survey) we still had less than 50 completed surveys. Finally, we contacted some of the companies again for a third time, added some new companies suggested by others, and at the end, 35 days after sending first surveys, reached our target of 80 responses. The final result was 83 completed surveys out of 187 contacted companies (success ratio of 44%). The final sample had an average of 528 employees (the biggest company had 11,000 employees, 12 companies had more than 1,000 employees and 23 of them less than 20; 8 respondents did not want to answer this question). Regarding yearly turnover only 42 respondents answer this question, mostly the big companies, resulting in very high average annual turnover of 42.5 million EUR. This might be due to the fact that this information is publicly available in the Slovenian Business Register as a central public database on all business entities, and representatives did not have a problem with sharing this information, in contrast to small, privately owned companies. Finally, to be competitive in the industry sector also outside of the local community there is a need for high investments and thereof the majority of the industry-oriented companies in Slovenia are relatively big.

- *The attributes of the purchasing decision*

Reliability is the most important factor in the investment decision also in Slovenia, with 91% of the respondents from Slovenian industry companies ranking it as *very important*, followed by safety with 78% and price with 53%. On the other hand, time to deliver and energy efficiency are less important factors while the ease of operation is ranked similarly as the price. The interesting fact is that safety and ease of operation are almost important as the price for many companies. This fits to the Slovenian and EU standards where in the industry and machines in general quality is the most important attribute and companies are ready to pay more in order to have best quality products.
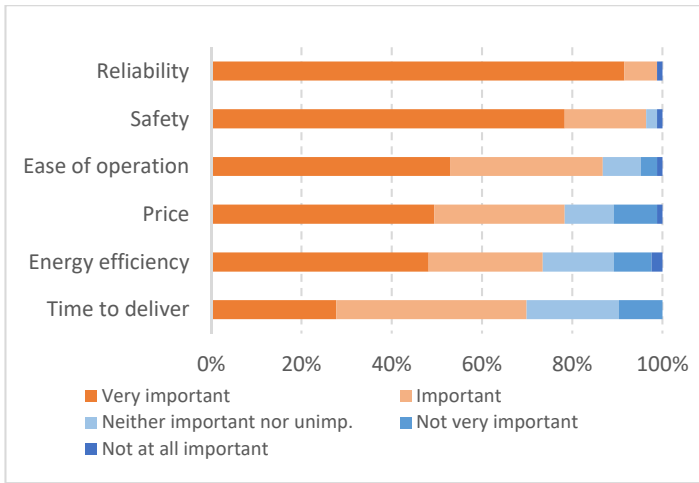
Figure 72: Importance of the purchasing decision attributes for industry sector – machinery in Slovenia
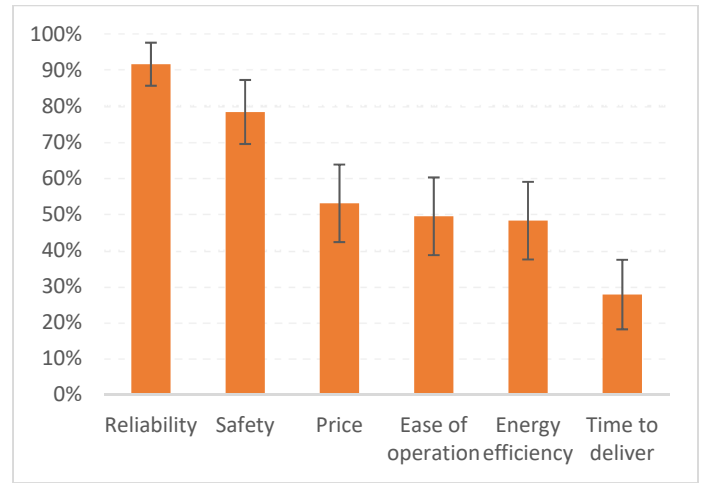
Figure 73: Percentage of Very Important scores for the purchasing decision attributes for industry sector – machinery in Slovenia with 95% confidence intervals

- *Attitudes towards Energy Efficiency*

4 out of 5 Slovenian companies *strongly agree* with the statement that the government should provide support for companies to invest in energy efficiency and that these sorts of investments will save them money in the future. On the contrary, 87% of the respondents disagree that reducing of their energy consumption will negatively affect their profitability/efficiency. Similarly, three quarters of the companies also disagree that more energy efficient machines perform poorly and are likely to break down sooner. It can be concluded that the expectation of government support seems a little at odds with the expectation that such investments will be profitable and similarly as in Norway it does not seem to be explained by non-price factors either.
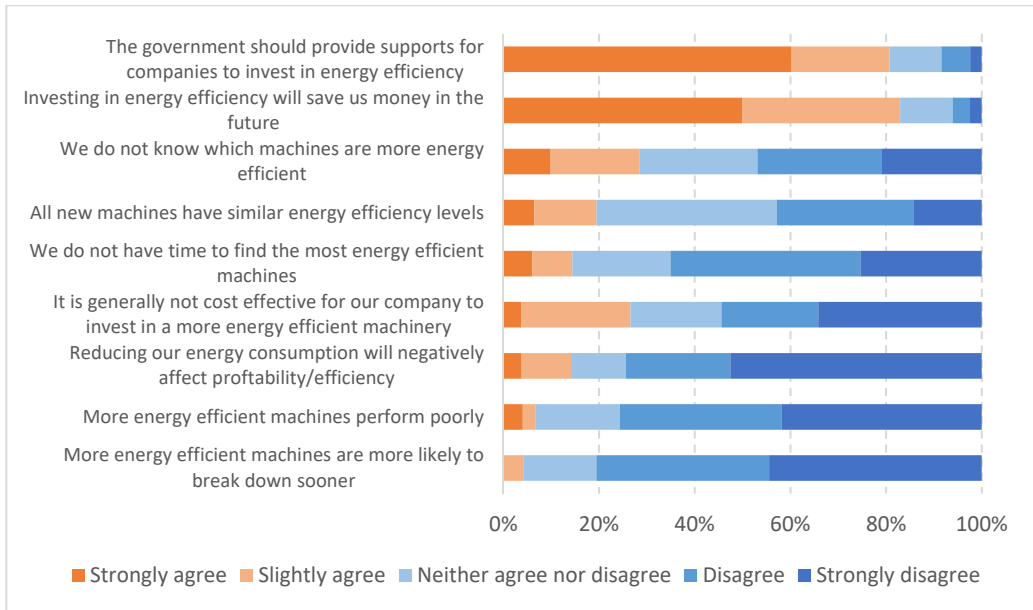
Figure 74: Agreement with behavioural statements on energy efficiency, case of industry – machinery in Slovenia
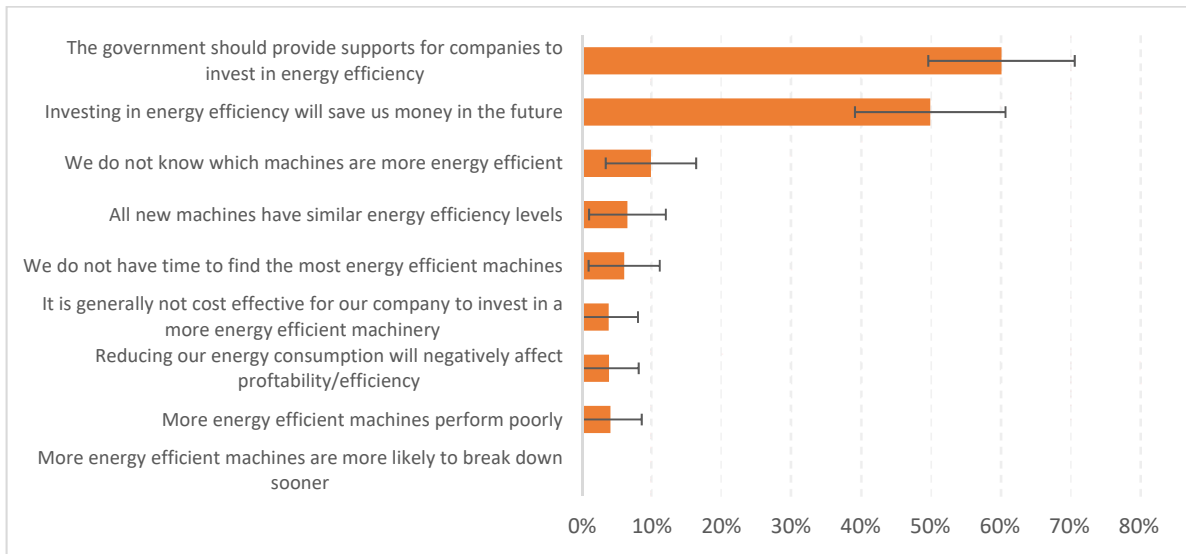
Figure 75: Agreement with behavioural statements on energy efficiency, case of industry – machinery in Slovenia: The Strongly Agree scores with 95% confidence intervals
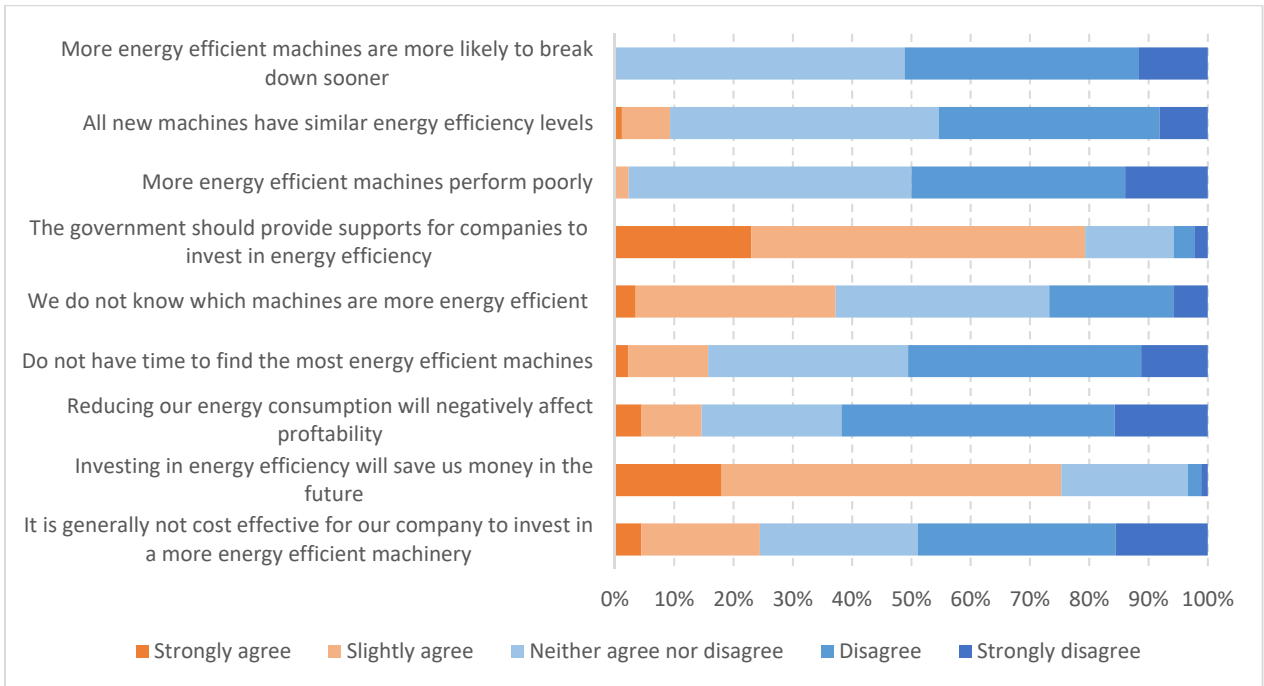
- *Understanding of existing and future monetary labels*

Since there is no mandatory EU-wide energy labelling scheme for machinery we asked questions regarding the technical specifications currently provided, and the potential for a cost labelling scheme. We introduced the hypothetical label as in Norway. Similar to the results from Norway, also in Slovenia 66% of respondents *agreed* or *strongly agreed* that labels would be easy to understand, and 53% agreed *slightly* or *strongly* that the label might influence which machinery they choose to purchase. Furthermore, 67% of respondents *agreed* or *strongly agreed* that information provided would help them to understand how much energy a machine use but also 61% of them believe it could be easy manipulated by sellers. Regarding the trustworthiness of the label the companies were quite indecisive since 55% neither *agree* or *disagree* they would trust it.
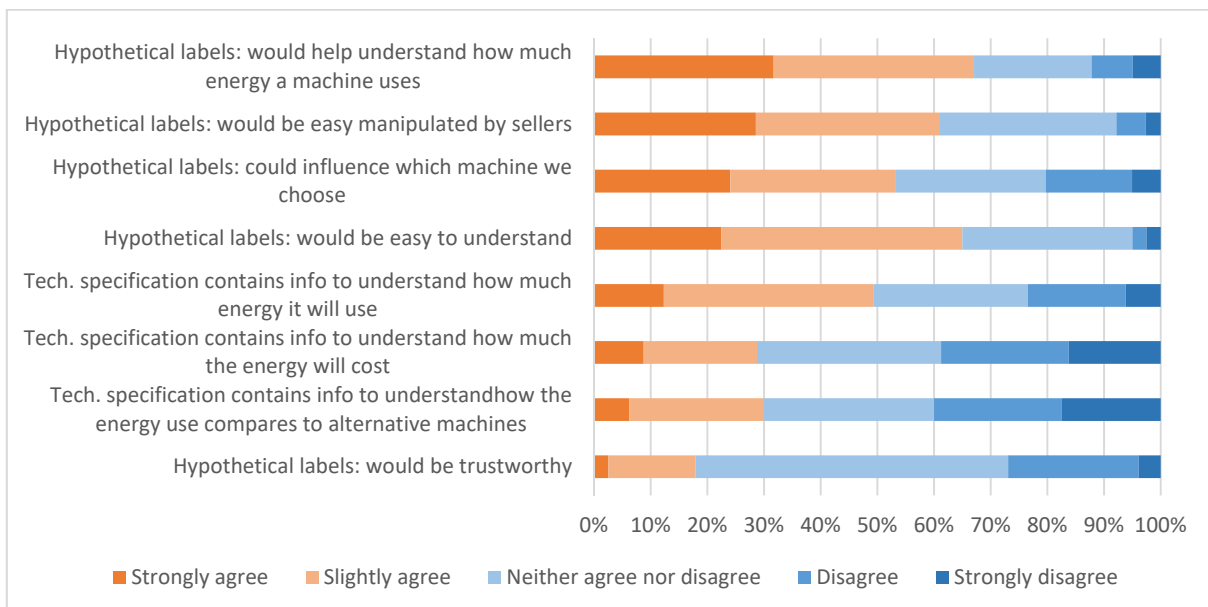
Figure 76: Understanding of technical documentation and potential monetary label with cost labelling scheme for industry sector – machinery in Slovenia
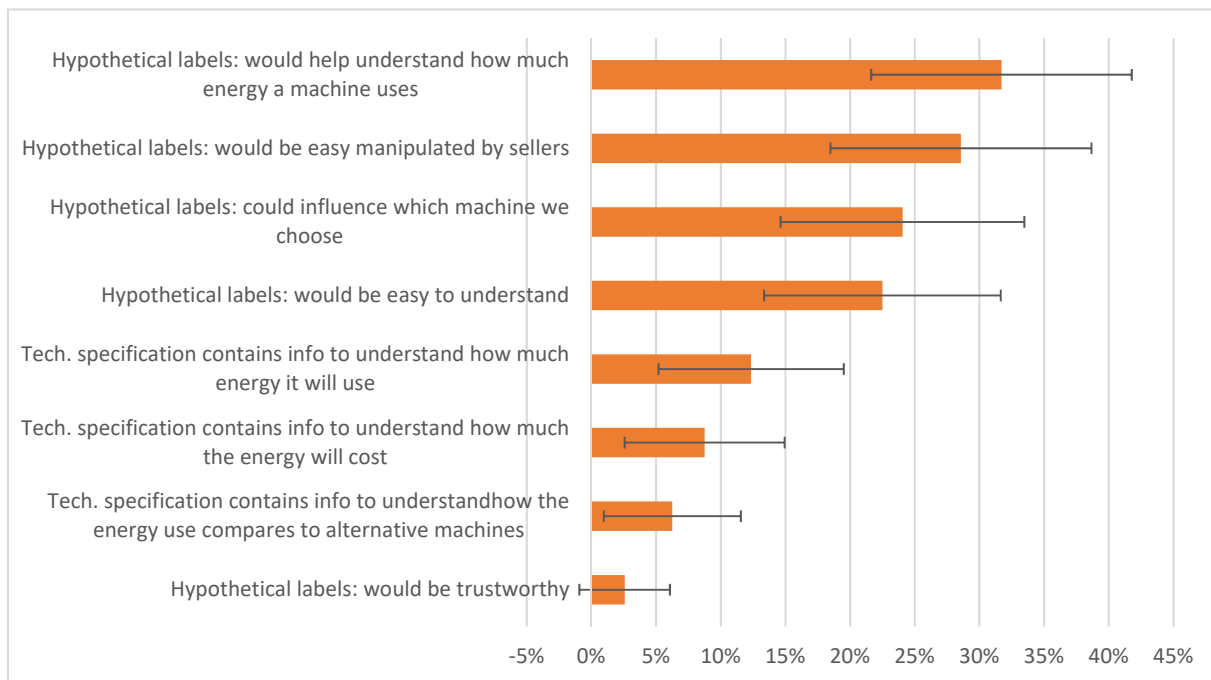
Figure 77: Understanding of technical documentation and potential monetary label with cost labelling scheme for industry sector – machinery in Slovenia: The Strongly Agree scores

3.5.2.1 Conclusions

For Norwegian and Slovenian industry companies the reliability of the machinery is the most important factor in the investment decisions, followed by safety. Whereas price and ease of operation are also important factors, they are not rated as equally crucial. Time to deliver and energy efficiency are the least important factors. This fits with the general picture of Norwegian industry and EU standards where general quality is the most important attribute and companies are ready to pay more in order to have top quality products.

The respondents in both countries agreed that the government should provide support for companies to invest in energy efficiency since it will save them money in the future. There were no clear majority views regarding the current technical documentation since almost half of the respondents in Norway disagree and half of them in Slovenia agree, that current technical specifications contain all relevant and necessary information needed to understand how much energy the machine use. In both countries respondents were quite favourable to the potential introduction of the label and agreed that information provided in monetary units would help them to understand how much energy the machine use and that info might influence the

choice of their purchase. The respondents also pointed out that labels would not be trustworthy since it could be easily manipulated by sellers.

4 Conclusions

This deliverable analyses the role of energy efficiency and energy labelling schemes in five countries (Ireland, Greece, Norway, Slovenia and Spain) and for five product categories: appliances, vehicles, properties, heating and cooling systems, and machinery used in four different sectors: households, services, agriculture and industry.

Energy efficiency is seen as a *very important* attribute in the majority of the investment decisions analysed, but some exceptions have been observed by countries, sectors and products. For example, for the case of vehicles, energy efficiency is the fourth most important attribute (but still it is valued by 40 to 50 % of respondents in Norway (households) and Ireland (agriculture)), and reliability is the most important consideration, followed by safety, maintenance and power attributes.

For heating and cooling systems in the services sector, a country difference is observed: EE is significantly more frequently seen as *very important* in Greece than in Spain. For appliances in the household sector, a product/country effect is observed as EE is more valued in the case of refrigerators in Greece than for washing machines in Spain. In the case of properties, no country effect is observed between Ireland and Slovenia, but a sector effect is present within Ireland: 26% of firms consider EE very important, compared to 57% for households.

We explored the determinants of valuing the EE attribute as *very important* for the purchasing decision by means of binary econometric models. These models aim at explaining the probability of valuing EE as a *very important* attribute. Results show that the environmental and climate change concerns of households and firms increase the likelihood of valuing very importantly the EE attribute. Some exceptions are observed in the case of vehicles (both for households and agricultural sectors) as well as for properties (both households and services sectors). In almost all case studies, respondents who are willing to take a chance on new technologies to reduce their energy consumption are more likely to very importantly value EE.

Knowledge and informational gaps are observed in the different markets analysed. There is potentially room for improvement regarding the information of labelling schemes and the knowledge of elements of the energy decision such as prices of energy. Testing the approach in practice, e.g. using field trials, can

help provide a more definitive conclusion regarding the usefulness of monetary labels. The degree of awareness of the current label varies between countries and products. The lowest degree of awareness is observed for the label of vehicles. For other products, respondents are generally aware of the label. However, the two lowest levels of awareness are observed in the sectors where the colour-based labelling scheme is not compulsory or is constrained by the product type: namely the Car directive (1999/94/CE) and the directives 2013/811/EU and 2013/812/EU for heating and cooling systems.

The understanding of energy consumption varies considerably between sectors, countries and products. In the case of properties, about a third of respondents know the energy consumption level of their house, whatever the sector and country. For vehicles in Ireland and Norway (households and agriculture), about half of the respondent are aware of the energy consumption level. However, for appliances, this knowledge on energy consumption falls to 5-25% (Spain and Greece). A great disparity is also observed for heating and cooling systems between Spain and Greece in the services sector: 8% of respondents in Spain and 81% in Greece understand their consumption. The same pattern is observed regarding the awareness of the price of energy per product, sector and country. Vehicles are the product for which the price of energy is the most frequently known. Electricity price is much less known in countries such as Spain. The private services sector tends to be more informed than households.

Filling knowledge and informational gaps is important in all cases. Respondents who are aware of the label state that it influences their final decision – as seen in the cases of appliances in the household sector, and heating and cooling in the services sector. For properties and vehicles, however, respondents recognizing an influence of the label are a minority.

Financial barriers, and more specifically limited access to loans from institutions, are important in some countries. Greek households and firms express the strongest limitation: about half of households and two third of hotels *strongly agree* that limited access to loans prevents them from making more energy efficient investments.

Given the knowledge and informational gaps, one could think that displaying monetary cost information would boost energy efficient investment. We test of this possibility by comparing the score received to six different statements (is the label understandable? Trustworthy? Manipulated? Does it help to understand energy consumption? To calculate running costs? And does it influence the purchasing decision?) for current labels and for labels displaying monetary information.

Results generally show a high level of distrust in all countries (with a lesser extent in Spain) and sectors: respondents tend to believe that labels are manipulated by manufacturers or sellers. In spite of this, results show that households and firms of all sectors generally believe that this monetary information performs better: it would be easier to understand as well as helping to understand energy consumption and running costs.

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6 Annexes

6.1 Survey questionnaires

A common questionnaire (Table A 1) has been developed and adapted for each sector and products. Below is the example of washing machine in the household sector. Blue statements are specific to the sector and product. The specific statements used in each case study are displayed in the figure of results. A slightly different questionnaire has been used for the industry sector (Table A 2).

Table A 1: Common survey questionnaire

Attribute of the purchasing decision	
Please rate the importance of each of the following characteristics when buying your washing machine	
Price	1 (not at all important); 2 (not very important); 3 (fairly important); 4 (very important); 99 (Don't know/Don't answer)
Energy efficiency / Energy consumption	1 (not at all important); 2 (not very important); 3 (fairly important); 4 (very important); 99 (Don't know/Don't answer)
Brand	1 (not at all important); 2 (not very important); 3 (fairly important); 4 (very important); 99 (Don't know/Don't answer)
Water consumption	1 (not at all important); 2 (not very important); 3 (fairly important); 4 (very important); 99 (Don't know/Don't answer)
Load capacity	1 (not at all important); 2 (not very important); 3 (fairly important); 4 (very important); 99 (Don't know/Don't answer)
Dimensions (Height, Width, Depth)	1 (not at all important); 2 (not very important); 3 (fairly important); 4 (very important); 99 (Don't know/Don't answer)
Performance	1 (not at all important); 2 (not very important); 3 (fairly important); 4 (very important); 99 (Don't know/Don't answer)
Aesthetic (colour, design)	1 (not at all important); 2 (not very important); 3 (fairly important); 4 (very important); 99 (Don't know/Don't answer)
Attitudes towards energy efficiency (exploring costs and benefits)	
In relation to energy efficiency, please state whether you disagree or agree with the following statements:	

Buying a more energy efficient washing machine would reduce my household's environmental impact	1 (strongly disagree); 2 (slightly disagree); 3 (slightly agree); 4 (strongly agree); 99 (Don't know/Don't answer)
All new washing machines have similar energy efficiency levels	1 (strongly disagree); 2 (slightly disagree); 3 (slightly agree); 4 (strongly agree); 99 (Don't know/Don't answer)
More energy efficient washing machines are less reliable	1 (strongly disagree); 2 (slightly disagree); 3 (slightly agree); 4 (strongly agree); 99 (Don't know/Don't answer)
I am willing to take a chance on new technologies to reduce my energy consumption	1 (strongly disagree); 2 (slightly disagree); 3 (slightly agree); 4 (strongly agree); 99 (Don't know/Don't answer)
My lack of access to loans (excluding loans from friends and family) prevents me from making more energy efficient choices	1 (strongly disagree); 2 (slightly disagree); 3 (slightly agree); 4 (strongly agree); 99 (Don't know/Don't answer)
I have a good understanding of my washing machine's energy consumption	1 (strongly disagree); 2 (slightly disagree); 3 (slightly agree); 4 (strongly agree); 99 (Don't know/Don't answer)
I am aware of the price of the kwh	1 (strongly disagree); 2 (slightly disagree); 3 (slightly agree); 4 (strongly agree); 99 (Don't know/Don't answer)
I understand how much money I would save if I bought a more energy efficient washing machine	1 (strongly disagree); 2 (slightly disagree); 3 (slightly agree); 4 (strongly agree); 99 (Don't know/Don't answer)
I would be more likely to buy an energy efficient washing machine if my friends, neighbours or colleagues also do so	1 (strongly disagree); 2 (slightly disagree); 3 (slightly agree); 4 (strongly agree); 98 (Not applicable); 99 (Don't know/Don't answer)
I cannot afford to upgrade the energy efficiency of my washing machine	1 (strongly disagree); 2 (slightly disagree); 3 (slightly agree); 4 (strongly agree); 98 (Not applicable); 99 (Don't know/Don't answer)
Understanding and use of existing labels and simulated monetary labels	
Are you aware with the Energy Label for Appliances?	1 (Yes); 2 (No)
Did the Energy Label affect the choice of your washing machine?	1 (Yes); 2 (No); 99 (Don't know/Don't answer)
What is the energy efficiency grade of your washing machine?	1 (A+++); 2 (A++); 3 (A+); 4 (A); 5 (B); 6 (C); 7 (D); 99 (Don't know/Don't answer)
Could you please provide me with the exact model of your washing machine?	[open text - model]; 99 (Don't know/Don't answer)
In relation to the information provided in the Energy Efficiency label for Appliances, please state whether you disagree or agree with the following statements (order of current and monetary label was randomised):	
It is understandable	1 (strongly disagree); 2 (slightly disagree); 3 (slightly agree); 4 (strongly agree); 99 (Don't know/Don't answer)
It is trustworthy	1 (strongly disagree); 2 (slightly disagree); 3 (slightly agree); 4 (strongly agree); 99 (Don't know/Don't answer)
It is manipulated by sellers	1 (strongly disagree); 2 (slightly disagree); 3 (slightly agree); 4 (strongly agree); 99 (Don't know/Don't answer)
It affects which washing machine I choose	1 (strongly disagree); 2 (slightly disagree); 3 (slightly agree); 4 (strongly agree); 99 (Don't know/Don't answer)
It helps me to understand how much energy a washing machine consumes	1 (strongly disagree); 2 (slightly disagree); 3 (slightly agree); 4 (strongly agree); 99 (Don't know/Don't answer)
It helps me calculate how much a washing machine will cost to run	1 (strongly disagree); 2 (slightly disagree); 3 (slightly agree); 4 (strongly agree); 99 (Don't know/Don't answer)

Imagine that the government is considering providing households with energy cost information for appliances: for example, "it is estimated that the energy cost during the useful life of this washing machine is € 178*". In relation to this new information, please state whether you disagree or agree with the following statements:	
It would be understandable	1 (strongly disagree); 2 (slightly disagree); 3 (slightly agree); 4 (strongly agree); 99 (Don't know/Don't answer)
It would be trustworthy	1 (strongly disagree); 2 (slightly disagree); 3 (slightly agree); 4 (strongly agree); 99 (Don't know/Don't answer)
It would be manipulated by sellers	1 (strongly disagree); 2 (slightly disagree); 3 (slightly agree); 4 (strongly agree); 99 (Don't know/Don't answer)
It would affect which washing machine I choose	1 (strongly disagree); 2 (slightly disagree); 3 (slightly agree); 4 (strongly agree); 99 (Don't know/Don't answer)
It would help me to understand how much energy a washing machine consumes	1 (strongly disagree); 2 (slightly disagree); 3 (slightly agree); 4 (strongly agree); 99 (Don't know/Don't answer)
It would help me calculate how much a washing machine will cost to run	1 (strongly disagree); 2 (slightly disagree); 3 (slightly agree); 4 (strongly agree); 99 (Don't know/Don't answer)

*: 100 euros for refrigerators, 3000€ per year to heat a property.

Table A 2: Questionnaire for the Industry sector - machinery in Norway and Slovenia

Question: Thinking of the most recent investment you made into a piece of machinery…	
Rate the importance of energy efficiency within a set of six attributes	
I want you to imagine that you are buying a new machine. Please rate the importance of each of the following characteristics:	
Price	1 (not at all important) - 5 (very important); 99 (Don't Know)
Reliability	1 (not at all important) - 5 (very important); 99 (Don't Know)
Safety	1 (not at all important) - 5 (very important); 99 (Don't Know)
Energy Efficiency	1 (not at all important) - 5 (very important); 99 (Don't Know)
Ease of operation	1 (not at all important) - 5 (very important); 99 (Don't Know)
Speed/time of delivery	1 (not at all important) - 5 (very important); 99 (Don't Know)
Attitudes towards energy efficiency (exploring costs and benefits)	
Please state whether you disagree or agree with the following statements:	

It is generally not cost effective for our company to invest in a more energy efficient machinery	1 (strongly disagree) - 5 (strongly agree); 99 (Don't Know)
Investing in energy efficiency will save us money in the future	1 (strongly disagree) - 5 (strongly agree); 99 (Don't Know)
Investing in energy efficiency helps us contribute to combating climate change	1 (strongly disagree) - 5 (strongly agree); 99 (Don't Know)
Reducing our energy consumption will negatively affect profitability/efficiency	1 (strongly disagree) - 5 (strongly agree); 99 (Don't Know)
We do not have time to find the most energy efficient machines	1 (strongly disagree) - 5 (strongly agree); 99 (Don't Know)
We do not know which machines are more energy-efficient	1 (strongly disagree) - 5 (strongly agree); 99 (Don't Know)
The government should provide supports for companies to invest in energy efficiency	1 (strongly disagree) - 5 (strongly agree); 99 (Don't Know)
More energy efficient machines perform poorly	1 (strongly disagree) - 5 (strongly agree); 99 (Don't Know)
All new machines have similar energy efficiency levels	1 (strongly disagree) - 5 (strongly agree); 99 (Don't Know)
More energy efficient machines are more likely to break down sooner	1 (strongly disagree) - 5 (strongly agree); 99 (Don't Know)

Understanding of energy efficiency

Please state whether you disagree or agree with the following statements:	
Improving energy efficiency means reducing energy consumption by changing behaviours and routines	1 (strongly disagree) - 5 (strongly agree); 99 (Don't Know)
Improving energy efficiency means reducing energy consumption by investing in better technology	1 (strongly disagree) - 5 (strongly agree); 99 (Don't Know)
We know how much money we would save if we invest in a more energy-efficient machine	1 (strongly disagree) - 5 (strongly agree); 99 (Don't Know)
We understand how much energy our current machinery uses	1 (strongly disagree) - 5 (strongly agree); 99 (Don't Know)
We understand how much it costs to provide the energy for our machinery	1 (strongly disagree) - 5 (strongly agree); 99 (Don't Know)

Importance of climate change

Do you disagree or agree with the following statements?	
Reducing energy consumption through changed behaviours and routines has a positive impact on climate change	1 (strongly disagree) - 5 (strongly agree); 99 (Don't Know)
Reducing energy consumption through investing in energy efficiency has a positive impact on climate change	1 (strongly disagree) - 5 (strongly agree); 99 (Don't Know)
Most businesses are doing their bit to combat climate change	1 (strongly disagree) - 5 (strongly agree); 99 (Don't Know)
Most governments are doing their bit to combat climate change	1 (strongly disagree) - 5 (strongly agree); 99 (Don't Know)
There is no point investing in energy efficiency as the company's contribution will have no effect on climate change	1 (strongly disagree) - 5 (strongly agree); 99 (Don't Know)
We will only invest in energy efficiency if we see other businesses doing it too	1 (strongly disagree) - 5 (strongly agree); 99 (Don't Know)
It is not my company's responsibility to combat climate change	1 (strongly disagree) - 5 (strongly agree); 99 (Don't Know)

Missing information in technical specifications/potential usefulness of a label

Q: When you look at the technical specification of a piece of machinery, does it provide enough information to…	
Understand how much energy it will use	1 (strongly disagree) - 5 (strongly agree); 99 (Don't Know)
Understand how much the energy will cost	1 (strongly disagree) - 5 (strongly agree); 99 (Don't Know)
Understand how the energy use compares to alternative machines	1 (strongly disagree) - 5 (strongly agree); 99 (Don't Know)
It would be possible to provide companies with energy cost labels for machinery. For example, "this machine is expected to cost €2,000 to operate per year". This new information would be based on typical usage patterns. In relation to this new information, please state whether you disagree or agree with the following statements:	
We would understand this new information	1 (strongly disagree) - 5 (strongly agree); 99 (Don't Know)
We would trust this new information	1 (strongly disagree) - 5 (strongly agree); 99 (Don't Know)
This new information would help us to understand which machine is more energy-efficient	1 (strongly disagree) - 5 (strongly agree); 99 (Don't Know)
This new information is easily manipulated by sellers	1 (strongly disagree) - 5 (strongly agree); 99 (Don't Know)
This new information would affect which machine we would buy	1 (strongly disagree) - 5 (strongly agree); 99 (Don't Know)
"Demographics"	
Which (sub-) sector does your company work in?	Write your answer.
How many employees does the company currently have	Write your answer.
What was the company's turnover last year? (Ranges)	Write your answer.

6.2   Methodology

- **Descriptive statistics**

The qualitative variables are described using their relative frequency (percentage) and the 95% confidence interval. Confidence intervals are computed at the 95% level of confidence, assuming a normal distribution.

For discrete variables, a confidence interval is computed as $P \pm 1.96 \sqrt{\frac{P(1-P)}{N}}$ where P is the sample proportion, N the sample size. For continuous variables, the confidence interval is computed as $\bar{x} \pm t \frac{S}{\sqrt{N}}$ where $\bar{x}$ is the sample mean, S the sample standard deviation and t the critical value from the t_{N-1} Student distribution at the 95% confidence level. Confidence interval (CI) enables us to generalize the results to a larger representative population for which the true statistical value (here the mean or the proportion) is unknown. A CI informs that the true value for the population is trapped by the intervals with a probability

of 95% (Agresti and Finlay 2008). The relative frequencies and the CIs of each variable analysed are provided in graphical representations.

- **Econometric regression**

Binary response models are used to analyse the data. The specification of these types of models is the following. Suppose y^* is a latent variable which follows $y^* = X\beta + e$, where X is the $1 \times K$ vector, β is a $K \times 1$ vector of parameters, e is independent of X and $e \sim$ Normal $(0,1)$. However, instead of observing y^*, we observe only a binary variable indicating the sign of y^*:

$$y = \begin{cases} 1 & if \ y^* > 0 \\ 0 & if \ y^* \leq 0 \end{cases} \tag{1}$$

In binary response models, the interest lies in the response probability:

$P(y = 1 \mid X) = P(y^* > 0 \mid X) = P(e > -X\beta \mid X) = 1 - G(-X\beta) = G(X\beta) \equiv p(x)$ where G is the cumulative distribution function of a standard normal densify function (called Probit models). G can also be the cumulative distribution of logistic function (Logit models). The vector X is a $1 \times K$ vector of explanatory variables so that $= \beta_1 + \beta_2 x_2 + \cdots + \beta_K x_K$. To know the marginal effect of a particular variable x_j on $p(x)$ is of particular interest in order to test the effect of this variable on the probability. The marginal effect is measured by $\frac{\partial p(X)}{\partial x_j} = g(X\beta)\beta_j$ where $g(z) = \frac{dG}{dx}(z)$. A peculiarity of this discrete response model is that the partial effect of a variable x_K depends on X through the function $g(X\beta)$. Knowing the sign of β_K would help to determine whether the effect is positive or negative, as $g(z) > 0$ for all z. However, to know the magnitude of the effect, i.e. the marginal effect, when x_K is a dummy variable (like having received subsidies), one has to estimate $G(\beta_1 + \beta_2 x_2 + \cdots + \beta_{K-1} x_{K-1} + \beta_K)$ - $G(\beta_1 + \beta_2 x_2 + \cdots + \beta_{K-1} x_{K-1})$. When x_K is a continuous variable (like age), the effect on the probability $p(x)$ of x_K going from c_K to $c_K + 1$ is determined by $G[\beta_1 + \beta_2 x_2 + \cdots + \beta_{K-1} x_{K-1} + \beta_K(c_K + 1)]$ - $G[\beta_1 + \beta_2 x_2 + \cdots + \beta_{K-1} x_{K-1} + \beta_K(c_K)]$.

The applied Probit/Logit model can be expressed as: $P(y = 1 \mid X)$ where y is "Energy Efficiency is a *Very Important* attribute in the purchasing decision" and X contains explanatory variables referring to: the respondent's attitudes towards EE ($Attitudes$), perception on the existing labels ($Existing\ labels$), economic incentives ($Economic\ incentives$), socio-demographics($SocioDemographics$) and income information ($Income$) :

$$P(y = 1 \mid X) = \beta_1 + \beta_2 Attitudes + \beta_3 Existing\ labels + \beta_4 Economic\ incentives \qquad (2)$$
$$+ \beta_5 SocioDemographics + \beta_6 Income + e$$

Tables of results present the marginal effect of these explanatory variables on the probability that respondents valued energy efficiency as a *Very Important* attribute.

6.3   Households – Appliances
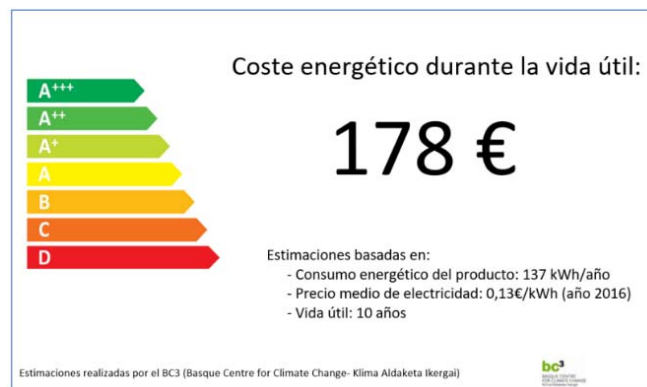
Text interpretation:
    Energy cost during the useful life. 178 €
    Estimations are based on:
    -    Energy consumption of 137 kWh/year
    -    Average price of electricity: 0.13€/kWh (year 2016)
    -    Lifespan: 10 years

Figure A 1: Experimental monetary information in the current label on washing machines in Spain
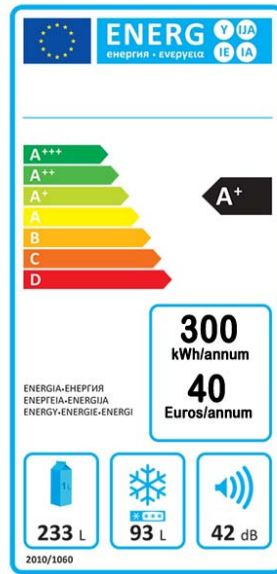
Figure A 2: The monetary energy label presented to the respondents in Greece

Table A 3:Factors influencing washing machine energy efficiency valuation for households in Spain –Probit marginal effects

	Marginal effects
Attitudes towards EE	
Environmental impact reduction (=1 if strongly agree)	0.110**
	(0.052)
Similar EE levels (=1 if strongly agree)	-0.121
	(0.077)
New technologies (=1 if strongly agree)	0.172***
	(0.051)
Understanding the energy consumption (=1 if strongly agree)	0.208
	(0.136)
Money savings (=1 if strongly agree)	-0.161
	(0.158)
Cannot afford to upgrade the EE (=1 if strongly agree)	0.079
	(0.113)
Perception on existing label	
Understandable label (=1 if strongly agree)	0.103
	(0.063)
Trustworthy label (=1 if strongly agree)	0.083
	(0.066)
Manipulated label (=1 if strongly agree)	-0.090
	(0.109)
Economic incentives	

Subsidy for EE (=1 if subsidy received)	0.006
	(0.080)
Socio-demographics	
Female	0.078*
	(0.046)
Age	0.001
	(0.002)
Household size	0.017
	(0.020)
Current income description	
Finding it very difficult to live on current income	*-Reference-*
Finding it difficult to live on current income	0.142
	(0.091)
Coping on current income	0.173**
	(0.081)
Living comfortably or very comfortably on current income	0.240***
	(0.082)
Observations	486
Wald chi2(16)	53.8
Prob > chi2	0.00
Log pseudolikelihood	-292.3
Pseudo R2	0.0905

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table A 4:Factors influencing refrigerators energy efficiency valuation for households in Greece –Probit marginal effects

	Marginal effects
Attitudes towards EE	
Environmental impact reduction (=1 if strongly agree)	0.167***
	(0.053)
Similar EE levels (=1 if strongly agree)	-0.226***
	(0.076)
New technologies (=1 if strongly agree)	0.135**
	(0.056)
Aware of electricity prices (=1 if strongly agree)	0.150***
	(0.046)
Perception on existing label	
It would affect my choice (=1 if strongly agree)	0.097**
	(0.048)
Economic incentives	
Lack of incentives for EE (=1 if there are no incentives)	-0.015
	(0.048)
Environmental awareness	
Willing to buy an EE refrigerator to combat CC (=1 if yes)	0.132**
	(0.059)
Socio-demographics	

Female	0.094**
	(0.046)
Age	0.005***
	(0.002)
Household size	0.024
	(0.016)
Current income description	
Coping on current income	-0.056
	(0.054)
Living comfortably or very comfortably on current income	-0.033
	(0.067)
Observations	426
LR chi2(12)	95.9
Prob > chi2	0.00
Log pseudolikelihood	-211.6
Pseudo R^2	0.185

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

A. Influence of the existing energy label in choosing a new refrigerator in Greece

In order to investigate the determinants of the energy label's influence on consumers' judgment (dependent variable coded as: 1 = Yes; 0 = No), a probit model was used, the results of which are given in Table A 5.

According to the model, the MEM for those who strongly agree that buying a more energy efficient refrigerator would reduce the impact of their household is 9.7% (i.e. on average the probability of being influenced by the energy label is 9.7% higher than it is for those who believe the opposite) and 8.6% for those who are aware of the refrigerator's energy consumption. Moreover, the probability is significantly higher (24.7%) for those who are aware of the existing refrigerator energy label. The MEM for women is -8.3%, i.e. on average women's probability of being affected by the energy label during the purchase of a new refrigerator is 8.3% lower than it is for men. Finally, in comparison with those who state that they are finding it very difficult to on their current income, the respondents who find it difficult to live on current income, cope on current income and live very comfortable on current income are more likely to be influenced by the energy label (by 6.8%, 12% and 6.6%, respectively).

Table A 5: Factors influencing the energy label's influence in refrigerators purchases by households in Greece –Probit marginal effects

	Marginal effects
Attitudes towards EE	
Environmental impact reduction (=1 if strongly agree)	0.097**
	(0.038)
Good understanding of refr. consumption (=1 if strongly agree)	0.086*

	(0.048)
Perception on existing label	
Label awareness (1=yes)	0.242***
	(0.039)
Environmental awareness	
Act now for climate change (1=yes)	0.081**
	(0.032)
Socio-demographics	
Female	-0.083**
	(0.038)
Current income description	
Living difficult with current income	0.068
	(0.052)
Coping on current income	0.120**
	(0.054)
Living comfortably or very comfortably on current income	0.066
Coping on current income	(0.063)
Observations	386
LR chi2(8)	80.7
Prob > chi2	0.00
Log pseudolikelihood	-140.9
Pseudo R^2	0.223

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

B. Willingness to buy an energy efficient refrigerator to combat climate change in Greece

As regards the factors influencing the willingness of the respondent to buy a more energy efficient refrigerator (dependent variable coded as: 1 = Yes; 0 = No), a probit model was run. Again, a number of attitudinal, sociodemographic and socioeconomic factors were examined.

Based on the results of the model (in terms of marginal effects), which are presented in Table A 6, the probability of being willing to buy a more energy efficient refrigerator so as to contribute to the mitigation of climate change is higher for those who: strongly agree that buying a more energy efficient refrigerator would reduce the impact of their household (6.9%), are willing to take a chance on new technologies so as to reduce their energy consumption (8.6%), are aware of the energy labels (15.8%), are concerned about the environment (6.5%) and believe that we should act now in combating climate change (14.7%). On the contrary, those who state that the price of a new refrigerator is a very important attribute for their decision are less willing to buy a more expensive, yet more energy efficient, refrigerator (by 6.4%). The age of the respondent is associated with an insignificant decrease in the probability of buying a more energy efficient refrigerator (0.5%). Finally, in comparison with those who state that they find it very difficult to live with their current income, the respondents who find it difficult to live on current income, cope on current income

and live very comfortable on current income are more likely to buy a more energy efficient refrigerator (by 4.9%, 13.6% and 14.3%, respectively).

Table A 6: Factors influencing the willingness to buy an EE refrigerator by households in Greece –Probit marginal effects

	Marginal effects
Attitudes towards EE	
Environmental impact reduction (=1 if strongly agree)	0.069
	(0.047)
New technologies (=1 if strongly agree)	0.086*
	(0.047)
Importance of refrigerator's price (1=very important)	-0.064*
	(0.037)
Perception on existing label	
Label awareness (1=yes)	0.158***
	(0.043)
Environmental awareness	
Concern about the environment (1=not concerned; 4=extremely concerned)	0.065**
	(0.027)
Act now for climate change (1=yes)	0.147***
	(0.044)
Socio-demographics	
Age	-0.005***
	(0.002)
Current income description	
Living difficult with current income	0.049
	(0.063)
Coping on current income	0.136**
	(0.067)
Living comfortably or very comfortably on current income	0.143*
Coping on current income	(0.076)
Observations	459
LR chi2(10)	81.9
Prob > chi2	0.00
Log pseudolikelihood	-219.6
Pseudo R^2	0.159

6.4   Households – Properties

Table A 7: Factors influencing property energy efficiency valuation for households in Ireland – logit marginal effects

	Marginal Effects	Std. Err.	P>|z|
Attitudes			

EE improves property value [D]	0.184***	0.057	0.001
Very concerned about climate change [D]	0.213***	0.053	0.000
Knowledge			
Understands property energy consumption [D]	0.004	0.062	0.946
Understands money savings associated with higher EE [D]	0.156**	0.063	0.013
Personality			
Patience [D]	0.004	0.061	0.954
Risky [D]	0.022	0.075	0.770
Household Characteristics/Demographics			
Income 1 (finding it very difficult) [D]	0.083	0.091	0.361
Income 2 (finding it difficult) [D]	-0.046	0.072	0.525
Income 3 (coping) [D]	------*Reference group* ------		
Income 4 (living comfortably) [D]	-0.012	0.072	0.862
Income 5 (living very comfortably) [D]	0.052	0.156	0.740
Female [D]	0.129**	0.058	0.027
Age 1 (less than 30) [D]	0.180**	0.083	0.030
Age 2 (30 - 39) [D]	0.063	0.081	0.438
Age 3(40 - 49) [D]	------*Reference group* ------		
Age 4 (50 - 59) [D]	0.107	0.081	0.184
Age 5 (over 59) [D]	0.267***	0.078	0.001
Dublin [D]	-0.192***	0.063	0.002
Married [D]	0.124	0.079	0.116
Education (less than higher degree) [D]	------*Reference group* ------		
Education (higher degree) [D]	0.010	0.064	0.876
Education (above higher degree) [D]	0.033	0.092	0.722
Children [D]	-0.020	0.067	0.768
Number of bedrooms	-0.049**	0.024	0.048
Number of Observations			416
Pseudo R-Squared			0.138
LR Chi-Squared (21 df)			78.26
P>|Chi-Squared|			0.000

Notes: ***, ** and * indicate significance at 1%, 5% and 10% level. [D] indicates dummy variable. The marginal effect for a dummy variable is the change in probability for a discrete change from zero and one.

Table A 8: Factors influencing property energy efficiency valuation for households in Slovenia – logit marginal effects

	Marginal Effects	Std. Err.	P>|z|
Attitudes			
EE improves property value [D]	0.100	0.061	0.101
Very concerned about climate change [D]	0.141**	0.065	0.029
Knowledge			
Understands property energy consumption [D]	0.037	0.065	0.574
Understands money savings associated with higher EE [D]	0.082	0.068	0.229
Household Characteristics/Demographics			
Income 1 (finding it very difficult) [D]	-0.099	0.207	0.632
Income 2 (finding it difficult) [D]	-0.120	0.100	0.231
Income 3 (coping) [D]	------*Reference group* ------		
Income 4 (living comfortably) [D]	-0.011	0.064	0.858
Income 5 (living very comfortably) [D]	0.007	0.123	0.952
Female [D]	0.156***	0.059	0.008
Age 1 (less than 30) [D]	0.085	0.095	0.370
Age 2 (30 - 39) [D]	0.097	0.073	0.187
Age 3 (40 - 49) [D]	------*Reference group* ------		
Age 4 (50 - 59) [D]	0.146	0.089	0.101
Age 5 (over 59) [D]	0.025	0.111	0.821
Ljubljana [D]	0.033	0.058	0.575
Married [D]	0.242***	0.080	0.003
Education (less than higher degree) [D]	------*Reference group* ------		
Education (higher degree) [D]	-0.004	0.061	0.945
Education (above higher degree) [D]	0.023	0.154	0.880
Children [D]	-0.072	0.066	0.276
Number of bedrooms	-0.044***	0.016	0.005
Number of Observations			363
Pseudo R-Squared			0.085
LR Chi-Squared (21 df)			42.4

P>|Chi-Squared|	0.085

Notes: ***, ** and * indicate significance at 1%, 5% and 10% level. [D] indicates dummy variable. The marginal effect for a dummy variable is the change in probability for a discrete change from zero and one.

6.5   Households – Cars

Figure A 3: Current label as shown to respondents in the survey in Norway
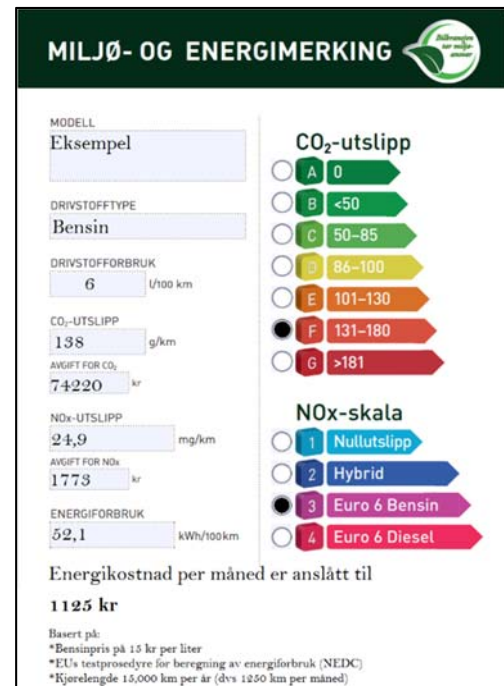
Figure A 4: Alternative label as shown to respondents in the survey in Norway

The added text says "energy cost per month is estimated to be:", and the three bullet points below explain how this number has been calculated:

- *Gasoline price of NOK 15 per litre.*
- *The EU test procedure for estimating energy use (NECD)*
- *Driving range 15,000 km per year (i.e. 1250 km per month).*

Table A 9: Factors influencing cars energy efficiency valuation for households in Norway –probit marginal effects

	Marginal effects
Attitudes towards EE	
Environmental impact reduction	0.062
	(0.096)
Similar EE levels	0.154**
	(0.065)
New technologies	0.329***
	(0.080)
Understanding the energy consumption	0.060
	(0.085)
Money savings	0.237***
	(0.081)
Cannot afford to upgrade the EE	0.029
	(0.063)
Perception on existing label	
Understandable label	0.063
	(0.066)
Trustworthy label	0.114
	(0.101)
Manipulated label	0.104
	(0.086)
Socio-demographics	
Female	0.155***
	(0.031)
Age	0.002**
	(0.001)
Current income description	
Finding it difficult to live on current income	-0.171
	(0.128)
Coping on current income	-0.181
	(0.132)
Living comfortably or very comfortably on current income	-0.300***
	(0.102)
Observations	1084
Log Likelihood	-901.30
LR Chi-Squared	186.0
P > |Chi-Squared|	0.0001
Pseudo R-Squared	0.187

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

6.6 Services – Appliances

Table A 10: Factors influencing the energy efficiency valuation of heating and cooling systems for hotels in Greece – probit marginal effects

	Marginal effects
Attitudes towards EE	
Take a chance on new technologies (=1 if strongly agree)	0.134
	(0.103)
Economic incentives	
Lack of incentives for EE (=1 if there are no incentives)	-0.057
	(0.042)
Hotel ownership type	
Franchise (=1 if privately owned; =2 if franchise)	-0.506**
	(0.218)
Socio-demographics	
Female	0.093**
	(0.047)
Age	0.003
	(0.002)
Observations	97
LR chi2(5)	29.91
Prob > chi2	0.00
Log pseudolikelihood	-19.4
Pseudo R^2	0. 4360

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table A 11: Factors influencing the energy label influence of heating and cooling systems for hotels in Greece – probit marginal effects

	Marginal effects
Attitudes towards EE	
New technologies (=1 if strongly agree)	0.711**
	(0.352)
Annual energy cost (=1 very important)	0.470**
	(0.207)
Economic incentives	
Lack of incentives for EE (=1 if there are no incentives)	-0.182
	(0.120)
Perception on existing label	
Label awareness (1=yes)	0.406***
	(0.110)
Environmental awareness	
CO_2 emissions (1=very important)	-0.329
	(0.200)
Socio-demographics	

Age	-0.011**
	(0.005)
Observations	95
LR chi2(6)	43.5
Prob > chi2	0.00
Log pseudolikelihood	-36.7
Pseudo R^2	0.372

<center>Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1</center>

Influence of the existing energy label in choosing hotel heating/cooling systems in Greece

The influence of the energy label influence on hotel managers' decision was explored using a probit model (dependent variable coded as: 1 = Yes; 0 = No). The results are given in Table A 12.

The MEMs show that the probability of being affected by the energy label is significantly higher for those who are willing to take a chance on new technologies to reduce their energy consumption (i.e. 71.1%), are concerned about the system's energy consumption (i.e. 47%) and are aware of the existing energy labels (i.e. 40.6%). The MEM for an increase in age is -1.1%. Again, the probability is negatively associated with the lack of financial incentives (i.e. 18.2%) and, surprisingly, with the importance of the CO_2 emissions attribute (i.e. 32.9%). These variables, however, are not statistically significant.

Table A 12: Factors influencing the energy efficiency valuation of heating and cooling systems for lodgings in Spain – probit marginal effects

	Marginal effects
Attitudes towards EE	
Loan access limits my purchases (=1 if strongly agree)	-0.110
	(0.103)
Understand the energy consumption (=1 if strongly agree)	-0.002
	(0.097)
Take a chance on new technologies (=1 if strongly agree)	0.259***
	(0.076)
Effectiveness of energy consumption information[a] (=1 if strongly agree)	0.149
	(0.103)
Climate	
Mediterranean	-reference-
Atlantic climate (=1 yes)	0.095
	(0.131)
Continental climate (=1yes)	0.224*
	(0.123)

Subtropical climate (=1yes)	0.281**
	(0.116)
Mountain climate (=1yes)	-0.013
	(0.140)
Socio-demographics	
Number of years in operation	0.001
	(0.003)
Lodging type	
Hotel	*-reference-*
Hostel (=1yes)	0.146*
	(0.081)
Cottage (=1yes)	-0.133
	(0.109)
Occupancy rate in high season	0.005**
	(0.002)
Technical characteristics	
Heating with propane gas (=1yes)	0.218***
	(0.083)
Unique heating system (=1yes)	0.197*
	(0.105)
Environmental behaviour	
Concern for the environment (=1 if extremely concerned)	0.231***
	(0.076)
Income	
Financial situation	-0.032
	(0.024)
Observations	188
LR chi2(16)	48.86
Prob > chi2	0.00
Pseudo R2	0.2037
Log likelihood	-95.46

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1
(a) effective measures to raise customer awareness of energy consumption

6.7 Services – Properties

Table A 13: Factors influencing property energy efficiency valuation for the Services sector in Ireland –logit marginal effects

	Marginal Effects	Std. Err.	P>|z|

Attitudes

	Marginal Effects	Std. Err.	P>|z|
Very concerned about climate change [D]	0.123	0.075	0.104
Knowledge			
Understands property energy consumption [D]	0.003	0.081	0.974
Understands money savings associated with higher EE [D]	-0.073	0.085	0.387
Personality of Respondent			
Patience [D]	0.066	0.070	0.349
Risky [D]	-0.018	0.072	0.806
Firm Characteristics			
Rents main premises [D]	-0.208***	0.076	0.006
Number of employees	-0.005	0.003	0.114
Good current financial condition [D]	0.041	0.080	0.604
Number of Observations			164
Pseudo R-Squared			0.105
LR Chi-Squared (21 df)			19.64
P>|Chi-Squared|			0.012

Notes: ***, ** and * indicate significance at 1%, 5% and 10% level. [D] indicates dummy variable. The marginal effect for a dummy variable is the change in probability for a discrete change from zero and one.

6.8 Agriculture

Table A 14: Factors influencing fuel efficiency valuation in the Agricultural sector in Ireland –logit marginal effects

	Marginal Effects	Std. Err.	P>|z|
Attitudes			
Very concerned about climate change [D]	-0.010	0.081	0.903
Believes all new tractors have same EE [D]	-0.261**	0.112	0.020
Knowledge			
Understands tractor energy consumption [D]	-0.073	0.075	0.330
Understands money savings associated with higher EE [D]	0.317***	0.069	0.000
Personality			
Patience [D]	0.148**	0.075	0.049
Risky [D]	-0.001	0.080	0.987
Farm/Farmer Characteristics			

Full-time	-0.104	0.080	0.195
Number of tractors (1-2) [D]	------Reference group ------		
Number of tractors (3-4) [D]	0.104	0.084	0.213
Number of tractors (5-6) [D]	0.153	0.097	0.117
Number of tractors (7+) [D]	0.069	0.122	0.573
Age 1 (less than 30) [D]	-0.025	0.104	0.813
Age 2 (30 - 39) [D]	0.063	0.087	0.467
Age 3(40 - 49) [D]	------Reference group ------		
Age 4 (50 - 59) [D]	0.105	0.112	0.349
Age 5 (over 59) [D]	0.136	0.172	0.431
Education (less than lower degree) [D]	------Reference group ------		
Education (lower degree) [D]	0.027	0.088	0.762
Education (higher degree) [D]	-0.019	0.105	0.857
Education (above higher degree) [D]	-0.217	0.162	0.182
Number of Observations			252
Pseudo R-Squared			0.104
LR Chi-Squared (21 df)			36.12
P>|Chi-Squared|			0.007

Notes: ***, ** and * indicate significance at 1%, 5% and 10% level. [D] indicates dummy variable. The marginal effect for dummy variables is the change in probability for a discrete change from zero and one.