Study on consumer understanding of the energy label for space heaters and air conditioners

Final report

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1. Research questions and study set-up

The product categories of space heaters and air conditioners each comprise several product types. As regards space heaters that heat air to heat a room, there are energy labelling regulations for local space heaters (Regulation (EU) 2015/1186) and air-to-air heat pumps (Regulation (EU) No. 626/2011). The latter regulation also covers air conditioning appliances, comprising both portable (single duct) and fixed (double duct and other room) air conditioners.

These different product types use different technologies, some of which are more energy efficient than others. Currently, different product types have different efficiency scales, which allow for fine-grained within-category comparisons of the energy efficiency among products (e.g. comparing a heat pump with another heat pump with the same capacity) but not cross-category comparisons (e.g. comparing a heat pump with a local space heater). This is different from the energy labelling regulation for space heaters that heat water (Regulation (EU) 811/213), where the energy efficiency of subtypes (e.g. boilers, cogeneration heat and power units, air-to-water heat pumps) is expressed on the same energy efficiency scale.

1.1. Research questions

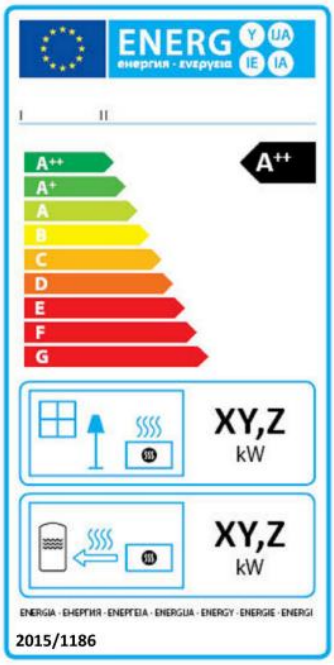
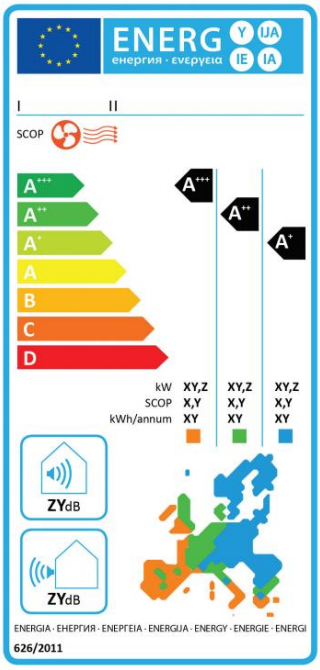
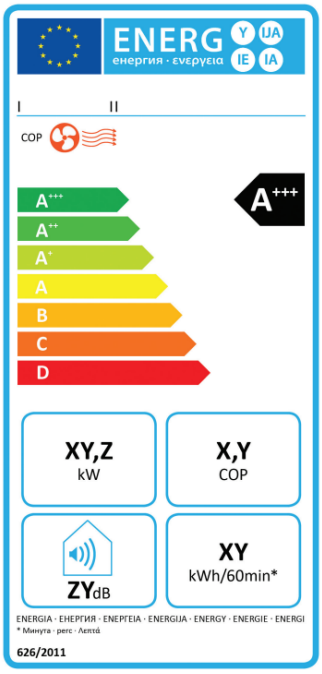
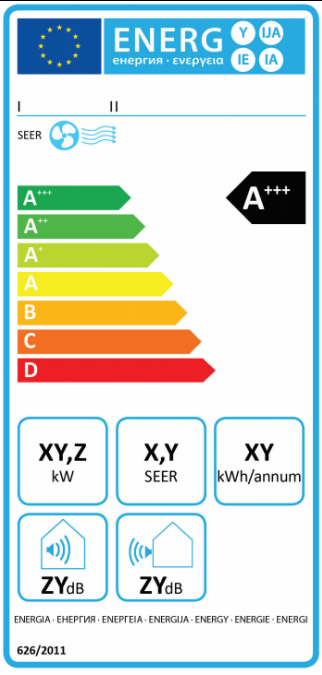
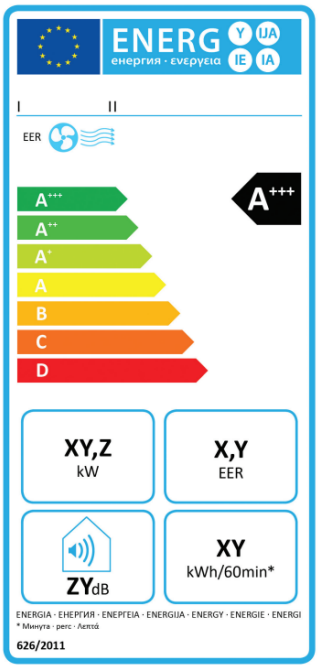
The central question in this study is whether consumers **understand** and **expect** that different heating/air conditioning technologies have different energy efficiency scales, and whether they take the efficiency differences between technologies **into account in their choices** of heating appliances and air conditioners. We also explore how the label best guides consumers towards more efficient technologies and appliances.

Currently, the energy labels provide information that allows consumers to directly compare the energy efficiency of alternatives of the same product type (same technology) with the same heating/cooling output (capacity). All labels provide information on the energy efficiency class and the heating/cooling output of the product in kW (see Table 1.1). Heat pumps and air conditioners further display the indoor sound level and, where relevant, the outdoor sound level, the (S)EER or (S)COP value, and, in some cases, also the energy consumption in kWh/annum or kWh/60 minutes. (S)EER and (S)COP information enables consumers to further discriminate more versus less efficient product alternatives within an efficiency class.

Currently, consumers cannot learn from studying the energy efficiency classes which *technology* is more energy efficient. However, if the (e.g. seasonal) **energy consumption** of the different appliances under comparison is provided (in addition to their heating/cooling output), consumers may be able to integrate the information and understand which technology is more efficient, and hence, which appliance is the most efficient overall. More specifically, if the capacity is the same (kW), appliances that use less energy are more energy efficient. However, energy consumption is only directly comparable between products when provided in a similar unit of measurement; currently, energy labels present either kWh/annum or kWh/60min, depending on the

product type; for local space heaters, no information on (seasonal) energy consumption is currently provided on the energy label (see Table 1.1).

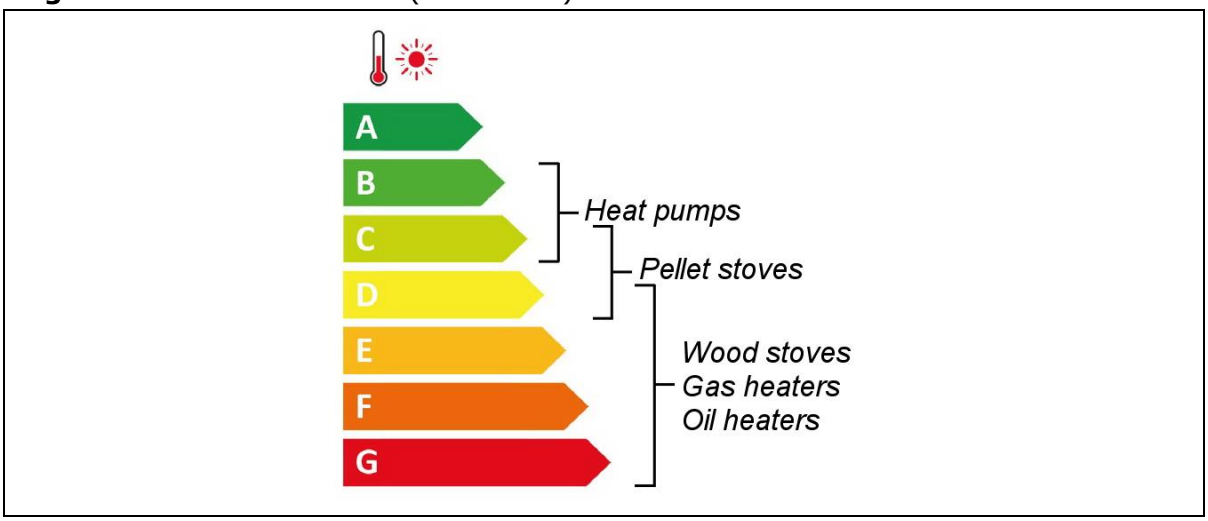
Table 1.1. Current energy labels

Local space heaters	Heat pumps (except single and double duct)	Single duct and double duct heat pumps
		
	Air conditioners (except single and double duct)	**Single and double duct air conditioners**
		

However, such information integration may be too complex for the average consumer. Many consumers may not fully understand the difference between energy efficiency

and energy consumption.[1] Another way to communicate differences in energy efficiency of technologies is to **combine** the different product types on the **same energy efficiency scale** (see Figure 1.1), akin to the energy label for space heaters that heat water. Showing the energy efficiency of different product types on the same scale should enable consumers to quickly identify the more energy efficient technology. However, the drawback of this approach is that all alternatives of the same product type which were previously shown on a scale from (e.g.) A+++ to D will now populate only a few classes of the efficiency scale (e.g. all heat pumps fall in the top classes), which impairs detailed comparisons of alternatives of the same product type.

Figure 1.1. Combined scale (illustration)



To solve this, the combined label may provide more detailed energy efficiency information in the form of seasonal space cooling energy efficiency ($\eta_{s,c}$) and seasonal space heating energy efficiency ($\eta_{s,h}$) values. In fact, information about the energy efficiency of heat pumps and air conditioners is already present on the energy labels that fall under Regulation (EU) No. 626/2011 (see Table 1.1) in the form of (S)EER and (S)COP values. More efficient product alternatives have higher (S)EER/(S)COP values, so consumers can use this information to discriminate between more and less efficient alternatives of a certain product type. Earlier research by CentERdata suggests, however, that consumers generally find this information difficult to understand.[2] When presented with multiple product alternatives in the top efficiency class, a substantial group of consumers identified the product with the *lower* SEER or SCOP value as the more energy efficient one. When providing $\eta_{s,c}$ and $\eta_{s,h}$ values this problem might be circumvented since these values are provided as percentages, with higher percentages indicating more efficient appliances.

1 Waechter, S., Sütterlin, B. and Siegrist, M. (2015), "The misleading effect of energy efficiency information on perceived energy friendliness of electric goods", *Journal of Cleaner Production*, Vol. 93, pp. 193-202.

2 CentERdata consortium (2019). Study on consumer understanding of the energy label for air conditioners and heat pumps ≤ 12 kW. Research report for DG Energy.

The present study examines to what extent consumers take into account the energy efficiency of technologies in their choices of heaters and air conditioners. It examines whether consumers understand the difference between energy efficiency and energy consumption, and whether they understand that energy efficiency classes of products using different technologies cannot be compared. Furthermore, in an online experiment, we investigate whether the energy label would guide consumers towards more energy efficient technologies if the energy efficiency of different product types were to be expressed on the *same* efficiency scale instead of on separate scales. The experiment also examines whether the provision of $\eta_{s,c}$ and $\eta_{s,h}$ values would fully compensate for the loss in granularity that results from the combination of scales.

The study aims to answer the following general research questions:

- *To what extent do consumers take into account the efficiency of technologies in their choices of heating appliances and air conditioners? (RQ1)*
- *To what extent do consumers understand that different heating/cooling technologies have different energy efficiency scales? (RQ2)*
- *To what extent do consumers understand the difference between values indicating energy efficiency and the annual consumption? (RQ3)*

1.2. Study set-up

In order to answer the research questions, a survey research was performed in six Member States in the period from 27 November until 9 December 2020.

Country sample

The survey was administered in six Member States – Germany, Spain, France, Italy, Romania, and Sweden – that together cover 56% of the EU28-population with adequate geographical spread (see Figure 1.2).

Table 1.2 shows the details per country for relevant country characteristics. The sample includes:

- two countries with an average level of **consumer concern for the environment** (Germany and Sweden), and four with a high level of concern (Spain, France, Italy, Romania). The selection also includes three countries where there has been a big (positive) change in this figure since 2011 (Spain, Italy, Romania), two where the change has been around average (Germany and France) and one where there has been little change since 2011 (Sweden);
- two countries with a high percentage of households with **broadband internet** (Germany and Sweden), three with a low broadband rate (France, Italy, Romania) and one with an around average rate (Spain). The selection also includes two countries with an above average percentage of people that use internet daily (Germany and Sweden), two countries with around average daily

internet access (Spain and France) and two countries with below average daily internet access (Italy and Romania);

- two countries with a low **GDP/capita** (Romania and Spain), two countries with an around average GDP/capita (Italy and France) and two countries with a high GDP/capita (Germany and Sweden).

Figure 1.2. Country sample

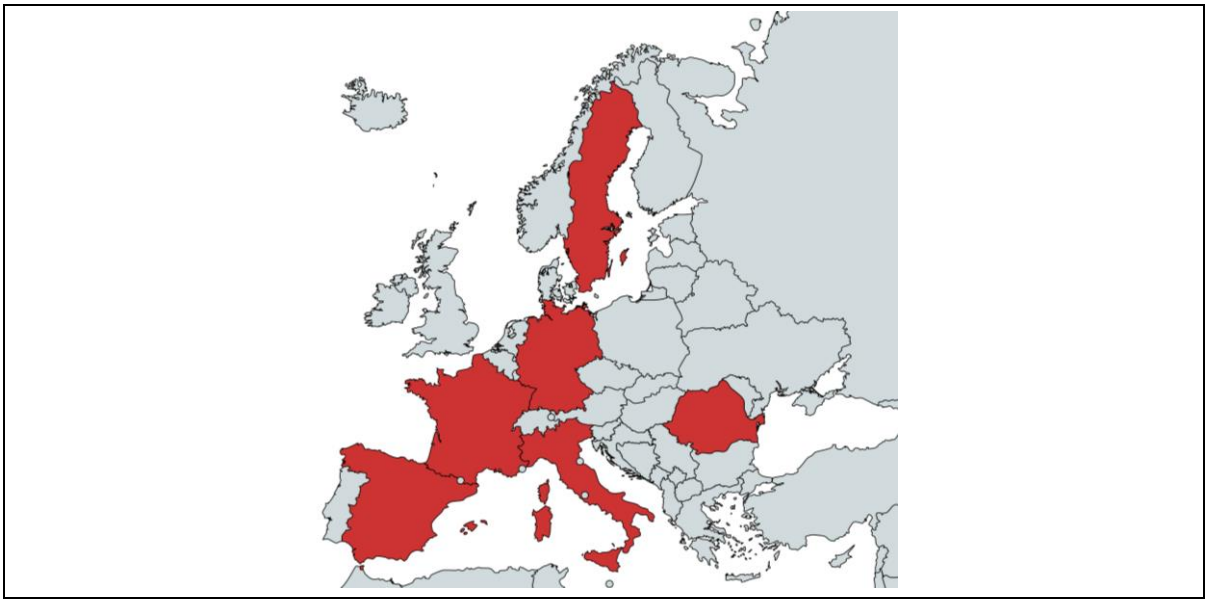


Table 1.2. Country sample

Country code	Region	Popula-tion (2019)[3]	GDP per capita (in PPS) EU-27 = 100 [4]	Concern for the environment (2014)[5]	Change in concern for the environment (2011-2014)	Broadband internet at home (2019)[6]	Daily internet access (2019)[7]
		%	Level	%	%	%	%
DE	West	16,2%	121	54%	25%	94%	85%
ES	South	9,1%	91	59%	37%	91%	78%
FR	West	13,1%	106	58%	25%	83%	77%
IT	South	11,8%	95	59%	31%	84%	73%
RO	East	3,8%	69	65%	34%	82%	57%
SE	North	2,0%	120	56%	16%	95%	91%
EU-28	-	100,0%	101	55%	26%	89%	79%

3 Source: Eurostat (2019). Population on 1 January by age and sex, see https://ec.europa.eu/eurostat/databrowser/view/demo_pjan/default/table?lang=en

4 Source: Eurostat (2019). GDP per capita in PPS, Index (EU27_2020 = 100) (dataset nama_10_gdp.), see https://ec.europa.eu/eurostat/web/products-datasets/-/tec00114

5 Source: Concern for the environment: Flash Eurobarometer 397, http://ec.europa.eu/COMMFrontOffice/PublicOpinion/index.cfm/Survey/getSurveyDetail/instruments/FLASH/surveyKy/2031

6 Source: Eurostat (2019) Households having access to the internet by type of connection (code tin00073), see https://ec.europa.eu/eurostat/web/products-datasets/-/tin00073

7 Source: Eurostat (2019) Frequency of internet use (code isoc_ci_ifp_fu), see

Respondent samples

The total respondent sample consisted of **9600 consumers** and comprised three subsamples:

1. A sample of the **general public**, aged 18-70, nationally representative on age and gender (N = 1200 per country);
2. A sample of **prospective buyers of space heating appliances**, aged 18-70 (N = 200 per country);
3. A sample of **prospective buyers of air conditioning appliances**, aged 18-70 (N = 200 per country).

To ensure representativeness, the subsamples were recruited completely independently. Thus, consumers who were recruited for the general public sample remained in that sample, regardless of whether they were prospective buyers or not. Consumers who were recruited for the prospective buyer sample but did not meet the selection criteria were not included in the general public sample. Tables 1.3-1.5 provide a description of the sample sizes and sample characteristics per subsample and per country.

Table 1.3. Sample description: general public[8]

	Total	DE	IT	FR	ES	RO	SE
Sample size	7270	1202	1215	1214	1203	1220	1216
Gender							
Male	50,0%	50,1%	49,0%	48,7%	49,5%	52,5%	50,6%
Female	50,0%	49,9%	51,0%	51,3%	50,5%	47,5%	49,4%
Age							
Age: 18-24	8,9%	3,7%	6,3%	12,4%	8,1%	10,1%	12,9%
Age: 25-34	18,7%	23,8%	18,0%	16,1%	16,7%	19,9%	17,6%
Age: 35-44	17,4%	12,7%	20,1%	14,2%	24,2%	19,5%	13,7%
Age: 45-54	22,7%	25,4%	21,6%	23,8%	19,9%	22,6%	22,9%
Age: 55-64	15,9%	19,4%	15,9%	4,3%	16,7%	21,7%	17,5%
Age: 65+	16,4%	15,1%	18,1%	29,2%	14,5%	6,2%	15,5%
Education							
Low (ISCED 1-4)	48,2%	62,6%	60,2%	40,0%	39,5%	30,8%	56,6%
High (ISCED 5-8)	51,8%	37,4%	39,8%	60,0%	60,5%	69,2%	43,4%
Household financial situation[9]	2,9	2,8	3,0	3,0	2,9	2,9	2,7

http://appsso.eurostat.ec.europa.eu/nui/submitViewTableAction.do

[8] Percentages may not add up to 100% due to rounding.

[9] Financial situation ("Would you say that making ends meet every month is…") measured on a 5-point scale from 1 = very easy to 5 = very difficult.

	Total	DE	IT	FR	ES	RO	SE
Concern for the environment[10]	5,1	4,9	5,3	4,8	5,3	5,3	4,7
Planning to buy a heater in the coming 12 months (prospective buyer)	14,1%	7,0%	15,3%	9,6%	17,0%	25,8%	9,9%
Planning to buy an air conditioner in the coming 12 months (prospective buyer)	10,5%	3,9%	13,7%	5,4%	10,1%	23,1%	6,7%

Table 1.4. Sample description: prospective buyers of space heaters

	Total	DE	IT	FR	ES	RO	SE
Sample size	1208	200	200	201	200	203	204
Gender							
Male	55,6%	52,5%	50,0%	47,8%	58,5%	59,1%	65,7%
Female	44,4%	47,5%	50,0%	52,2%	41,5%	40,9%	34,3%
Age							
Age: 18-24	5,6%	5,0%	7,5%	6,0%	9,5%	3,9%	1,5%
Age: 25-34	16,2%	22,0%	22,0%	21,4%	15,0%	10,8%	6,4%
Age: 35-44	18,0%	18,5%	21,0%	9,5%	18,0%	33,0%	7,8%
Age: 45-54	24,2%	24,0%	22,5%	24,9%	26,0%	26,1%	21,6%
Age: 55-64	18,9%	12,5%	17,5%	10,0%	20,5%	22,2%	30,4%
Age: 65+	17,2%	18,0%	9,5%	28,4%	11,0%	3,9%	32,4%
Education							
Low (ISCED 1-4)	42,1%	59,5%	47,5%	29,9%	37,0%	32,0%	47,1%
High (ISCED 5-8)	57,9%	40,5%	52,5%	70,2%	63,0%	68,0%	52,9%
Household financial situation[11]	2,8	2,6	3,0	2,9	3,0	2,9	2,5
Concern for the environment[12]	5,2	5,2	5,6	4,9	5,4	5,4	4,7

[10] Environmental concern ("I am worried about the environment", "People should buy environmentally-friendly products", "It concerns me that people do not care enough for the environment", "I have switched to another brand sometimes, because it was better for the environment", "To protect the environment, I often buy environmentally-friendly products") measured on 7-point scales from 1 = strongly disagree to 7 = strongly agree. Cronbach's alpha = 0,91.

[11] Financial situation ("Would you say that making ends meet every month is…") measured on a 5-point scale from 1 = very easy to 5 = very difficult.

[12] Environmental concern ("I am worried about the environment", "People should buy environmentally-friendly products", "It concerns me that people do not care enough for the environment", "I have switched to another brand sometimes, because it was better for the environment", "To protect the environment, I often buy environmentally-friendly products") measured on 7-point scales from 1 = strongly disagree to 7 = strongly agree. Cronbach's alpha = 0,91.

Table 1.5. Sample description: prospective buyers of air conditioners

	Total	DE	IT	FR	ES	RO	SE
Sample size	1214	200	203	200	203	204	204
Gender							
Male	57,3%	56,5%	49,8%	53,5%	59,1%	54,9%	69,6%
Female	42,8%	43,5%	50,3%	46,5%	40,9%	45,1%	30,4%
Age							
Age: 18-24	7,6%	6,0%	6,9%	13,0%	13,8%	4,4%	1,5%
Age: 25-34	18,2%	25,5%	20,7%	22,5%	20,7%	12,8%	7,4%
Age: 35-44	18,6%	16,0%	18,7%	11,5%	22,2%	31,9%	11,3%
Age: 45-54	23,0%	23,5%	23,2%	27,0%	15,8%	28,9%	19,6%
Age: 55-64	17,2%	15,0%	16,3%	5,5%	20,7%	19,1%	26,5%
Age: 65+	15,4%	14,0%	14,3%	20,5%	6,9%	2,9%	33,8%
Education							
Low (ISCED 1-4)	44,2%	58,5%	58,1%	32,5%	32,0%	30,4%	53,4%
High (ISCED 5-8)	55,9%	41,5%	41,9%	67,5%	68,0%	69,6%	46,6%
Household financial situation[13]	2,7	2,4	2,9	3,0	2,9	2,9	2,4
Concern for the environment[14]	5,2	5,1	5,5	5,1	5,6	5,4	4,5

Questionnaire

The online questionnaire consisted of four parts: (1) screening questionnaire, (2) choice experiment, (3) questions to assess understanding and expectations, (4) post-experiment questionnaire. The complete questionnaire is in Appendix A.

The purpose of the **screening questionnaire** was to identify prospective buyers. To give respondents a better idea of the types of appliances the questionnaire was about, the main types of heaters and air conditioners were described, with several pictures of appliances shown to them as examples. Consumers (in the prospective buyers sample) who indicated that they intended to buy an air conditioner or a heater in the coming 12 months, received several follow-up questions about their intended use of the appliance and which type(s) of appliances they considered buying.

Next, all respondents took part in a (hypothetical) **choice experiment.** They were asked to imagine that they were looking for a heater (or an air conditioner) and were presented with an assortment of nine appliances they could choose from. The assortment included different types of appliances (e.g. three heat pumps, three gas

[13] Financial situation ("Would you say that making ends meet every month is…") measured on a 5-point scale from 1 = very easy to 5 = very difficult.

[14] Environmental concern ("I am worried about the environment", "People should buy environmentally-friendly products", "It concerns me that people do not care enough for the environment", "I have switched to another brand sometimes, because it was better for the environment", "To protect the environment, I often buy environmentally-friendly products") measured on 7-point scales from 1 = strongly disagree to 7 = strongly agree. Cronbach's alpha = 0,91.

heaters and three wood/pellet stoves). The appliances were presented with energy labels, which varied across experimental groups. For half of the respondents, the efficiency classes of the appliances were expressed on separate efficiency scales for heat pumps and local space heaters. The other half of the respondents saw energy labels with combined scales.

In the third part of the questionnaire, respondents were exposed to pairs of energy labels. The labels were either for two appliances using the same technology (e.g. two heat pumps) or for two appliances using different technologies (e.g. a heat pump and a gas heater). For each pair, respondents were asked to indicate which appliance is most energy efficient or which appliance consumes the least amount of energy, as a measure of **comprehension**. This part also assessed respondents' **expectations** and **preferences** regarding ways in which energy labels inform consumers about differences in energy efficiency of different (types of) appliances.

Finally, the **post-experiment questionnaire** assessed whether respondents bought an air conditioner or space heater in the past three years, which type of appliance they bought, and whether they had seriously considered other product types (using other technologies) as well. The remainder of the post-experiment questionnaire assessed relevant background characteristics, including socio-demographic characteristics (e.g. educational level, financial situation) and other relevant person-related factors (e.g. environmental concern, product expertise).

The survey took about 10 minutes to complete, on average. Respondents were incentivised as part of their membership of the Ipsos online panel, where they receive points, which can then be converted into shopping vouchers, as reward for taking part in surveys.

2. Recent buyers of air conditioners and heaters

Respondents of the general public were asked whether they purchased a (reversible) air conditioner or heater in the past three years. It was emphasized that the question related to appliances for heating or cooling a room, and not to central heating or cooling systems or devices that circulate air without cooling it (fans). Averaged across the selected countries, 10,6% of the respondents indicated to have purchased an air conditioner, 10,6% a reversible air conditioner, and 12,6% a heater. Table 2.1 shows the percentages per country.

Table 2.1. Have your purchased an air conditioner or heater in the past three years?

	Total	DE	IT	FR	ES	RO	SE
Air conditioner	10,6%	4,3%	15,1%	8,5%	10,3%	16,2%	9,0%
Reversible air conditioner	10,6%	3,2%	18,9%	6,4%	14,1%	14,2%	6,5%
Heater	12,6%	5,6%	8,6%	9,5%	22,9%	19,4%	9,3%
(Reversible) air conditioner and heater	4,1%	2,9%	4,2%	1,2%	5,0%	5,8%	5,5%
N	7270	1202	1215	1214	1203	1220	1216

2.1. Air conditioners

Of the respondents who bought an air conditioner in the past three years, about two third bought a fixed air conditioner and a third bought a portable one, on average (see Table 2.2). Romanian, Italian and Spanish respondents frequently bought a fixed air conditioner (Figure 2.1). For German, French and Swedish respondents, the distribution is more or less equal. However, when respondents were asked which specific type of air conditioner they bought – a fixed (multi-)split or double duct air conditioner, or a portable single duct air conditioner – more respondents indicated to have bought a fixed air conditioner (see Table 2.3). Thus, despite the information that respondents received in the questionnaire on the differences between the different types of appliances (including pictures of example products), it seemed quite difficult for respondents to indicate what type of appliance they had purchased. In Italy, Spain and Romania, most respondents reported to have bought a (multi-)split air conditioner. In Germany, France and Sweden, single duct air conditioners are bought relatively frequently.

Table 2.2. Did you buy a fixed or portable air conditioner?

	Total	DE	IT	FR	ES	RO	SE
Fixed air conditioner	67,4%	45,2%	80,8%	46,2%	65,5%	81,2%	48,6%
Portable air conditioner	31,0%	50,8%	17,5%	51,3%	34,2%	17,7%	49,0%
N	1836	126	464	195	354	442	255

Figure 2.1. Did you buy a fixed or portable air conditioner?

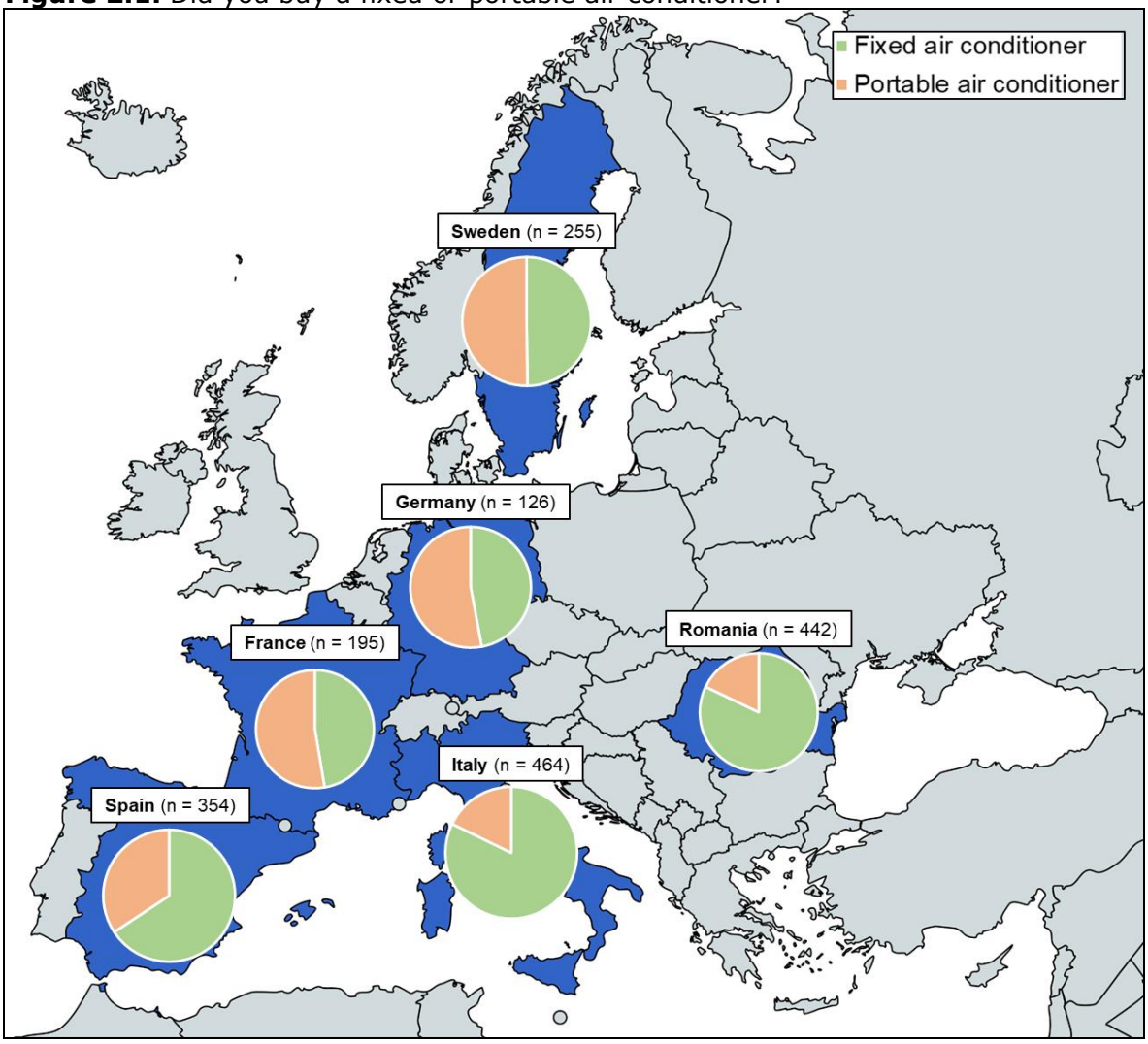


Table 2.3. What type of air conditioner did you buy?

	Total	DE	IT	FR	ES	RO	SE
Fixed (multi-) split air conditioner	48,6%	31,0%	62,9%	31,8%	52,5%	52,7%	31,8%
Fixed double duct air conditioner	19,7%	31,0%	17,0%	15,4%	16,7%	21,7%	22,8%
Portable single duct air conditioner	24,2%	31,0%	15,1%	39,5%	22,0%	21,3%	33,7%
Other	1,1%	0%	0,9%	3,6%	1,4%	0,5%	0,8%
I don't know/don't remember	6,4%	7,1%	4,1%	9,7%	7,3%	3,9%	11,0%
N	1836	126	464	195	354	442	255

When choosing which air conditioner to buy, about half of the respondents did not consider other types of air conditioners than the type they bought (see Table 2.4). For respondents who bought a split air conditioner, the three main reasons for not considering other types of appliances are (1) that other types of air conditioners had a

low energy efficiency or high energy consumption (31,8%), that other types of air conditioners were not proposed to them by their installer (25,9%), and that other types were more expensive (24,0%; see Table 2.5). This last reason was the most important reason for buyers of double duct air conditioners not to consider other types (35,6%), followed by the perception that other appliance types are less efficient or more energy consuming (26,7%). Furthermore, and not surprisingly, higher purchase prices (45,7%) and the fact that other appliance types are not portable (33,2%) or could not be installed (e.g. due to practical or legal constraints; 29,2%) were the most important reasons for buyers of portable air conditioners for not considering other product types.

Table 2.4. Did you also consider other types of air conditioners?

	Total	DE	IT	FR	ES	RO	SE
No	51,1%	54,7%	57,1%	68,8%	53,7%	37,4%	45,8%
Yes	39,9%	41,0%	33,3%	22,7%	37,8%	52,5%	44,9%
I don't know/don't remember	9,0%	4,3%	9,7%	8,5%	8,5%	10,1%	9,3%
N	1718	117	445	176	328	425	227

Table 2.5. Why did you *not* consider other types of air conditioners?

Other types of air conditioners…	Total	Type of air conditioner purchased		
		Fixed (multi-) split air conditioner	Fixed double duct air conditioner	Portable single duct air conditioner
were expensive	30,9%	24,0%	**35,6%**	**45,7%**
were noisy	17,9%	19,5%	21,9%	11,1%
had an unattractive design	11,4%	11,7%	18,5%	6,0%
had a low energy efficiency/high energy consumption	25,6%	**31,8%**	26,7%	9,6%
were not proposed to me by my installer	19,0%	25,9%	17,8%	2,5%
could not be installed (e.g. due to legal or practical issues)	19,0%	16,1%	15,8%	29,2%
were not portable	9,3%	0,8%	7,5%	**33,2%**
Other	6,0%	6,3%	1,4%	8,0%
I don't know/don't remember	6,5%	7,1%	4,1%	6,0%
N	878	522	146	199

About 4 in 10 respondents did consider other types of air conditioners (Table 2.4). For instance, of the respondents who eventually bought a split or multi-split air conditioner but considered other product types, 53,0% also considered buying a double duct air conditioner and 44,9% also considered buying a single duct air conditioner (see Table 2.6). And, of the respondents who purchased a portable air conditioner but considered other types of appliances, 61,7% also considered buying a (multi-)split air conditioner and 43,0% also considered buying a double duct air conditioner.

Table 2.6. What other types of air conditioners did you consider?

	Other type(s) of air conditioners considered			
Type of air conditioner purchased:	Fixed (multi-) split air conditioner	Fixed double duct air conditioner	Portable single duct air conditioner	N
Fixed (multi-) split air conditioner	(34,7%)	53,0%	44,9%	285
Fixed double duct air conditioner	51,6%	(48,4%)	30,4%	184
Portable single duct air conditioner	61,7%	43,0%	(17,6%)	193

Table 2.7 shows the main reasons for buying the type of air conditioner that respondents bought. The most important reason for buying a fixed air conditioner is the high energy efficiency/low energy consumption: 52,5% of buyers of (multi-)split air conditioners and 40,7% of buyers of double duct air conditioners considered this the most important reason. Portable air conditioners were mainly chosen because they are portable (53,4%) and less expensive (40,8%).

Table 2.7. What were the main reason(s) for choosing the type of air conditioner that you bought?

This type of air conditioner…	Total	Type of air conditioner purchased		
		Fixed (multi-) split air conditioner	Fixed double duct air conditioner	Portable single duct air conditioner
was inexpensive	32,4%	27,6%	34,4%	**40,8%**
was quiet	34,2%	39,0%	31,6%	27,0%
had an attractive design	17,2%	18,7%	21,3%	11,0%
had a high energy efficiency/low energy consumption	42,6%	**52,5%**	**40,7%**	25,0%
was advised to me by my installer	28,1%	36,8%	29,4%	9,9%
was the only type of appliance that could be installed (e.g. due to legal or practical constraints)	16,4%	13,7%	17,7%	20,5%
was portable	16,9%	2,2%	7,5%	**53,4%**
Other	2,1%	2,2%	0,6%	2,7%
I don’t know/don’t remember	0,9%	0,3%	1,1%	1,8%
N	1718	893	361	444

2.2. Space heaters

Of the respondents who bought a heater in the past three years, about 3 in 10 bought a fixed heater and about 7 in 10 a portable heater (see Table 2.8). Only French respondents more frequently bought a fixed heater (56,4%) than a portable one (42,1%, see Table 2.8 and Figure 2.2). Most respondents bought a portable electric heater (52,2%; see Table 2.9). As regards fixed appliances, solid fuel heaters are

purchased relatively frequently by Italian (15,8%) and French respondents (14,3%), gas heaters by Romanian respondents (10,7%), and heat pumps by Swedish respondents (12,2%). Figure 2.2 shows the results, broken down by fuel based versus electricity based fixed and portable heaters, per country.

Table 2.8. Did you buy a fixed or portable heater?

	Total	DE	IT	FR	ES	RO	SE
Fixed heater	29,9%	26,2%	40,3%	56,4%	12,7%	30,7%	36,0%
Portable heater	68,1%	64,3%	58,3%	42,1%	87,0%	68,3%	59,8%
N	1143	84	139	126	330	300	164

Figure 2.2. What type of heater did you buy?

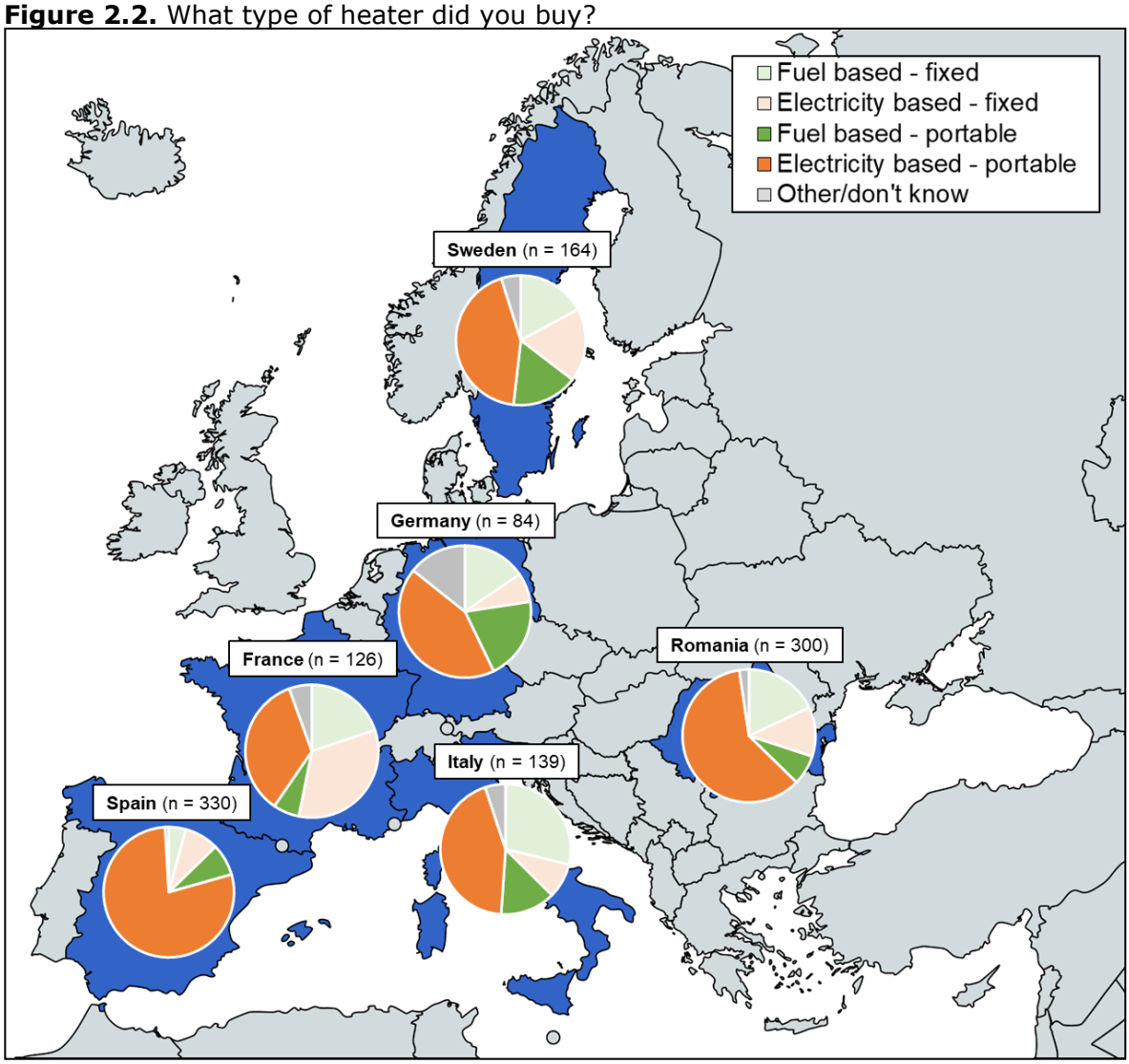


Table 2.9. What type of heater did you buy?

		Total	DE	IT	FR	ES	RO	SE
Solid fuel heater (e.g. wood stove, pellet stove)	Fixed	7,2%	6,0%	**15,8%**	**14,3%**	1,8%	6,7%	6,7%
	Portable	2,5%	6,0%	2,2%	1,6%	1,8%	3,0%	1,8%
Liquid fuel heater (e.g. ethanol heater, kerosene heater)	Fixed	2,2%	2,4%	5,0%	0,0%	0,3%	0,7%	7,9%
	Portable	3,3%	8,3%	4,3%	2,4%	1,5%	1,3%	7,9%
Gas heater	Fixed	5,9%	7,1%	7,9%	5,6%	2,1%	**10,7%**	2,4%
	Portable	4,6%	6,0%	7,2%	2,4%	4,6%	3,0%	6,7%
Air-to-air heat pump	Fixed	3,3%	1,2%	3,6%	4,8%	1,2%	0,7%	**12,2%**
	Portable	4,8%	2,4%	5,0%	2,4%	7,9%	2,7%	5,5%
Electric heater	Fixed	**10,2%**	6,0%	5,0%	**28,6%**	7,3%	**11,3%**	6,1%
	Portable	**52,2%**	**40,5%**	**38,9%**	**32,5%**	**70,6%**	**57,7%**	**37,8%**
Other/don't know		3,9%	14,3%	5,0%	5,6%	0,9%	2,3%	4,9%
N		1143	84	139	126	330	300	164

When choosing which heater to buy, 47,0% of the respondents did not consider other types of heaters than the type they bought (see Table 2.10 and Figure 2.3). This percentage did not depend on whether respondents bought a fixed or portable heater (Table 2.10). The main reason for buyers of fixed heaters to *not* consider other types of heaters is that other heaters could not be installed (e.g. due to practical of legal constraints; 30,4%, see Table 2.11). For buyers of portable heaters, the main reasons for not considering other types of heaters were that other types of heaters were not portable (48,9%) and/or relatively expensive (35,4%; see Table 2.11).

Table 2.10. Did you also consider other types of heaters?

		Total	DE	IT	FR	ES	RO	SE
Total	No	47,0%	50,0%	42,7%	65,1%	55,3%	33,8%	42,7%
	Yes	43,7%	43,8%	47,1%	30,2%	34,0%	57,5%	45,1%
	I don't know/don't remember	9,4%	6,3%	10,3%	4,8%	10,6%	8,7%	12,2%
	N	1134	80	136	126	329	299	164
Respondents who bought a *fixed* heater	No	46,9%	40,0%	44,4%	63,4%	59,5%	30,8%	47,5%
	Yes	45,4%	50,0%	42,6%	33,8%	33,3%	61,5%	44,1%
	I don't know/don't remember	7,7%	10,0%	13,0%	2,8%	7,1%	7,7%	8,5%
	N	337	20	54	71	42	91	59
Respondents who bought a *portable* heater	No	46,7%	49,1%	42,5%	66,0%	54,9%	34,6%	39,8%
	Yes	43,4%	45,3%	48,8%	26,4%	34,3%	56,6%	45,9%
	I don't know/don't remember	9,9%	5,7%	8,8%	7,6%	10,8%	8,8%	14,3%
	N	775	53	80	53	286	205	98

Figure 2.3. Did you also consider other types of heaters? (total)

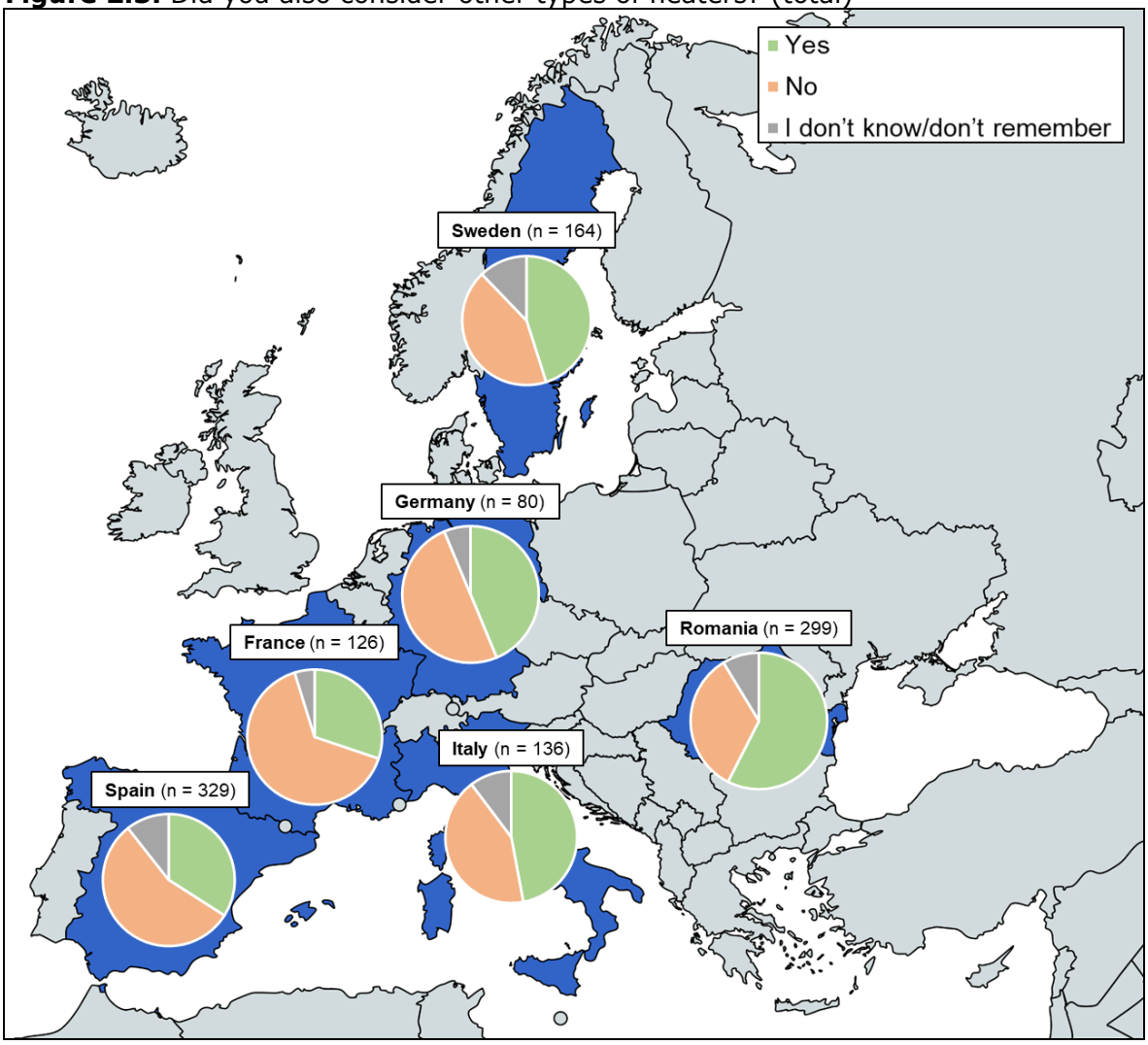


Table 2.11. Why did you *not* consider other types of heaters?

Other types of heaters…	Total	Type of heater purchased		Type of heater purchased (fixed or portable)				
		Fixed	Portable	Solid fuel heater	Liquid fuel heater	Gas heater	Air-to-air heat pump	Electric heater
were expensive	33,0%	26,6%	**35,4%**	**28,6%**	29,4%	**32,6%**	**26,7%**	**35,1%**
were noisy	9,9%	10,1%	9,9%	14,3%	35,3%	6,5%	15,6%	8,0%
had an unattractive design	6,4%	9,5%	5,0%	10,7%	35,3%	4,4%	15,6%	3,6%
had a low energy efficiency/high energy consumption	11,1%	23,4%	5,5%	23,2%	**41,2%**	15,2%	17,8%	6,4%
were not proposed to me by my installer	7,1%	13,3%	4,1%	14,3%	11,8%	23,9%	8,9%	3,6%
could not be installed (e.g. due to legal or practical issues)	19,9%	**30,4%**	15,2%	25,0%	11,8%	**32,6%**	15,6%	18,5%

Other types of heaters…	Total	Type of heater purchased		Type of heater purchased (fixed or portable)				
		Fixed	Portable	Solid fuel heater	Liquid fuel heater	Gas heater	Air-to-air heat pump	Electric heater
were not portable	33,2%	0,0%	**48,9%**	1,8%	11,8%	4,4%	**26,7%**	**44,2%**
Other	14,1%	19,0%	12,2%	25,0%	0,0%	4,4%	13,3%	13,8%
I don't know/don't remember	5,4%	3,2%	5,8%	7,1%	0,0%	8,7%	0,0%	5,5%
N	533	158	362	56	17	46	45	362

On average, 43,7% of the respondents reported that they did consider buying other types of heaters. Gas heaters, heat pumps and electric heaters seem to be considered together relatively often (see Figure 2.4). Furthermore, consumers who considered multiple types of appliances but eventually bought a solid fuel heater, relatively frequently also considered buying a gas heater, and consumers who eventually bought a liquid fuel heater, relatively frequently also considered buying a solid fuel heater and/or a gas heater (Figure 2.4). Note, however, that the number of observations is low (e.g. overall, only 64 respondents bought a liquid fuel heater, and only 41 of these respondents indicated that they considered other types of heaters).

Figure 2.4. What other types of heaters did you consider? (split by type purchased)

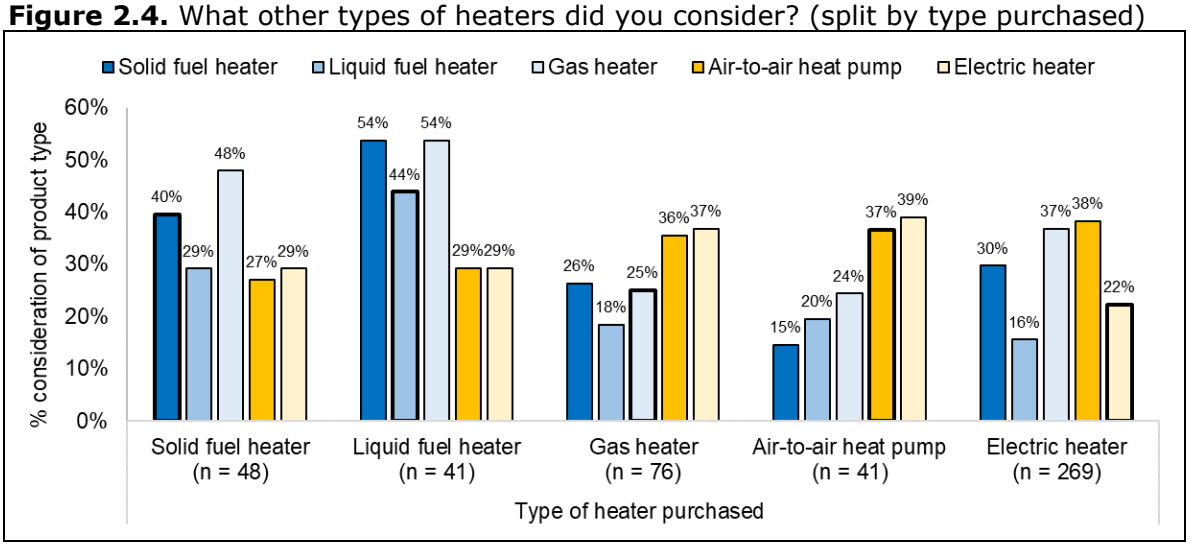


Table 2.12 shows the main reasons for choosing the type of heaters that respondents purchased. For respondents who purchased a fixed heater, the higher energy efficiency or low energy consumption of the appliance was the main reason for their choice of heater (38,9%). Respondents who bought a portable heater report the portability (62,3%) and low purchase price (55,4%) as the main reasons for their product choice (see Table 2.12).

Solid (and liquid) fuel heaters are mainly bought because of their higher energy efficiency or lower energy consumption relative to other types of heaters that the respondent considered buying. The main reasons for buying an electric heater are the lower purchase costs (57,9%) and portability (58,9%). Buyers of heat pumps and gas

heaters also relatively frequently report the lower purchase price to be among the main reasons for their choice (36,4% and 37,0%, respectively). As expected, the lower purchase price appeared a decisive factor much more for respondents who bought a portable heat pump (49,1%) or gas heater (47,2%) than for respondents who bought a fixed heat pump (21,1%) or gas heater (28,4%).

Table 2.12. What were the main reason(s) for choosing the type of heater that you bought?

This type of heater…	Total	Type of heater purchased		Type of heater purchased (fixed or portable)				
		Fixed	Portable	Solid fuel heater	Liquid fuel heater	Gas heater	Air-to-air heat pump	Electric heater
was inexpensive	48,2%	**32,3%**	**55,4%**	24,8%	26,6%	**36,4%**	**37,0%**	**57,9%**
was quiet	29,5%	23,2%	32,5%	19,5%	26,6%	23,3%	19,0%	34,0%
had an attractive design	14,5%	23,2%	10,8%	29,2%	29,7%	14,0%	14,0%	11,1%
had a high energy efficiency/low energy consumption	25,4%	**38,9%**	19,9%	**43,4%**	**34,4%**	32,6%	27,0%	19,7%
was advised to me by my installer	12,3%	24,6%	6,3%	26,6%	21,9%	27,1%	22,0%	5,2%
was the only type of appliance that could be installed (e.g. due to legal or practical constraints)	18,1%	26,4%	14,2%	28,3%	31,3%	21,7%	21,0%	14,4%
was portable	42,6%	0,0%	**62,3%**	3,5%	21,9%	14,0%	24,0%	**58,9%**
Other	3,1%	5,6%	2,1%	8,9%	1,6%	0,8%	2,0%	2,7%
I don’t know/don’t remember	1,0%	0,9%	0,8%	0,0%	0,0%	1,6%	2,0%	1,0%
N	1134	337	775	113	64	129	100	715

3. Prospective buyers of air conditioners and heaters

In each Member State, approximately 200 consumers (1200 in total) who indicated that they intended to buy an air conditioner or heater in the coming 12 months received follow-up questions regarding their intended use of the appliance and their decision-making process.

3.1. Air conditioners

About 6 in 10 respondents in the prospective buyer sample plan to buy a fixed air conditioner – from 39,0% in Germany to 81,3% in Italy – and about 3 in 10 respondent plan to buy a portable air conditioner (the remainder of respondents doesn't know yet; see Table 3.1). These findings are largely in line with the buying behaviour in the recent buyer sample (see Table 3.1).

Table 3.1. Comparison of recent and prospective buyers: air conditioners

		Total	DE	IT	FR	ES	RO	SE
Do you intend to buy a fixed or portable air conditioner? *(prospective buyers)*	Fixed air conditioner	61,0%	39,0%	81,3%	50,5%	62,6%	77,5%	54,4%
	Portable air conditioner	30,7%	52,0%	13,8%	38,0%	28,1%	17,2%	35,8%
	I don't know (yet)	8,3%	9,0%	4,9%	11,5%	9,4%	5,4%	9,8%
	N	1214	200	203	200	203	204	204
Did you buy a fixed or portable air conditioner? *(recent buyers)*	Fixed air conditioner	67,4%	45,2%	80,8%	46,2%	65,5%	81,2%	48,6%
	Portable air conditioner	31,0%	50,8%	17,5%	51,3%	34,2%	17,7%	49,0%
	N	1836	126	464	195	354	442	255

On average, slightly less than half of the prospective buyers of air conditioners plans to buy the air conditioner as a replacement (47,2%, see Table 3.2). This percentage ranges from 33,3% in Sweden to 70,9% in Spain. When the air conditioner is bought as a replacement, consumers generally are more likely to already know what type of air conditioner – fixed or portable – they will buy (see Table 3.3).

Table 3.2. Do you intend to buy it to replace an air conditioner you currently own?

	Total	DE	IT	FR	ES	RO	SE
Yes	47,2%	40,0%	52,2%	39,0%	70,9%	47,6%	33,3%
No	51,0%	59,0%	45,3%	59,5%	26,1%	51,5%	64,7%
I don't know	1,8%	1,0%	2,5%	1,5%	3,0%	1,0%	2,0%
N	1214	200	203	200	203	204	204

Table 3.3. Do you intend to buy a fixed or portable air conditioner?

		Total	DE	IT	FR	ES	RO	SE
Air conditioner bought as a replacement	A fixed air conditioner	68,9%	51,3%	88,7%	60,3%	67,4%	78,4%	58,8%
	A portable air conditioner	26,0%	45,0%	8,5%	37,2%	25,7%	19,6%	27,9%
	I don't know (yet)	5,1%	3,8%	2,8%	2,6%	6,9%	2,1%	13,2%
	N	573	80	106	78	144	97	68
Air conditioner *not* bought as a replacement	A fixed air conditioner	54,4%	31,4%	73,9%	43,7%	56,6%	77,1%	52,3%
	A portable air conditioner	34,4%	55,9%	19,6%	39,5%	26,4%	14,3%	40,2%
	I don't know (yet)	11,1%	12,7%	6,5%	16,8%	17,0%	8,6%	7,6%
	N	619	118	92	119	53	105	132

22,0% of all prospective buyers reported to already know which specific type of air conditioner to buy. Most of these respondents plan to buy a fixed (multi-)split air conditioner (58,1%; see Table 3.4, bottom part). A much larger group of prospective buyers is still considering different types of air conditioners (51,2% of all prospective buyers). Split air conditioners are considered most frequently (58,8%), particularly in Romania (71,9%) and Italy (66,1%). A substantial group of respondents (also) considers buying a portable air conditioner (41,2%, on average), particularly in Germany (59,1%) and France (49,2%; see Table 3.4, middle part).

Table 3.4. Do you already know which specific type of air conditioner you will buy?

	Total	DE	IT	FR	ES	RO	SE
No, I have no idea yet	26,8%	41,0%	23,2%	36,0%	19,2%	22,6%	19,1%
No I'm still considering different types of air conditioners	51,2%	44,0%	62,6%	29,5%	53,7%	62,8%	54,4%
Fixed (multi-)split*	58,8%	53,4%	66,1%	42,4%	59,6%	71,9%	47,7%
Fixed double duct	34,9%	38,6%	38,6%	35,6%	40,4%	32,8%	24,3%
Portable single duct	41,2%	59,1%	29,1%	49,2%	48,6%	35,2%	36,0%
Yes	22,0%	15,0%	14,3%	34,5%	27,1%	14,7%	26,5%
Fixed (multi-)split**	58,1%	40,0%	82,8%	58,0%	50,9%	60,0%	61,1%
Fixed double duct	19,9%	33,3%	10,3%	14,5%	29,1%	23,3%	13,0%
Portable single duct	21,0%	26,7%	6,9%	26,1%	18,2%	16,7%	24,1%
Other	1,1%	0,0%	0,0%	1,5%	1,8%	0,0%	1,9%
N	1214	200	203	200	203	204	204

* Percentage of respondents who indicate that they are seriously considering this type of air conditioner (base = respondents who are still considering different types of air conditioners). ** Percentage of respondents who indicate that they will buy this type of air conditioner (base = respondents who already know which specific type of air conditioners they will buy).

To gain insight into the perceived importance of energy efficiency vis-à-vis other aspects in purchase decisions, prospective buyers of air conditioners were presented with the two choice options in Figure 3.1 and asked which of the two air conditioners

they would most likely choose. The differences between the two air conditioners were explained to them.[15] 75,8% of the prospective buyers would most likely choose the split air conditioner (air conditioner 2), 15,3% would most likely choose the double duct air conditioner (air conditioner 1), and 8,9% didn't know which product they would choose. For most respondents, the higher energy efficiency/lower energy consumption was the main reason for choosing the split air conditioner (59,1%; see Table 3.5).

Figure 3.1. Hypothetical choice task: choice options

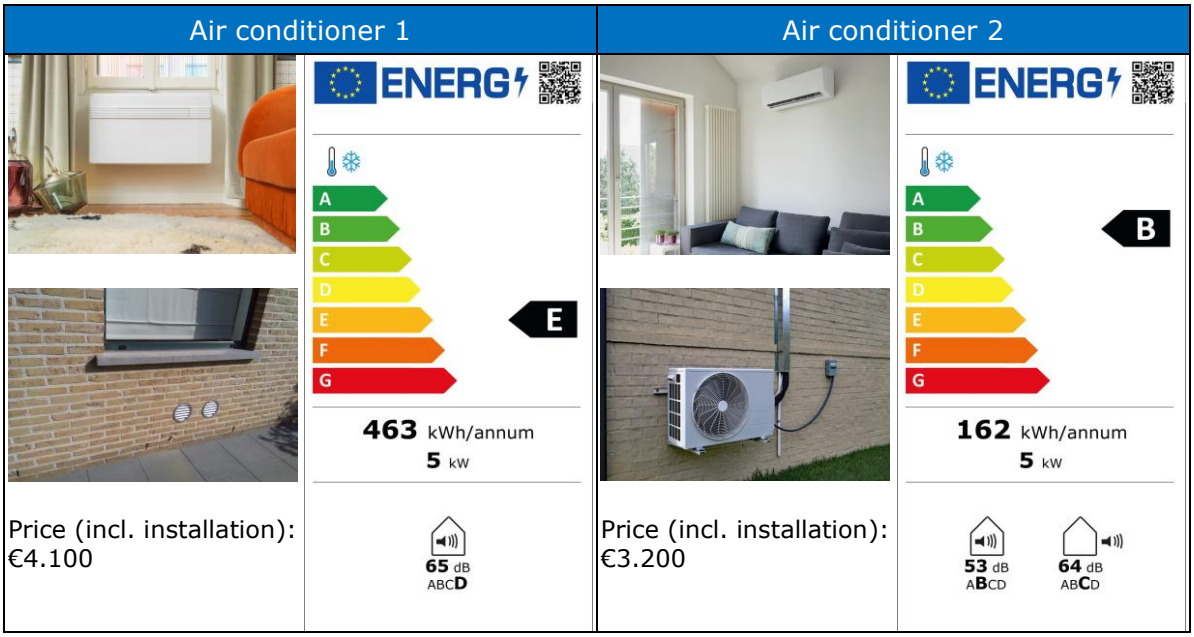


Table 3.5. Most important reason for choosing the split air conditioner

	% of prospective buyers who would choose the split air conditioner (N = 460)	% of all prospective buyers (N = 607)
Less expensive	32,6%	24,7%
Less indoor noise	33,3%	25,2%
Higher energy efficiency/lower energy consumption	78,0%	59,1%

Respondents could select multiple reasons (percentages do not add up to 100%).

3.2. Space heaters

On average, about half of the prospective buyers (50,7%) intend to buy a fixed heater, 42,2% a portable heater, and 7,1% doesn't know yet (see Table 3.6). The percentages strongly differ across countries. For instance, 76,6% of the French respondents plan to buy a fixed heater, compared to only 26,5% of Spanish respondents. These figures deviate from the actual purchase behaviour of recent

[15] Respondents read: "*As you can see, air conditioner 1 has no outdoor unit while air conditioner 2 does have an outdoor unit. However, air conditioner 1 is also more expensive, makes more noise inside your house, and has a lower energy efficiency*".

buyers (as descibed in Chapter 2). While, overall, slightly more prospective buyers report to be planning to buy a fixed (rather than a portable) heating appliance, the majority of recent buyers bought a portable heater (see Table 3.6). A potential explanation for this difference is that the purchase of portable heating appliances is more likely to be a spontaneous purchase: Consumers may be less likely to plan this purchase months in advance.

Table 3.6. Comparison of recent and prospective buyers: heaters

		Total	DE	IT	FR	ES	RO	SE
Do you intend to buy a fixed or portable heater? *(prospective buyers)*	A fixed heater	50,7%	45,0%	59,0%	76,6%	26,5%	45,8%	51,0%
	A portable heater	42,2%	47,0%	36,0%	19,9%	63,0%	47,8%	39,7%
	I don't know (yet)	7,1%	8,0%	5,0%	3,5%	10,5%	6,4%	9,3%
	N	1208	200	200	201	200	203	204
Did you buy a fixed or portable heater? *(recent buyers)*	Fixed heater	29,9%	26,2%	40,3%	56,4%	12,7%	30,7%	36,0%
	Portable heater	68,1%	64,3%	58,3%	42,1%	87,0%	68,3%	59,8%
	N	1143	84	139	126	330	300	164

About a third of the prospective buyers of heaters intend to use the heater as main heating and about two third as additional heating (see Table 3.7, bottom part). The majority of respondents who intend to buy a portable heater will use it as additional heating. Compared to portable heating appliances, fixed heaters are more frequently bought as main heating (see Table 3.7, top part).

Table 3.7. Do you intend to use that heater as main or additional heating?

		Total	DE	IT	FR	ES	RO	SE
Consumers with intention to buy a *fixed* heater	As main heating	43,1%	34,4%	42,4%	55,8%	56,6%	43,0%	26,0%
	As additional heating	55,6%	64,4%	55,1%	43,5%	43,4%	54,8%	73,1%
	I don't know	1,3%	1,1%	2,5%	0,7%	0,0%	2,2%	1,0%
	N	612	90	118	154	53	93	104
Consumers with intention to buy a *portable* heater	As main heating	15,1%	7,5%	13,9%	15,0%	16,7%	13,4%	24,7%
	As additional heating	84,1%	91,5%	86,1%	85,0%	81,7%	86,6%	74,1%
	I don't know	0,8%	1,1%	0,0%	0,0%	1,6%	0,0%	1,2%
	N	510	94	72	40	126	97	81
Total	As main heating	30,2%	20,5%	32,0%	47,3%	29,5%	27,6%	24,5%
	As additional heating	68,0%	76,0%	66,5%	51,7%	68,5%	70,4%	74,5%
	I don't know	1,8%	3,5%	1,5%	1,0%	2,0%	2,0%	1,0%
	N	1208	200	200	201	200	203	204

For about 4 in 10 respondents, the heater is bought to replace a heater that they currently own (e.g. because it is broken; see Table 3.8). Of the respondents who intend to buy a heater to replace a heater that they currently own, about 6 in 10 plan to buy a fixed heater and 3 in 10 a portable one (see Table 3.9). Respondents who do

not buy the heater as a replacement are slightly more likely to buy a portable heater (50,3%) than a fixed heater (43,2%). However, there are substantial differences across countries (see Table 3.9).

Table 3.8. Do you intend to buy it to replace a heater you currently own?

	Total	DE	IT	FR	ES	RO	SE
Yes	42,5%	35,0%	45,0%	60,7%	45,0%	39,4%	29,9%
No	54,5%	61,5%	51,0%	35,8%	51,0%	58,1%	69,1%
I don't know	3,1%	3,5%	4,0%	3,5%	4,0%	2,5%	1,0%
N	1208	200	200	201	200	203	204

Table 3.9. Do you intend to buy a fixed or portable heater?

		Total	DE	IT	FR	ES	RO	SE
Heater bought as a replacement	A fixed heater	62,0%	61,4%	70,0%	84,4%	28,9%	61,3%	55,7%
	A portable heater	31,6%	31,4%	23,3%	12,3%	60,0%	32,5%	39,3%
	I don't know (yet)	6,4%	7,1%	6,7%	3,3%	11,1%	6,3%	4,9%
	N	513	70	90	122	90	80	61
Heater *not* bought as a replacement	A fixed heater	43,2%	37,4%	50,0%	68,1%	25,5%	35,6%	49,7%
	A portable heater	50,3%	55,3%	46,1%	30,6%	66,7%	59,3%	39,7%
	I don't know (yet)	6,5%	7,3%	3,9%	1,4%	7,8%	5,1%	10,6%
	N	658	123	102	72	102	118	141

Table 3.10. Do you already know which specific type of heater you will buy? – fixed heaters

Do you intend to buy a fixed or portable heater?	Do you already know which specific type of heater you will buy?	Total	DE	IT	FR	ES	RO	SE
A fixed heater	No, I have no idea yet	14,7%	40,0%	9,3%	13,6%	9,4%	12,9%	4,8%
	No, I'm still considering different types of heaters	40,7%	31,1%	58,5%	23,4%	49,1%	47,3%	44,2%
	Yes	44,6%	28,9%	32,2%	63,0%	41,5%	39,8%	51,0%
	N	612	90	118	154	53	93	104

Respondents who plan to buy a fixed heater, but are still considering different types of heaters (fuel based = solid fuel heater, liquid fuel heater or gas heater; electricity based = air-to-air heat pump or electric heater). The country-specific results should be interpreted with caution; the number of observations is low.

Now, we zoom in on the group of respondents who intend to buy a *fixed* heater. On average, 44,6% of the prospective buyers of fixed heaters report that they already know which specific heater they will buy, 40,7% indicate that they are still considering different types of heaters, and 14,7% have no idea yet (see Table 3.10). Most of the respondents who already know what type of appliance they want to buy plan to buy

an fuel based heater (57,2%; see Table 3.11).[16] Most of the respondents who are considering different types of heaters are considering both fuel based and electricity based technologies (44,0% on average; see Table 3.12). Only in Sweden, most respondents consider only electricity based heating appliances (56,1%; Table 3.12).

Table 3.11. Do you already know which specific type of heater you will buy? – fixed heaters

Do you intend to buy a fixed or portable heater?	Type of heater	Total	DE	IT	FR	ES	RO	SE
A fixed heater	Fuel based	57,2%	80,8%	60,5%	51,5%	63,6%	59,5%	49,1%
	Electricity based	41,0%	15,4%	39,5%	47,4%	36,4%	40,5%	45,3%
	Other	1,8%	3,9%	0,0%	1,0%	0,0%	0,0%	5,7%
	N	273	26	38	97	22	37	53

Respondents who plan to buy a fixed heater and already know which specific type of heater they will buy (fuel based = solid fuel heater, liquid fuel heater or gas heater; electricity based = air-to-air heat pump or electric heater). The country-specific results should be interpreted with caution; the number of observations is low.

Table 3.12. Which types of heaters are you *considering*? – fixed heaters

Do you intend to buy a fixed or portable heater?	Type of heater	Total	DE	IT	FR	ES	RO	SE
A fixed heater	Fuel based only	22,4%	30,8%	11,7%	25,8%	17,4%	23,8%	31,7%
	Electricity based only	33,6%	15,4%	25,0%	35,5%	39,1%	31,0%	56,1%
	Both	44,0%	53,9%	63,3%	38,7%	43,5%	45,2%	12,2%
	N	223	26	60	31	23	42	41

Respondents who plan to buy a fixed heater, but are still considering different types of heaters (fuel based = solid fuel heater, liquid fuel heater or gas heater; electricity based = air-to-air heat pump or electric heater). The country-specific results should be interpreted with caution; the number of observations is low.

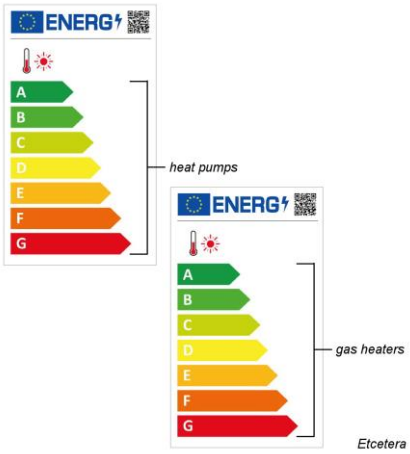
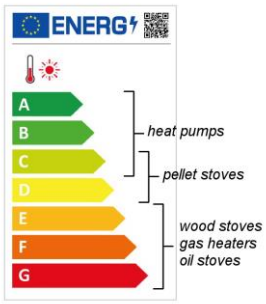
3.3. Preferences for energy labels with separate vs. combined scales

The next chapter describes the results of a choice experiment that was performed to gain insight into the effect of energy labels with combined versus separate energy efficiency scales for different types of appliances on consumers' choice behaviour. In the questionnaire, we also asked prospective buyers directly which type of energy label they would prefer: a label with separate scales for different types of appliances or a label with a combined scale. The two options were carefully explained first (textually and visually; see Figure 3.2). Respondents who indicated that they understood what the two options meant (76,8% of all prospective buyers) were subsequently asked to indicate their preference. Most of these respondents – 45,2% -

[16] More specifically, 48,0% (N = 131) plans to buy a solid fuel heater, 3,3% (N = 9) a liquid fuel heater and 5,9% (N = 16) a gas heater.

preferred energy labels with a combined scale (see Table 3.9). A smaller group had a preference for energy labels with separate scales (36,4%).[17]

Figure 3.2. Description of label options in survey (example for heaters)

	Option 1: Energy efficiency of different types of heaters is expressed on <u>different</u> energy efficiency scales	**Option 2**: Energy efficiency of different types of heaters is expressed on the <u>same</u> energy efficiency scale
What does this mean?	Each type of heater (e.g. heat pumps, gas heaters, wood stoves) has its own scale from A to G. Within each type, the most energy efficient appliances fall in class A, while the least energy efficient appliances fall in class G. 	On a scale from A to G, more energy efficient *types* of heaters (e.g. heat pumps) fall in the top classes, while less energy efficient types of heaters (e.g. wood stoves, gas heaters) fall in the bottom classes. 
Which appliances can you compare?	You can compare the energy efficiency class of heaters of the same type, that is, heat pumps with heat pumps, gas heaters with gas heaters, etcetera.	You can compare the energy efficiency class of heaters of different types, such as heat pumps with gas heaters.
Which appliances can you not compare (well)?	You cannot compare the energy efficiency of heaters of different types. For instance, a gas heater with energy class A is <u>not</u> as efficient as a heat pump with energy class A.	You will have less information about the differences in energy efficiency of heaters of the same type (e.g. different heat pumps), because these will fall in the same energy classes.

[17] We also asked this group whether they would still prefer this option if an energy efficiency score (%) would be added to allow for more detailed comparisons of appliances of the same type (which are likely to fall into the same energy class). About a quarter of the respondents with a preference for separate scales (9,5% of the total) would change their preference to a combined scale in that case.

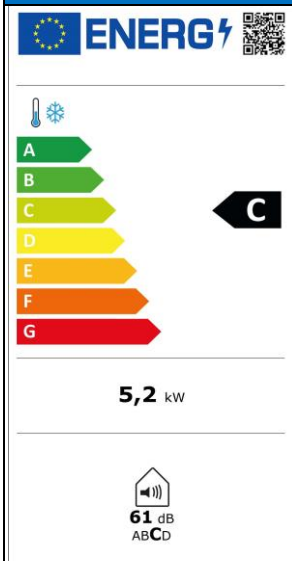
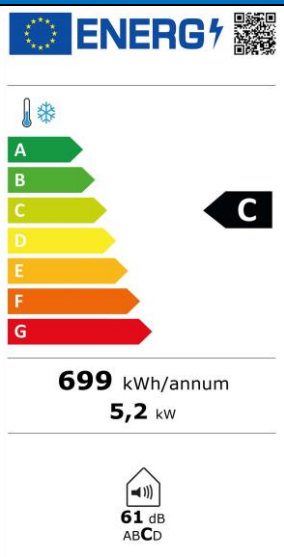
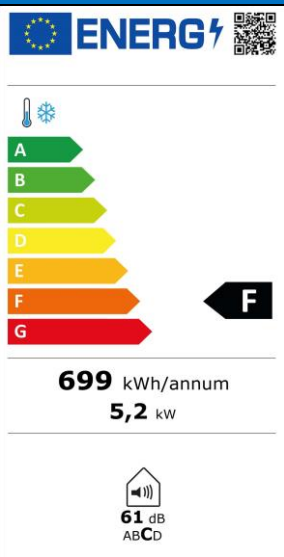
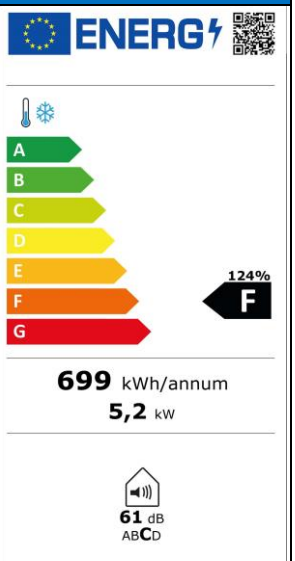
Table 3.10. Which of the two options would you prefer?

	Space heaters	Air conditioners	Total
Option 1: separate scales	35,8%	36,9%	36,4%
Option 2: combined scale	**46,1%**	**44,4%**	**45,2%**
I have no preference	12,5%	12,6%	12,5%
I (really) don't know	5,6%	6,2%	5,9%
N	935	924	1859

4. Choice experiment

An online experiment was performed to gain insight into consumers' choices for heating/cooling appliances, and whether and how these are influenced by the way energy efficiency information is displayed on the energy label. More specifically, the experiment aimed to test whether expressing the energy efficiency class of different types of appliances on the same efficiency scale is effective in steering consumers towards more efficient technologies. To this end, half of the respondents (randomly decided) made a choice from an assortment of appliances that carried energy labels with separate scales (the current situation) and half of the respondents made a choice from the same assortment of appliances that carried energy labels with combined scales.

Figure 4.1. Examples of labels used in the experiment (portable air conditioner)

Separate scales		Combined scale	
Group 1	Group 2	Group 3	Group 4
No information on energy consumption	Information on energy consumption	Information on energy consumption	Information on energy consumption and efficiency percentage
			

When looking for a heater or air conditioner, consumers are likely to be looking for an appliance with a certain heating or cooling output, depending on the size of the room that they want to heat or cool. In that case, providing information on the energy consumption of different appliances might be sufficient to guide consumers towards more efficient technologies. To test this, half of the respondents in the "separate scales" group (randomly decided) were presented with energy labels that displayed information on the energy consumption of the appliances (in kWh/annum) and the other half saw the same energy labels without such information (see Figure 4.1, group 1 versus group 2).

Furthermore, the drawback of combining scales is that all alternatives of the same product type will populate only a few classes of the entire scale, which impairs detailed comparisons of alternatives using the same technology. Adding seasonal space cooling energy efficiency and seasonal space heating energy efficiency values, which allow for fine-grained comparisons of products in terms of their energy efficiency, might solve this. To test the effectiveness of this solution, half of the respondents (randomly decided) who saw labels with combined scales were presented with energy labels that also displayed $\eta_{s,c}$ and $\eta_{s,h}$ values, while the other half saw the same energy labels without this information (see Figure 4.1, group 3 versus group 4).

Finally, appliances that use more efficient technologies tend to have higher purchase prices. Exposure to price information might therefore reduce the effectiveness of the energy label. Labels with combined (vs. separate) scales might encourage consumers to buy more efficient technologies, but consumers may nevertheless opt for a less efficient type of appliance if they receive information on the price differences between appliance types. Therefore, we also test to what extent inherently higher (purchase) prices of more efficient technologies reduce the effectiveness of labelling strategies that promote choice of more efficient technologies.

In summary, the experiment aims to answer the following questions:

1. Do consumers take into account the efficiency of different technologies?
2. How does the energy label best guide consumers towards more efficient technologies/alternatives?
3. (To what extent) do the higher upfront costs that are associated with more efficient technologies reduce the impact of informing them about efficiency differences between technologies via the energy label?

4.1. Experiment set-up

All subsamples took part in the choice experiment. In the general public sample, respondents were randomly assigned to either a scenario in which they were asked to imagine buying a heater or a scenario in which they were asked to imagine buying an air conditioner. The subsamples of prospective buyers read the scenario related to the product category they actually planned to purchase. They read that an appliance with a heating (or cooling) capacity of about 5 kW is sufficient to heat (or cool) the room, that there were no constraints regarding the type of heater (air conditioner) that they could install, and – in the heater scenario – that they had access to all energy sources (electricity, wood, and gas). The complete scenarios can be found in the questionnaire in Appendix A.

Next, respondents were presented with a set of nine appliances that use different technologies. For each technology, three alternatives were available (see Table 4.1). The products were presented with a product image, energy label, design rating and price information (if applicable, see below). Respondents were asked to indicate which type(s) of appliances they would *consider* buying, and which appliance they would most likely *choose* if they had to make a choice from this assortment. By asking both questions, we can analyse whether changes to the information on the label (1)

increase the likelihood that different, more efficient technologies are considered, and (2) improve the energy efficiency of final product choices.

Product sets

Table 4.1 and 4.2 provide an overview of characteristics of the nine products in the assortment. The tables show the energy efficiency class of each product in case the scales are kept separate (first row) versus combined (second row). To enhance realism, other product characteristics, such as the sound level and their visual attractiveness, also vary across the product alternatives. Note that while these aspects vary within a product set (as in reality), the product set is the same in each experimental group. Therefore, differences in these aspects cannot explain differences in choices between experimental groups (e.g. between the group that is exposed to energy labels with separate scales and the group that is exposed to energy labels with combined scales). The product sets were assembled such that:

- When efficiency scales are kept separate, the most efficient product within a certain technology can always be determined from the energy class (to mimic the greater degree of granularity in labels with separate scales);
- When efficiency scales are combined, the most efficient product across technologies can be determined by looking at the energy classes (e.g. heat pumps are in the highest efficiency classes). Here, realistic overlap occurs between the technologies (e.g. some gas heaters receive a higher class than some solid fuel heaters, whereas no local space heaters fall within the same energy class as heat pumps – though this may change in the future). This way, we can test whether the combined label promotes choice for more efficient technologies.
- From the labels with combined scales, it is never possible to determine the most efficient appliance *within* a technology just from looking at the energy class: there are always two appliances that have the highest class within a technology. This way, we examine whether providing more specific efficiency information ($\eta_{s,c}$ /$\eta_{s,h}$ values) steers towards more efficient products within technologies and hence, helps tackle the issue of reduced granularity.

Figure 4.2 provides an example of a choice set used in the experiment. Since the average consumer is unlikely to know which types of heaters or air conditioners are available and their differences, respondents received information to familiarize them with the different types of appliances. Short descriptions of each product type were provided above the product alternatives, and respondents could click on these to receive more information (see Figure 4.3). Finally, to control for order effects, the three product types were displayed in random order.

Table 4.1. Product set air conditioners: overview of product characteristics

	AC 1 (split)	AC 2 (split)	AC 3 (split)	AC 4 (double duct)	AC 5 (double duct)	AC 6 (double duct)	AC 7 (single duct)	AC 8 (single duct)	AC 9 (single duct)
Energy efficiency class (separate scales)	B	C	D	B	C	D	B	C	D
Energy efficiency class (combined scale)	B	B	C	E	E	F	F	F	G
Capacity (kW)	5.0	5.2	5.0	5.0	5.3	5.0	5.0	5.2	5.3
Energy consumption (kWh/annum)	162	188	244	463	535	595	641	699	748
$\eta_{s,c}$ (%)	515%	461%	348%	180%	165%	140%	130%	124%	118%
Indoor sound	53(B)	56(B)	48(B)	50 (B)	52(B)	60(C)	65(C)	61(C)	63(C)
Outdoor sound	64(C)	65(C)	58(C)	--	--	--	--	--	--
Aesthetics	7.2/10	7.4/10	7.0/10	8.5/10	8.7/10	8.3/10	8.4/10	8.5/10	8.2/10
Price (including installation)	€3.250	€3.150	€2.450	€4.130	€3.400	€2.670	€930	€885	€825

Table 4.2. Product set heating appliances: overview of product characteristics

	Heater 1 (heat pump)	Heater 2 (heat pump)	Heater 3 (heat pump)	Heater 4 (pellet stove)	Heater 5 (pellet stove)	Heater 6 (wood stove)	Heater 7 (gas fireplace)	Heater 8 (gas fireplace)	Heater 9 (gas fireplace)
Energy efficiency class (separate scales)	B	C	D	B	C	D	C	D	E
Energy efficiency class (combined scale)	B	B	C	D	D	E	E	E	F
Capacity (kW)	5.0	5.2	5.0	5.1	5.0	5.3	5.0	5.1	5.0
Energy consumption (kWh/annum)	1270	1500	1800	7950	9750	13750	8050	8950	10000
$\eta_{s,h}$ (%)	275%	233%	187%	130%	105%	78%	87%	80%	71%
Indoor sound	44(A)	48(B)	42(A)	--	--	--	--	--	--
Outdoor sound	53(B)	56(C)	50(B)	--	--	--	--	--	--
Aesthetics	7.5/10	7.6/10	7.2/10	8.4/10	8.6/10	8.3/10	8.7/10	8.8/10	8.4/10
Price (incl. installation)	€3.700	€2.700	€2.000	€2.099	€1.899	€1.155	€2.200	€1.700	€1.500

Experimental manipulations

Across experimental groups, we systematically varied the type of energy label that was presented and the presence of price information.

The energy labels presented in Figure 4.1 are for a portable single duct air conditioner (air conditioner 8 in Table 4.1), adapted to the new house style. The two labels on the left reflect the situation in which different product types have different efficiency scales. In that case, this portable air conditioner has energy efficiency class C. The two labels on the right reflect the situation in which the scales of the three different types of air conditioners – split, double duct and single duct air conditioners – are combined. In that case, this portable air conditioner has efficiency class F. Respondents in group 1 and 2 thus saw this portable air conditioner in the product assortment with energy efficiency class C, and respondents in group 3 and 4 saw the exact same portable air conditioner with class F.

Group 1	Group 2	Group 3	Group 4
Separate scales	Separate scales	Combined scale	Combined scale
No info on energy consumption	Info on energy consumption	Info on energy consumption	Info on energy consumption and efficiency percentage

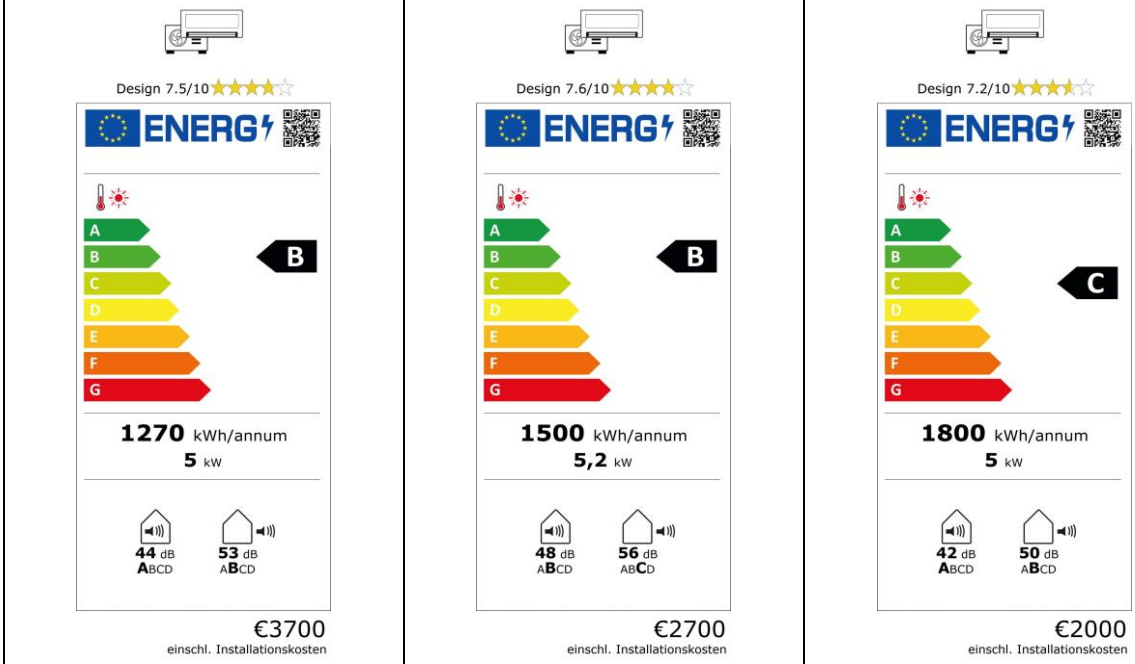
Group 1 is the control group. This group received information to identify energy efficient alternatives within a certain product group (e.g. heat pumps), but no information to identify more efficient technologies (i.e. no cross-category comparisons). Group 2 was exposed to the same energy labels as group 1, except for the fact that these labels now also displayed (comparable) information on the seasonal energy consumption of the different appliances (kWh/annum). Comparing the consideration sets and choices of group 2 with those of group 1 provides insight into whether adding energy consumption information to all labels is effective in guiding consumers towards more energy efficient technologies. Group 3 was presented with energy labels in which the efficiency of products with different technologies is expressed on the same efficiency scale (combined scale). In this group, the labels also included information on the seasonal energy consumption of the appliance. As such, the comparison of group 2 and 3 provides insight into the added benefit of a combined scale over just adding consumption information. Finally, combining scales into one makes efficiency differences between technologies more salient, but reduces consumer information on efficiency differences between product alternatives of the same technology. To mitigate the risk that a combined label results in more choices for less efficient alternatives within technologies, $\eta_{s,c}/\eta_{s,h}$ values were added to the combined label in group 4. Respondents in group 4 thus received the same information as respondents in group 3, but now the $\eta_{s,c}/\eta_{s,h}$ values were presented on the labels as well, enabling respondents to make more fine-grained comparisons between alternatives. By comparing groups 2, 3 and 4, we can thus examine whether increased cross-category comparisons as a result of a combined label go together with reduced within-category comparisons (i.e. consumer no longer selecting the most efficient alternatives *within* a category), and whether the provision of $\eta_{s,c}/\eta_{s,h}$ information on the energy label mitigates this problem, if it exists.

Figure 4.2. Example of a choice set

Air-to-air heat pumps

Air-to-air heat pumps extract heat from the outdoor air and release it indoors. As such, they make smart use of the heat that is already present in the outside air. Heat pumps run on electricity.

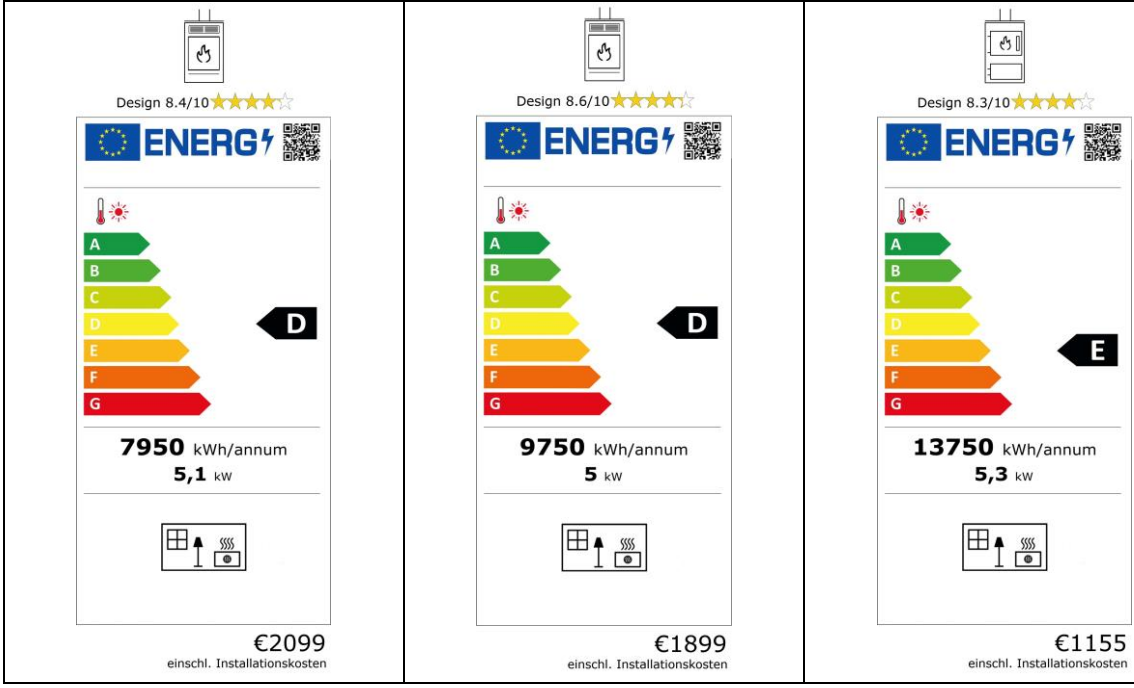
Click here to read more about this type of heater.



Wood stoves/pellet stoves

Wood and pellet stoves generate heat by burning wood. Wood stoves use wood logs, while pellet stoves use small-sized wood chips (pellets) to generate heat.

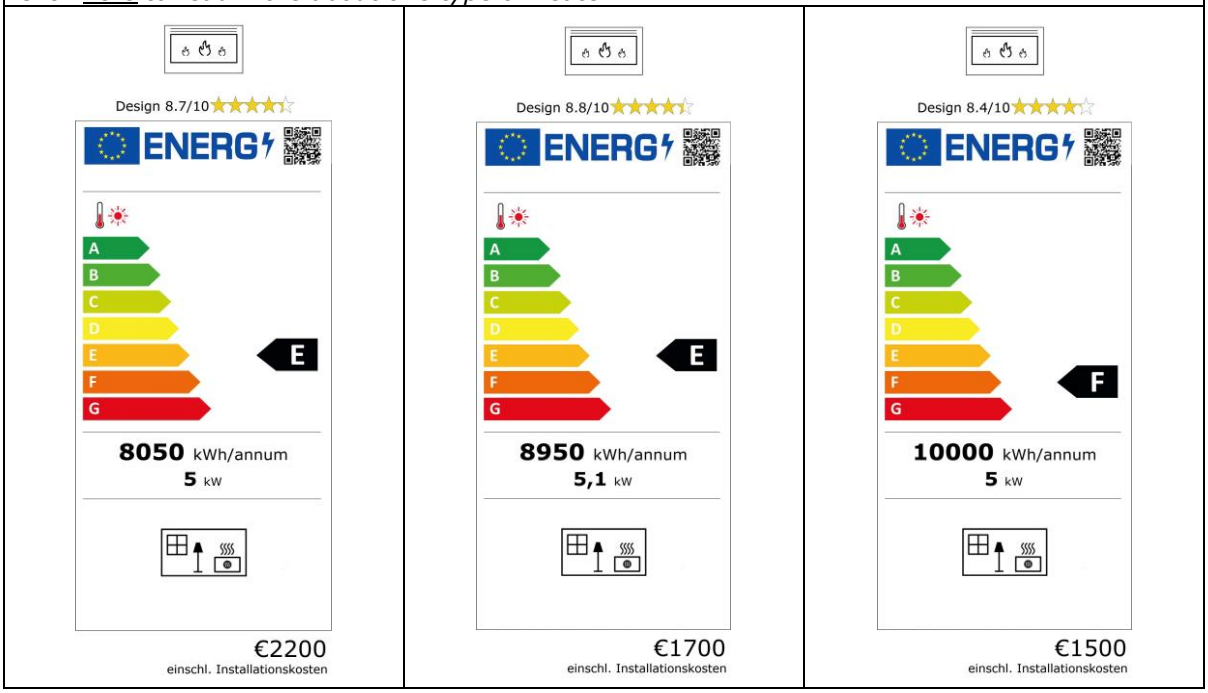
Click here to read more about this type of heater.



Gas heaters

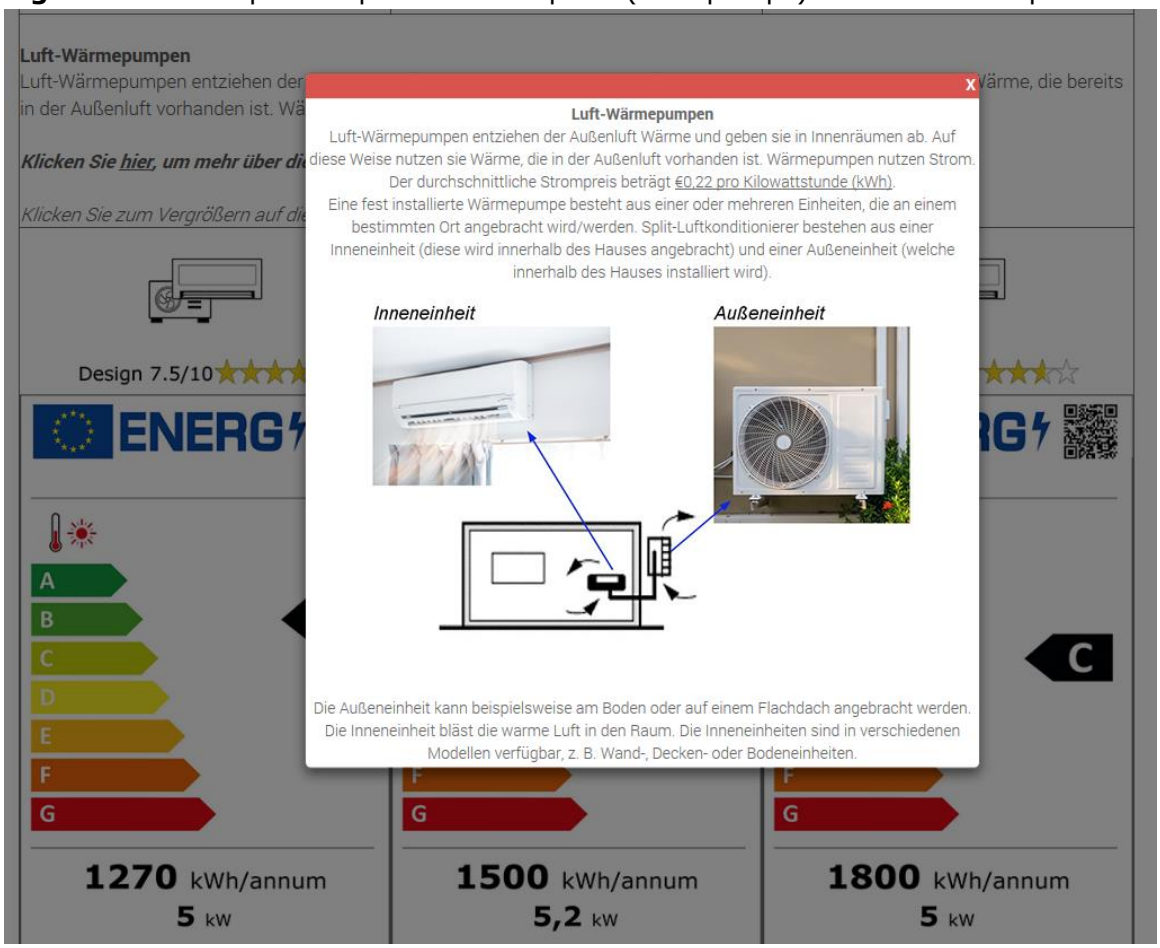
Gas heaters generate heat by burning gas. They may burn natural gas, which is delivered to homes through gas pipes, or liquefied petroleum gas (LPG), which is supplied in a cylinder or tank.

Click here to read more about this type of heater.



Furthermore, half of the respondents (randomly decided) received price information for the products. They received information on the purchase prices of all products within the assortment (including installation costs), reflecting realistic price differences between technologies (see Tables 4.1 and 4.2), as well as on the energy prices (EU averages). The other half of the respondents did not receive this information. By comparing the choices of the two groups, we can examine to what extent inherently higher (purchase) prices of more efficient technologies reduce the effectiveness of labelling strategies that promote choice of more efficient technologies.

Figure 4.3. Example of a product description (heat pumps) in the choice experiment



4.2. Results: air conditioners

In this section, we present the results of the choice experiment for air conditioners. In the experiment, respondents were asked to indicate which type(s) of air conditioner(s) they would consider buying, and which specific air conditioner they would most likely choose. In the next sections, we first examine the influence of changes to the energy label on the extent to which more versus less efficient product types are *considered*, and then examine how these changes affect consumers' final product *choices*. To facilitate interpretation of the results, Table 4.3 provides an overview of the characteristics of the nine air conditioners in the choice set (but note that the respondents saw the information as presented in Figure 4.2 and 4.3).

Consideration

The large majority of the general public (91,7%) indicated that they would consider only one type of air conditioner, 6,5% would consider two types, and 1,8% would consider all three types. Of the three types of air conditioners, fixed split air conditioners were considered most frequently (47,5%), followed by portable single duct air conditioners (38,5%), and fixed double duct air conditioners were considered least frequently (24,1%).

Box 4.1. How to read the results tables

Throughout this chapter, descriptive results (i.e. mean scores or percentages) experimental group are presented in tables, with superscripts indicating whether or not the differences in means or percentages are statistically significant. Means with different superscripts are statistically significantly different from each other (at $p < 0,05$): the observed difference is highly unlikely to be due to chance (e.g. 52,6%^{a} versus 46,9%^{b} in Table 4.4). Means with the same superscript are *not* significantly different from each other: the observed difference could be due to chance (e.g. in Table 4.4, 50,5%^{ab} is neither significantly different from 52,6%^{a} nor from 46,9%^{b}).

Table 4.3. Product set air conditioners: overview of product characteristics

	AC 1 (split)	AC 2 (split)	AC 3 (split)	AC 4 (double duct)	AC 5 (double duct)	AC 6 (double duct)	AC 7 (single duct)	AC 8 (single duct)	AC 9 (single duct)
Energy efficiency class (separate scales)	B	C	D	B	C	D	B	C	D
Energy efficiency class (combined scale)	B	B	C	E	E	F	F	F	G
Capacity (kW)	5.0	5.2	5.0	5.0	5.3	5.0	5.0	5.2	5.3
Energy consumption (kWh/annum)	162	188	244	463	535	595	641	699	748
$\eta_{s,c}$ (%)	515%	461%	348%	180%	165%	140%	130%	124%	118%
Indoor sound	53(B)	56(B)	48(B)	50 (B)	52(B)	60(C)	65(C)	61(C)	63(C)
Outdoor sound	64(C)	65(C)	58(C)	--	--	--	--	--	--
Aesthetics	7.2/10	7.4/10	7.0/10	8.5/10	8.7/10	8.3/10	8.4/10	8.5/10	8.2/10
Price (including installation)	€3.250	€3.150	€2.450	€4.130	€3.400	€2.670	€930	€885	€825

Whether respondents considered buying a certain product type significantly depended on the type of energy label that was presented. Table 4.4 and Figure 4.4 show the results. If information on energy consumption in kWh/annum was displayed on the energy label (versus not), keeping scales separate, significantly more respondents considered buying a split air conditioner (from 40% to 47%), while double duct and single duct air conditioners were considered slightly less frequently (see Figure 4.4, left part). Combining the efficiency scales further increased the likelihood that split air conditioners were considered, but only if the label also displayed the seasonal heating energy efficiency as a percentage (53% vs. 47% in Figure 4.4).

Furthermore, the presence of price information reduced the likelihood that double duct air conditioners were considered, and slightly (but non-significantly) increased the likelihood that split and single duct air conditioners were considered.[18] The impact of the different label types on consideration did not depend on the presence (vs. absence) of price information.[19]

[18] Effect of price information: $b = -0,18$, $z = -2,30$, $p = 0,021$ for double duct air conditioners; $b = 0,05$, $z = 0,72$, $p = 0,471$ for split air conditioners; $b = 0,09$, $z = 1,24$, $p = 0,214$ for single duct air conditioners.

[19] All ps > 0,17, see Table 4.4 (bottom).

Figure 4.4. Consideration of product types

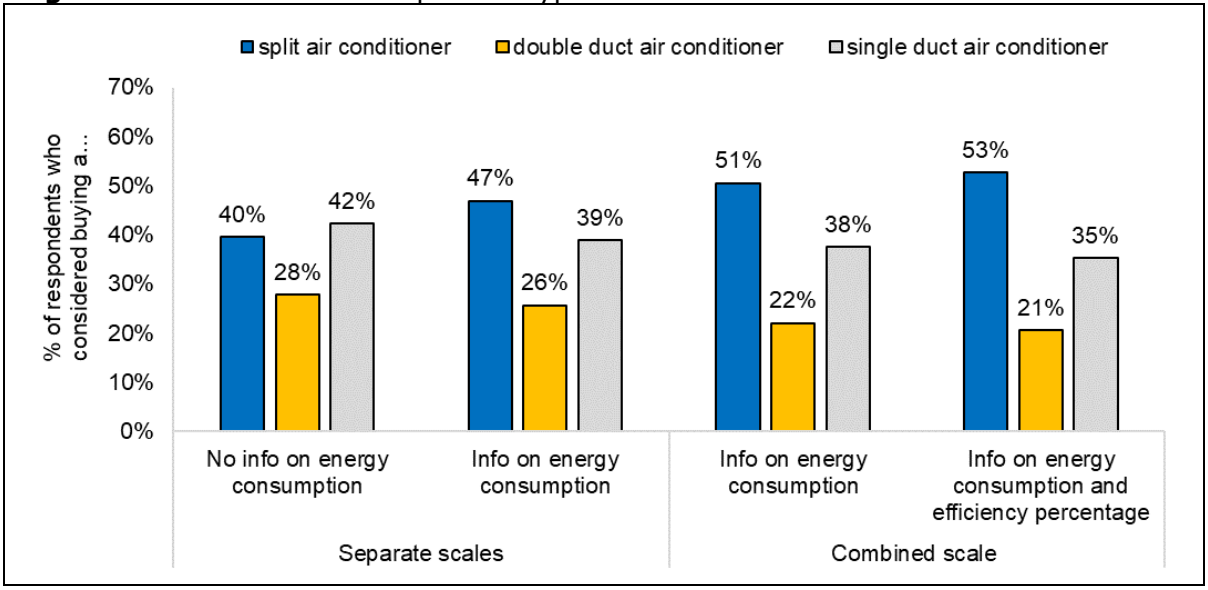


Table 4.4. Consideration of product types

		% of respondents who would **consider** buying a…		
		Fixed split AC	Fixed double duct AC	Portable single duct AC
Price information absent				
Separate scales	No info on energy consumption	38,0%	30,7%	41,8%
	Info on energy consumption	46,7%	29,4%	36,7%
Combined scale	Info on energy consumption	51,6%	22,8%	35,0%
	Info on energy consumption and efficiency percentage	51,2%	20,1%	36,6%
Price information present				
Separate scales	No info on energy consumption	41,3%	25,1%	42,9%
	Info on energy consumption	47,2%	22,1%	41,0%
Combined scale	Info on energy consumption	49,5%	21,4%	40,3%
	Info on energy consumption and efficiency percentage	54,0%	21,2%	33,9%
Total				
Separate scales	No info on energy consumption	39,7%^{c}	27,8%^{a}	42,3%^{a}
	Info on energy consumption	46,9%^{b}	25,7%^{ab}	38,9%^{ab}
Combined scale	Info on energy consumption	50,5%^{ab}	22,1%^{bc}	37,6%^{b}
	Info on energy consumption and efficiency percentage	52,6%^{a}	20,7%^{c}	35,3%^{b}
Label effect		$p < 0,001$	$p = 0,001$	$p = 0,013$
Label x price information effect		$p = 0,617$	$p = 0,172$	$p = 0,270$

Note – In this and other tables, means with different superscripts (in rows) indicate statistically significant differences at $p < 0,05$. These differences are highly unlikely to be due to chance (i.e. they reflect real differences). In contrast, differences in means with the same superscript may reflect chance variation.

Choice

Next, we examine whether and how product *choices* are influenced by the way in which energy efficiency is presented on the label. Here, we look at three outcome measures: (1) the percentage of respondents who selected the most efficient product type (in this case, a split air conditioner), (2) the percentage of respondents who selected the most energy efficient product alternative of a certain type, and (3) the average energy efficiency and average energy consumption of the selected product.

- The first measure is *the percentage of respondents who selected the most efficient product type* (split air conditioners), regardless of which specific split air conditioner (air conditioner 1, 2 or 3 in Table 4.3) is chosen. By comparing this measure across experimental groups, we can analyse to what extent label changes steer respondents' choices towards the most efficient technology.
- The second measure is *the percentage of respondents who selected the most energy efficient product of a certain type* (air conditioner 1, 4 or 7 in Table 4.3). It thus assesses the extent to which respondents are inclined to opt for the most energy efficient alternative within a product group, regardless of whether this is a split, double duct or single duct air conditoner.
- The *average energy efficiency of the selected product* is computed by averaging the seasonal space heating (or cooling) energy efficiency percentage ($\eta_{s,c}/\eta_{s,h}$) across the selected products. We use this measure to assesses whether, overall, product choices become more energy efficient as a result of changes to the label. The *average energy consumption of the selected product* is computed by averaging the seasonal energy consumption (in kWh/annum) across the selected products. Note that because all appliances in a choice set have more or less the same heating (or cooling) capacity, the average energy efficiency and energy consumption of the products are close to perfectly (negatively) correlated.

The results are summarised in Table 4.5 and Figure 4.5.

When separate scales were used and the energy labels did not provide energy consumption information, 32,4% of the respondents selected a split air conditioner (see Table 4.5, bottom part). This percentage rose to 41,1% (a significant increase) when energy consumption information was displayed on the energy label. The percentage further increased to 55,6% (significant increase) when the scales were combined, and then remained more or less the same (53,1%; non-significant change) when the seasonal cooling energy efficiency percentage was additionally displayed. Further analyses revealed that these effects depended on whether or not respondents received price information. More specifically, providing energy consumption information (keeping scales separate) signficantly increased choice for split air conditioners when price information was absent (from 29,8% to 45,4%, see also Figure 4.5, panel A), but not when price information was present (34,9% vs. 36,9%). The combination of scales, in contrast, remained effective in promoting choice of split air conditioners when respondents received price information (37% vs. 51%; see Figure 4.5, panel A).

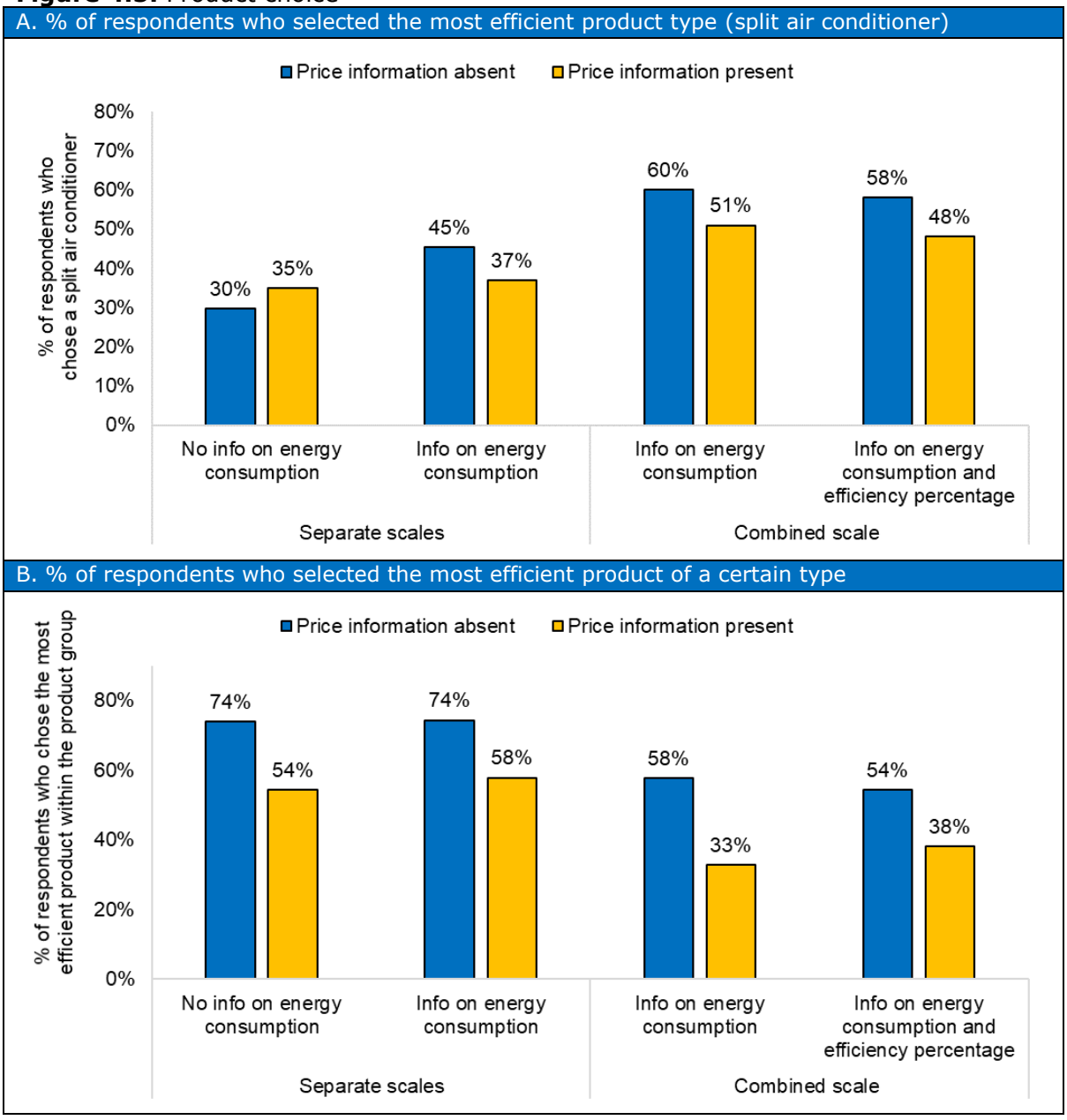
Table 4.5. Product choice

		% of respondents who selected the most efficient product type	% of respondents who selected the most efficient product of a certain type	Average energy efficiency of the selected product (%)	Average energy consumption of the selected product (kWh/annum)
Price information absent					
Separate scales	No info on energy consumption	29,8%[c]	74,0%	252[c]	453[c]
	Info on energy consumption	45,4%[b]	74,3%	306[b]	397[b]
Combined scale	Info on energy consumption	60,2%[a]	57,8%	350[a]	345[a]
	Info on energy consumption and efficiency percentage	58,1%[a]	54,3%	340[a]	358[a]
Price information present					
Separate scales	No info on energy consumption	34,9%[b]	54,3%	257[b]	469[b]
	Info on energy consumption	36,9%[b]	57,9%	264[b]	459[b]
Combined scale	Info on energy consumption	51,0%[a]	32,8%	298[a]	417[a]
	Info on energy consumption and efficiency percentage	48,1%[a]	38,1%	293[a]	420[a]
Total					
Separate scales	No info on energy consumption	32,4%[c]	64,1%[a]	254[c]	461[c]
	Info on energy consumption	41,1%[b]	66,0%[a]	285[b]	428[b]
Combined scale	Info on energy consumption	55,6%[a]	45,3%[b]	324[a]	381[a]
	Info on energy consumption and efficiency percentage	53,1%[a]	46,2%[b]	316[a]	389[a]
Label effect		$p < 0,001$	$p < 0,001$	$p < 0,001$	$p < 0,001$
Label x price information effect		$p = 0,003$	$p = 0,242$	$p < 0,001$	$p = 0,034$

The increased choice for the most efficient product type as a result of combining scales goes hand in hand with decreased choice for the most efficient alternative within a certain product group (see Table 4.5 and Figure 4.5, panel B). On average, about 65% of the respondents selected the most energy efficient alternative of a certain type (i.e. the most efficient split, double duct or single duct air conditioner) if the efficiency scales were kept separate (independent of whether energy consumption information was displayed). This percentage dropped significantly, to 45,3%, if energy efficiency was expressed on a combined scale. This finding is not surprising, because the labels with combined scales do not allow for fine-grained comparisons between product alternatives of the same type. The results also show that the provision of the seasonal space cooling energy efficiency ($\eta_{s,c}$) did not solve this issue: it did not increase the likelihood that the most efficient alternative within a product group was selected (46,2% vs. 45,3%). Furthermore, while, on average, price information had a strong negative effect on the likelihood that a respondent selected the most energy

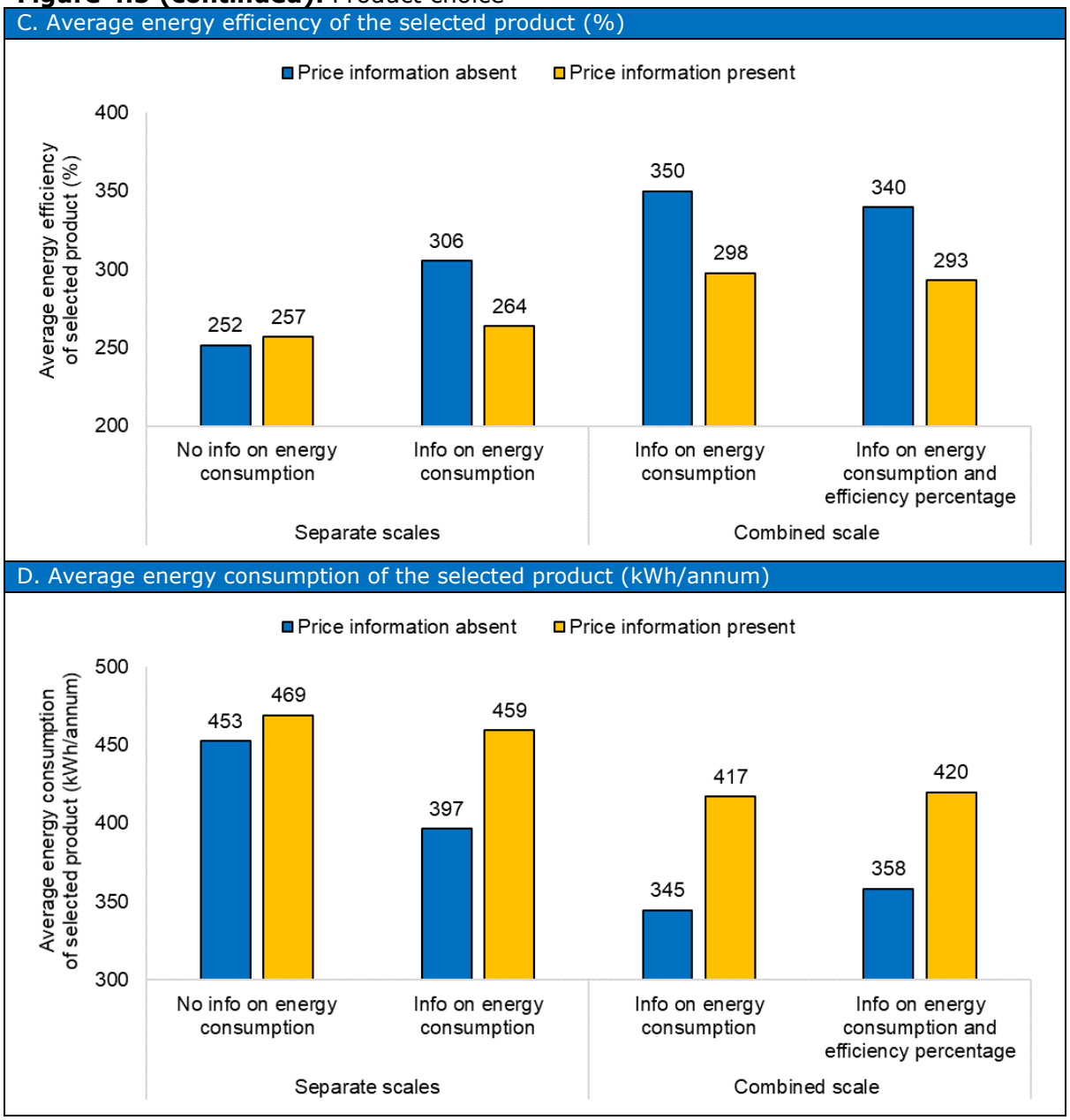
efficient alternative of a certain product type[20], the effects of the label changes did not depend on the presence or absence of price information (see Figure 4.5, panel B).

Figure 4.5. Product choice



[20] Effect of price information: b = -0,84, z = -11,97, p < 0,001.

Figure 4.5 (continued). Product choice



These results thus demonstrate that the combination of efficiency scales (on top of the display of energy consumption information) significantly increases choice for the most efficient product type, but at the same time reduces choice for the most efficient alternative within product groups (due to the label's reduced granularity), and that the space cooling energy efficiency percentage does not compensate for this. The key question then is whether, *overall*, product choices are more energy efficient if scales are combined: Is the increase in choice for more efficient product types sufficient to compensate for the reduced choice for more efficient alternatives within product types? To answer this question, we compare the average efficiency of the selected products across experimental groups. The results, summarised in Table 4.5 (third column) and Figure 4.5 (panel C), show that the impact of changes to the label on the average efficiency of the selected products depends on whether or not respondents

received price information.[21] If price information was absent, adding energy consumption information to the label resulted in significantly more energy efficient product choices (the average energy efficiency increased from 252% to 306%). The average efficiency of the selected products increased further (to 350%) when efficiency scales were combined (significant difference). The added benefits of these label changes were smaller if respondents received price information. In that case, adding information on energy consumption did not result in a significant increase in the average efficiency of the selected products (264% vs. 257%). When energy consumption information was added *and* scales were combined, product choices became significantly more energy efficient, overall (298% vs. 264%; see Figure 4.5, panel C).

4.3. Results: space heaters

In this section, we present the results of the choice experiment for space heaters. Again, we first examine the influence of changes to the energy label on the extent to which certain technologies are *considered*, and then examine how these changes affect final product *choices*. To facilitate interpretation of the results, Table 4.6 provides an overview of the characteristics of the nine air conditioners in the choice set (but note that the respondents saw the information as presented in Figure 4.2 and 4.3).

Table 4.6. Product set heating appliances: overview of product characteristics

	Heater 1 (heat pump)	Heater 2 (heat pump)	Heater 3 (heat pump)	Heater 4 (pellet stove)	Heater 5 (pellet stove)	Heater 6 (wood stove)	Heater 7 (gas fireplace)	Heater 8 (gas fireplace)	Heater 9 (gas fireplace)
Energy efficiency class (separate scales)	B	C	D	B	C	D	C	D	E
Energy efficiency class (combined scale)	B	B	C	D	D	E	E	E	F
Capacity (kW)	5.0	5.2	5.0	5.1	5.0	5.3	5.0	5.1	5.0
Energy consumption (kWh/annum)	1270	1500	1800	7950	9750	13750	8050	8950	10000
$\eta_{s,h}$ (%)	275%	233%	187%	130%	105%	78%	87%	80%	71%
Indoor sound	44(A)	48(B)	42(A)	--	--	--	--	--	--
Outdoor sound	53(B)	56(C)	50(B)	--	--	--	--	--	--
Aesthetics	7.5/10	7.6/10	7.2/10	8.4/10	8.6/10	8.3/10	8.7/10	8.8/10	8.4/10
Price (incl. installation)	€3.700	€2.700	€2.000	€2.099	€1.899	€1.155	€2.200	€1.700	€1.500

Consideration

The large majority of the general public (88,2%) indicated that they would consider only one product type (i.e. one technology), 9,7% would consider two product types, and 2,1% all three product types. Of the three types of heaters, heat pumps were part

[21] The label x price information interaction is significant: $p < 0{,}001$, see Table 4.5, bottom part.

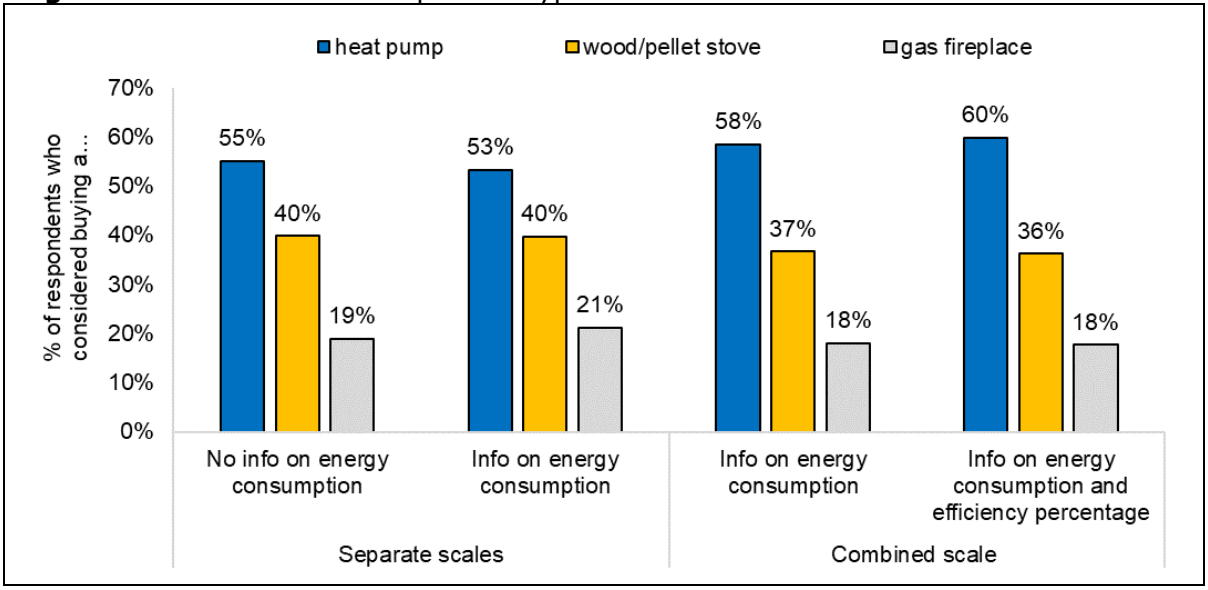
of the consideration set most frequently (56,7%), followed by pellet/wood stoves (38,1%), and gas heaters (gas fireplaces) least frequently (19,0%).

The results, summarized in Table 4.7 and visualised in Figure 4.6, show no substantial shifts in the types of products respondents considered as a result of label changes. Only for heat pumps, a significant label effect was observed. When efficiency scales were combined, heat pumps were significantly more likely to be considered compared to when the scales were kept separate and the energy labels displayed information on the energy consumption of the appliance (58,4% and 59,9% vs. 53,3%). Surprisingly, however, the percentage of respondents who considered heat pumps when energy labels were shown with separate scales and no consumption information fell in between (55,1%). These results thus do not provide strong evidence that combining scales encourages consumers to consider heat pumps when they intend to buy a heater.

Table 4.7. Consideration of product types

		% of respondents who would **consider** buying a…		
		Heat pump	Pellet/wood stove	Gas heater
Price information absent				
Separate scales	No info on energy consumption	56,3%	37,6%	19,9%
	Info on energy consumption	55,5%	41,2%	19,2%
Combined scale	Info on energy consumption	59,0%	37,7%	17,8%
	Info on energy consumption and efficiency percentage	59,6%	38,6%	18,1%
Price information present				
Separate scales	No info on energy consumption	53,9%	42,1%	18,0%
	Info on energy consumption	51,1%	38,3%	23,3%
Combined scale	Info on energy consumption	58,0%	35,8%	18,4%
	Info on energy consumption and efficiency percentage	60,2%	33,9%	17,3%
Total				
Separate scales	No info on energy consumption	55,1%^{bc}	39,8%^{a}	19,0%^{a}
	Info on energy consumption	53,3%^{c}	39,8%^{a}	21,3%^{a}
Combined scale	Info on energy consumption	58,4%^{ab}	36,8%^{a}	18,1%^{a}
	Info on energy consumption and efficiency percentage	59,9%^{a}	36,3%^{a}	17,7%^{a}
Label effect		p = 0,017	p = 0,241	p = 0,204
Label x price information effect		p = 0,745	p = 0,192	p = 0,370

Figure 4.6. Consideration of product types



Choice

The changes to the label seem to have a stronger impact on final product *choices*. Again, we examine (1) the percentage of respondents who selected the most efficient technology (here, a heat pump), (2) the percentage of respondents who selected the most efficient product alternative of a certain type (that is, the most efficient heat pump, pellet stove, or gas fireplace), and (3) the average efficiency of the selected heaters (as an "overall" efficiency measure).

The results, summarized in Table 4.8 and Figure 4.7, show that the provision of information on energy consumption (in kWh/annum) did not encourage respondents to choose the most efficient technology (heat pumps; 39,5% vs. 42,2%, difference is not significant). Combining the efficiency scales of heat pumps and local space heaters (on top of providing energy consumption information) was effective: the percentage of respondents who selected heat pumps significantly increased from 42,2% to 54,3% (see Table 4.8, first column, and Figure 4.7, panel A). The display of the energy efficiency percentage did not contribute to this effect (51,6% vs. 54,3%, difference is not significant).

Again, the increase in choice of the most efficient product type due to combining the scales goes hand in hand with a drop in choice of the most efficient alternatives within product types, because the label with combined scales loses discriminative value for within-type comparisons. On average, 60,4% of the respondents selected the most energy efficient alternative within a certain product group if scales were kept separate and no energy consumption information was displayed on the energy label (see Table 4.8, second column). This percentage did not (significantly) change when energy consumption information was added (57,4% vs. 60,4%), but it significantly dropped (to 40,4%) when the efficiency scales of heat pumps and local space heaters were combined. Similar to the results for air conditioners, we find that the display of the seasonal space heating energy efficiency percentage does not solve the issue: the share of respondents who selected the most efficient product alternative within the

product group was not signficantly higher compared to when the energy efficiency percentage is not included in the label (39,1% vs. 40,4%). Table 4.8 (second column) and Figure 4.7 (panel B) further show that the negative effect of combining scales on the likelihood that the most efficient product of a certain type is selected is stronger when price information is present (vs. absent).[22]

Table 4.8. Product choice

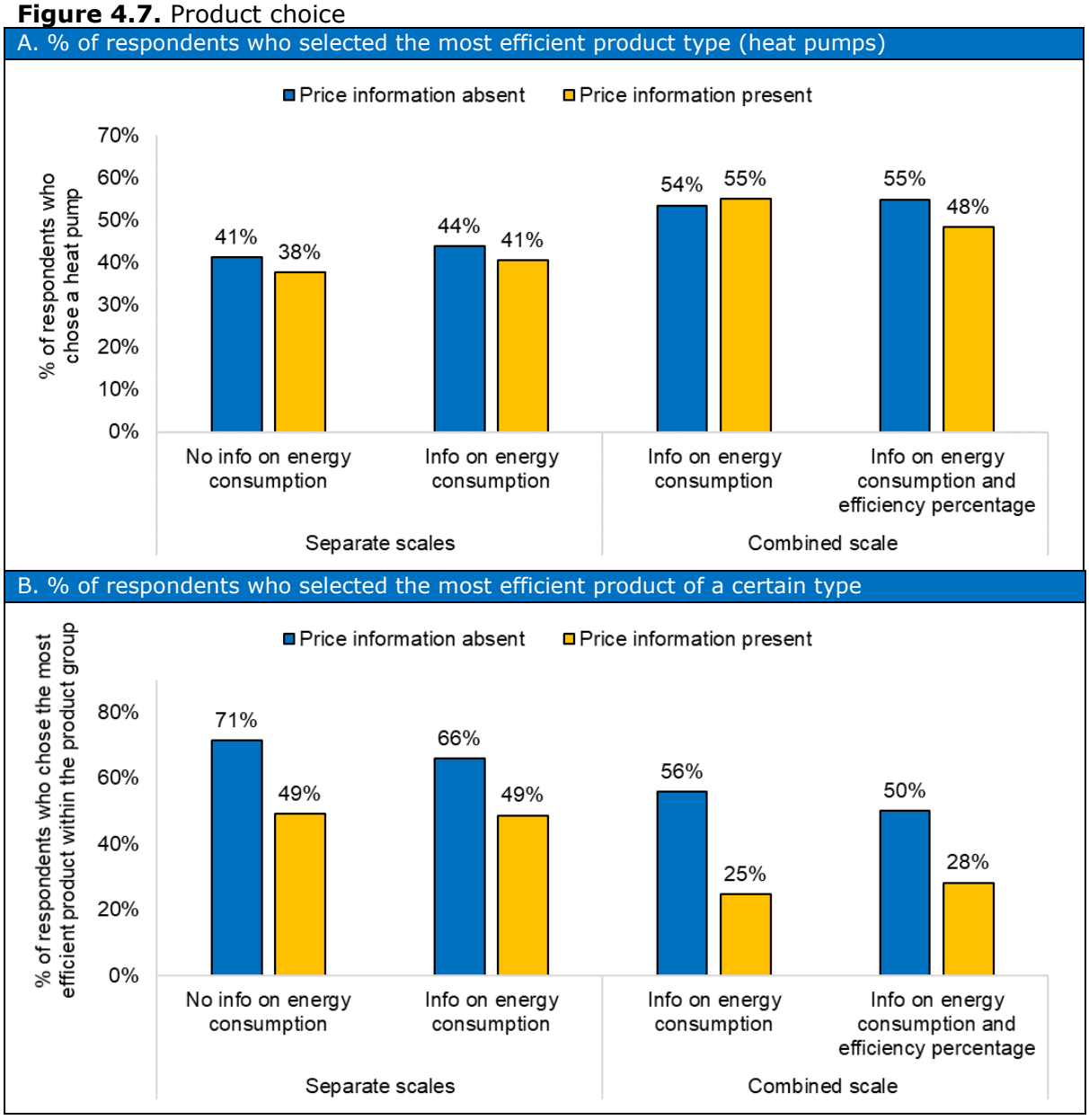
		% of respondents who selected the most efficient product type	% of respondents who selected the most efficient product of a certain type	Average energy efficiency of the selected product (%)	Average energy consumption of the selected product (kWh/annum)
Price information absent					
Separate scales	No info on energy consumption	41,3%	71,4%[a]	170	5639
	Info on energy consumption	43,8%	66,1%[a]	172	5553
Combined scale	Info on energy consumption	53,5%	55,9%[b]	183	4949
	Info on energy consumption and efficiency percentage	55,0%	50,1%[b]	183	4937
Price information present					
Separate scales	No info on energy consumption	37,6%	49,2%[a]	154	6402
	Info on energy consumption	40,5%	48,7%[a]	159	6151
Combined scale	Info on energy consumption	55,1%	24,7%[b]	170	5349
	Info on energy consumption and efficiency percentage	48,4%	28,2%[b]	163	5806
Total					
Separate scales	No info on energy consumption	39,5%[b]	60,4%[a]	162[b]	6017[a]
	Info on energy consumption	42,2%[b]	57,4%[a]	165[b]	5852[a]
Combined scale	Info on energy consumption	54,3%[a]	40,4%[b]	177[a]	5148[b]
	Info on energy consumption and efficiency percentage	51,6%[a]	39,1%[b]	173[a]	5373[b]
Label effect		$p < 0,001$	$p < 0,001$	$p < 0,001$	$p < 0,001$
Label x price information effect		$p = 0,363$	$p = 0,015$	$p = 0,732$	$p = 0,633$

Lastly, we examine how changes to the label affect the average efficiency of the selected products. The analysis reveals that the average energy efficiency of the selected heaters was significantly higher when a combined scale was used on top of providing energy consumption information (177% vs. 165%; see Table 4.8, third column). Only adding information on the energy consumption of appliances, while keeping the scales separate, did not encourage consumers to choose more energy efficient heaters, overall (165% vs. 162%). Respondents who received information on the purchase prices of the different appliances selected significantly less energy

[22] The label x price information interaction is significant: $p = 0,015$; see Table 4.8.

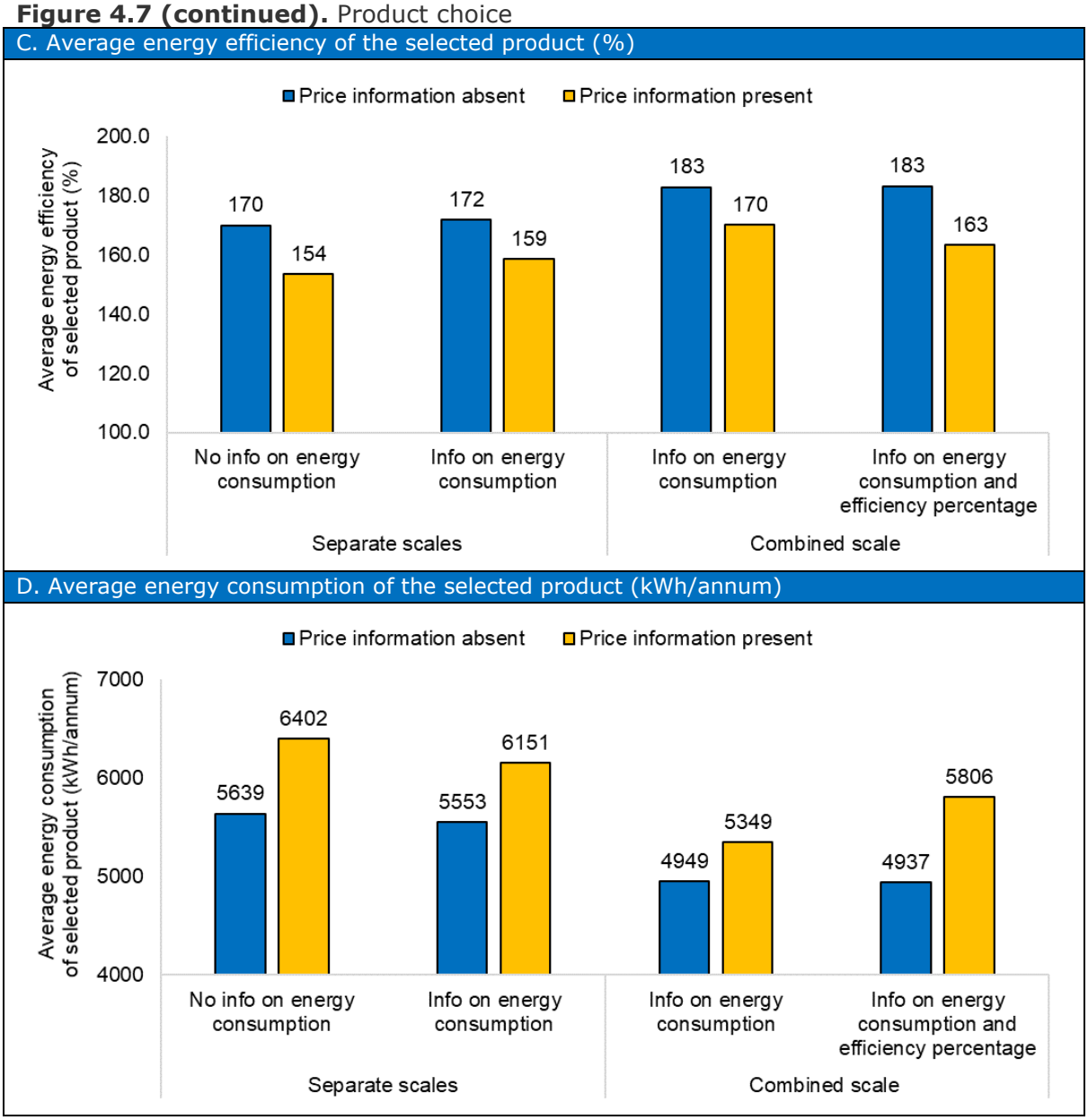
efficient heaters, on average, compared to respondents who did not receive this information (see Figure 4.7, panel C).[23] However, the effects of changes to the energy label did not significantly depend on the presence (vs. absence) of price information.[24]

Figure 4.7. Product choice



[23] Effect of price information: b = -15,53, z = -6,04, p < 0,001.
[24] The label x price information interaction is not significant: p = 0,732; see Table 4.7.

Figure 4.7 (continued). Product choice



4.4. Conclusion

The experiment aimed to provide insight into how the energy label best guides consumers towards more efficient technologies and alternatives:

1. Does the display of energy consumption information on the energy label encourage consumers to choose more energy efficient products?
2. What is the added benefit of a combined scale over the display of consumption information?
3. Does the provision of the seasonal space heating/cooling energy efficiency values ($\eta_{s,c}/\eta_{s,h}$) compensate for the loss in granularity that results from the combination of scales?

Tables 4.9 and 4.10 present an overview of the results for air conditioners and space heaters, respectively.

Air conditioners

For air conditioners, the display of energy consumption information increased consideration of the most efficient technology (split air conditioners) by 7%-point and choice of this technology by 9%-point, resulting in an 31%-point increase in the average energy efficiency ($\eta_{s,c}$) of the chosen products (from 254% to 285%, on average). The air conditioners that were selected based on energy labels with energy consumption information were thus more energy efficient, on average, than the air conditioners that were selected based on energy labels without this information. However, these positive effects of adding consumption information on the efficiency of product choices completely disappeared when consumers received information about the prices of the different types of appliances.

Combining the efficiency scales, on top of the display of energy consumption information, increased the likelihood that the most efficient technology was chosen by 15%-point (over the provision of consumption information alone). However, despite the fact that energy consumption information was readily available which could be used to infer and compare the energy efficiency of alternatives within technologies, significantly less respondents opted for the most efficient appliance *within* a certain technology (21%-point decrease). The display of the $\eta_{s,c}$ values above the black arrow in the energy label did not mitigate this negative effect of combining scales on the efficiency of choices within technologies; it had no effect. Despite the fact that respondents were less likely to choose the most efficient alternative within technologies, the average efficiency ($\eta_{s,c}$) of the chosen products increased with 39%-point (from 285% to 324%) when scales were combined (over the provision of consumption information alone), because the use of a combined scale encouraged respondents to choose more efficient technologies in the first place.

Table 4.9. Overview of results: air conditioners

	Most efficient technology considered	Most efficient technology chosen	Most efficient appliance within technology chosen	Average energy efficiency of appliance choices
1. Adding information on seasonal energy consumption (in kWh/annum)	+7%-point	+9%-point*	No effect	+31%-point change in $\eta_{s,c}$ *
2. Expressing energy efficiency of different product types on the same scale (combined scale)	No effect	+15%-point	-21%-point	+39%-point change in $\eta_{s,c}$
3. Adding seasonal space heating/cooling energy efficiency values ($\eta_{s,c}/\eta_{s,h}$)	No effect	No effect	No effect	No effect

* Effect disappears if price information is present.

Space heaters

For space heaters, the display of energy consumption information had no effect on the energy efficiency of appliance choices, despite the greater differences in energy consumption between technologies (compared to air conditioners).

Combining the efficiency scales, on top of the display of energy consumption information, increased consideration of the most efficient technology (heat pumps) by 5%-point and choice of this technology by 12%-point (compared to the provision of consumption information alone). Again, we observed a negative effect of combining scales on choice for the most efficient appliance within technologies (-17%-point). Also here, the display of the $\eta_{s,h}$ values did not solve the issue. Despite the fact that respondents were less likely to choose the most efficient alternative within technologies, the average efficiency ($\eta_{s,h}$) of the chosen products increased with 12%-point (from 165% to 177%) when scales were combined (over the provision of consumption information alone).

Table 4.10. Overview of results: space heaters

	Most efficient technology considered	Most efficient technology chosen	Most efficient appliance within technology chosen	Average energy efficiency of appliance choices
1. Adding information on seasonal energy consumption (in kWh/annum)	No effect	No effect	No effect	No effect
2. Expressing energy efficiency of different product types on the same scale (combined scale)	+5%-point	+12%-point*	-17%-point	+12%-point change in $\eta_{s,h}$
3. Adding seasonal space heating/cooling energy efficiency values ($\eta_{s,c}$/$\eta_{s,h}$)	No effect	No effect	No effect	No effect

Conclusion

All in all, the experimental results do not provide convincing evidence that the provision of energy consumption information and/or the combination of efficiency scales increases the effectiveness of the energy label in promoting more efficient appliance choices. The experiment revealed both positive and negative effects of the use of a combined scale: While it encouraged choice for more efficient technologies, it reduced choice for the most efficient product alternatives within those technologies. The negative effect was present despite the availability of information on the seasonal energy consumption of the appliances, which – given that heating/cooling output was more or less constant in the presented assortments – enabled respondents to discriminate between more and less efficient appliances within technologies. The display of seasonal heating/cooling energy efficiency percentage ($\eta_{s,h}$/$\eta_{s,c}$) did not counteract this negative effect.

While, in the experiment, the positive effect of combining scales outweighed the negative effect, resulting in an overall increase in the average energy efficiency (and decrease in the average energy consumption) of product choices, the actual "net effect" is likely to be contingent on the relative shares of consumers who are versus are not already buying the more efficient technology. It is important to note that the experimental choice shares cannot be interpreted as market shares. After all, to ensure that an observed shift in product choices could only be attributed to a change in the energy label, all other factors that could also influence choices were controlled for in the study (e.g. by keeping them constant). In reality, however, many other factors may play in role in consumers' purchasing decisions; different consumers may be looking for different types of appliances (in the experiment, all respondents had to imagine that they were looking for a 5kW heating or air conditioning appliance for a single room in their house), be exposed to different product assortments, receive different product information, etcetera. If, in reality, the majority of consumers already have a preference for the most efficient technology, the positive effect of the use of a combined scale (i.e. more consumers choosing more efficient technologies) may no longer outweigh its negative effect (i.e. more consumers choosing less efficient alternatives within technologies).

5. Consumer understanding and expectations

This chapter provides insight into the extent to which consumers understand (and can integrate) the information displayed on the energy label, the extent to which the label alternatives improve consumer understanding, as well as prospective buyers' self-reported preferences for labels with separate versus combined scales.

To gain insight in consumer understanding of the label, respondents performed several product identification tasks in which they were presented with pairs of energy labels. For each label pair, they were asked to identify (1) the most energy efficient product, and (2) the product with the lowest energy consumption. Label information (efficiency classes, heating/cooling capacity, etc.) was selected such that we could infer from respondents' choices whether they accurately understood specific aspects of the label. More specifically, the product identification tasks were set up to provide answers to the following research questions:

1. Do consumers understand the difference between energy consumption and energy efficiency?
2. Are consumers able to use $\eta_{s,c}$ /$\eta_{s,h}$ information to identify the more efficient product if two products fall in the same efficiency class (if scales are combined)?
3. Do consumers understand that energy efficiency classes cannot be directly compared if different product types have different efficiency scales?
4. Are consumers able to use energy consumption information to identify the most efficient product for products with the same heating/cooling capacity (if separate scales are used)?
5. Are consumers able to use energy consumption information to identify the most efficient product for products with different heating/cooling capacity (if separate scales are used)?

As before, half of the respondents in the general public sample performed the product identification tasks for space heaters, and half of the respondents performed the tasks for air conditioners. Which information was displayed on the energy label again depended on the experimental group the respondent was randomly assigned to (respondents remained in the same information group as they were in the choice experiment):

- Group 1 (control group): separate efficiency scales, no information on nergy consumption;
- Group 2: separate efficiency scales, information on energy consumption;
- Group 3: combined scale, information on energy consumption;
- Group 4: combined scale, information on energy consumption and efficiency percentage $\eta_{s,c}$ /$\eta_{s,h}$).

By comparing respondents' performance on the product identification tasks across the experimental groups, we gain insight in the contribution of specific label elements (adding information on energy consumption, combining scales, etc.) to understanding.

5.1. Label understanding

This section describes the results of the product identification tasks. Section 5.1.1 examines label understanding in case a comparison is made between two appliances that use the same technology (e.g. two heat pumps). Section 5.1.2 focuses on the comparisons of appliances that use different technologies (e.g. a heat pump versus a gas heater). The results for heating and air conditioning appliances are discussed separately.

5.1.1. Comparing two appliances using the same technology

Q1. Do consumers understand the difference between energy consumption and energy efficiency?

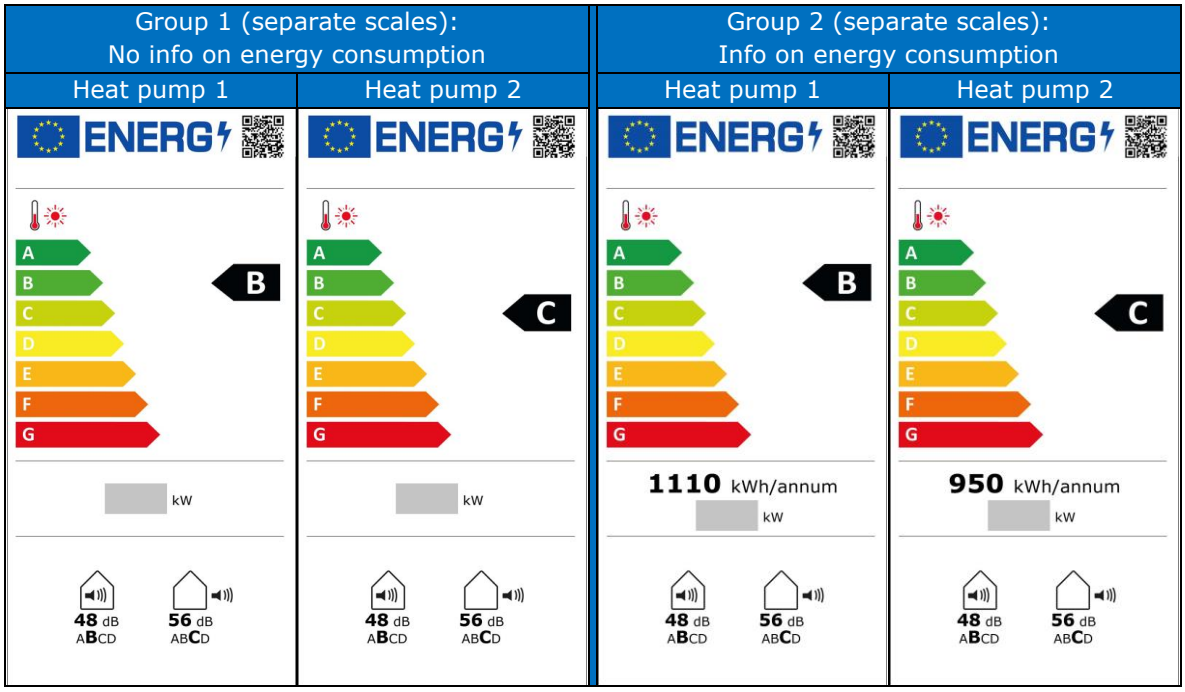
To gain insight into whether consumers understand the difference between energy consumption and energy efficiency, respondents were presented with energy labels of two appliances using the same technology (either two heat pumps or two split air conditioners). Appliance 1 is more energy efficient than appliance 2, but annual energy consumption is lower for appliance 2 compared to 1 (because appliance 2 has lower heating/cooling output). The label pairs that were shown to the respondents are in Figure 5.1 (for space heaters) and Figure 5.2 (for air conditioners).

Space heaters

In group 1 and 2 (separate scales), heat pump 1 falls in class B and heat pump 2 in class C. The labels presented in group 2 further display energy consumption information, showing that heat pump 2 (which is less efficient) consumers less energy than heat pump 1. This situation may arise if heat pump 2 has a lower heating capacity than heat pump 1. To be able to examine whether consumers understand the information on energy efficiency and energy consumption, the information on heating capacity was covered (see Figure 5.1).

Table 5.1 shows the results. The correct response is shaded green. We first examine the responses in group 2 (Table 5.1, bottom part) that received information on both energy efficiency and energy consumption. Only around a quarter of the respondents in this group (26,9%) accurately identified heat pump 1 as the more efficient appliance and heat pump 2 as the appliance with lower energy consumption. Also about a quarter of the respondents (25,8%) falsely believed that the appliance with higher energy efficiency also consumed the least amount of energy, and another quarter (23,1%) falsely believed that the appliance with the lower energy consumption was also the most efficient one (see Table 5.1, bottom part).

Figure 5.1. Label pairs presented (task 1a)



In group 1, that only received information on the energy efficiency classes of the two heat pumps, only 6% accurately indicated that it is impossible to tell, based on this information, which heat pump consumes less energy (while accurately identifying heat pump 1 as the most efficient appliance; see Table 5.1, top part). The majority of this group (59,3%) assumed that the appliance with the higher efficiency also consumes less energy, not taking into account the heating output of the appliances.

Table 5.1. Understanding of difference between efficiency and consumption (task 1a)

Group 1: No info on energy consumption		Which of the two heaters uses the least amount of energy?				
		"1 uses the least amount of energy"	"2 uses the least amount of energy"	"1 and 2 use an equal amount of energy"	"Can't tell based on this information"	Total
Which of these two heaters is most energy eficient?	"1 is more energy efficient"	**59,3%**	2,7%	4,1%	6,2%	72,2%
	"2 is more energy efficient"	3,0%	3,8%	1,0%	0,4%	8,2%
	"1 and 2 are equally energy efficient"	3,0%	0,3%	6,7%	1,3%	11,4%
	"Can't tell based on this information"	2,8%	0,1%	0,4%	5,0%	8,3%
	Total	68,0%	6,8%	12,2%	12,9%	100% (N =907)

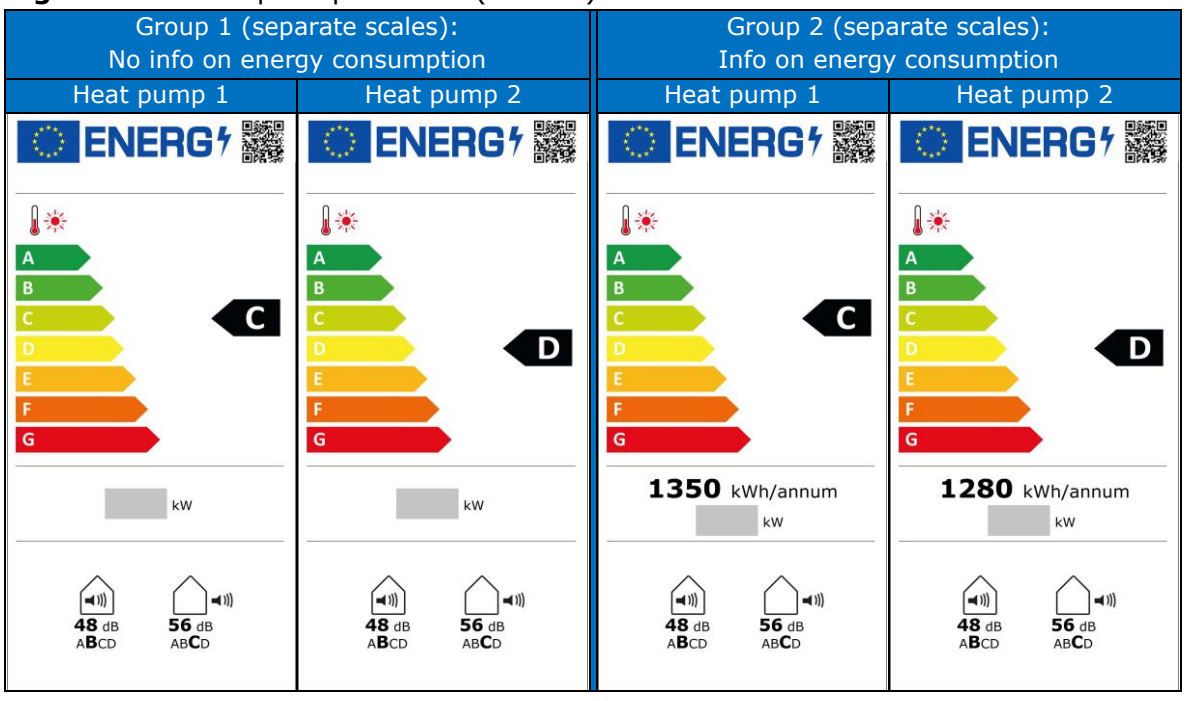
Note – correct answer is shaded green.

Table 5.1 (continued).

Group 2: Info on energy consumption		Which of the two heaters uses the least amount of energy?				
		"1 uses the least amount of energy"	"2 uses the least amount of energy"	"1 and 2 use an equal amount of energy"	"Can't tell based on this information"	Total
Which of these two heaters is most energy eficient?	"1 is more energy efficient"	**25,8%**	**26,9%**	1,8%	2,6%	57,1%
	"2 is more energy efficient"	2,4%	**23,1%**	1,2%	0,4%	27,2%
	"1 and 2 are equally energy efficient"	0,9%	2,5%	1,4%	0,1%	5,0%
	"Can't tell based on this information"	0,9%	3,5%	0,1%	6,3%	10,8%
	Total	30,0%	56,1%	4,5%	9,5%	100% (N = 908)

Note – correct answer is shaded green.

Figure 5.2. Label pairs presented (task 1a)



It could be that consumers provided an incorrect answer simply because they did not understand the question (i.e. they might not understand what is meant by "energy efficient"). Therefore, after the first product identification task, the meaning of energy efficiency was briefly explained to respondents ("*A higher energy efficiency means that a heater uses more energy to provide the same amount of heating. In other words, if two heaters have the same heating capacity (i.e. produce the same amount of heat), the one that uses less energy is more efficient.*"). Next, they performed a task similar to the first one, to see whether they were able to identify more efficient versus less energy consuming appliances after they had been informed about the

meaning of energy efficiency. Figure 5.2 shows the pairs of energy labels that were presented to respondents. The results are in Table 5.2.

Table 5.2. Understanding of difference between efficiency and consumption (task 1a)

Group 1: No info on energy consumption		Which of the two heaters uses the least amount of energy?				
		"1 uses the least amount of energy"	"2 uses the least amount of energy"	"1 and 2 use an equal amount of energy"	"Can't tell based on this information"	Total
Which of these two heaters is most energy eficient?	"1 is more energy efficient"	**64,9%**	2,7%	2,4%	4,1%	74,1%
	"2 is more energy efficient"	2,1%	3,6%	0,7%	0,3%	6,7%
	"1 and 2 are equally energy efficient"	2,1%	0,8%	6,0%	0,7%	9,5%
	"Can't tell based on this information"	2,3%	0,3%	1,1%	6,0%	9,7%
	Total	71,4%	7,4%	10,1%	11,0%	100% (N = 907)

Group 2: Info on energy consumption		Which of the two heaters uses the least amount of energy?				
		"1 uses the least amount of energy"	"2 uses the least amount of energy"	"1 and 2 use an equal amount of energy"	"Can't tell based on this information"	Total
Which of these two heaters is most energy eficient?	"1 is more energy efficient"	**27,8%**	**24,0%**	1,8%	1,3%	54,9%
	"2 is more energy efficient"	3,0%	**26,8%**	1,3%	0,8%	31,8%
	"1 and 2 are equally energy efficient"	0,6%	1,1%	2,5%	0,2%	4,4%
	"Can't tell based on this information"	0,9%	1,3%	0,2%	6,5%	8,9%
	Total	32,2%	53,2%	5,8%	8,8%	100% (N = 908)

Note – correct answer is shaded green.

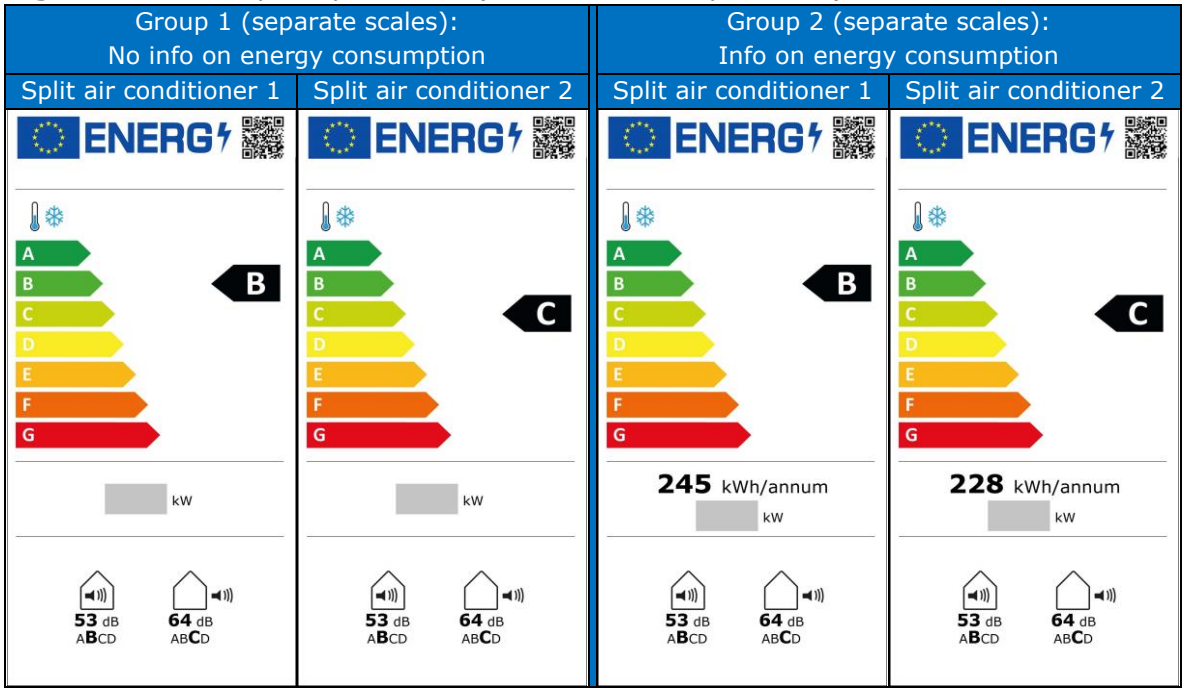
The results in Table 5.2 are very similar to those in Table 5.1, which shows that the brief explanation of the meaning of "energy efficiency" did not improve understanding. In group 2, which received information on both energy efficiency and energy consumption, again around a quarter of the respondents (24,0%) accurately identified both the more efficient appliance (heat pump 1) and the appliance with lower energy consumption (heat pump 2), around a quarter (27,8%) falsely believed that the appliance with higher energy efficiency also consumed the least amount of energy, and another quarter (26,8%) falsely believed that the appliance with the lower energy consumption was also the most efficient one (see Table 5.2, bottom part). In group 1, which received information on energy efficiency but not on energy consumption or

heating capacity, 64,9% of the respondents automatically assumed that the more efficient heat pump would also use less energy (see Table 5.2, top part).

Air conditioners

Similar tasks were performed for air conditioners. The pairs of energy labels that were presented had similar information patterns as the labels for space heaters. That is, the energy labels were for two air conditioners of the same type (two split air conditioners). Appliance 1 is more efficient, but appliance 2 has a lower energy consumption. After the first product identification task (see energy label pairs in Figure 5.3), a brief explanation of the meaning of energy efficiency was provided[25], after which respondents performed another, similar product identification task (see energy label pairs in Figure 5.4).

Figure 5.3. Label pairs presented (task 1b, after explanation)



The findings for air conditioners, which are summarized in Table 5.3 (results before explanation of energy efficiency) and Table 5.4 (results after explanation), are very similar to the findings for space heaters. Of the respondents who saw labels with both energy efficiency and energy consumption information (group 2), 27,0% accurately identified the more efficient air conditioner as more efficient and air conditioner with lower energy consumption as having lower energy consumption (see Table 5.3, bottom part). 30,0% falsely believed that the air conditioner with lower consumption was also more efficient, and 23,0% falsely believed that the air conditioner with the better energy class also consumed less energy. Of the respondents who saw labels that only displayed the energy efficiency classes of the two air conditioners, 65,3%

[25] Respondents read: *"A higher energy efficiency means that an air conditioner uses more energy to provide the same amount of cooling. In other words, if two air conditioners have the same cooling capacity (i.e. can cool an equally large room), the one that uses less energy is more efficient."*

inaccurately assumed that the more efficient appliance also uses less energy (see Table 5.3, top part). Only 4,5% accurately understood that one cannot tell, based on efficiency information only, which air conditioner uses the least amount of energy (while correctly understanding that the appliance with the higher energy efficiency class is more efficient; Table 5.3, top part). Also for air conditioners, a brief explanation of the meaning of energy efficiency did not improve identification of more efficient versus less energy consuming appliances: The pattern of results in Table 5.4 (after explanation) is similar to the pattern of results in Table 5.3 (before explanation).

Table 5.3. Understanding of difference between efficiency and consumption (task 1b)

Group 1: No info on energy consumption		Which of the two air conditioners uses the least amount of energy?				
		"1 uses the least amount of energy"	"2 uses the least amount of energy"	"1 and 2 use an equal amount of energy"	"Can't tell based on this information"	Total
Which of these two air conditioners is most energy eficient?	"1 is more energy efficient"	**65,3%**	2,2%	4,0%	4,5%	76,0%
	"2 is more energy efficient"	1,8%	3,3%	1,1%	0,3%	6,5%
	"1 and 2 are equally energy efficient"	2,5%	1,3%	5,1%	1,2%	10,2%
	"Can't tell based on this information"	1,8%	0,2%	0,3%	5,0%	7,3%
	Total	71,4%	7,1%	10,5%	11,1%	100% (N = 905)

Group 2: Info on energy consumption		Which of the two air conditioners uses the least amount of energy?				
		"1 uses the least amount of energy"	"2 uses the least amount of energy"	"1 and 2 use an equal amount of energy"	"Can't tell based on this information"	Total
Which of these two air conditioners is most energy eficient?	"1 is more energy efficient"	**23,0%**	**27,0%**	0,8%	1,1%	51,9%
	"2 is more energy efficient"	3,2%	**30,0%**	1,1%	0,8%	35,1%
	"1 and 2 are equally energy efficient"	1,2%	1,7%	1,3%	0,7%	4,8%
	"Can't tell based on this information"	0,3%	2,9%	0,6%	4,5%	8,2%
	Total	27,7%	61,5%	3,7%	7,0%	100% (N = 910)

Note – correct answer is shaded green.

Figure 5.4. Label pairs presented (task 1b, after explanation)

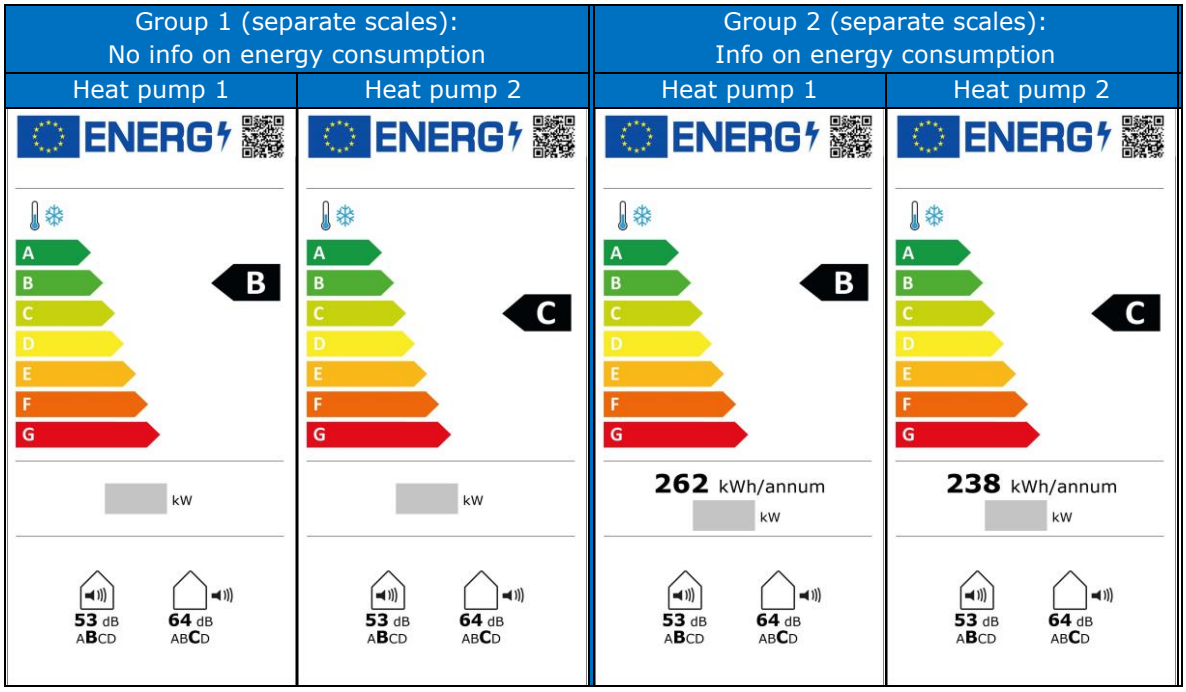


Table 5.4. Understanding of difference between efficiency and consumption (task 1b)

Group 1: No info on energy consumption		Which of the two air conditioners uses the least amount of energy?				
		"1 uses the least amount of energy"	"2 uses the least amount of energy"	"1 and 2 use an equal amount of energy"	"Can't tell based on this information"	Total
Which of these two air conditioners is most energy eficient?	"1 is more energy efficient"	**66,4%**	2,3%	3,0%	4,6%	76,4%
	"2 is more energy efficient"	1,7%	3,8%	0,8%	0,2%	6,4%
	"1 and 2 are equally energy efficient"	1,9%	0,7%	5,8%	0,6%	8,8%
	"Can't tell based on this information"	2,0%	0,1%	1,0%	5,3%	8,4%
	Total	71,9%	6,9%	10,5%	10,7%	100% (N = 905)

Table 5.4 (continued).

Group 2: Info on energy consumption		Which of the two air conditioners uses the least amount of energy?				
		"1 uses the least amount of energy"	"2 uses the least amount of energy"	"1 and 2 use an equal amount of energy"	"Can't tell based on this information"	Total
Which of these two air conditioners is most energy eficient?	"1 is more energy efficient"	**18,4%**	**23,3%**	0,9%	0,8%	43,3%
	"2 is more energy efficient"	2,8%	**39,8%**	0,6%	0,6%	43,6%
	"1 and 2 are equally energy efficient"	0,6%	2,1%	2,1%	0,3%	5,1%
	"Can't tell based on this information"	0,4%	2,0%	0,2%	5,4%	8,0%
	Total	22,1%	67,1%	3,7%	7,0%	100% (N = 910)

Note – correct answer is shaded green.

Q2. Are consumers able to use $\eta_{s,c}/\eta_{s,h}$ information to identify the more efficient product if two products fall in the same efficiency class (if scales are combined)?

If the scales are combined, two heat pumps (or split air conditioners) that were originally in class B and C, for instance, will likely end up in the same energy efficiency class (class B). In that case, consumers can no longer distinguish between the more and less efficient alternative based on the energy label. We examine whether adding the seasonal heating/cooling efficiency percentage ($\eta_{s,c}/\eta_{s,h}$) solves this issue; i.e. are consumers able to use this information in the correct way to identify the more efficient alternative?

Space heaters

This section presents the results of a product identification task that was performed by respondents after they had read about the meaning of energy efficiency (see page 58). In groups 3 and 4 (combined scale), both heat pump 1 and heat pump 2 fall in class C (see Figure 5.5). The labels presented in group 4 further display the seasonal heating efficiency percentage ($\eta_{s,h}$), showing that heat pump 1 is more energy efficient (250%) than heat pump 2 (231%). This information is not displayed on the energy labels in group 3 (see Figure 5.5).

Table 5.5 shows the results. When both heat pumps fall in class C and the efficiency percentage is not displayed (group 3), 14,8% of the respondents think the two heat pumps are equally efficient, and 8,2% indicate that one cannot identify the more efficient appliance based on this information. Surprisingly, the majority of respondents (61,5%) falsely believed that heat pump 2 is more efficient than heat pump 1. It again appears that respondents generally do not understand the difference between efficiency and consumption: If the comparison of the efficiency classes of the two appliances does not provide a conclusive answer, they appear to simply look at the

energy consumption information to make inferences about energy efficiency, which leads to the wrong conclusion.

In group 4, respondents saw the same energy labels with the seasonal energy efficiency percentage ($\eta_{s,h}$) displayed above the black arrow (see Figure 5.5.), showing that heat pump 1 is more efficient (higher percentage). However, only 3 in 10 respondents in this group accurately identified heat pump 1 as the most efficient appliance (29,1%; see Table 5.5), which suggests that most consumers do not understand the meaning of this information. Instead, the results suggest that, as before, most respondents (52,2%) relied on energy consumption information to draw conclusions about the efficiency of appliances in case they fall in the same energy efficiency class, ignoring potential differences between the appliances in heating capacity. Furthermore, about 1 in 10 respondents believed that the two heat pumps are equally energy efficient. These respondents most likely based their answer on the fact that the two appliances fall in the same energy class, ignoring the efficiency percentages above the black arrows.

Figure 5.5. Label pairs presented (task 1b, after explanation)

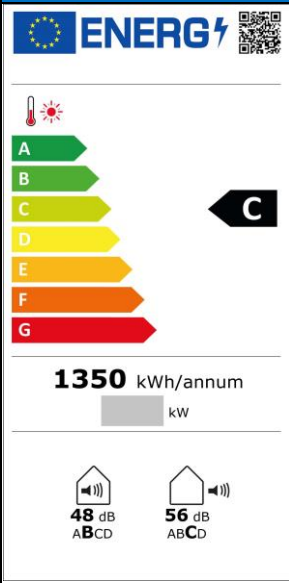
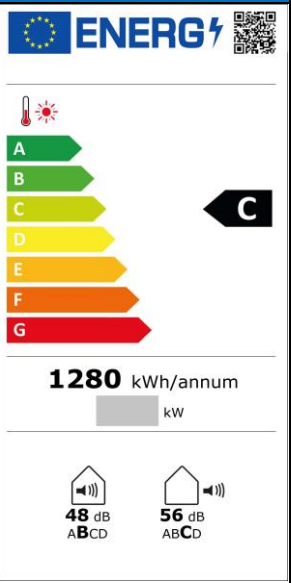
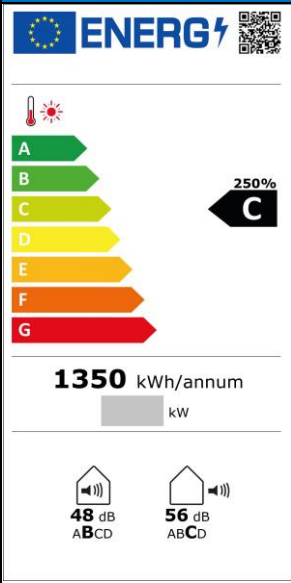
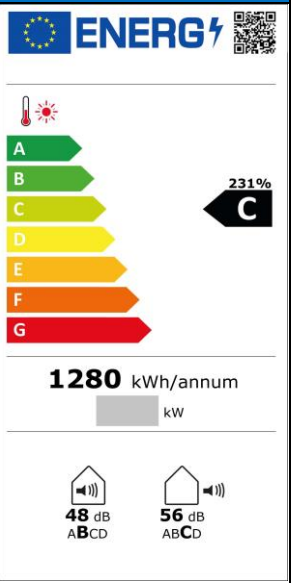
Group 3 (combined scale): efficiency percentage ($\eta_{s,h}$) absent		Group 4 (combined scale): efficiency percentage ($\eta_{s,h}$) present	
Heat pump 1	Heat pump 2	Heat pump 1	Heat pump 2
			

Table 5.5. Identification of the more efficient appliance (task 1b, after explanation)

Which of these two heaters is the most energy efficient?	Group 3 (combined scale): efficiency percentage ($\eta_{s,h}$) absent	Group 4 (combined scale): efficiency percentage ($\eta_{s,h}$) present
"1 is more energy efficient"	15,6%	29,1%
"2 is more energy efficient"	61,5%	52,2%
"1 and 2 are equally energy efficient"	14,8%	10,2%
"Can't tell based on this information"	8,2%	8,5%
N	906	910

Note – correct answer is shaded green.

Air conditioners

The same task was performed for air conditioners. Respondents were presented with energy labels for two split air conditioners falling in the same efficiency class (class B) and asked to find the most efficient appliance. The labels presented in group 4 displayed the seasonal cooling efficiency percentage ($\eta_{s,c}$), showing that air conditioner 1 is more energy efficient (444%) than air conditioner 2 (410%). The labels presented to group 3 did not contain information that enabled respondents to identify the more efficient appliance (see Figure 5.6).

Table 5.6 shows the findings, which are similar to the findings for heaters.

Figure 5.6. Label pairs presented (task 1b, after explanation)

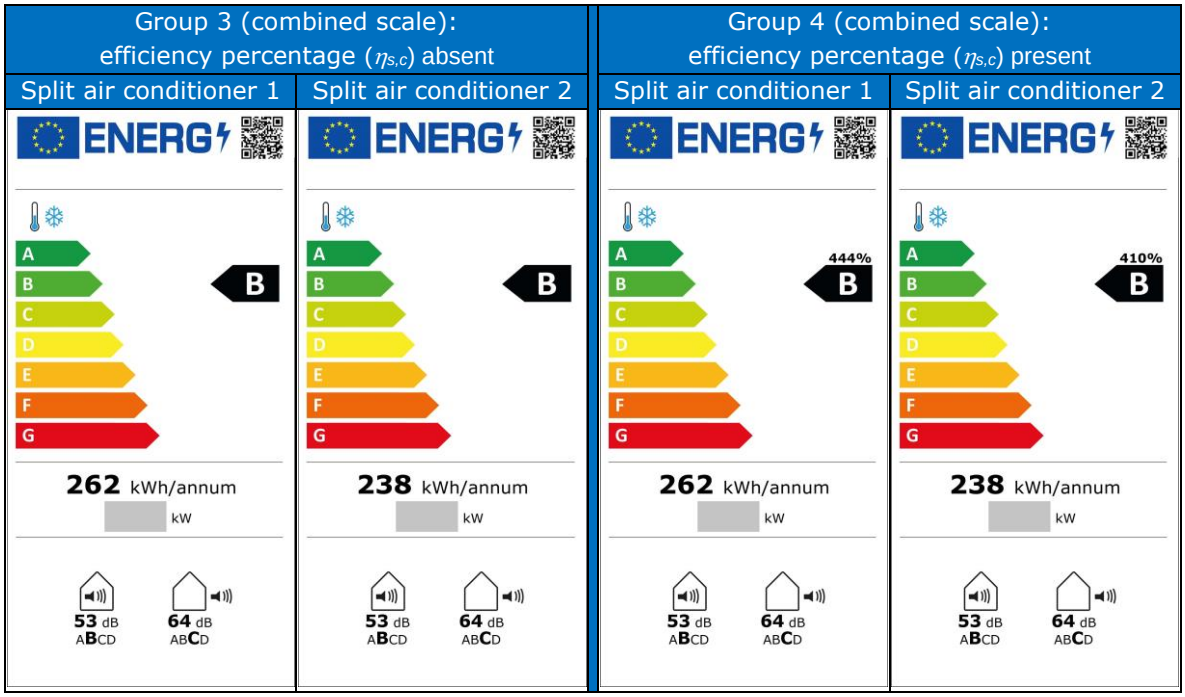


Table 5.6. Identification of the more efficient appliance (task 1b, after explanation)

Which of these two air conditioners is the most energy efficient?	Group 3 (combined scale): efficiency percentage ($\eta_{s,c}$) absent	Group 4 (combined scale): efficiency percentage ($\eta_{s,c}$) present
"1 is more energy efficient"	9,2%	20,9%
"2 is more energy efficient"	69,4%	65,5%
"1 and 2 are equally energy efficient"	12,9%	7,4%
"Can't tell based on this information"	8,5%	6,3%
N	914	910

Note – correct answer is shaded green.

5.1.2. Comparing two appliances using different technologies

If different product types have different energy efficiency scales as currently is the case for the product types under investigation, the energy efficiency classes of appliances of different types cannot be directly compared. In this section, we examine whether consumers understand this. More specifically, we investigate whether

consumers can integrate information on efficiency, consumption and capacity in order to identify more efficient appliances if separate scales are used (current situation), or whether scales need to be combined for consumers to make them aware of the efficiency differences between technologies.

Q3. Do consumers understand that energy efficiency classes cannot be directly compared if different product types have different efficiency scales?

Q4. And are consumers able to use energy consumption information to identify the most efficient product for products with the same heating/cooling capacity (if separate scales are used)?

Space heaters

In order to answer these questions, respondents were presented with energy labels for appliances using different technologies, namely a gas heater and a heat pump. Both appliances have the same heating output (5 kW), but one appliance consumes less energy than the other. On their separate scales, both appliances are in energy class B, but if scales are combined, the heat pump falls in class B, while the gas heater falls in class E; see Figure 5.7). We examine whether providing information on energy consumption enables consumers to identify the more efficient appliance (group 2 versus group 1) or whether the scales need to be combined to improve understanding that, in this case, the heat pump is more efficient (group 3 versus group 2). The results are in Table 5.7.

Table 5.7. Identification of the more efficient appliance (task 2)

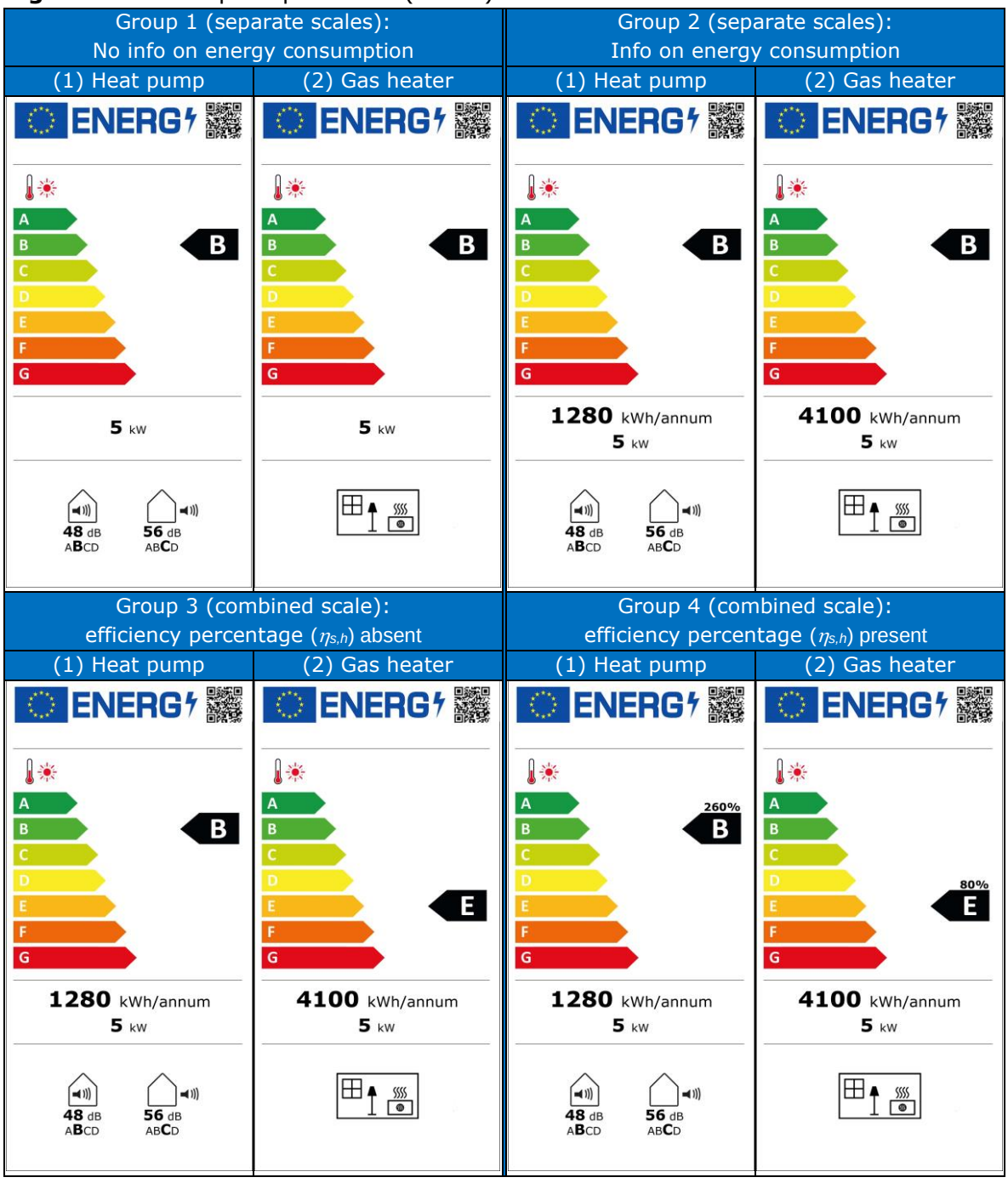
Which of these two heaters is the most energy efficient?	Separate scales		Combined scale	
	Group 1: No info on energy consumption	Group 2: Info on energy consumption	Group 3: efficiency percentage ($\eta_{s,h}$) absent	Group 4: efficiency percentage ($\eta_{s,h}$) present
"Appliance 1 is more energy efficient"	14,6%^{c}	52,6%^{b}	72,5%^{a}	74,0%^{a}
"Appliance 2 is more energy efficient"	11,6%	18,9%	13,0%	14,3%
"1 and 2 are equally energy efficient"	62,1%	18,6%	6,6%	4,5%
"Can't tell based on this information"	11,8%	9,8%	7,8%	7,3%
N	907	908	906	910

Note – correct answer is shaded green. Percentages with different superscripts – row-wise – are significantly different at $p < 0,05$.

Most consumers do not seem to realise that energy efficiency classes cannot be direct compared if different product types have different efficiency scales. The majority of respondents in group 1 (62,1%) thought that the heat pump and gas heater were equally efficient (see Table 5.7). Only 14,6% accurately indicated that a heat pump uses energy more efficiently compared to a gas heater. Adding information on energy consumption significantly increased accurate responses: In group 2, 52,6% of the respondents identified the heat pump as the more efficient appliance. Note that (some

of) these respondents might have provided the right answer because they falsely believed that lower energy consumption equals higher energy efficiency, as demonstrated previously (we will return to this issue later on).

Figure 5.7. Label pairs presented (task 2)



When the scales are combined on top of providing energy consumption information (groups 3), 72,5% of the respondents accurately indicated that the heat pump is more efficient, which is significantly more compared to when only energy consumption information is added. Thus, combining scales is more effective in increasing understanding that, in this case, a heat pump is more efficient than a gas heater than

adding energy consumption information alone. Finally, whether respondents could accurately identify the more efficient appliance did not significantly depend on the presence (vs. absence) of the energy efficiency percentage above the black arrow (group 4 vs. group 3 in Table 5.7; the difference between 72,5% and 74,0% is not statistically significant).

Air conditioners

Respondents who performed the task for air conditioners were exposed to an energy label of a split air conditioner and an energy label of a double duct air conditioner. Both air conditioners have the same cooling output (5 kW), but one appliance consumes less energy than the other. On their separate scales, both appliances are in energy class B. If scales are combined, the split air conditioner falls in class B and the double duct air conditioner in class F (see Figure 5.8). The results are in Table 5.8.

In line with the findings for space heaters, providing information on energy consumption (keeping scales separate) increased accurate identification of the split air conditioner as the more efficient appliance (from 25,0% in group 1 to 66,3% in group 2; see Table 5.8). When the scales are combined (groups 3), accurate identification of the split air conditioner as the more efficient appliance increased further, to 75,2% (a statistically significant improvement). Thus, consistent with the results for space heaters, combining scales on top of adding energy consumption information is more effective than adding energy consumption information alone.

Figure 5.8. Label pairs presented (task 2)

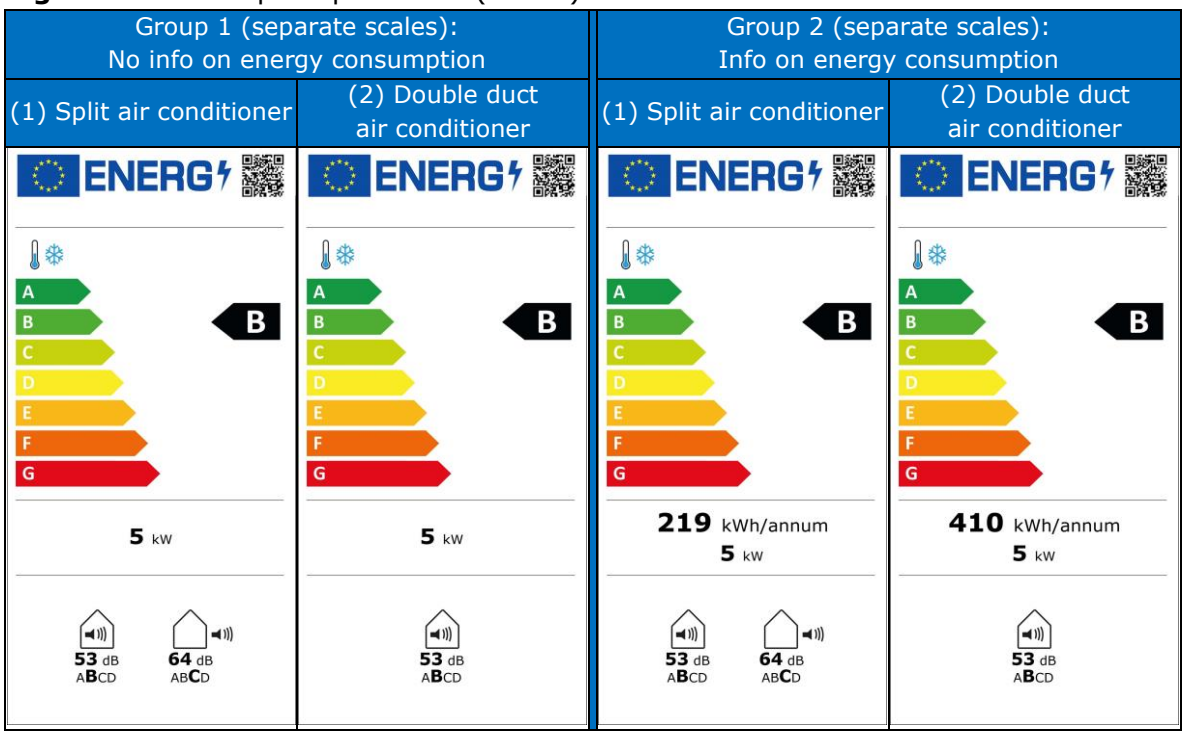


Figure 5.8 (continued).

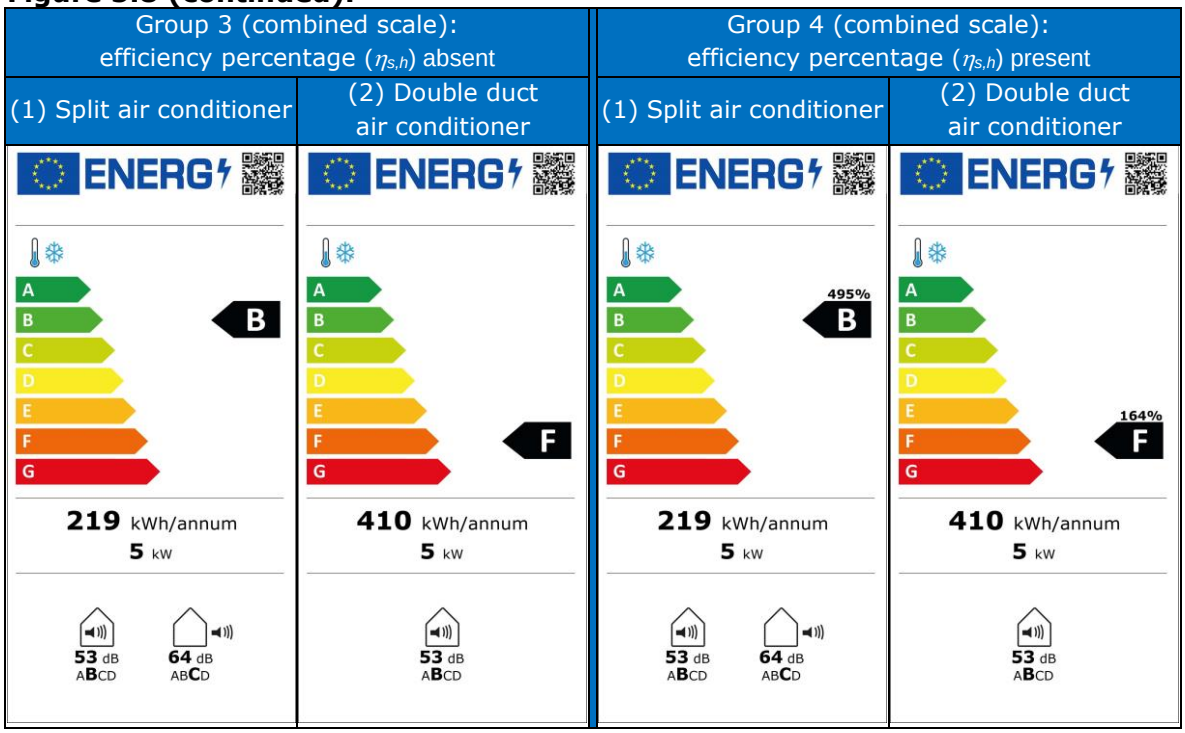


Table 5.8. Identification of the more efficient appliance (task 2)

Which of these two air conditioners is the most energy efficient?	Separate scales		Combined scale	
	Group 1: No info on energy consumption	Group 2: Info on energy consumption	Group 3: efficiency percentage ($\eta_{s,h}$) absent	Group 4: efficiency percentage ($\eta_{s,h}$) present
"Appliance 1 is more energy efficient"	25,0%[c]	66,3%[b]	75,2%[a]	78,0%[a]
"Appliance 2 is more energy efficient"	13,0%	11,4%	12,9%	10,8%
"1 and 2 are equally energy efficient"	53,3%	15,8%	5,3%	4,2%
"Can't tell based on this information"	8,7%	6,5%	6,7%	7,0%
N	905	910	914	910

Note – correct answer is shaded green. Percentages with different superscripts – row-wise – are significantly different at $p < 0,05$.

Q5. Are consumers able to use energy consumption information to identify the most efficient product for products with <u>different</u> heating/cooling capacity (if separate scales are used)?

In the last task, consumers were presented with two energy labels for two different types of appliances with different heating/cooling capacity. The two appliances have the same energy efficiency class (on their separate scale) and they use the same amount of energy. This situation may occur if the appliance using the more efficient technology has a higher capacity (see Figure 5.9). Again, we examine whether adding

information on energy consumption is sufficient for consumers to understand that the appliance with the higher capacity must be the more energy efficient one (group 2 versus group 1), or whether the scales need to combined in order to improve this understanding (group 3 versus group 2).

Space heaters

In the product identification task, respondents were presented with an energy label of a heat pump and an energy label of a gas heater. Both appliances fall in energy class B on their separate scales (groups 1 and 2), but if combined, the heat pump falls in class B and the gas heater in class E (groups 3 and 4). The heating capacity of the heat pump (12 kW) is higher than the heating capacity of the gas heater (3 kW), and the two appliances consume an equal amount of energy (3000 kWh/annum). Figure 5.9 shows the pairs of energy labels that were presented in each experimental group. Table 5.9 presents the results.

In group 1, 21,1% of the respondents identified the heat pump as the more efficient appliance. Substantially more respondents (39,1%) falsely believed the gas heater to be more energy efficient than the heat pump, perhaps because they misinterpreted the lower heating output as lower energy consumption (which they tend to confuse with energy efficiency). The findings further suggest that relatively many respondents just compared the energy efficiency classes, leading to the false conclusion that the two appliances are equally energy efficient (28,7%). Providing information on energy consumption did not significantly improve understanding. If consumption information was displayed on the labels (group 2), still only 22,1% accurately identified the heat pump as the more efficient appliance, compared to 21,1% in group 1 (the difference is not statistically significant; see Table 5.9).

Combining the scales did improve understanding: Accurate identification of the heat pump as the more efficient appliance increased substantially, from 22,1% in group 2 to 57,5% in group 3 (see Table 5.9, top part). If scales were combined, task performance did not depend on whether or not the energy efficiency percentage was displayed on the label (group 4 vs. group 3 in Table 5.9, top part; the difference between 57,5% and 61,1% is not statistically significant). The increased ability to identify the most efficient appliance when scales are combined goes hand in hand with slightly worse performance when asked to identify the appliance with lower energy consumption, however (see Table 5.9, bottom part). Significantly *less* respondents thought that the two appliances consumed the same amount of energy when they saw labels with combined (vs. separate) scales.

Table 5.10, which shows the combinations of answers in group 4 (combined scale), provides further insight into this finding. Consistent with the earlier findings, this table again shows that many respondents do not seem to understand the difference between energy efficiency and energy consumption: Most respondents thought that the heat pump, which is more energy efficient, also consumes less energy (36,0%). Only 12,0% of the respondents correctly identicated that the heat pump is more efficient *and* that the two appliances consume an equal amount of energy.

Figure 5.9. Label pairs presented (task 3)

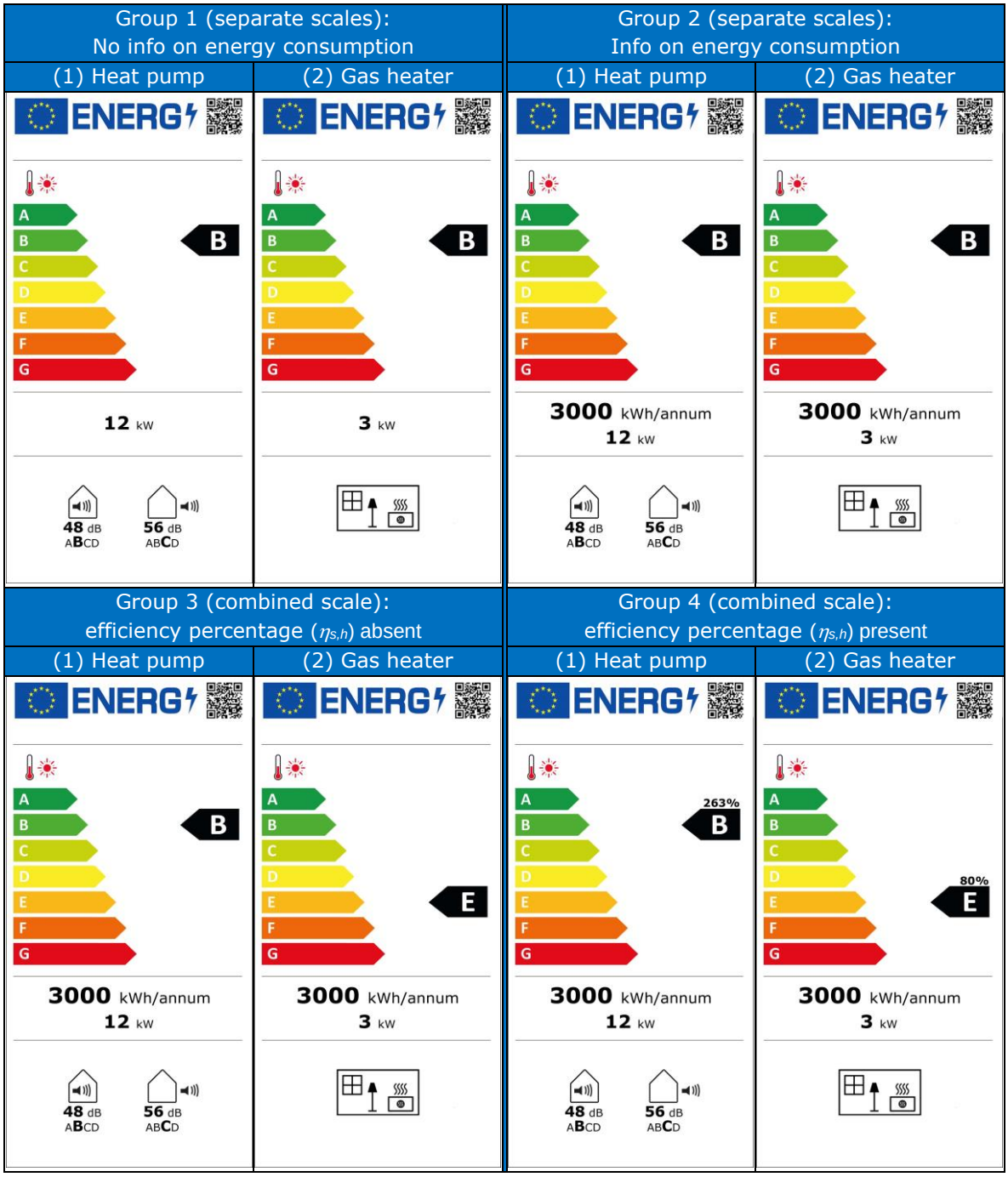


Table 5.9. Identification of the more efficient vs. less energy consuming appliance (task 3)

Energy efficiency	Separate scales		Combined scale	
	Group 1: No info on energy consumption	Group 2: Info on energy consumption	Group 3: efficiency percentage ($\eta_{s,h}$) absent	Group 4: efficiency percentage ($\eta_{s,h}$) present
"Appliance 1 is more energy efficient"	21,1%[b]	22,1%[b]	57,5%[a]	61,1%[a]
"Appliance 2 is more energy efficient"	39,1%	35,8%	21,4%	20,3%
"1 and 2 are equally energy efficient"	28,7%	32,1%	12,4%	9,3%
"Can't tell based on this information"	11,1%	10,0%	8,7%	9,2%
N	907	908	906	910
Energy consumption	**Separate scales**		**Combined scale**	
	Group 1: No info on energy consumption	Group 2: Info on energy consumption	Group 3: efficiency percentage ($\eta_{s,h}$) absent	Group 4: efficiency percentage ($\eta_{s,h}$) present
"1 uses the least amount of energy"	13,7%	12,4%	37,5%	41,7%
"2 uses the least amount of energy"	57,2%	46,6%	30,9%	29,3%
"1 and 2 use an equal amount of energy"	18,9%	32,4%[a]	23,4%[b]	19,9%[b]
"Can't tell based on this information"	10,3%	8,6%	8,2%	9,1%
N	907	908	906	910

Note – correct answer is shaded green. Percentages with different superscripts – row-wise – are significantly different at $p < 0,05$.

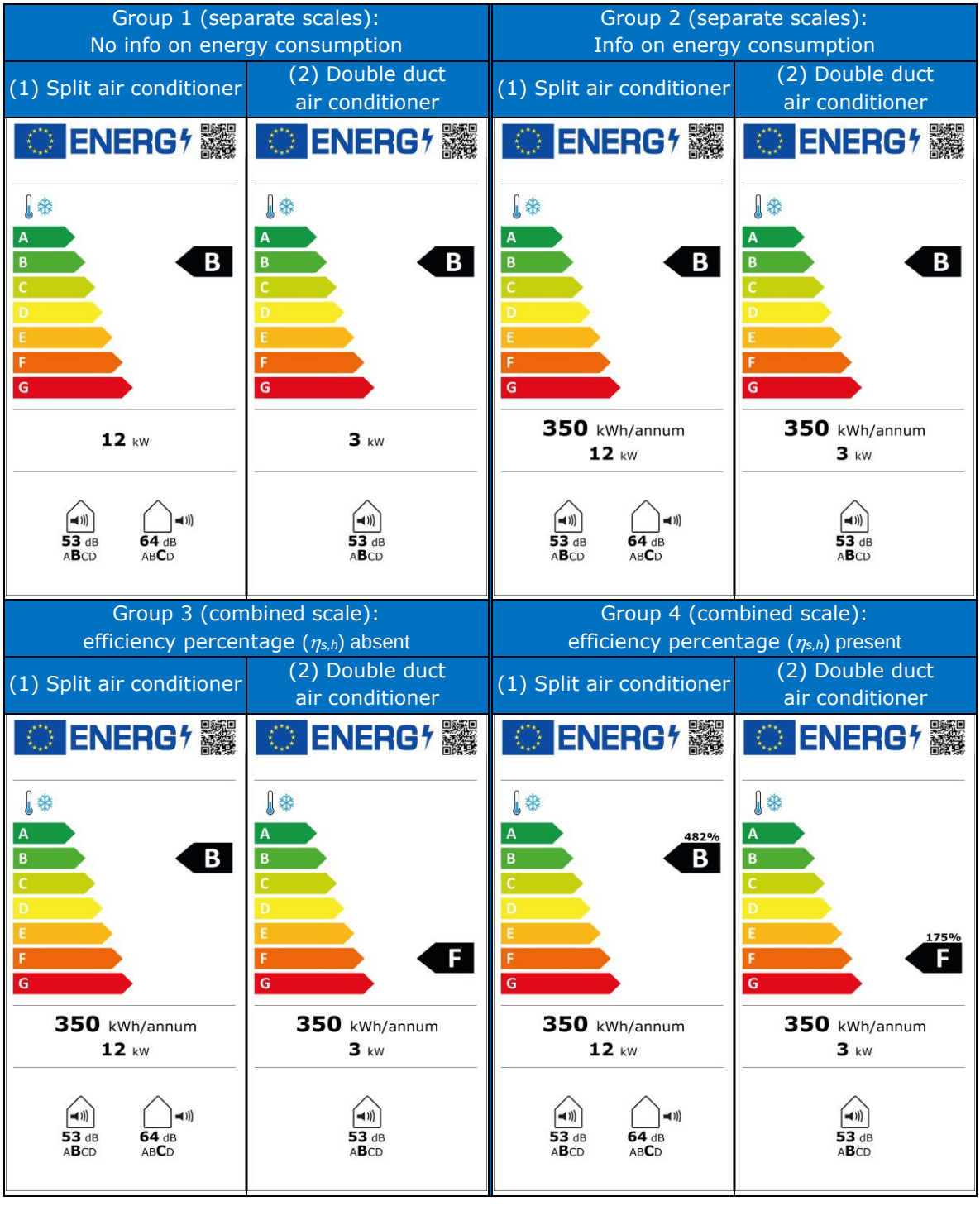
Table 5.10. Understanding of difference between efficiency and consumption (task 3)

Group 4 (combined scale): efficiency percentage ($\eta_{s,h}$) present		Which of the two air conditioners uses the least amount of energy?				
		"1 uses the least amount of energy"	"2 uses the least amount of energy"	"1 and 2 use an equal amount of energy"	"Can't tell based on this information"	Total
Which of these two air conditioners is most energy eficient?	"1 is more energy efficient"	36,0%	11,7%	12,0%	1,4%	61,1%
	"2 is more energy efficient"	3,6%	14,0%	2,4%	0,3%	20,3%
	"1 and 2 are equally energy efficient"	1,0%	2,6%	5,0%	0,8%	9,3%
	"Can't tell based on this information"	1,0%	1,1%	0,6%	6,6%	9,2%
	Total	41,7%	29,3%	19,9%	9,1%	100% (N = 910)

Air conditioners

A similar task was performed for air conditioners. Here, respondents saw an energy label of a split air conditioner and an energy label of a double duct air conditioner. The split air conditioner is more energy efficient (but this only becomes apparent in the efficiency classes if scales are combined); it consumes the same amount of energy than the double duct air conditioner, but has a higher heating output (see Figure 5.10).

Figure 5.10. Label pairs presented (task 3)



Again, the results are largely in line with the results for space heaters. Providing energy consumption information did not improve understanding that the split air conditioner is more energy efficient (17,0% vs. 19,6%; see Table 5.11, top part). Combining the efficiency scales did: Accurate identification of the split air conditioner as more efficient showed a substantial improvement from 17,0% in group 2 (separate scales) to 50,7% in group 3 (see Table 5.7, top part). Here, adding the energy efficiency percentage (group 4) further improved understanding, to 58,6% (a statistically significant improvement). The large improvement in understanding that the split air conditioner is more efficient than the double duct air conditioner due to the combination of scales is associated with a slight reduction in understanding that the two appliances consume the same amount of energy (see Table 5.11, bottom part).

Table 5.11. Identification of the more efficient vs. less energy consuming appliance (task 3)

Energy efficiency	Separate scales		Combined scale	
	Group 1: No info on energy consumption	Group 2: Info on energy consumption	Group 3: efficiency percentage ($\eta_{s,h}$) absent	Group 4: efficiency percentage ($\eta_{s,h}$) present
"Appliance 1 is more energy efficient"	19,6%^{c}	17,0%^{c}	50,7%^{b}	58,6%^{a}
"Appliance 2 is more energy efficient"	45,8%	40,4%	22,5%	19,1%
"1 and 2 are equally energy efficient"	26,7%	34,7%	16,6%	15,0%
"Can't tell based on this information"	8,0%	7,8%	10,2%	7,4%
N	905	910	914	910
Energy consumption	**Separate scales**		**Combined scale**	
	Group 1: No info on energy consumption	Group 2: Info on energy consumption	Group 3: efficiency percentage ($\eta_{s,h}$) absent	Group 4: efficiency percentage ($\eta_{s,h}$) present
"1 uses the least amount of energy"	12,7%	8,2%	32,1%	38,7%
"2 uses the least amount of energy"	66,1%	50,0%	32,4%	29,0%
"1 and 2 use an equal amount of energy"	14,3%	33,3%^{a}	26,2%^{b}	24,3%^{b}
"Can't tell based on this information"	7,0%	8,5%	9,4%	8,0%
N	905	910	914	910

Note – correct answer is shaded green. Percentages with different superscripts – row-wise – are significantly different at $p < 0,05$.

Consistent with the findings for space heaters, around 12% of the respondents correctly identicated that the split air conditioner is more efficient than the double duct air conditioner *and* that the two appliances consume an equal amount of energy (see Table 5.12). A substantially larger group of respondents falsely believed that the split

air conditioner is more efficient *and* consumes less energy (34,1%), which suggests that consumers find it difficult to distinguish between efficiency and consumption.

Table 5.12. Understanding of difference between efficiency and consumption (task 3)

Group 4 (combined scale): efficiency percentage ($\eta_{s,h}$) present		Which of the two air conditioners uses the least amount of energy?				
		"1 uses the least amount of energy"	"2 uses the least amount of energy"	"1 and 2 use an equal amount of energy"	"Can't tell based on this information"	Total
Which of these two air conditioners is most energy eficient?	"1 is more energy efficient"	34,1%	10,8%	12,3%	1,4%	58,6%
	"2 is more energy efficient"	3,0%	13,4%	2,6%	0,1%	19,1%
	"1 and 2 are equally energy efficient"	1,1%	4,0%	8,9%	1,0%	15,0%
	"Can't tell based on this information"	0,6%	0,9%	0,4%	5,5%	7,4%
	Total	38,7%	29,0%	24,3%	8,0%	100% (N = 910)

5.2. Consumer expectations

Do consumers actually *expect* to be able to compare the energy efficiency class of products that use different technologies? In order to answer this question, respondents were shown a pair of energy labels for different types of products and were asked whether they would expect to be able to compare the energy efficiency classes in the two labels. Prospective buyers of space heaters and half of the general public sample (randomly decided) were presented with a label of a heat pump and a label of a gas heater. Most respondents – 42,3% of the general public and 44,5% of the prospective buyers – expected to be able to compare the energy efficiency classes of the two types of appliances (see Table 5.13).

Table 5.13. Consumer expectations: space heaters

Would you expect to be able to compare the energy efficiency class of a heat pump with the energy efficiency class of a gas heater?	General public	Prospective buyers
Yes	**42,3%**	**44,5%**
No	27,0%	26,0%
I don't know	30,7%	29,5%
N	3631	1208

Prospective buyers of air conditioners and the other half of the general public sample were presented with a label of a fixed and a label of a portable air conditioner. Again, most respondents – 48,3% of the general public and 54,7% of the prospective buyers – expected to be able to compare the energy efficiency classes of the two types of appliances (see Table 5.14).

Table 5.14. Consumer expectations: air conditioners

Would you expect to be able to compare the energy efficiency class of a fixed air conditioner with the energy efficiency class of a portable air conditioner?	General public	Prospective buyers
Yes	**48,3%**	**54,7%**
No	24,6%	26,7%
I don't know	27,2%	18,6%
N	3639	1214

5.3. Conclusion

The product identification tasks were set-up to provide answers to specific questions, which are discussed below.

Do consumers understand the difference between energy consumption and energy efficiency?

The findings suggest that consumers have difficulty understanding the difference between energy consumption and energy efficiency. Presented with two appliances of which one is more efficient and the other consumes less energy (because it has a lower capacity), only about a quarter of the respondents correctly identified the more efficient appliance as being more efficient and the appliance with lower energy consumption as having lower energy consumption. About half of the respondents incorrectly assumed either that the more efficient appliance also consumed less energy, or that the less energy consuming alternative was also more efficient. When presented with two energy labels of appliances falling in the same energy class, many respondents appeared to use the energy consumption information to make inferences about the relative energy efficiency of the appliances, while ignoring the information on their capacity. A brief explanation of the meaning of energy efficiency did not improve understanding.

Are consumers able to use $\eta_{s,c}/\eta_{s,h}$ information to identify the more efficient product if two products fall in the same efficiency class (if scales are combined)?

The presence of $\eta_{s,c}/\eta_{s,h}$ values above the black arrows in the energy labels did not improve respondents' ability to identify the more efficient product if two products fell in the same efficiency class. If two appliances had the same energy efficiency class, most respondents (around 50%) relied on the energy consumption information to draw conclusions about which appliance is more efficient, ignoring potential capacity differences between appliances. Another group (around 10%) did not seem to look at any other information than the energy efficiency class to identify the more efficient appliance: They simply seemed to assume that if two appliances are in the same energy class, they must be equally efficient.

Do consumers understand that energy efficiency classes cannot be directly compared if different product types have different efficiency scales? And are consumers able to use energy consumption information to identify the most efficient product for products with the same heating/cooling capacity (if separate scales are used)?

When asked directly, about 4 in 10 respondents (the largest group) expected to be able to compare the energy efficiency classes of two appliances using different technologies. About 3 in 10 respondents did not expect to be able to compare different types of appliances, and the remaining respondents had no idea. Consistent with these expectations, the majority of respondents did not appear to understand that energy efficiency classes of products of different types cannot be directly compared (if different product types have separate scales): More than 60% of respondents falsely believed a heat pump and gas heater with the same capacity and same energy class (on their separate scales) to be equally efficient, for instance.

The display of energy consumption information on the energy label seemed to make respondents more aware of the efficiency differences between technologies: If energy consumption information was present (while capacity and energy class were the same for the two appliances), the majority of respondents correctly identified the appliance with the lower energy consumption as the more efficient appliance. However, it could also be that (some of) these respondents falsely believed that lower consumption *equals* higher efficiency, which would also lead to a correct identification of the more efficient product in this case (because the two appliances have the same capacity). Furthermore, combining scales on top of adding consumption information was more effective in increasing understanding of efficiency differences between technologies than adding consumption information alone.

Are consumers able to use energy consumption information to identify the most efficient product for products with different heating/cooling capacity (if separate scales are used)?

Finally, we examined whether respondents were able to use energy consumption information (keeping scales separate) to identify the most efficient product if two products using different technologies (e.g. a heat pump and a gas heater) also have a different heating/cooling capacity, or whether scales need to combined in order to improve this understanding. Do they understand that if energy consumption is the same, the appliance with the higher capacity must be the more efficient one (if separate scales are used)? The results demonstrated that while adding energy consumption information did not improve understanding, combining scales did: In that case, accurate identification of the more efficient appliance increased substantially. However, the improved ability to identify the more energy efficient appliance went hand in hand with a reduced ability to identify the appliance with the lower energy consumption, which is consistent with the earlier finding that consumers tend to think of energy efficiency and energy consumption as inversely related (i.e. appliances that use less energy are more energy efficient).

6. Discussion and recommendations

The present study provides important insights into consumer understanding of the energy label for local space heaters (under Regulation (EU) 2015/1186) and air-to-air heat pumps and air conditioners (under Regulation (EU) No. 626/2011). A central question was whether consumers understand and expect that different heating/air conditioning technologies have different energy efficiency scales, and whether they take the efficiency differences between technologies into account in their product choices. Via an online experiment, it was also investigated whether an energy label in which the energy efficiency of products using different technologies on the same efficiency scale – akin to the energy label for space heaters that heat water (under Regulation (EU) 811/1213) – is more effective in guiding consumers towards more efficient product choices compared to the current situation in which the different technologies have separate efficiency scales. In total, over 9600 European consumers took part in the study. The findings are discussed below.

6.1. Label understanding and consumer expectations

Separate scales (current situation)

It was investigated whether consumers understand and expect that energy efficiency classes of different heating/cooling technologies have separate energy efficiency scales and hence, cannot be compared, and to what extent they understand energy consumption information and are able to use this information to identify more efficient technologies.

Most consumers do not seem to realise that current energy efficiency classes of different heating/cooling technologies cannot be compared. For example, when shown an energy label of a heat pump and a gas heater, less than 3 in 10 consumers (27%) correctly indicated that the energy efficiency classes could not be compared between these products; 4 in 10 consumers (42%) thought they could compare the two products, and the remainder (30%) did not know. Similarly, when respondents were presented with, for example, a heat pump and gas heater with the same efficiency class ("B") and were asked to indicate the most efficient product, the majority of respondents (62%) thought both products were equally energy efficient. Comparable findings were obtained for air conditioners.

Only in certain cases, consumers were able to use *energy consumption information* to identify the most efficient product. Specifically, in one task, respondents were shown energy labels of different technologies (e.g. a heat pump and a gas heater) but with the *same energy efficiency class and capacity*. In this case, a small majority of respondents (53%) correctly indicated that the heat pump (with its lower energy consumption) is the most efficient device, versus only 15% indicating this when no information on annual energy consumption was provided. Thus, in situations where other energy-related values are constant, consumers appear able to use energy consumption information to identify more efficient products.

However, other findings revealed that consumers do not fully understand the differences between energy consumption, energy efficiency, and product capacity. For example, in one task, respondents were shown energy labels of two heat pumps of which one had a higher energy efficiency class and the other a lower energy consumption (due to differences in capacity). It was found that only one quarter (27%) was able to accurately identify the product with the lowest energy consumption *as well as* the most efficient product. Further, when presented with energy labels of (for example) a heat pump and a gas heater that varied in capacity but not in energy efficiency class, only one in five respondents (21%) correctly indicated that the heat pump (with the higher capacity) is the most energy efficient; about 4 in 10 consumers (39%) falsely indicated that the product with the lower capacity (the gas heater) is the most efficient.

Thus, overall, consumers show very limited understanding of the differences between energy efficiency, energy consumption, and capacity. This suggests that presenting (or adding) information on energy consumption on the energy label is not sufficient to help consumers identify more efficient technologies.

Combined scales

It was tested whether combined scales better inform consumers of more efficient technologies, and whether adding $\eta_{s,c}/\eta_{s,h}$ information to the combined scale helps in identifying more efficient products when the products fall in the same energy efficiency class (hence, counteracting its reduced granularity).

Indeed, combining the energy scales helped consumers to identify more efficient technologies. A clear majority of respondents (58% - 75%) now correctly indicated the most efficient product when exposed to different technologies (e.g. a heat pump and gas heater) – a substantial increase compared with the 17% - 53% who correctly indicated this when separate scales were provided. Further, when asked directly regarding their preference for a separate vs. combined scale after having described the benefits of each option, prospective buyers preferred the combined scale (preferred by 45%) over the separate scale (preferred by 36%). Thus, the combined scale leads to significant increases in understanding of the most efficient technology and seems to be preferred by consumers.

Most consumers did not appear to understand how to use $\eta_{s,c}/\eta_{s,h}$ information to identify more efficient products of the same technology. For example, when presented with the energy labels of two products of the same type (e.g. two heat pumps) that have the same energy efficiency class (but differing energy consumption levels), only 3 in 10 respondents (29%) correctly identified the most efficient heat pump (i.e. the heat pump with the highest $\eta_{s,c}/\eta_{s,h}$). In addition, slightly fewer respondents now incorrectly identified the heat pump with the lowest consumption as being the more efficient alternative (52% vs. 62%) – suggesting that yet again, some respondents used energy consumption information to identify more efficient products. Thus, overall, adding $\eta_{s,c}/\eta_{s,h}$ information does not seem very effective in counteracting the reduced granularity of the combined scale.

6.2. Impact of label information on consumers' appliance choices

Respondents were exposed to a product set of nine different air conditioners or space heaters (of different technologies) and asked to make a choice. It was investigated to what extent consumers take into account efficiency information in their product choices and how the energy label might best guide consumers towards more efficient technologies/product alternatives. In addition, it was examined whether the higher costs associated with more efficient technologies reduce the impact of the energy label on choices for more efficient technologies/alternatives.

Separate scales (current situation)

In most cases, the provision of information about *seasonal energy consumption* (using separate scales) on the energy label did not promote choices for more efficient appliances. The only exception to this was when choices were made regarding air conditioners and when no product prices were displayed: in this case, the choice for split air conditioners increased from 30% to 45%. The limited effectiveness of the provision of energy consumption information might be explained by the finding that consumers tend to believe that energy efficiency classes can be compared across technologies. Since the different technologies in the choice set all had similar energy classes (when presented on separate scales), this could have led consumers to believe that their energy efficiency differences are rather small – and not worth paying a higher product price for.

Combined scales

In fact, when energy scales of different technologies were combined, this led to more reliable increases in choices for more efficient technologies (a split air conditioner or a heat pump). More specifically, choices for more efficient technologies increased from 41% - 42% to 54% - 56% when energy labels were combined, and these effects remained present when price information was provided. This again suggests that consumers compare energy classes of different technologies, and use this information when making product choices.

As outlined earlier, a downside of combining energy scales of different technologies is that consumers find it more difficult to identify the most efficient product within a technology, since products using the same technology are now more likely to fall into the same energy efficiency classes. Similarly, combining energy scales reduced choices for the most energy efficient products within technologies. Specifically, when scales were combined, about 4 to 5 in 10 consumers (40% - 45%) chose the most efficient product within a technology, compared with about 6 in 10 (57% - 66%) when separate scales were used. Finally, adding $\eta_{s,c}/\eta_{s,h}$ information was not effective in counteracting the negative effects of the combined label – likely because relatively few consumers seemed to understand how they can use this information to identify more efficient products.

6.3. Separate or combined?

Thus, when considering combining scales of different heating/cooling technologies, it appears that a trade-off needs to be made. On the one hand, a considerable number of consumers believe they can compare the energy classes of different technologies;

as a result, combining scales would better inform them of the most efficient technologies, and helps steer their choices towards these technologies. On the other hand, separate scales are more effective in informing consumers of – and steering their choices towards – the most efficient product *within* a technology, albeit at the cost of reducing understanding of, and choices for, the most efficient technology.

Therefore, the answer to the question whether separate or combined energy labels should be used is not clear-cut. One possible solution is to present both types of information on an "integrated" energy label: that is, providing information on the product's efficiency class both within and between technologies. This would inform consumers of the differences in energy efficiency between technologies while still enabling fine-grained comparisons within technologies. Of course, in this case, one must be careful as to not overload or confuse consumers, who already appear to frequently misunderstand the different types of energy-related information that are provided on energy labels. Information campaigns can also aid in educating consumers about how to interpret the different types of scales (or an integrated one).

Another option might be to use the current data to examine the net effect of using combined vs. separate scales – in other words, which type of scale leads to the strongest increases in *overall* energy efficiency, weighing their unique benefits? In the present study, we aimed to gain insight into this by examining which of the label types (separate or combined) led to the largest increases in the average energy efficiency of the selected product ($\eta_{s,c}/\eta_{s,h}$%). It was found that the combined energy label led to choices for more efficient products overall. However, it is important to note that it is unknown whether the choice distributions in the current study match consumer choices in the current market:[26] If actual market shares of split air conditioners and heat pumps are (substiantially) higher, this reduces the relative effectiveness of the combined label, and instead, the separate label with greater granularity may be more effective. Thus, detailed consumer market share data will be needed to help determine which of the label formats is expected to result in the largest overall increase in energy efficiency of air conditioners and heaters.

The main aim of the current study was to assess the relative effectiveness of different types of label information/label formats. To this end, choice contexts were simulated in which respondents were presented with different heating or cooling appliances with (specific types of) energy labels. This way, the study provides important insights into the effects of different label types (e.g. if a combined vs. separate energy label steers towards more efficient technologies). Although this set-up provided a rigorous test of our research questions, one might note that the energy labels of the different products were relatively salient (e.g. presented at a large size) compared with real-life situations, in which consumers may have to more actively search for this information and in which other product characteristics are more salient instead (such as product design) – which are then more readily used when making product choices. Therefore,

[26] In fact, market share data suggest that heat pumps and split air conditioners are more frequently chosen than was the case in the current study (see e.g. https://www.marketdataforecast.com/market-reports/europe-air-conditioning-systems-market); however, these data might primarily reflect product choices by experts (instead of consumers).

in real-life, the absolute effects of different energy labels on product choices might be smaller than the current study suggests (although, notably, the *relative* effectiveness of the different labels is not expected to change). Further, in real-life choice contexts, it might be that (some) consumers may actively search for information as to how to compare energy labels of different technologies, which could partly mitigate issues associated with separate energy labels.

6.4. Conclusion

Overall, the current findings suggest that the provision of energy consumption information (on separate scales) does not sufficiently help consumers to identify more efficient technologies, nor does it promote choices for more efficient technologies. Combining energy efficiency scales of different technologies, on the other hand, helps consumers to identify more efficient technologies and also steers choices towards these products. However, this comes at a cost: Due to their reduced granularity, combining scales also led to lower levels of understanding of, and less choices for, more efficient products within technologies. A proposed solution – namely, additionally providing detailed $\eta_{s,c}/\eta_{s,h}$ information on the energy label – was ineffective in counteracting this negative effect. Future research could aim at identifying ways to mitigate the negative effects of the combined scale on choices within technologies, for example by providing energy efficiency information both within and between technologies on the energy labels, and/or by implementing an information campaign.

A. Questionnaire

Questionnaire is a desktop-only questionnaire.

Three samples are recruited:
1. General public (18-75), nationally representative (quotas on age and gender), N = 1200, LOI = 15 min.
2. Prospective buyers of space heaters (18-75), N = 200, LOI = 10 min.
3. Prospective buyers of air conditioners (18-75), N = 200, LOI = 10 min.

Different subsamples will receive different questionnaire parts, as follows:

Subsample		Questionnaire part							
		1a	1b	1c	1d	2	3	4	5
SUB1	General public	X	X			X	X		X
SUB2	PB – space heaters	X	X	X		X	X	X	X
SUB3	PB – air conditioners	X	X		X	X	X	X	x

X1	Product type	Number of respondents per country		
		General public sample	Prospective buyers space heaters	Prospective buyers air conditioners
1	Space heaters	600	200	0
2	Air conditioners	600	0	200

X2	Label information	Type of scale	Number of respondents per country		
			General public sample	Prospective buyers space heaters	Prospective buyers air conditioners
1	Version 1	Separate	300	50	50
2	Version 2	Separate	300	50	50
3	Version 3	Combined	300	50	50
4	Version 4	Combined	300	50	50

X3	Price information	Number of respondents per country		
		General public sample	Prospective buyers space heaters	Prospective buyers air conditioners
1	Absent	600	100	100
2	Present	600	100	100

Respondents are assigned randomly to (combinations of) X1 (general public sample), X2 and X3.

PART 1a. SCREENING QUESTIONS (age, gender)

SD1. What is your date of birth?

YEAR
- ☐ _1910 1910
- ☐ ...
- ☐ _2015 2015

MONTH
- ☐ _1 January
- ☐ _2 February
- ☐ _3 March
- ☐ _4 April
- ☐ _5 May
- ☐ _6 June
- ☐ _7 July
- ☐ _8 August
- ☐ _9 September
- ☐ _10 October
- ☐ _11 November
- ☐ _12 December

SD2. Are you…?
- ○ _1 Male
- ○ _2 Female

Screen 2 [General introduction]

Base: all respondents

[Info]

This questionnaire consists of several parts. The first part is about heaters and air conditioners. In this part, you are asked to imagine that you are planning to buy either a heater or an air conditioner, and to make a choice from a number of options.

PART 1b. SCREENING QUESTIONS (prospective buyers)

Screen 3

Base: all respondents

[Info]

But first, we would like to know whether you actually plan to buy a heater or air conditioner within the next 12 months.

To give you a better idea of the types of appliances this questionnaire is about, the main types of heaters and air conditioners are shown on the next two screens.

Screen 4

Base: all respondents

S3. [S]

The table below provides an overview of the main types of heaters, and some examples.

Type of heater	*How does it generate heat?*	*Examples*
Solid fuel heater	A solid fuel heater generates heat by **burning wood** (wood logs or pellets) or coal.	<display example1_solid.jpg, example2_solid.jpg, example3_solid.jpg>
Liquid fuel heater	A liquid fuel heater generates heat **by liquid fuel**, such as ethanol or kerosene.	<display example1_liquid.jpg, example2_liquid.jpg>
Gas heater	A gas heater generates heat by **burning gas** (natural gas or liquefied petroleum gas (LPG)).	<display example1_gas.jpg, example2_gas.jpg , example3_gas.jpg>
Air-to-air heat pump	An air-to-air heat pump uses **electricity** to generate heat. It	<display example1_HP.jpg, example2_HP.jpg,

	extracts heat from the outdoor air and releases it indoors.	example3_HP.jpg, example4_HP.jpg, example5_HP.jpg>
Electric heater	An electric heater uses **electricity** to generate heat. Common types are convector heaters and radiant heaters.	<display example1_electric.jpg, example2_electric.jpg , example3_electric.jpg , example4_electric.jpg>

Are you planning to buy any of these types of heaters in the coming 12 months?
We are not referring to central heating systems.

1 No, definitely not
2 Probably not
3 Maybe
4 Probably
5 Yes, definitely

Screen 5

Base: all respondents

S4. [S]

Air conditioners use electricity to cool the indoor air. An air conditioner extracts heat from the indoor air and releases it outdoors. The table below provides an overview of the main types of air conditioners, and some examples.

Type of air conditioner	*Description*	*Examples*
Fixed (multi-)split air conditioner	A split air conditioner consists of two units: an outdoor unit (installed outside the house) and an indoor unit (installed inside the house). A multi-split air conditioner consists of one outdoor unit and multiple indoor units.	Split air conditioner: <display example1_split.jpg> Multi-split air conditioner: <display example2_split.jpg>
Fixed double duct air conditioner	A double duct air conditioner only consists of one unit, the indoor unit. These air conditioners are typically connected to the outside of the house via two ducts or hoses through the wall.	<display example1_double.jpg>
Portable single duct air conditioner	A single duct air conditioner is a portable air conditioner. It consists of one unit and one duct or hose, typically connected to the outside of the house through a window.	<display example1_single.jpg>

Are you planning to buy any of these types of air conditioners in the coming 12 months?
We are not referring to devices that circulate air without cooling it (fans).

1 No, definitely not
2 Probably not
3 Maybe
4 Probably
5 Yes, definitely

Scripter: Define PROSPECTIVE BUYER SAMPLES (SUB2 & SUB3):
If S3 > 3 AND S4 < 4, then X1 = 1 (SUB2).
If S4 > 3 AND S3 < 4, then X1 = 2 (SUB3).
If S3 > 3 AND S4 > 3, then X1 = 1 (SUB2) OR 2 (SUB3) (random allocation based on least filled method).

PART 1c. Follow-up questions (prospective buyers - space heaters)

Screen 6 [heater use: primary or secondary heating, replacement or not]

Base: SUB2

S5. [S]

You indicated that you will [if S3 = 4: probably, if S3 = 5: definitely] buy a heater in the coming 12 months.

Do you intend to use that heater as main or additional heating?

1. As main heating
2. As additional heating
3. I don't know

Base: SUB2

S6. [S]

Do you intend to buy it to *replace* a heater you currently own (e.g. because it is broken)?

1. Yes
2. No
3. I don't know

Screen 7 [heater type: fixed vs portable]

Base: SUB2

S7. [S]

Do you intend to buy a fixed or portable heater?

Fixed heaters are installed by a professional installer at a pre-determined location and cannot be moved. Portable heaters can be moved and do not require installation by a professional installer.

1. A fixed heater
2. A portable heater
3. I don't know (yet)

Screen 8 [heater type: technology]

Base: SUB2

S8a. [S]

Do you already know which specific type of heater you will buy? *You can click here for a description of the main types of heaters that are available*.

Scripter: if the respondent clicks on 'here', please show pop-up window with the table shown in S3

1. No, I have no idea yet
2. No, I'm still considering different types of heaters
3. Yes, namely [*dropdown from S8b*]

Base: IF S8a=3

S8b. [S]

1. a solid fuel heater (e.g. wood stove, pellet stove)
2. a liquid fuel heater (e.g. ethanol heater, kerosene heater)
3. a gas heater

4. an air-to-air heat pump
5. an electric heater
6. other

Screen 9 [heater type: technology]

Base: IF S8a=2

S9. [SGRID, progressive grid]

Which of the following types of heaters are you considering? *You can click here for a description of the main types of heaters that are available*.

Scripter: if the respondent clicks on 'here', please show pop-up window with the table shown in S3

Rows:

1. Solid fuel heater (e.g. wood stove, pellet stove)
2. Liquid fuel heater (e.g. ethanol heater, kerosene heater)
3. Gas heater
4. Air-to-air heat pump
5. Electric heater

Columns

1. 1 – Not considering it at all
2. 2
3. 3
4. 4
5. 5 – Seriously considering it

PART 1d. Follow-up questions (prospective buyers – air conditioners)

Screen 10 [air conditioner use: replacement or not]

Base: SUB3

S10. [S]

You indicated that you will [if S4 = 4: probably, if S4 = 5: definitely] buy an air conditioner in the coming 12 months.

Do you intend to buy it to *replace* an air conditioner you currently own (e.g. because it is broken)?

1. Yes
2. No
3. I don't know

Screen 11 [air conditioner type: fixed vs portable]

Base: SUB3

S11. [S]

Do you intend to buy a fixed or portable air conditioner?

Fixed air conditioners are installed by a professional installer at a pre-determined location and cannot be moved. Portable air conditioners can be moved and do not require installation by a professional installer.

1. A fixed air conditioner
2. A portable air conditioner
3. I don't know (yet)

Screen 12 [air conditioner type: technology]

Base: SUB3

S12a. [S]

Do you already know which specific type of air conditioner you will buy? *You can click here for a description of the main types of air conditioners that are available*.
Scripter: if the respondent clicks on 'here', please show pop-up window with the table shown in S4
1. No, I have no idea yet
2. No, I'm still considering different types of air conditioners
3. Yes, namely [*dropdown from S12b*]

Base: IF S12a=3
S12b. [S]
1. a fixed (multi-)split air conditioner
2. a fixed double duct air conditioner
3. a portable single duct air conditioner
4. other

Screen 13 [air conditioner: technology]
Base: IF S12a=2
S13. [SGRID, progressive grid]
Which of the following types of air conditioners are you considering? *You can click here for a description of the main types of air conditioners that are available*.
Scripter: if the respondent clicks on 'here', please show pop-up window with the table shown in S4
Rows:
1. Fixed (multi-)split air conditioner
2. Fixed double duct air conditioner
3. Portable single duct air conditioner

Columns
1. 1 – Not considering it at all
2. 2
3. 3
4. 4
5. 5 – Seriously considering it

PART 2. Choice behaviour

Screen 14 [introduction]
Base: if X1 = 1 (SUB1 + SUB2)
[Info]
Now, imagine that you are looking for a heater to heat your living room.

Buying the heater that best suits your wishes and needs is not easy. There is a wide range of heaters (stoves, fireplaces) that you can choose from. Your choice may depend on several factors, such as the heating capacity, the desired fuel, how attractive it looks, and your budget.

Imagine that you have already looked up some information about heaters. You have determined that an appliance with a heating capacity of about 5 kW is sufficient to heat your living room. There are no constraints regarding the type of heater that you can install and you have access to all energy sources (electricity, wood, and gas).

Screen 14b [introduction - continued]
Base: if X1 = 1 (SUB1 + SUB2)
[Info]

On the next screen, you will receive information about 9 heaters. Imagine that you want to buy a heater to heat your living room and these are the options you can choose from.

You will receive information about the different types of heaters that are offered, their heating capacity, [*if X3 = 1:* and their energy use; *if X3 = 2:* their energy use, and costs], amongst others. Each heater also has a "design" rating. This rating indicates how attractive the appliance looks.

First, we ask you which of the different types of heaters you would **consider**. Then, we ask you to indicate which specific heater you would **choose**.

Screen 15 [Choice task – consideration set]

Base: if X1 = 1 (SUB1 + SUB2)

Q1. [MA]

Scripter: set-up of the choice task screen:

[TEXT H]

[TEXT H1]		
H1a_LX_PX.jpg	*H1b_LX_PX.jpg*	*H1c_LX_PX.jpg*

[TEXT H2]		
H2a_LX_PX.jpg	*H2b_LX_PX.jpg*	*H2c_LX_PX.jpg*

[TEXT H3]		
H3a_LX_PX.jpg	*H3b_LX_PX.jpg*	*H3c_LX_PX.jpg*

Scripter: If respondents click on "Click to read more", a pop-up window should appear with a more detailed description (including text and images, see below).
Scripter: Respondents should be able to enlarge (all) images (e.g. by clicking on them).
Scripter: Please randomize order of product types (H1-H3).

Scripter: LX depends on the level of X2 and PX depends on the level of X3

Text H:

HEATERS

Heaters come in many different types. We offer air-to-air heat pumps, wood stoves, pellet stoves, and gas fireplaces. Check out our product range below.

Text H1 - Short description:

Air-to-air heat pumps

Air-to-air heat pumps extract heat from the outdoor air and release it indoors. As such, they make smart use of the heat that is already present in the outside air. Heat pumps run on electricity.

Click here to read more about this type of heater.

You can click on the product images below to enlarge them.

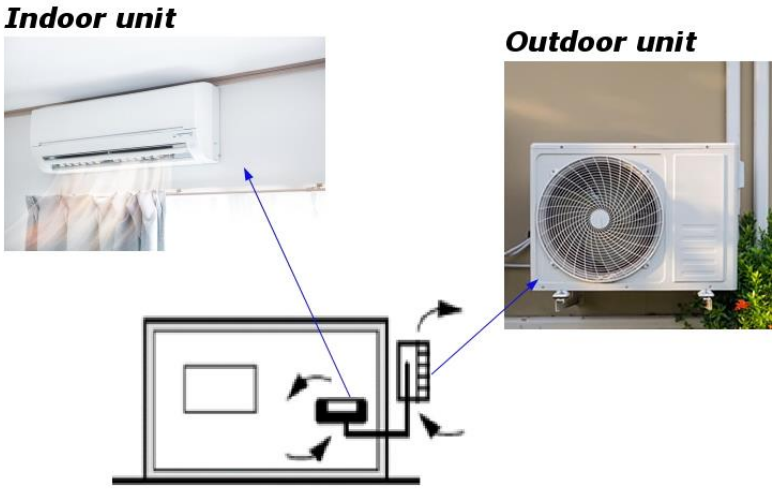
*Text H1 - More detailed description (**shown upon "Click to read more"**):*

Air-to-air heat pumps

Air-to-air heat pumps extract heat from the outdoor air and release it indoors. As such, they make smart use of the heat that is present in the outside air. Heat pumps run on electricity. IF *X3 = 2 (price information condition):* The average price of electricity is [if country=1-4: €0,22; if country=5: 1,07 lei; if country=6: 2,28 kr] per kilowatt-hour (kWh).

A fixed air-to-air heat pump consists of one or more units that are installed at a pre-determined location. Split heat pumps consist of an indoor unit (installed inside the house) and an outdoor unit (installed outside the house).

<display HP_photo.jpg>



The outdoor unit can be placed on the ground or on a flat roof, for instance. The indoor unit blows the warm air into the room. These indoor units come in different models, such as wall units, ceiling units or floor units.

Text H2 - Short description:

Wood stoves/pellet stoves

Wood and pellet stoves generate heat by burning wood. Wood stoves use wood logs, while pellet stoves use small-sized wood chips (pellets) to generate heat.

Click here to read more about this type of heater.

You can click on the product images below to enlarge them.

*Text H2 - More detailed description (**shown upon "Click to read more"**):*

Wood stoves/pellet stoves

Wood and pellet stoves generate heat by burning wood. Wood stoves use wood logs, while pellet stoves use small-sized wood chips (pellets) to generate heat.

<display wood_photo.jpg and pellet_ photo.jpg>

Wood stove

Pellet stove

Pellets are generally made from compressed sawdust and related industrial wood wastes. One kilogram of pellets generates 5 kilowatt-hours (kWh) of energy, on average. Thus, a pellet stove with a capacity of 5 kilowatt (kW) uses around a kilo of pellets per hour at maximum capacity. *IF X3 = 2 (price information condition):* The average price of pellets is [if country=1-4: €0,26; if country=5: 1,27 lei; if country=6: 2,60 kr] per kilogram.

Wood and pellet stoves typically consist of a container with a chimney. Wood stoves are usually loaded manually. Pellet stoves can also be loaded automatically. In that case, a small, electrical device controls the flow of pellets into the stove.

Text H3 - Short description:

Gas heaters

Gas heaters generate heat by burning gas. They may burn natural gas, which is delivered to homes through gas pipes, or liquefied petroleum gas (LPG), which is supplied in a cylinder or tank.

Click here to read more about this type of heater.

You can click on the product images below to enlarge them.

*Text H3 - More detailed description (**shown upon "Click to read more"**):*

Gas heaters

Gas heaters generate heat by burning gas. They may burn natural gas, which is delivered to homes through gas pipes, or liquefied petroleum gas (LPG), which is supplied in a cylinder or tank. *IF X3 = 2 (price information condition):* The average price of gas is [if country=1-4: €0,07; if country=5: 0,34 lei; if country=6: 0,73 kr] per kilowatt-hour (kWh).

Flued gas heaters or fireplaces are fixed heaters that direct combustion gases out of your home

through a flue pipe or chimney.

<display gasheater_photo.jpg and fireplace_photo.jpg>

Flued gas heater

Flued gas fireplace

Which of these types of heaters would you **consider**? You can select multiple types.
Scripter: Please display response categories in same order as in images.

1. Heat pump
2. Pellet stove/wood stove
3. Gas fireplace

Screen 16 [Choice task – final choice]

Base: if X1 = 1 (SUB1 + SUB2)

Q2. [SA]

Scripter: display the same information in the same order as in Q1.

If you had to make a choice among these heaters, which one would you **choose**?

Scripter: Now, respondents should be able to select one of the twelve products, e.g. by checking a box below the product, for instance:

[TEXT]		
H1a_LX_PX.jpg	*H1b_LX_PX.jpg*	*H1c_LX_PX.jpg*
☑ *= 1*	☐ *= 2*	☐ *= 3*

Etc.

Screen 17 [introduction]

Base: if X1 = 2 (SO SUB1 + SUB3)

[Info]

Now, imagine that one of the rooms in your house is too hot and you are looking for a way to cool this room.

Buying the air conditioner that best suits your wishes and needs is not easy. There is a wide range of air conditioners that you can choose from. Your choice may depend on several factors, such as the type of room you want to cool (please take a specific room in mind!), the desired cooling capacity, how attractive the air conditioner looks, and your budget.

Imagine that you have already looked up some information about air conditioners. You have determined that an air conditioner with a cooling capacity of about 5 kW is sufficient to cool the room. There are no constraints regarding the type of air conditioner that you can install.

Screen 17b [introduction - continued]

Base: if X1 = 2 (SO SUB1 + SUB3)

[Info]

On the next screen, you will receive information about 9 air conditioners. Imagine that you want to buy an air conditioner and these are the options you can choose from.

You will receive information about the different types of air conditioners that are offered, their cooling capacity, [*if X3 = 1:* and their energy use; *if X3 = 2:* their energy use, and costs], amongst others. Each air conditioner also has a "design" rating. This rating indicates how attractive the air conditioners looks.

First, we ask you which of the different types of air conditioners you would **consider**. Then, we ask you to indicate which specific air conditioner you would **choose**.

Screen 18 [Choice task – consideration set]

Base: if X1 = 2 (SO SUB1 + SUB3)

Q3. [MA]

Scripter: set-up of the choice task screen:

[TEXT C]

[TEXT C1]		
C1a_LX_PX.jpg	*C1b_LX_PX.jpg*	*C1c_LX_PX.jpg*

[TEXT C2]		
C2a_LX_PX.jpg	*C2b_LX_PX.jpg*	*C2c_LX_PX.jpg*

[TEXT C3]		
C3a_LX_PX.jpg	*C3b_LX_PX.jpg*	*C3c_LX_PX.jpg*

Scripter: If respondents click on "Click to read more", a pop-up window should appear with a more detailed description (including text and images, see below).
Scripter: Respondents should be able to enlarge (all) images (e.g. by clicking on them).
Scripter: Please randomize order of product types (C1-C3).
Scripter: LX depends on the level of X2 and PX depends on the level of X3.

Text C:
AIR CONDITIONERS
Air conditioners use electricity to cool a room. They extract heat from the indoor air and release it outdoors. Air conditioners come in many different types. We offer split systems and ducted air conditioners, both fixed and portable. Check out our product range below.

If X3 = 2 (price information condition): *The average price of electricity is* [if country=1-4: €0,22; if country=5: 1,07 lei; if country=6: 2,28 kr] *per kilowatt-hour (kWh).*

Text C1 - Short description:

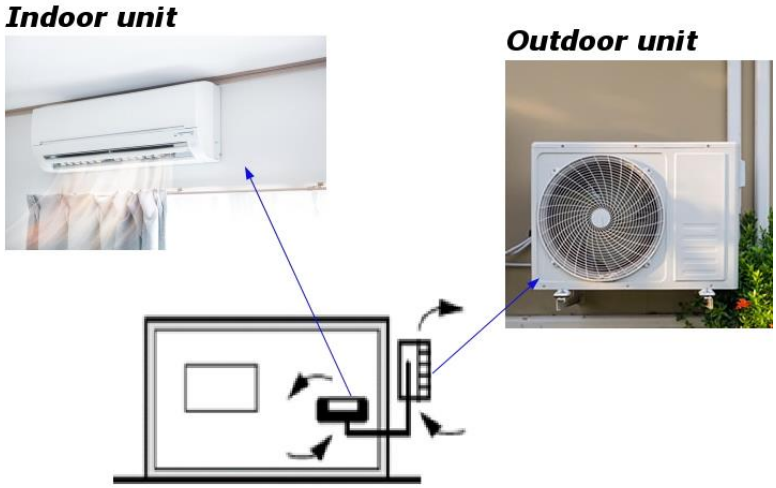
Fixed split air conditioners
A split air conditioner consists of two interconnected units: an outdoor unit (installed outside the house) and an indoor unit (installed inside the house). These units are installed by a professional installer at a pre-determined location, they cannot be moved.

Click to read more…

*Text C1 - More detailed description (**shown upon "Click to read more"**):*

Fixed split air conditioners
A split air conditioner consists of two interconnected units: an outdoor unit (installed outside the house) and an indoor unit (installed inside the house). These units are installed by a professional installer at a pre-determined location, they cannot be moved.

<display split_photo.jpg>



The outdoor unit can be placed on the ground or on a flat roof, for instance.

Text C2 - Short description:

Fixed double duct air conditioners

A fixed double duct air conditioner consists of one unit that is installed inside the space that needs to be cooled. This unit is installed by a professional installer at a pre-determined location, it cannot be moved.

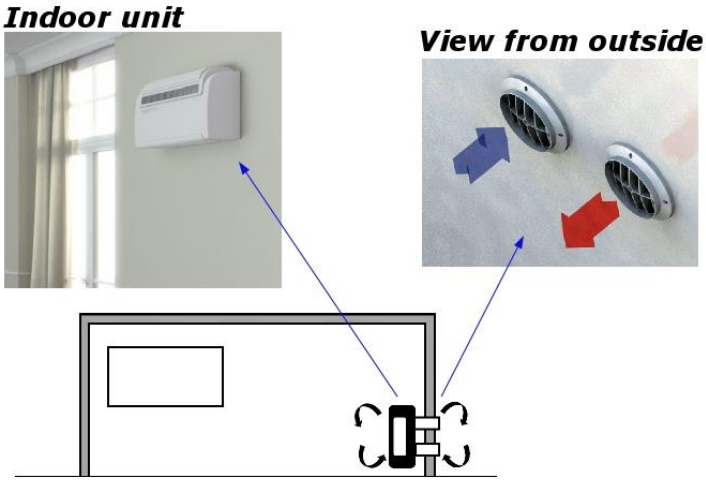
Click to read more…

*Text C2 - More detailed description (**shown upon "Click to read more"**):*

Fixed double duct air conditioners

A fixed double duct air conditioner consists of one unit that is installed inside the space that needs to be cooled. This unit is installed by a professional installer at a pre-determined location, it cannot be moved.

<display double_photo.jpg>



The indoor unit is connected to the outside of the house via two ducts or hoses through the wall. These ducts supply cold outside air to the unit and release warm air from the unit to the outside air.

Text C3 - Short description:

Portable single duct air conditioners

A single duct air conditioner is a portable air conditioner. It consists of one unit and one duct or hose that is connected to the outside of the house typically through a window. This type of air conditioner can be moved and does not require installation by a professional installer.

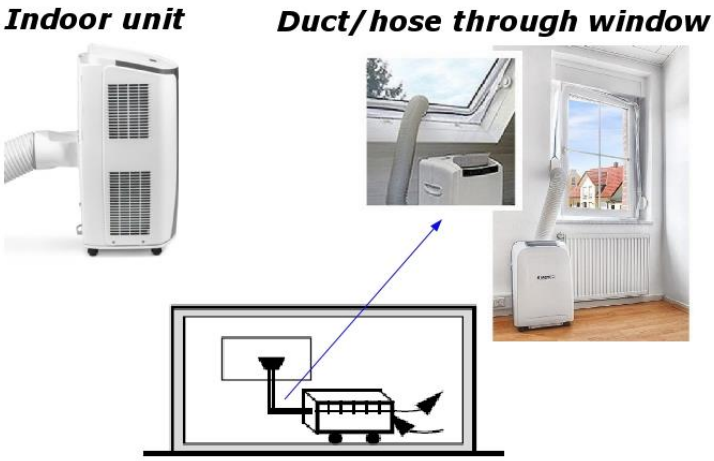
Click to read more…

*Text C3 - More detailed description (**shown upon "Click to read more"**):*

Portable single duct air conditioners

A single duct air conditioner is a portable air conditioner. It consists of one unit and one duct or hose that is connected to the outside of the house typically through a window. This type of air conditioner can be moved and does not require installation by a professional installer.

<display single_photo.jpg>



Which of these types of air conditioners would you **consider**? You can select multiple types.

Scripter: Please display response categories in same order as in images.

1. Fixed split air conditioner
2. Fixed double duct air conditioner
3. Portable single duct air conditioner

Screen 19 [Choice task – final choice]

Base: if X1 = 2 (SO SUB1 + SUB3)

Q4. [SA]

Scripter: display the same information in the same order as in Q3.

If you had to make a choice among these air conditioners, which one would you **choose**?

Scripter: Now, respondents should be able to select one of the twelve products, e.g. by checking a box below the product, for instance:

[TEXT]		
C1a_LX_PX.jpg	*C1b_LX_PX.jpg*	*C1c_LX_PX.jpg*

☑ = 1	☐ = 2	☐ = 3

Etc.

Screen 20

Base: all respondents

Q5. [MA, max 3 answers, randomize items]

You chose this [*if X1 = 1:* heater; *if X1 = 2:* air conditioner]:

If X1 = 1: <display HXX_LX_PX.jpg>
If X1 = 2: <display CXX_LX_PX.jpg>

Scripter: The value of HXX/CXX depends on Q2/Q4, and the values of LX and PX depend on X2 and X3, respectively.

What were the most important reason(s) for your choice?
Maximum 3 answers possible.

1. Attractive design
2. Low energy consumption/Low running costs
3. *If X3 = 1:* I expected the purchase/installation costs to be low*; if X3 = 2:* Low purchase/installation costs
4. Low noise inside the house
5. Low/no noise outside the house
6. *If X1 = 2 & Q4 < 7:* It is a fixed (non-portable) air conditioner*; if X1 = 2 & Q4 > 6:* The air conditioner is portable
7. Other, namely [OE]

Screen 21

Base: IF X1=2

Q5b. [SA]

You were just asked to imagine to be looking for an air conditioner to cool a certain room in your house. Which room did you have in mind when making your choice?

1. Living room
2. Bed room
3. Other room
4. I did not have a specific room in mind

PART 3. UNDERSTANDING

Screen 22 [introduction]

Base: all respondents

[Info]

Each of the products you saw previously was accompanied by an EU energy label. The next part of the questionnaire is about this energy label.

On the next screens, you will repeatedly see the energy labels of two [*if X1 =1:* heaters; *if X1 = 2:* air conditioners]. Each time, we ask you to take a good look at the labels and to indicate which of the two appliances is most energy efficient, or which one uses the least amount of energy.

Screen 23 [Task 1a]

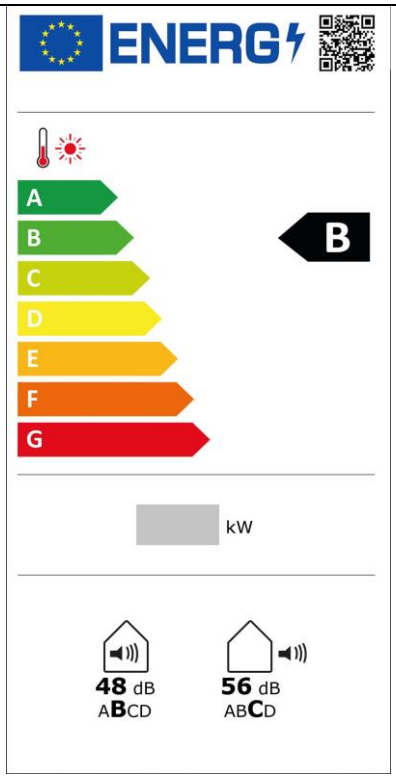
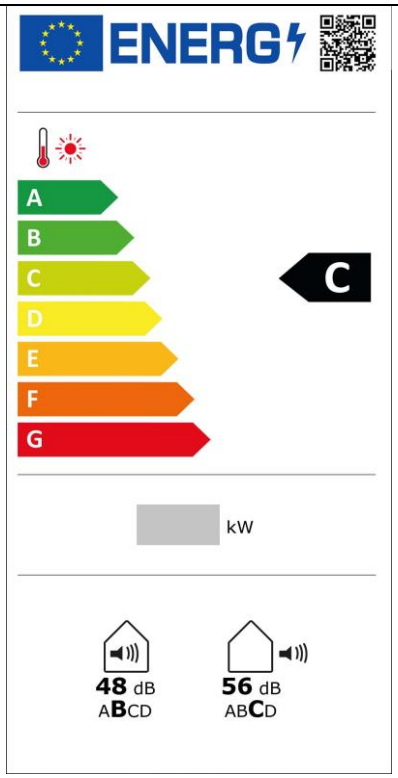
Base: all respondents

Q6. [SA]

Below, you see the energy labels of two [*if X1 = 1:* heat pumps; *if X1 = 2:* air conditioners]. Please take a good look at them.

[if X1 = 1: Heat pump; *if X1 = 2:* Split air conditioner] 1	*[if X1 = 1:* Heat pump; *if X1 = 2:* Split air conditioner] 2
If X1 = 1: <display H_LX_T1a_P1.jpg> *If X1 = 2: <display C_LX_T1a_P1.jpg>*	*If X1 = 1: <display H_LX_T1a_P2.jpg>* *If X1 = 2: <display C_LX_T1a_P2.jpg>*

Example image (same set-up for all quiz questions):

Heat pump 1	Heat pump 2
	

According to you, which of these two [*If X1 = 1:* heat pumps; *if X1 = 2:* air conditioners] <u>is the most energy efficient</u>?

1. 1 is more energy efficient
2. 2 is more energy efficient
3. 1 and 2 are equally energy efficient
4. Can't tell based on this information

Screen 24

Base: all respondents

Q7. [SA]

Below, you see the energy labels of two [*if X1 = 1:* heat pumps; *if X1 = 2:* air conditioners] once more.

[if X1 = 1: Heat pump; *if X1 = 2:* Split air conditioner] 1	*[if X1 = 1:* Heat pump; *if X1 = 2:* Split air conditioner] 2
If X1 = 1: <display H_LX_T1a_P1.jpg>	*If X1 = 1: <display H_LX_T1a_P2.jpg>*

If X1 = 2: <display C_LX_T1a_P1.jpg>	*If X1 = 2: <display C_LX_T1a_P2.jpg>*

According to you, which of these two [*if X1 = 1:* heat pumps; *if X1 = 2:* air conditioners] uses the least amount of energy?
1. 1 uses the least amount of energy
2. 2 uses the least amount of energy
3. 1 and 2 use an equal amount of energy
4. Can't tell based on this information

Screen 25 [Task 1b]

Base: all respondents

Q8. [SA]

Appliances such as [*if X1 = 1:* heat pumps; *if X1 = 2:* air conditioners] can differ in how energy efficient they are.

What is energy efficiency?
A higher energy efficiency means that [*if X1 = 1:* a heater; *if X1 = 2:* an air conditioner] uses more energy to provide the same amount of [*if X1 = 1:* heating; *if X1 = 2:* cooling]. In other words, if two [*if X1 = 1:* heaters; *if X1 = 2:* air conditioners] have the same [*if X1 = 1:* heating capacity (i.e. produce the same amount of heat); *if X1 = 2:* cooling capacity (i.e. can cool an equally large room)], the one that uses less energy is more efficient.

Below, you see the energy labels of two other [*if X1 = 1:* heat pumps; *if X1 = 2:* air conditioners]. Please take a good look at them.

[if X1 = 1: Heat pump; *if X1 = 2:* Split air conditioner] 1	*[if X1 = 1:* Heat pump; *if X1 = 2:* Split air conditioner] 2
If X1 = 1: <display H_LX_T1b_P1.jpg> *If X1 = 2: <display C_LX_T1b_P1.jpg>*	*If X1 = 1: <display H_LX_T1b_P2.jpg>* *If X1 = 2: <display C_LX_T1b_P2.jpg>*

According to you, which of these two [*If X1 = 1:* heat pumps; *if X1 = 2:* air conditioners] is the most energy efficient?
1. 1 is more energy efficient
2. 2 is more energy efficient
3. 1 and 2 are equally energy efficient
4. Can't tell based on this information

Screen 26

Base: all respondents

Q9. [SA]

Below, you see the energy labels of two [*if X1 = 1:* heat pumps; *if X1 = 2:* air conditioners] once more.

[if X1 = 1: Heat pump; *if X1 = 2:* Split air conditioner] 1	*[if X1 = 1:* Heat pump; *if X1 = 2: Split* air conditioner] 2
If X1 = 1: <display H_LX_T1b_P1.jpg> *If X1 = 2: <display C_LX_T1b_P1.jpg>*	*If X1 = 1: <display H_LX_T1b_P2.jpg>* *If X1 = 2: <display C_LX_T1b_P2.jpg>*

According to you, which of these two [*if X1 = 1:* heat pumps; *if X1 = 2:* air conditioners] uses the least amount of energy?
1. 1 uses the least amount of energy
2. 2 uses the least amount of energy
3. 1 and 2 use an equal amount of energy

4. Can't tell based on this information

Screen 27 [task2]

Base: all respondents

Q10. [SA]

This time, you see the energy labels of a [*if X1 = 1:* heat pump and a gas heater; *if X1 = 2:* split air conditioner and a double duct air conditioner]. Please take a good look at them.

[if X1 = 1: Heat pump; *if X1 = 2:* Split air conditioner] 1	*[if X1 = 1:* Gas heater; *if X1 = 2:* Double duct air conditioner] 2
If X1 = 1: <display H_LX_T2_P1.jpg> *If X1 = 2: <display C_LX_T2_P1.jpg>*	*If X1 = 1: <display H_LX_T2_P2.jpg>* *If X1 = 2: <display C_LX_T2_P2.jpg>*

According to you, which of these two different [*If X1 = 1:* heaters; *if X1 = 2:* air conditioners] is the most energy efficient?

1. 1 is more energy efficient
2. 2 is more energy efficient
3. 1 and 2 are equally energy efficient
4. Can't tell based on this information

Screen 28 [task3]

Base: all respondents

Q11. [SA]

Finally, you see the energy labels of another [*if X1 = 1:* heat pump and a gas heater; *if X1 = 2:* split air conditioner and a double duct air conditioner]. Please take a good look at them.

[if X1 = 1: Heat pump; *if X1 = 2:* Split air conditioner] 1	*[if X1 = 1:* Gas heater; *if X1 = 2:* Double duct air conditioner] 2
If X1 = 1: <display H_LX_T3_P1.jpg> *If X1 = 2: <display C_LX_T3_P1.jpg>*	*If X1 = 1: <display H_LX_T3_P2.jpg>* *If X1 = 2: <display C_LX_T3_P2.jpg>*

According to you, which of these two different [*If X1 = 1:* heaters; *if X1 = 2:* air conditioners] is the most energy efficient?

1. 1 is more energy efficient
2. 2 is more energy efficient
3. 1 and 2 are equally energy efficient
4. Can't tell based on this information

Screen 29 [task3]

Base: all respondents

Q12. [SA]

Here, you see the same energy labels once more.

[if X1 = 1: Heat pump; *if X1 = 2:* Split air conditioner] 1	*[if X1 = 1:* Gas heater; *if X1 = 2:* Double duct air conditioner] 2
If X1 = 1: <display H_LX_T3_P1.jpg> *If X1 = 2: <display C_LX_T3_P1.jpg>*	*If X1 = 1: <display H_LX_T3_P2.jpg>* *If X1 = 2: <display C_LX_T3_P2.jpg>*

According to you, which of these two [*if X1 = 1:* heaters; *if X1 = 2:* air conditioners] uses the least amount of energy?

1. 1 uses the least amount of energy
2. 2 uses the least amount of energy
3. 1 and 2 use an equal amount of energy

4. Can't tell based on this information

Screen 30

Base: all respondents

Q13. [SA]

You just repeatedly saw two energy labels. Each time, you were asked to indicate which of the two appliances is most energy efficient, or which one uses the least amount of energy.

Below, you see three statements about how you answered these questions. Which of these statements applies to you the most?

1. I randomly selected answers
2. I selected answers based on my gut instinct
3. I answered the questions as best I could

Screen 31

Base: all respondents

Q14. [SA]

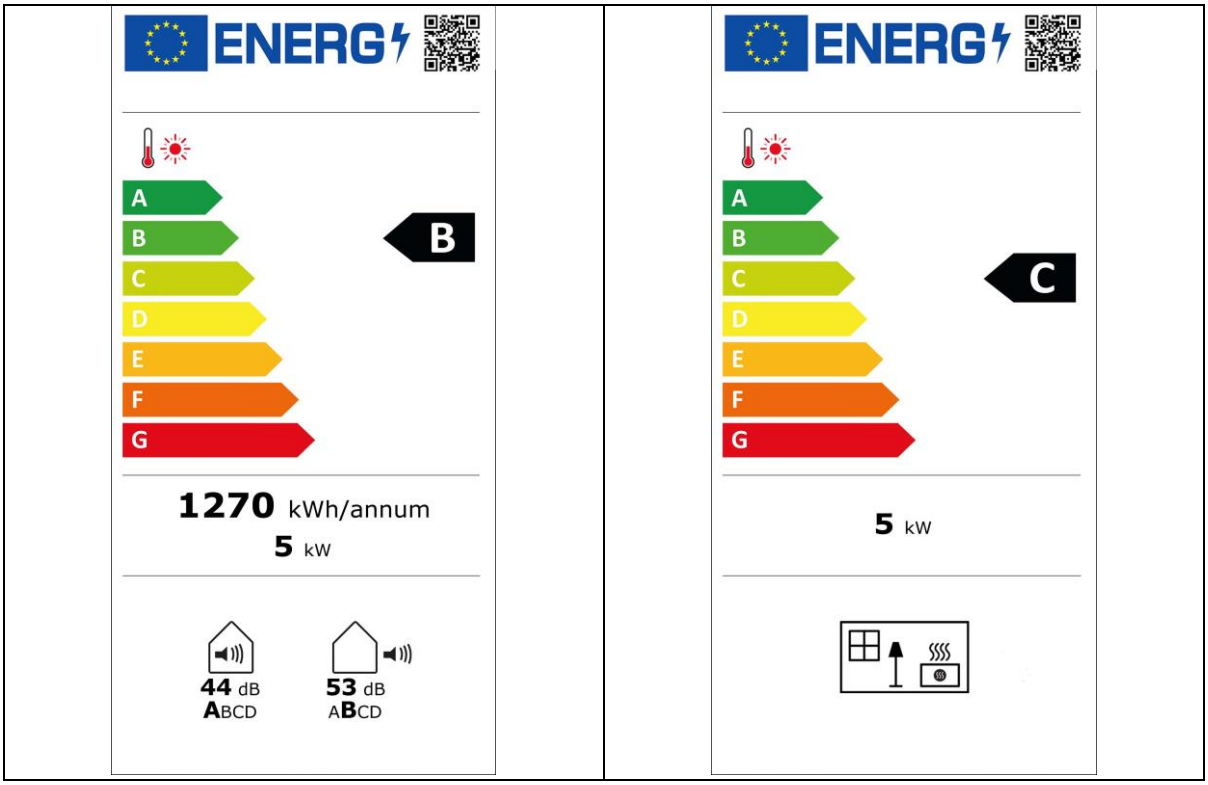
When buying *[if X1 = 1:* a heater*; if X1 = 2:* an air conditioner*]*, you can choose between different appliances that use different technologies, such as *[if X1 = 1:* heat pumps, gas heaters, and pellet stoves*; if X1 = 2:* fixed and portable air conditioners*]*. These appliances carry EU energy labels, which indicate the energy efficiency of the appliance.

Below, you can see an energy label of *[if X1 = 1:* a heat pump and an energy label of a gas heater*; if X1 = 2:* a fixed air conditioner and an energy label of a portable air conditioner*]*.

Energy label of a *[if X1 = 1:* heat pump*; if X1 = 2:* fixed air conditioner*]*	Energy label of a *[if X1 = 1:* gas heater*; if X1 = 2:* portable air conditioner
If X1 = 1: display H_EL_P1.jpg *If X1 = 2: display C_EL_P1.jpg*	*If X1 = 1: display H_EL_P2.jpg* *If X1 = 2: display C_EL_P2.jpg*

Example image:

Energy label of a heat pump	Energy label of a gas heater



Would you expect to be able to compare the energy efficiency class of a *[if X1 = 1:* heat pump; *if X1 = 2:* fixed air conditioner] with the energy efficiency class of a *[if X1 = 1:* gas heater; *if X1 = 2:* portable air conditioner]?

1. Yes
2. No
3. I don't know

Screen 32

Base: IF X1=2 AND X2 > 2

Q15. [SA]

Imagine once more that you want to buy an air conditioner. You have looked at different options and are considering the two air conditioners below. Please take a good look at them.

	Air conditioner 1	Air conditioner 2
Inside unit	 *<display Aest_inside_P1.jpg>*	 *<display Aest_inside_P2.jpg>*

Outside view	 <*display Aest_outside_P1.jpg*>	 <*display Aest_outside_P2.jpg*>
Price	[IF country=1-4: €4.100; if country=5: 19.980 lei; if country=6: 42.480 kr]	[IF country=1-4: €3.200; if country=5: 15.600 lei; if country=6: 33.150 kr]
Energy label	*If X2 = 3, then display <Aest_EL3_P1.jpg>* *If X2 = 4, then display <Aest_EL4_P1.jpg>*	*If X2 = 3, then display <Aest_EL3_P2.jpg>* *If X2 = 4, then display <Aest_EL4_P2.jpg>*

As you can see, air conditioner 1 has no outdoor unit while air conditioner 2 does have an outdoor unit. However, air conditioner 1 is also more expensive, makes more noise inside your house, and has a lower energy efficiency.

Which of these air conditioners would you most likely choose?
1. Air conditioner 1
2. Air conditioner 2
3. I (really) don't know

Screen 33

Base: IF Q15=2

Q16. [SA]

What is the most important reason for choosing this air conditioner?
1. Price
2. Noise level
3. Energy efficiency/energy consumption
4. All equally important

PART 4. EXPECTATIONS AND PREFERENCES

Screen 34

Base: IF SUB2 OR SUB3

Q17. [SA]

When looking for a [*If X1 = 1:* heater; *if X1 = 2:* air conditioner], there are different types of appliances you can choose, such as [*If X1 = 1:* a heat pump, a gas heater, a wood stove or pellet stove; *if X1 = 2:* a (fixed) split air conditioner, (fixed) double duct air conditioner or (portable) single duct air conditioner].

There are two possible ways in which energy labels can inform consumers about the differences in energy efficiency of these different types of heaters:

If X1 = 1:

	Option 1: Energy efficiency of different types of	**Option 2**: Energy efficiency of different types of

	heaters is expressed on <u>different</u> energy efficiency scales	heaters is expressed on the <u>same</u> energy efficiency scale
What does this mean?	Each type of heater (e.g. heat pumps, gas heaters, wood stoves) has its own scale from A to G. Within each type, the most energy efficient appliances fall in class A, while the least energy efficient appliances fall in class G. *<display H_EL_opt1.jpg>*	On a scale from A to G, more energy efficient *types* of heaters (e.g. heat pumps) fall in the top classes, while less energy efficient types of heaters (e.g. wood stoves, gas heaters) fall in the bottom classes. *<display H_EL_opt2.jpg>*
Which appliances can you compare?	You can compare the energy efficiency class of heaters of the same type, that is, heat pumps with heat pumps, gas heaters with gas heaters, etcetera.	You can compare the energy efficiency class of heaters of different types, such as heat pumps with gas heaters.
Which appliances can you not compare (well)?	You cannot compare the energy efficiency of heaters of different types. For instance, a gas heater with energy class A is <u>not</u> as efficient as a heat pump with energy class A.	You will have less information about the differences in energy efficiency of heaters of the same type (e.g. different heat pumps), because these will fall in the same energy classes.

If X1 = 2:

	Option 1: Energy efficiency of different types of air conditioners is expressed on <u>different</u> energy efficiency scales	**Option 2**: Energy efficiency of different types of air conditioners is expressed on the <u>same</u> energy efficiency scale
What does this mean?	Each type of air conditioner (e.g. split, single duct, double duct) has its own scale from A to G. Within each type, the most energy efficient appliances fall in class A, while the least energy efficient appliances fall in class G. *<display C_EL_opt1.jpg>*	On a scale from A to G, more energy efficient *types* of air conditioners (fixed split air conditioners) fall in the top classes, while less energy efficient types of air conditioners (portable single duct air conditioners) fall in the bottom classes. *<display C_EL_opt2.jpg>*
Which appliances can you compare?	You can compare the energy efficiency class of air conditioners of the same type, that is, split air conditioners with split air conditioners, single duct air conditioners with single duct air conditioners, etcetera.	You can compare the energy efficiency class of air conditioners of different types, such as (fixed) split air conditioners with (portable) single duct air conditioners.
Which appliances can you not compare (well)?	You cannot compare the energy efficiency of air conditioners of different types. For instance, a portable single duct air conditioner with energy class A is <u>not</u> as efficient as a fixed split air conditioner with energy class A.	You will have less information about the differences in energy efficiency of air conditioners of the same type (e.g. different split air conditioners), because these will fall in the same energy classes.

Do you understand what the two options mean?

1. No, not at all

2. No, I think not
3. Yes, I think so
4. Yes, completely

Screen 35

Base: IF Q17>2

Q18. [SA]

Which of the two options would you prefer?

1. Option 1
2. Option 2
3. I have no preference
4. I (really) don't know

Screen 36

Base: IF Q18=1

Q19. [SA]

Now imagine that energy labels would be designed according to **option 2**.

	Option 1: Energy efficiency of different types of [*if X1 = 1*: heaters, *if X1 = 2*: air conditioners] is expressed on <u>different</u> energy efficiency scales	**Option 2**: Energy efficiency of different types of [*if X1 = 1*: heaters, *if X1 = 2*: air conditioners] is expressed on the <u>same</u> energy efficiency scale
What does this mean?	Each type of [*if X1 = 1*: heater (e.g. heat pumps, gas heaters, wood stoves), *if X1 = 2*: air conditioner (e.g. split, single duct, double duct)] has its own scale from A to G. Within each type, the most energy efficient appliances fall in class A, while the least energy efficient appliances fall in class G. *If X1 = 1: <display H_EL_opt1.jpg>* *If X1 = 2: <display C_EL_opt1.jpg>*	On a scale from A to G, more energy efficient *types* of [*if X1 = 1*: heaters (e.g. heat pumps); *if X1 = 2*: air conditioners (fixed split air conditioners)] fall in the top classes, while less energy efficient types of [*if X1 = 1*: heaters (e.g. wood stoves, gas heaters); *if X1 = 2*: air conditioners (portable single duct air conditioners)] fall in the bottom classes. *If X1 = 1: <display C_EL_opt2.jpg>* *If X1 = 2: <display H_EL_opt2.jpg>*

In that case, less information is available to compare appliances of the same type (e.g. different heat pumps, or different pellet stoves), since these appliances are likely to fall into the same energy class.

To allow for more detailed comparisons of appliances of the same type, an energy efficiency score (in %) could be added to the energy label (*if X2 = 4*: as you have seen earlier):

If X1 = 1: <display H_EL_opt3.jpg>
If X1 = 2: <display C_EL_opt3.jpg>

This score allows you to identify the more energy efficient appliance even if two appliances have the same energy class. For instance, an appliance in energy class B with a score of 280% is more energy efficient than an appliance in energy class B with a score of 240%.

Imagine that this energy efficiency score (%) is indeed presented on the energy label described under option 2. Would you then still prefer option 1 over option 2?

1. Yes
2. No
3. I (really) don't know

PART 7. POST-EXPERIMENT QUESTIONNAIRE

Screen 50

Base: all respondents

[INFO]

Finally, we would like to ask you some more general questions about the products you have come across in this questionnaire, and about yourself.

Screen 51

Base: SUB1

Q31. [SA]

Have you purchased a tumble drier in the past 12 months?

1. Yes
2. No

Screen 52

Base: SUB1

Q32. [MA]

Have you purchased an air conditioner or heater in the past three years?

Respondent instruction: *By heaters and air conditioners, we mean appliances that you can use to heat or cool a room. We are not referring to central heating or cooling systems, nor to devices that circulate air without cooling it (fans).*

Multiple answers possible.

1. Yes, an air conditioner
2. Yes, a reversible air conditioner (i.e. an air conditioner that is capable of both cooling and heating)
3. Yes, a heater
4. No [S]
5. I don't know/don't remember [S]

Screen 53

Base: IF Q32<3

Q33. [SA]

Did you buy a fixed or portable air conditioner?

1. Fixed
2. Portable
3. I don't know/don't remember

Screen 54

Base: IF Q32<3

Q34. [SA]

What type of (if Q32 = 2: reversible) air conditioner did you buy?

You can click here for a description of the main types of air conditioners that are available.

Scripter: if the respondent clicks on 'here', please show pop-up window with the table shown in S4

1. Fixed (multi-)split air conditioner
2. Fixed double duct air conditioner
3. Portable single duct air conditioner
4. Other, namely [OE]

5. I don't know / don't remember

Screen 55

Base: IF Q34<5

Q35. [SA]

Did you also consider other types of air conditioners?

1. No
2. Yes
3. I don't know/don't remember

Screen 56

Base: IF Q35=1

Q36. [MA, max 3 answers, randomize items 1-7]

Why did you not consider other types of air conditioners? Please select the most important reasons(s).

You may select up to three options.

Other types of air conditioners…

1. were expensive
2. were noisy
3. had an unattractive design/looks
4. had a low energy efficiency/high energy consumption
5. were not proposed to me by my installer
6. could not be installed (e.g. due to legal or practical issues)
7. *If Q33 = 2:* were not portable
8. Other, namely [OE]
9. I don't know/don't remember [S]

Screen 57

Base: IF Q35=2

Q37. [MA]

What other type(s) of air conditioners did you consider?

Multiple answers possible.

1. Fixed (multi-)split air conditioner
2. Fixed double duct air conditioner
3. Portable single duct air conditioner
4. Other, namely [OE]
5. I don't know/don't remember [S]

Screen 58

Base: IF Q32<3 AND Q34<5

Q38. [MA, max 3 answers, randomize items 1-7]

What were the main reason(s) for choosing the type of air conditioner that you bought?

You may select up to three options.

This type of air conditioner…

1. was inexpensive
2. was quiet
3. had an attractive design/looks
4. had a high energy efficiency/low energy consumption
5. was advised to me by my installer
6. was the only type of appliance that could be installed (e.g. due to legal or practical constraints)
7. *If Q33 = 2:* was portable

8. Other, namely [OE]
9. I don't know/don't remember [S]

Screen 59

Base: IF Q32=1 & Q32=3) OR (Q32=2 & Q32=3)

[Info] The following questions are about the heater that you bought.

Base: IF Q32=3

Q39. [SA]

Did you buy a fixed or portable heater?

1. Fixed
2. Portable
3. I don't know/don't remember

Screen 60

Base: IF Q32=3

Q40. [SA]

What type of heater did you buy?

You can click here for a description of the main types of heaters that are available.

Scripter: if the respondent clicks on 'here', please show pop-up window with the table shown in S3

1. Solid fuel heater (e.g. wood stove, pellet stove)
2. Liquid fuel heater (e.g. ethanol heater, kerosene heater)
3. Gas heater
4. Air-to-air heat pump
5. Electric heater
6. Other, namely [OE]
7. I don't know / don't remember

Screen 61

Base: IF Q40<7

Q41. [SA]

Did you consider other types of heaters?

1. No
2. Yes
3. I don't remember

Screen 62

Base: IF Q41=1

Q42. [MA, max 3 answers, randomize items 1-7]

Why did you not consider other types of heaters? Please select the most important reasons(s).

You may select up to three options.

Other types of heaters…

1. were expensive
2. were noisy
3. had an unattractive design/looks
4. had a low energy efficiency/high energy consumption
5. were not proposed to me by my installer
6. could not be installed (e.g. due to legal or practical issues)
7. *If Q39 = 2:* were not portable
8. Other, namely [OE]

9. I don't know/don't remember [S]

Screen 63

Base: IF Q41=2

Q43. [MA]

What other type(s) of heaters did you consider?

Multiple answers possible.

1. Solid fuel heater (e.g. wood stove, pellet stove)
2. Liquid fuel heater (e.g. ethanol heater, kerosene heater)
3. Gas heater
4. Air-to-air heat pump
5. Electric heater
6. Other, namely [OE]
7. I don't know / don't remember [S]

Screen 64

Base: IF Q32=3 AND Q40<7

Q44. [MA, max 3 answers, randomize items 1-7]

What were the main reason(s) for choosing the type of heater that you bought?

You may select up to three options.

This heater…

1. was inexpensive
2. was quiet
3. had an attractive design/looks
4. had a high energy efficiency/low energy consumption
5. was advised to me by my installer
6. was the only type of appliance that could be installed (e.g. due to legal or practical constraints)
7. *If Q39 = 2:* was portable
8. Other, namely [OE]
9. I don't know/don't remember [S]

Screen 65

Base: all respondents

Q45. [MA]

Which energy sources do you have access to?

Multiple answers possible.

1. Electricity from renewable sources (e.g. solar, wind)
2. Electricity from non-renewable sources (e.g. oil, gas, coal)
3. Gas
4. Oil
5. Wood/pellets
6. Other, namely [OE]
7. I (really) don't know [S]

Screen 66

Base: all respondents

Q46. [MA]

Which of these energy sources do you use for heating?

Multiple answers possible.

1. Electricity from renewable sources (e.g. solar, wind)
2. Electricity from non-renewable sources (e.g. oil, gas, coal)
3. Gas

4. Oil
5. Wood/pellets
6. Other, namely [OE]
7. I (really) don't know [S]

Screen 67

Base: all respondents

Q47. [MA]

How is the energy that you use to heat your home supplied?

Multiple answers possible.

1. I have an energy provider
2. I have my own solar panels
3. I buy fuel myself (e.g. wood, pellets)
4. I have district heating (Scripter: add info button: District heating means that you are connected to a centralized heating system in which heat-producing plants supply heated water to residents.)
5. Other, namely [OE]
6. I (really) don't know [S]

Screen 68

Base: all respondents

Q48. [SA]

Some energy sources are more sustainable than others. For example, using solar energy instead of gas for heating is more energy efficient and leads to less carbon emissions.

Did you take into account sustainability aspects (e.g. energy efficiency or carbon emissions) when choosing your energy source or energy provider?

1. No, not at all
2. Yes, a little bit
3. Yes, certainly so
4. I did not have a choice between different energy sources or energy providers
5. I (really) don't know

Screen 69 [Self-reported product category expertise]

Base: all respondents

Q49. [SGRID, progressive]

Please indicate how much you agree or disagree with the following statements.

Rows:

1. I know a great deal about air conditioners
2. I know a great deal about heaters
3. [IF SUB1=1] I know a great deal about tumble driers

Columns

1. 1 - Completely disagree
2. 2
3. 3
4. 4
5. 5
6. 6
7. 7 - Completely agree

Screen 70 [Environmental concern; Thøgersen et al., 2010]

Base: all respondents

Q50. [SGRID, progressive]
Please indicate how much you agree or disagree with the following statements.
Rows:
1. I am worried about the environment
2. People should buy environmentally-friendly products
3. It concerns me that people do not care enough for the environment
4. I have switched to another brand sometimes, because it was better for the environment
5. To protect the environment, I often buy environmentally-friendly products

Columns
1. 1 - Completely disagree
2. 2
3. 3
4. 4
5. 5
6. 6
7. 7 - Completely agree

Screen 71
Base: all respondents
Q51. [S]
How important is energy consumption to you when you buy households products?
1. Not at all important
2. Not very important
3. Fairly important
4. Very important
5. Extremely important

Screen 72
Base: IF Q51>2
Q52. [S]
There are various reasons why people pay attention to energy consumption and/or energy efficiency when buying household products. What would be the most important reason for you, personally?
1. I want to save costs (a lower electricity bill)
2. I want to protect the environment / contribute to lower carbon emissions
3. I want to keep up with the times and own the newest technologies
4. Other, namely [OE]
5. I (really) don't know

Screen 73
Base: All respondents:
[INFO]
Finally, you receive some general questions.

Screen 74
Base: all respondents
SD3 [S]
What is the highest level of education you have successfully completed (usually by obtaining a certificate or diploma)?
SCRIPTER: insert country specific list; see Excel "SD3 education"
99. Don't know/no answer

Scripter: insert hidden variable 'Education' = recode from SD3 (see Excel)
1 'Low 0-2'
2 'Mid 3-4'
3 'High 5-8'

IF SD3=99, recode as Education = 1

Screen 75

Base: all respondents

SD4 [SA]
Thinking about your household's financial situation, how easy or difficult would you say it is to make ends meet?
1. Very easy
2. Fairly easy
3. Neither easy nor difficult
4. Fairly difficult
5. Very difficult
99. I don't know

Screen 76

Base: all respondents

SD5 [SA]
Which of the following best describes where you live?
1. A city
2. A town
3. A village
4. The countryside

Screen 77

Base: all respondents

SD6 [SA]
Which type of device did you use when completing this questionnaire?
1. Tablet
2. Laptop
3. Personal computer
4. Other, namely [OE]