



SPAIN: NATIONAL REPORT KEY DECISION FACTORS

National report on end-users decision making factors on H&C systems

Deliverable number: (D.4.1)

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EXECUTIVE SUMMARY

The main objective of this report is to identify end-users' decision making factors for heating and cooling (H&C) systems in Spain covered by the FROnT project.

The surveys, conducted in three different sectors: residential, non-residential and industry, allow us to identify key purchasing criteria (KPC) across the whole sector. These surveys have addressed the heating and cooling sector as whole, not only renewable energy solutions (RES). To achieve these objectives a national survey has been carried out in Spain by COTESA (Centro de Observación y Teledetección Espacial S.A.). The Institute for the Diversification and Energy Savings (IDAE) coordinated the survey carried out during April and May 2015.

The number of interviews conducted in Spain was: 1,250 in the residential sector, 300 in the non-residential sector and 150 in the industrial sector.

According to the results of surveys, the main energy source employed in all sectors is natural gas followed by oil heating and electricity. In the industrial sector special energy sources are used.

In general, the main information source is professionals' opinions. However its influence is more relevant in the non-residential and industrial sectors than in the residential sector where there are other important information sources, such as relatives or the Internet.

Regarding key purchasing criteria, the level of comfort is the most important criterion for the residential sector, followed by total savings, while for the non-residential sector it is reliability and safety, followed by the level of comfort. The industrial sector presents a different pattern, being the most important criterion the total savings followed by the requirements of the process.

Non-residential sector presents the greatest level of RES technology awareness in Spain (81%) followed by the industrial sector (74%). The residential sector is the least aware (63%). The most supported RHC technology is solar thermal energy, in the residential and non-residential sectors, while biomass is the most supported technology in the industrial sector. The perception of RHC technologies is very similar in all sectors. It is considered to be more eco-friendly than other technologies, to require high investment costs and to deliver high economic savings.

The main rejection reason for RES technologies in the residential sector is the approval of neighbours, followed by the high investment required. In the non-residential sector, the approval of superiors and the high investment required are the main causes of rejection. Finally, the main rejection factors in the industrial sector are those related to the process and classified as other causes.

The industrial and the residential sectors are most willing to pay for RHC, compared to non-residential sector.

1. OBJECTIVE

The objective of this report is to identify end-users decision making factors for heating and cooling (H&C) systems in Spain. This will be the first step to build an understanding about decision process when deciding on a H&C system and to provide tools that can facilitate stakeholders at European and national level to provide better and transparent information to consumers.

The surveys allow us to identify the key purchasing criteria (KPC). They will also provide information on “Willingness to pay”, including environmental and social parameters. The surveys have been addressed the heating and cooling sector as a whole and not only the renewable solutions. The surveys have been executed in three different sectors: residential, non-residential and industry in order to have a deep view of the whole sector.

2. SURVEYS IN SPAIN

To achieve this objective a national survey has been carried out by COTESA (Centro de Observación y Teledetección Espacial S.A.). It is a Spanish company specialized in survey development and analysis of results. The works have been hired and coordinated by IDAE (Institute for the Diversification and Energy Savings) participant in FROnT project.

The works have been executed in April and May 2015 (2 months).

The number of queries in Spain by sector and the related representativeness were the following:

SECTOR	NUMBER OF QUERIES	POPULATION SIZE	CONFIDENCE LEVEL	SAMPLE ERROR
Residential	1,250	25,837,108	95%	2.77%
Non-residential	300	-	95%	5.62%
Industry	150	-	95%	7.97%

3. SURVEY ON RESIDENTIAL SECTOR

The survey execution flow diagram is shown in Figures 1 and 2.

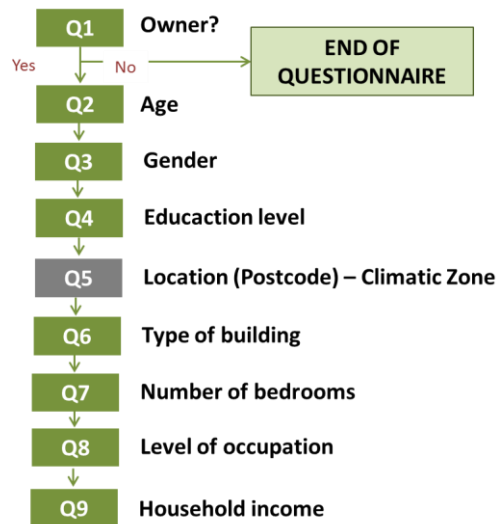


Figure 1 Characterisation of the sample in residential sector

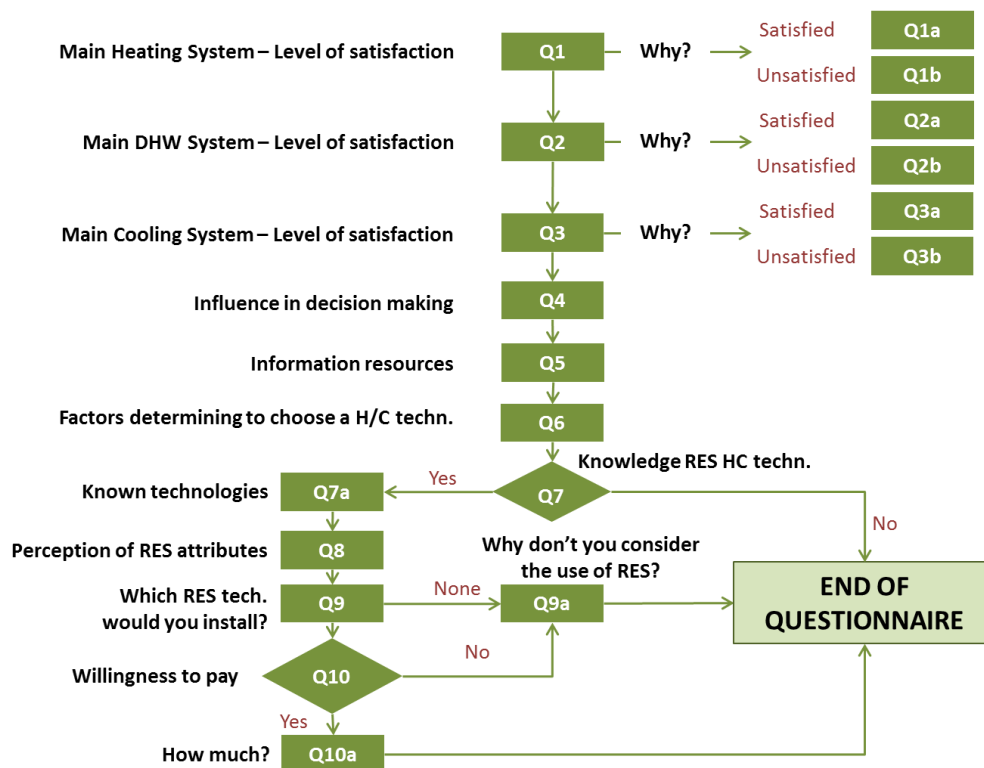


Figure 2 Flow diagram to follow in questionnaires – residential sector.

3.1 MAIN FEATURES OF THE SAMPLE

In Spain, 1,250 interviews were conducted for the residential sector. The main features of the sample interviewed are depicted in Figure 3. This sample is balanced compared with the relative figures of Spain (in terms of age, gender, level of education, etc.)

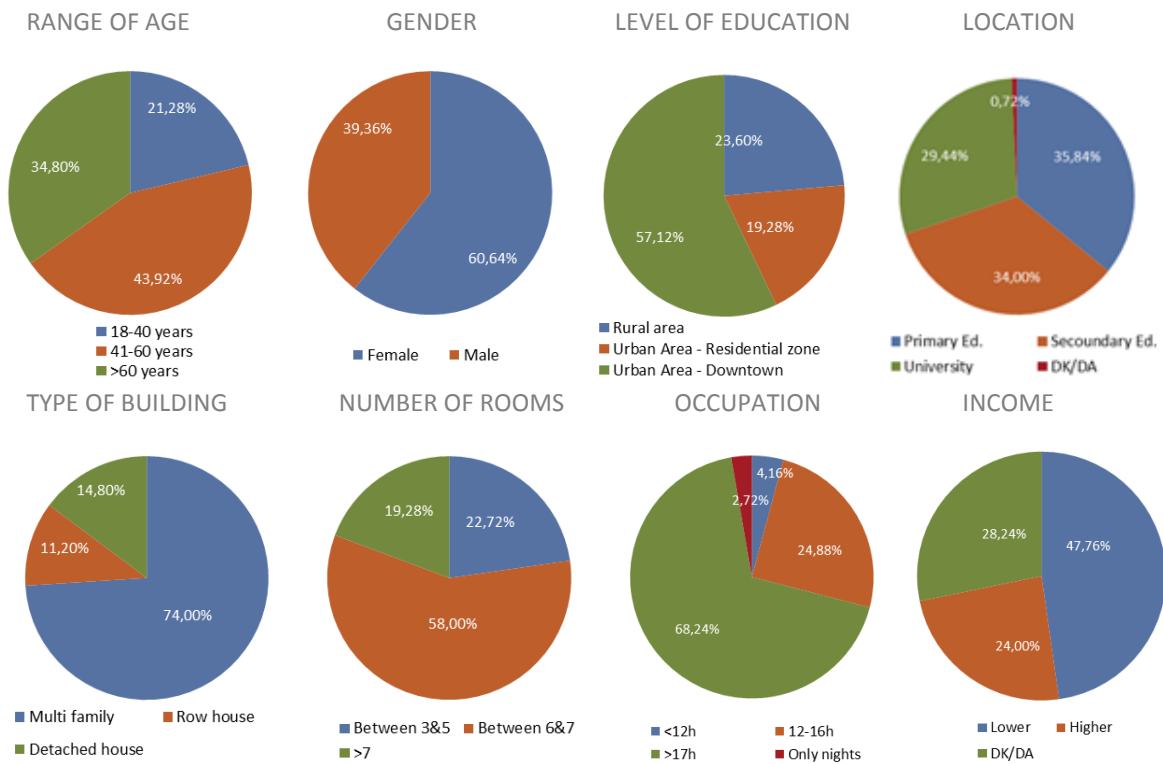


Figure 3 Characterisation of the sample

3.2 CURRENT HEATING AND COOLING SYSTEMS

The main heating systems used in residential sector in Spain are natural gas boilers (42%) – mainly in the north and centre of the country - and electrical systems (20%) – mainly in the south. Contribution of oil is around 15%. No heating system is present in 8.3% of Spanish dwellings. There are few renewable technologies like heat pump installations (aero thermal: 8%) and biomass boilers (1%), but the development of the rest of renewables is negligible. There are more decentralised systems than centralised ones (85% decentralised systems and 15% centralised systems).

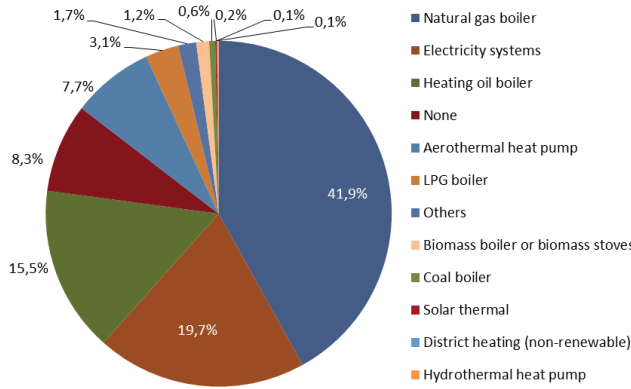


Figure 4 Distribution of heating systems in Spain (residential sector).

Heating system satisfaction is very high and it is not really dependant on the sample features, such as age, education, etc. (satisfied – 90%; dissatisfied: 10%). Satisfaction level is similar for all heating technologies. For those respondents satisfied with their heating systems, the main satisfaction reasons are: comfort levels (77%) and ease of use, reliability and safety (41%). On the other hand, the main dissatisfaction reasons are: fuel price (83%) and comfort levels (23%). Those who use natural gas, heat pumps and biomass are more satisfied than other users.

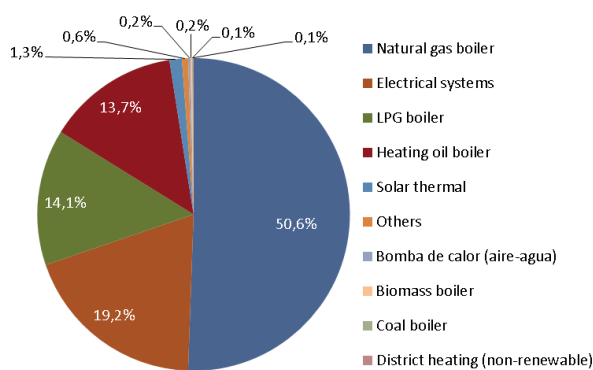
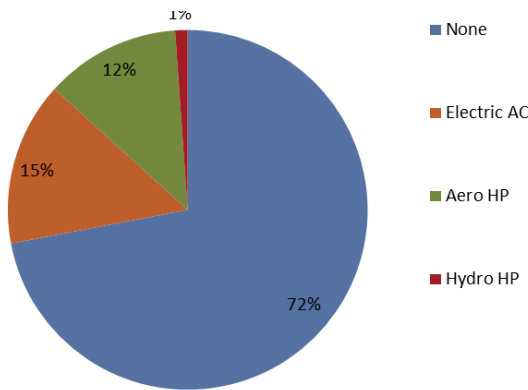


Figure 5 Distribution of DHW systems in Spain (residential sector)

Regarding the Domestic Hot Water (DHW) systems, the main used systems are again natural gas boilers (51%), following by electrical systems (19%). Also for DHW, the contribution of renewable energy is very low, only there are a few solar installations and biomass boilers for this purpose (1.3% and 0.2%, respectively).The majority of DHW installations in Spain are individual (88%)

Satisfaction level is high (satisfied – 94%; dissatisfied: 6%) and the main satisfaction reasons are: comfort level (76%) and ease of use, reliability and safety (40%). General sample features (such as age, gender, etc.) are not really influential. However, dissatisfaction is higher in oil and electric system users. Satisfaction is higher in individual system users.



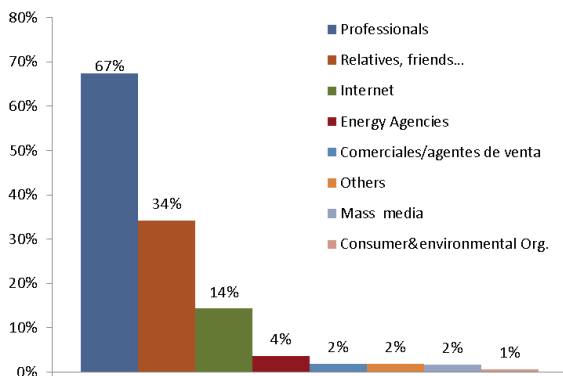
The majority of Spanish dwellings do not have any cooling system (72%). The existing cooling systems are mainly electricity air conditioning systems and aérothermal heat pumps (15% and 12%, respectively). Most of them are individual systems. In general, satisfaction of these systems is very high (satisfied – 93%; no answer – 1%; dissatisfied: 6%). The main satisfaction reasons are: fuel accessibility (38%) and no space requirements (33%). Dissatisfaction is mainly because fuel price (58%). Those with heat pump systems are less satisfied than average.

Figure 6 Distribution of cooling systems in Spain. Residential sector.

The main reason to use current heating and DHW systems in dwellings is because they already existing there (49% and 54%, respectively). This is the most repeated answer for those who have natural gas and oil boilers. Other reasons given by respondents are: access and fuel costs (28% – 26% in the case of DHW systems), mainly for electrical systems and biomass users; and equipment price (8% for heating and 7% for DHW) mainly for electricity devices users. Legal obligation is not a predominant reason to the installation of heating or DHW systems in Spain.

In cooling systems, the main reasons for acquisition of the current technology are: equipment price (27%), fuel accessibility (26%) and prior existence of the equipment in the dwelling (21%).

3.3 INFORMATION RESOURCES



Regarding the sources to search for information about R&H equipment, main sources are: professional consultation (architects, specialized stores, installers, etc.) with a share of 67%, followed by relatives and friends (34%). People over 60 are more confident with this source. Also the Internet, mainly for young people, has a crucial role in the information process in Spain (14%).

Figure 7 Information resources in Spain

In relative terms, men consult more often consumer organizations, the Internet and mass media than women. Relatives and friends opinion is useful for people over 60 years-old, whereas the Internet and other mass media is preferred by young people in Spain. People with primary studies consult less the Internet than the rest of the population. Rural population use less the Internet as information resource than the average.

3.4 KEY PURCHASING CRITERIA

This is a multi-option question. Respondents could choose more than one answer. According to the survey the key purchasing criteria (KPC) for H&C systems in Spain are:

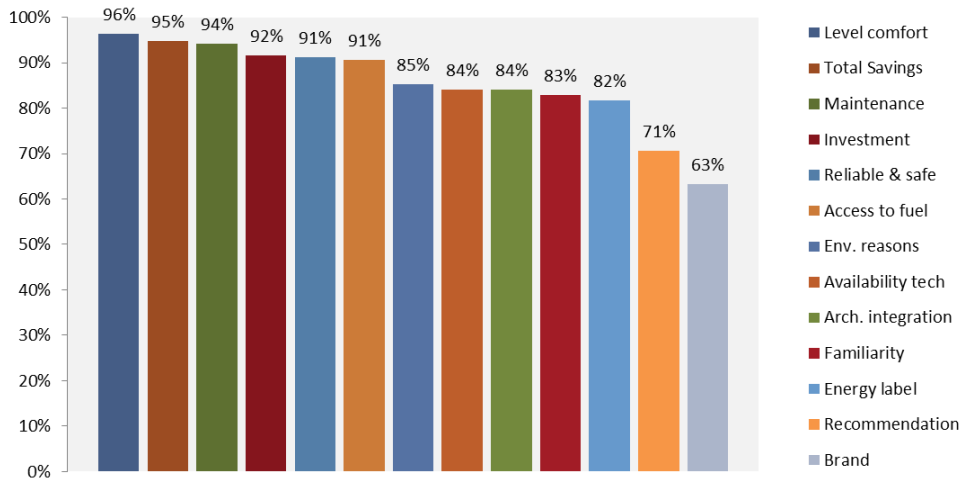


Figure 8 Key purchasing criteria in Spain

Comfort level is the main important criterion to choose H&C systems (96%), followed by economic criteria: savings (95%) and initial investment (92%). Some other technical reasons are also important (no maintenance requirements – 94% – and reliability/ safety – 91%). Environmental reasons (85%) are not as relevant for Spanish owners as other options. The rest of factors are less important for the survey respondents, although all of them have been taken into account in the purchasing decision.

In general, initial investment and no maintenance requirements are more important for men, whereas comfort level and environmental criteria are more relevant for women.

Savings are more important for people under 40 years, while the environmental reasons concern more to people over 60 years. Savings are more important for those with primary education (higher than average). On the other hand, this group consider initial investment less important than average.

The following tables show key purchasing criteria (KPF) considering demographical features analysed. First column (%) shows the total sample average of answers, while the rest of columns show the average of answers related to each feature. For instance, comfort level is a relevant factor for 96% of the sample. 97% of men chose this option and 96% of women. So, the gender is not influential for this key decision factor.

KEY DECISION FACTOR	%	Gender		Age			Level Education			Location of the building		
		Male	Female	18-40	41-60	>60	Prim. Edu	Sec Edu	Sup Edu	City Centre	Urban Area	Rural Area
Guarantee of comfort	96%	97%	96%	97%	98%	94%	95%	98%	96%	89%	96%	99%
Savings along the life expectancy	95%	95%	94%	99%	98%	88%	91%	98%	97%	78%	92%	98%
No need of maintenance	94%	94%	94%	96%	96%	91%	92%	97%	93%	89%	92%	97%
Initial investment	92%	90%	93%	97%	92%	88%	87%	97%	91%	89%	87%	93%
Reliability and safety	91%	92%	91%	95%	95%	84%	84%	95%	96%	89%	85%	95%
Accessibility to the fuel	91%	92%	89%	93%	97%	81%	83%	95%	95%	89%	85%	96%
Environmental reasons	85%	85%	86%	88%	87%	81%	82%	87%	88%	89%	84%	88%
Availability	84%	88%	82%	85%	90%	76%	77%	89%	86%	89%	77%	89%
Architectural integration	84%	82%	85%	83%	89%	78%	78%	89%	86%	78%	80%	88%
Familiarity with the technology	83%	83%	83%	87%	89%	73%	76%	88%	87%	78%	78%	86%
Existence of energy labelling	82%	83%	81%	89%	88%	70%	73%	89%	84%	78%	74%	85%
Recommendation from others	71%	68%	73%	71%	71%	70%	72%	75%	64%	78%	71%	69%
Reliable brand/manufacturer	63%	63%	64%	56%	63%	68%	66%	65%	58%	67%	63%	70%

KEY DECISION FACTOR	%	Type of building			Nºrooms			Level occupation				Income average	
		Apartment	Row house	Detached	3-5	6-7	>7	Mornings	Afternoons	All day	Nights	Higher	Lower
Guarantee of comfort	96%	97%	95%	97%	95%	97%	97%	100%	98%	95%	100%	96%	98%
Savings along the life expectancy	95%	95%	95%	92%	93%	95%	96%	98%	96%	94%	94%	95%	98%
No need of maintenance	94%	95%	95%	91%	93%	94%	95%	100%	95%	93%	97%	95%	95%
Initial investment	92%	93%	92%	84%	90%	92%	93%	94%	95%	90%	85%	92%	95%
Reliability and safety	91%	93%	91%	84%	88%	92%	93%	94%	94%	90%	94%	90%	97%
Accessibility to the fuel	91%	91%	89%	88%	88%	91%	92%	98%	93%	89%	97%	88%	96%
Environmental reasons	85%	85%	89%	84%	83%	86%	86%	92%	88%	84%	79%	85%	85%
Availability	84%	86%	78%	79%	81%	86%	83%	96%	91%	81%	85%	82%	90%
Architectural integration	84%	85%	83%	78%	83%	84%	85%	92%	85%	83%	85%	81%	89%
Familiarity with the technology	83%	84%	85%	76%	73%	86%	88%	88%	86%	81%	88%	83%	86%
Existence of energy labelling	82%	83%	78%	76%	74%	84%	84%	88%	88%	78%	91%	80%	87%
Recommendation from others	71%	70%	68%	77%	71%	70%	72%	85%	71%	70%	74%	73%	69%
Reliable brand/manufacturer	63%	62%	62%	68%	58%	63%	68%	71%	58%	65%	62%	65%	55%

Table 1. Key decision factors chosen by sample features. Residential sector.

3.5 AWARENESS ABOUT RHC

According to the results, 63% of survey are familiarised with RHC (renewable heating and cooling) systems. The following tables show the awareness of RHC, considering the sample features. The deviation of each group compared with the total distribution of the number of answers is shown below. For instance, 63% of the total sample is aware of the use of RES, 73% of the total men sample and 57% of the total women sample, so the conclusion could be that Spanish men are more aware of RHC than women.

	%	Gender		Age			Level Education			Location of the building		
		Male	Female	18-40	41-60	>60	Prim. Edu	Sec Edu	Sup Edu	City Centre	Urban Area	Rural Area
YES	63%	73%	57%	78%	71%	44%	44%	70%	79%	56%	54%	69%
NO	37%	27%	43%	22%	29%	56%	56%	30%	21%	44%	46%	31%

	%	Type of building			Nºrooms			Level occupation				Income average	
		Apart	Row house	Det	3-5	6-7	>7	Morn.	Aftern	All day	Nights	Higher	Lower
YES	63%	63%	66%	59%	58%	63%	68%	65%	73%	58%	85%	58%	79%
NO	37%	37%	34%	41%	42%	37%	32%	35%	27%	42%	15%	42%	21%

Table 2. Awareness of RHC by sample features. Residential sector.

The most well-known technologies for those familiarised with RHC (63%) of survey respondents are represented in the following tables. Solar thermal energy is the most well-known RHC technology for both uses, followed by biomass:

TECHNOLOGY	HEATING/DHW	COOLING
Biomass	29%	9%
Solar Thermal	96%	44%
Heat Pump (Renewable)	3%	3%
Geothermal	11%	5%
District Heating (Renewable)	2%	1%

Table 3. List of the known RHC technologies. Residential sector.

Data should be interpreted as the 96% of the respondents familiarised with RHC (63%) would be familiarised with solar thermal energy for heating uses. It means that 60% (0.63×0.96) of the total sample would be familiarised with solar thermal energy.

3.6 PERCEPTION OF RHC ATTRIBUTES

The perception of RHC attributes by those survey respondents familiarised with RHC (63%) is shown in the following table:

ATTRIBUTE	RENEWABLES	NON-RENEWABLES
Higher initial investment	66%	34%
Higher operation costs (maintenance and fuel)	23%	77%
Higher savings along the life expectancy of equipment	74%	26%
More eco-friendly	96%	4%
Higher working reliance	51%	49%
Higher visual impact and/or need of space to install/store fuel	61%	39%
Safer	51%	49%
More specialized installers	31%	69%

Table 4. Perception of RHC attributes by respondents. Residential sector.

Most of respondents think that RHC technologies are more expensive than non-renewable energies. They think that RHC imply lower operation costs and higher savings along life expectancy. According to the survey, RHC are more eco-friendly than fossil-fuel technologies. Respondents consider that RHC installers are less specialised. About reliance and safety, survey shows that the perception is almost equal for RHC and non-renewable technologies.

It is not really appreciated a clear influence of sample features (gender, age, etc.) in this answer. It is remarkable that maintenance costs are considered higher in RHC than average for people over 60 years-old and people living in rural areas.

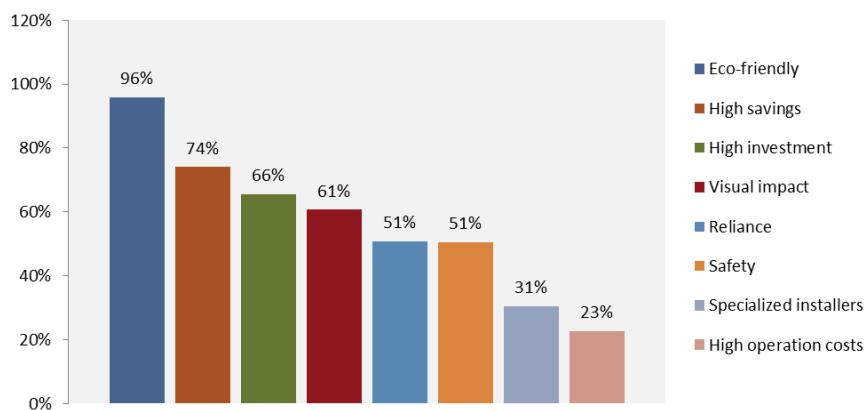
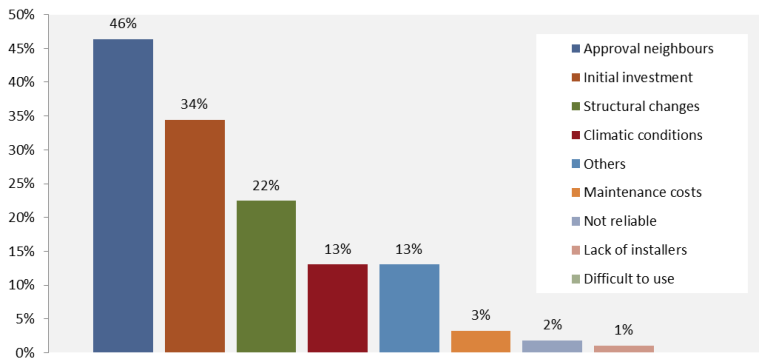


Figure 9 RHC perception in Spain. Residential sector.

3.7 ADEQUACY OF RHC

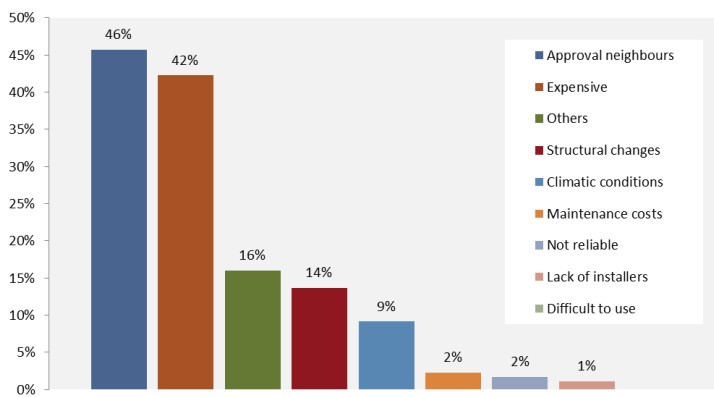
Regarding the question about the most suitable RHC to incorporate in their dwellings, 35% of the respondents familiarised with RHC (63%) do not support the installation of any RES technology for heating and DHW systems in their dwellings and 5% do not answer this question. Young people and those living in city centre, multifamily buildings and whose income is below average are more reluctant to install RES than the average.

On the other hand, regarding incorporation of renewable energy technologies in cooling systems, 80% of respondents who are familiarised with RHC (63%) do not consider any; in this case, young people and those living in city centre or in apartments are also more reluctant to installed cooling systems than the average.



The main rejecting reasons for using RES in heating or DHW systems are: neighbours approval (46%), initial investment (34%) and structural changes required in dwelling (27%). Figure 9 shows the share of other reasons. Difficulty of use is not a rejecting reason for Spanish respondents.

Figure 10 *Rejecting reasons for using RES in heating and DHW systems in Spain*



The main rejecting reasons for using RES in cooling systems are: neighbours approval (46%), initial investment (42%) and structural changes required in dwelling (16%). Figure 10 shows the share of other reasons.

Figure 11 *Rejecting reasons for using RES in cooling systems in Spain*

The 60% of the respondents who are familiarised with RHC (63%) support the installation of some RES technologies for heating or DWH systems. According to the results, the preferred technology is solar thermal energy (50%). Figure 11 depicted the most suitable technologies for heating and DHW systems in Spain. Biomass and geothermal energy are preferred by people from rural areas and detached houses.

Only 20% of respondents who are familiarised with RHC (63%) support the installation of RES technologies for cooling systems. Solar thermal energy is preferred for cooling applications for Spanish respondents (19%).

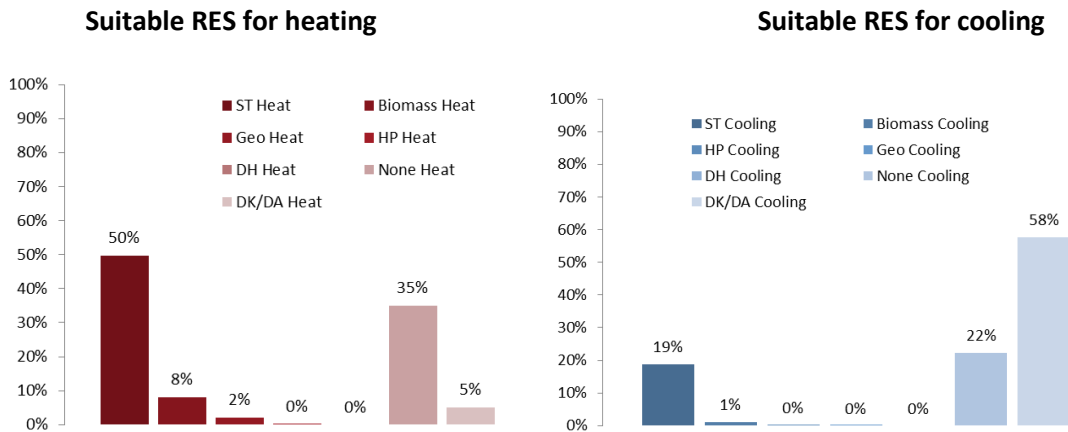


Figure 12 Suitable RHC technologies in Spain.

3.8 WILLINGNESS TO PAY

Figure 12 shows the percentage of respondents familiarised with RHC (63%) that is willing to pay more for a RHC system in residential sector. According to the results, 35% of respondents would not pay more for RHC systems, 8% of respondents do not answer and 57% of respondents would pay more: 20% of respondents familiarised with RHC (63%) would pay up to 5% more for a RHC system, 17% would pay between 5-10%, 1% would pay between 10-25%, 1% would pay between 25-40% and 17% do not answer this question.

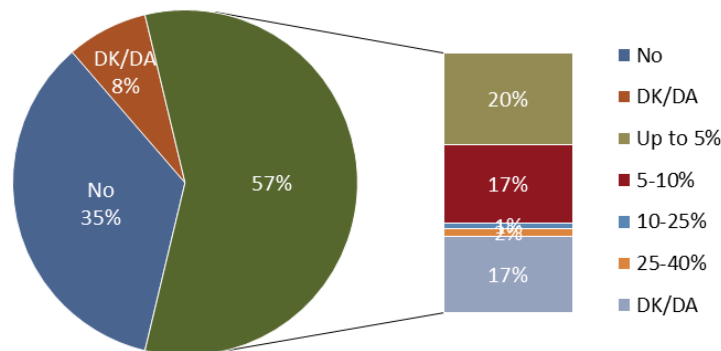


Figure 13 Willingness to pay for RHC technologies. Residential sector.

Young people, those with university education, people who live in rural areas and people with income higher than the average are in general, are in general, more willing to pay.

4. SURVEY ON NON-RESIDENTIAL SECTOR

The survey execution flow diagram is shown in Figures 13 and 14.

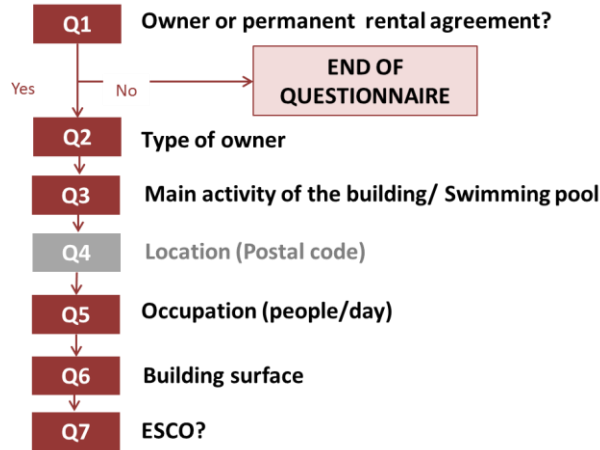


Figure 14 Characterisation of the sample

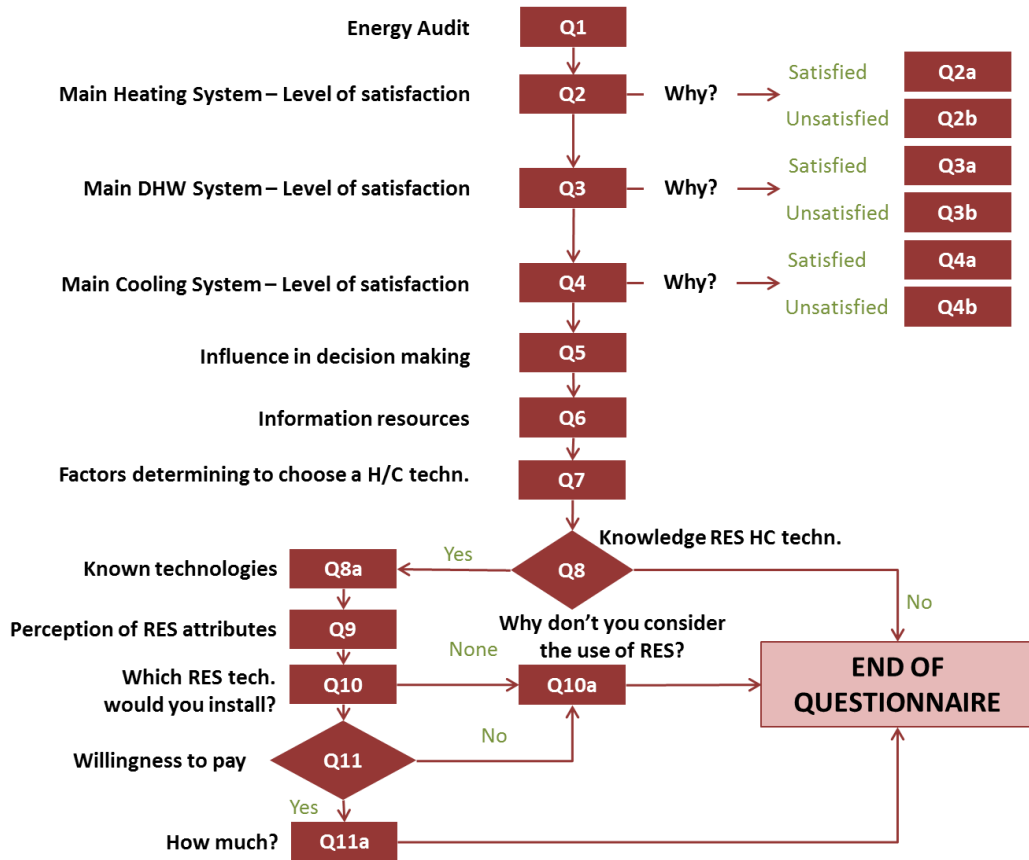


Figure 15 Flow diagram to follow in questionnaires – non-residential sector.

4.1 MAIN FEATURES OF THE SAMPLE

In Spain, 300 interviews were conducted in the non-residential sector. The main sample features are depicted in Figure 15. This sample is balanced (in terms of building owner, main activity, etc.) compared with the total data of Spain.

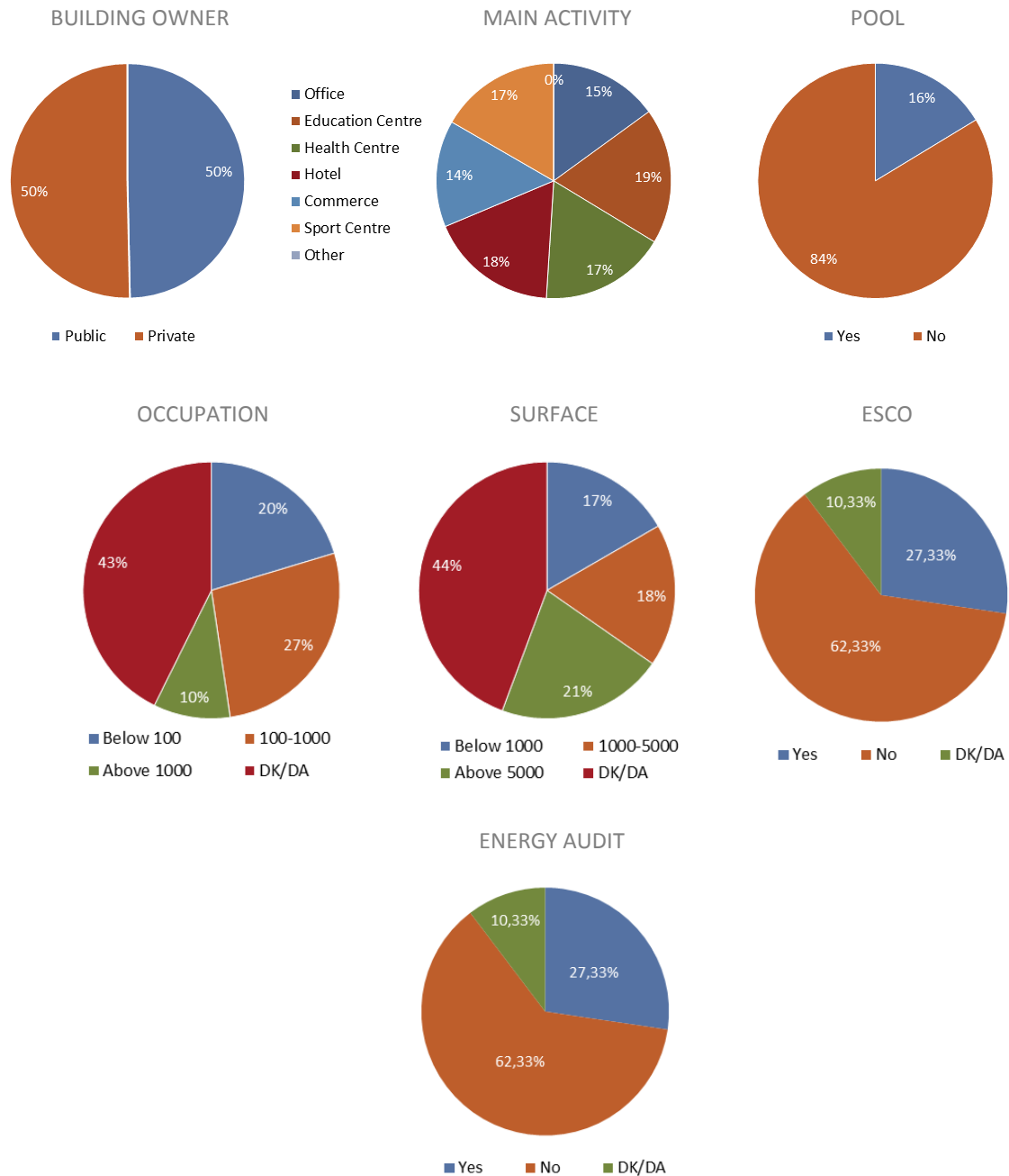
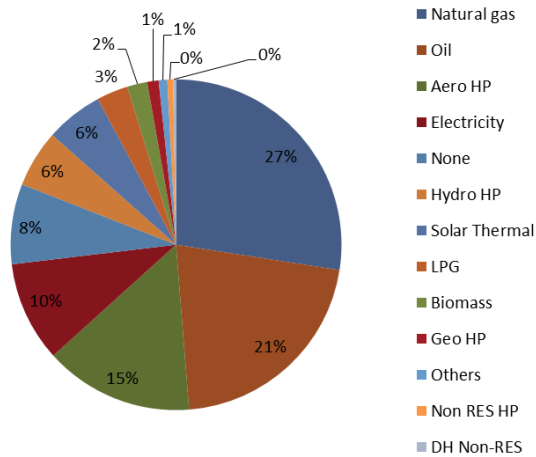


Figure 16 Characterization of the sample in non-residential sector.

4.2 CURRENT HEATING AND COOLING SYSTEMS

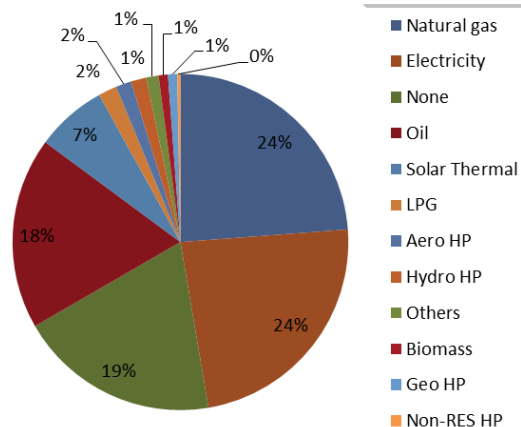
The main heating systems used in Spain in non-residential sector are natural gas boilers (27%) and heating oil boilers (21%), mainly in the north and centre, and aérothermal heat pumps (14%), mainly in the South. 8% of non-residential buildings do not have any heating system. Electrical systems represent 10%, while hydrothermal heat pumps represent 6%. Contribution from other sources is lower. Apart from heat pumps, there are few other renewable energy technologies (RES), like biomass boilers (2%), but the development of RES is negligible. In general, there are more centralised systems than centralised ones (68% centralised systems and 32% decentralised systems).



8% of non-residential buildings do not have any heating system. Electrical systems represent 10%, while hydrothermal heat pumps represent 6%. Contribution from other sources is lower. Apart from heat pumps, there are few other renewable energy technologies (RES), like biomass boilers (2%), but the development of RES is negligible. In general, there are more centralised systems than centralised ones (68% centralised systems and 32% decentralised systems).

Figure 17 Distribution of heating systems in Spain. Non-residential sector.

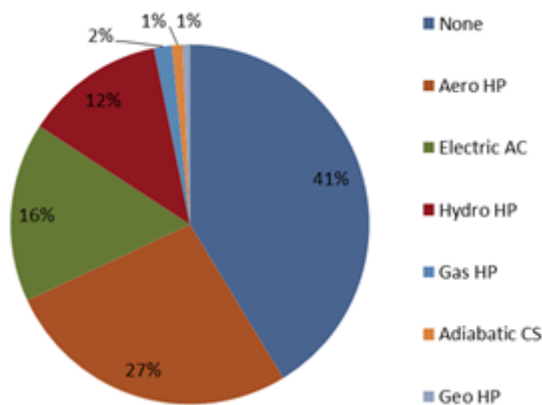
Heating system satisfaction is quite high and it is not really dependant on sample features (satisfied – 85%; do not answer – 1%; dissatisfied: 14%). Satisfaction level is higher in buildings with natural gas and heat pumps. For those satisfied respondents the main satisfaction is comfort levels (92%). On the other hand, main dissatisfaction reasons are: equipment price (39%) and comfort levels (37%).



Regarding DHW systems, natural gas boilers (24%) are mainly used, followed by electrical systems (24%). RES contribution in DHW systems is low, with the exception of solar thermal energy (7%). There are a few biomass boilers and geothermal installations (1% in both cases) and heat pumps. The majority of DHW installations in non-residential buildings in Spain are centralised (63%).

Figure 18 Distribution of DHW systems in Spain. Non-residential sector

Satisfaction level is high (satisfied – 88%; dissatisfied: 10%; do not answer – 2%) and the main satisfaction reasons are: comfort levels (79%) and fuel accessibility (17%). Main dissatisfaction reasons are: fuel price (48%) and comfort levels (30%). Satisfaction is higher for natural gas users than average.



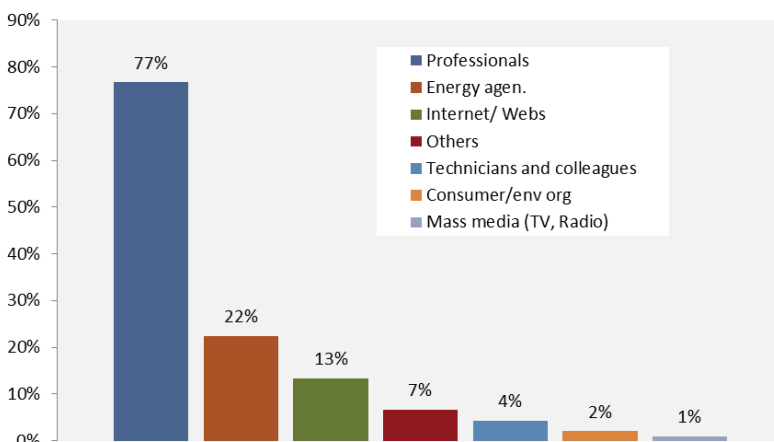
Many non-residential buildings do not have any cooling system (41%). Existing cooling systems are mainly aerothermal heat pumps and electrical air conditioning systems (27% and 16%, respectively). Most of them are decentralised systems (57%). In general, satisfaction is high (satisfied – 86%; dissatisfied: 14%) because, mainly, comfort levels (96%). Dissatisfaction is mainly because of comfort levels (34%) and maintenance costs (34%). Aerothermal heat pumps users are less satisfied than the average.

Figure 19 Distribution of cooling systems in Spain. Non-residential sector

The main reason to use the current system in non-residential buildings for heating and DHW is prior existence in the building (38% for heating and DHW systems). This is the most repeated answer for those natural gas and LPG users. 34% respondents consider that other people decided for them (politicians, stakeholders, etc.) in the decision process. This answer is more repeated for electrical systems and heating oil users. Legal obligation is not a reason for any of respondents in the non-residential sector in Spain. Regarding cooling systems, main reasons are: prior existence of equipment in buildings (41%) and decision was taken by others (28%).

4.3 INFORMATION RESOURCES

Regarding information sources about R&H equipment, 77% of respondents consult professionals' opinion (architects, specialized stores, installers, etc.). This choice is used mainly in private sector and



in activities like offices, schools and commercial areas. Energy agencies provide also information about R&H equipment to non-residential buildings (22%), mainly in public sector (health and sport centres). Also the Internet has a crucial role in the information process in Spain (13%) for both public and private sector and for all the analysed activities.

Figure 20 Information resources in Spain. Non-residential sector.

4.4 KEY PURCHASING CRITERIA

According to the survey the key purchasing criteria (KPC) for H&C systems in the non- residential buildings in Spain are:

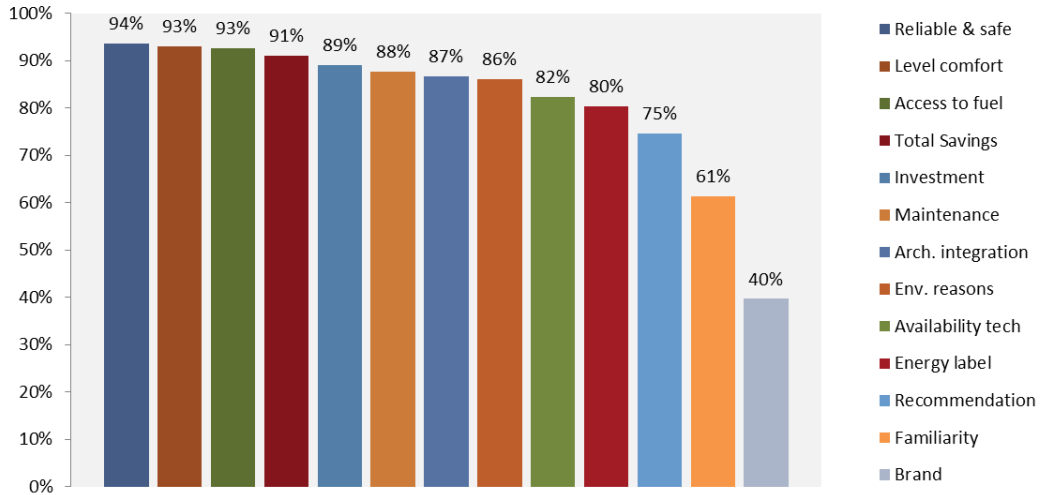


Figure 21 Key purchasing criteria in non-residential sector in Spain.

It is a multi-option question; the percentage corresponds to the number of answers compared with the total sample. Reliability and safety is the most common criterion to choose H&C systems (94%), followed by comfort levels and fuel accessibility (93%). In this sector, economic criteria are less important for users than in residential sector in Spain: savings (91%) and initial investment (89%). Some other technical reasons are also important (no maintenance requirements – 88% – and architectural integration – 87%). Environmental reasons (86%) are not as relevant as other criteria for Spanish non-residential sector. The other factors are less important for the survey respondents, although all of them have been taken into account by respondents.

Table 5 shows the key purchasing factors considering the criteria analysed. The first column (%) shows the answer average in the total sample, while the rest of columns show the average of answers related to each feature. For instance, investment is a relevant factor for 89% of the sample. 86% of public buildings chose this option and 92% of private ones. So, the ownership of the building is influential for this key decision factor.

In general, private buildings are more aware about economic issues (initial investment and savings). Environmental reasons are more important for public sector. Commerce, educational and sport sectors consider that comfort level is the most important criterion to choose R&H installations.

KEY DECISION FACTOR	%	Building owner		Main of activity						Pool	
		Public	Private	Offices	Commerce	Health Centres	Hotels	Educational Centres	Sport Centres	Yes	No
Investment	89%	86%	92%	91%	89%	87%	89%	89%	90%	86%	90%
Total Savings	91%	91%	91%	96%	89%	87%	94%	91%	90%	90%	91%
Maintenance	88%	86%	89%	91%	89%	87%	92%	86%	80%	82%	89%
Level comfort	93%	91%	95%	93%	96%	83%	94%	95%	96%	94%	93%
Env. reasons	86%	89%	83%	89%	93%	83%	79%	82%	90%	90%	85%
Familiarity	61%	60%	62%	62%	61%	58%	64%	70%	54%	65%	61%
Recommendation	75%	76%	74%	84%	61%	75%	72%	80%	80%	76%	75%
Reliable & safe	94%	94%	93%	93%	95%	90%	96%	91%	96%	96%	93%
Energy label	80%	77%	83%	87%	84%	73%	81%	77%	80%	84%	80%
Availability tech	82%	85%	79%	80%	86%	75%	85%	80%	88%	86%	82%
Access to fuel	93%	93%	93%	91%	96%	88%	94%	89%	96%	92%	93%
Arch. integration	87%	87%	86%	91%	91%	85%	92%	70%	88%	86%	87%
Brand	40%	34%	46%	47%	41%	35%	38%	50%	30%	37%	40%

KEY DECISION FACTOR	%	Occupation				Surface				ESCO			ENERGY AUDIT		
		Below 100	100-1000	Above 1000	DK/DA	Below 1000	1000-5000	Above 5000	DK/DA	Yes	No	DK/DA	Yes	No	DK/DA
Investment	89%	97%	90%	76%	88%	80%	94%	87%	91%	94%	89%	74%	85%	91%	91%
Total Savings	91%	98%	93%	86%	88%	88%	93%	92%	91%	95%	92%	74%	88%	94%	91%
Maintenance	88%	97%	88%	86%	84%	84%	85%	90%	89%	99%	85%	74%	91%	88%	81%
Level comfort	93%	98%	91%	93%	91%	90%	96%	95%	92%	98%	94%	74%	94%	93%	91%
Env. reasons	86%	89%	90%	86%	82%	80%	93%	86%	86%	93%	86%	71%	88%	83%	89%
Familiarity	61%	59%	65%	66%	59%	54%	67%	62%	62%	54%	64%	65%	65%	58%	61%
Recommendation	75%	85%	65%	79%	75%	70%	80%	79%	72%	74%	78%	58%	78%	73%	72%
Reliable & safe	94%	97%	95%	86%	93%	90%	100%	94%	92%	99%	94%	77%	96%	92%	93%
Energy label	80%	87%	82%	83%	76%	76%	81%	78%	83%	77%	83%	71%	85%	79%	74%
Availability tech	82%	84%	84%	76%	82%	78%	93%	83%	80%	79%	86%	71%	81%	84%	81%
Access to fuel	93%	97%	95%	90%	90%	90%	98%	92%	92%	96%	94%	74%	91%	95%	91%
Arch. integration	87%	95%	90%	66%	85%	84%	94%	78%	89%	93%	87%	71%	85%	88%	89%
Brand	40%	48%	33%	45%	39%	34%	44%	41%	39%	43%	40%	29%	44%	36%	37%

Table 5. Key decision factors chosen by sample feature. Non-residential buildings.

4.5 AWARENESS ABOUT RHC

According to the survey, 81% of survey respondents are familiarised with the use of RHC. The following tables show the aware of RHC, considering sample features. The deviation of each group compared with the distribution of the total answers is also shown:

KNOW	%	Building owner		Main of activity						Pool	
		Public	Private	Offices	Commerce	Health Centres	Hotels	Educational Centres	Sport Centres	Yes	No
Yes	81%	82%	81%	76%	84%	75%	83%	80%	90%	90%	80%
No	19%	18%	19%	24%	16%	25%	17%	20%	10%	10%	20%

KNOW	%	Occupation				Surface				ESCO			ENERGY AUDIT		
		Below 100	100-1000	Above 1000	DK/DA	Below 1000	1000-5000	Above 5000	DK/DA	Yes	No	DK/DA	Yes	No	DK/DA
Yes	81%	72%	82%	86%	84%	88%	87%	84%	75%	88%	81%	65%	86%	81%	72%
No	19%	28%	18%	14%	16%	12%	13%	16%	25%	12%	19%	35%	14%	19%	18%

Table 6. Awareness about RHC by sample feature. Non- residential sector.

Well-known technologies for those who are familiarised with RHC (81%) of survey respondents are represented in the following table. Solar thermal energy is the most well-known technology for heating followed by biomass and heat pump is the most well-common technology for cooling systems:

TECHNOLOGY	HEATING/DHW	COOLING
Biomass	41%	4%
Solar Thermal	80%	7%
Heat Pump (Renewable)	11%	13%
Geothermal	24%	7%
District Heating (Renewable)	1%	1%

Table 7. List of the known RHC technologies. Non-residential sector.

Data should be interpreted as the 80% of the respondents familiarised with RHC (81%) would be familiarised with solar thermal energy for heating uses. It means that 65% (0.80×0.81) of the total sample would be familiarised with solar thermal energy.

4.6 PERCEPTION OF RES ATTRIBUTES

RHC attributes perception by those survey respondents who are familiarised with RHC (81%) is shown in the following table:

ATTRIBUTE	RENEWABLES	NON-RENEWABLES
Higher initial investment	68%	32%
Higher operation costs (maintenance and fuel)	14%	86%
Higher savings along the life expectancy of equipment	79%	21%
More eco-friendly	92%	8%
Higher working reliance	36%	64%
Higher visual impact and/or need of space to install/store fuel	57%	43%
Safer	43%	57%
More specialized installers	20%	80%

Table 8. Perception of RHC attributes by respondents. Non-residential sector.

Respondents think that RHC technologies have higher investments, lower operation costs and higher savings along life expectancy. According to the survey, RHC are more eco-friendly than fossil-fuel technologies. Respondents think that RHC installers are less specialised. About the reliance and safety, the survey shows that the perception is quite close for renewable and non-renewable technologies, but in both cases these attributes are considered more positive in fossil fuels. The perception of attributes is different depending on the characteristics of the sample, as it is shown in the following table:

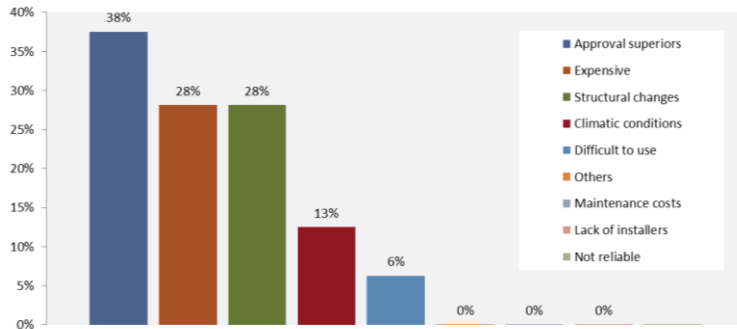
Perception	%	Building owner		Main of activity						Pool	
		Public	Private	Offices	Commerce	Health Centres	Hotels	Educational Centres	Sport Centres	Yes	No
Higher initial investment	68%	64%	73%	44%	60%	72%	77%	86%	71%	86%	65%
Higher operation	14%	12%	16%	15%	4%	10%	14%	23%	20%	27%	11%
Higher savings	79%	81%	77%	94%	77%	72%	80%	77%	78%	73%	81%
More eco-friendly	92%	89%	95%	100%	91%	90%	89%	100%	87%	91%	93%
Higher working reliance	36%	36%	36%	35%	28%	44%	41%	29%	40%	43%	35%
Higher visual impact	57%	61%	52%	44%	55%	51%	43%	69%	76%	68%	54%
Safer	43%	54%	33%	44%	45%	38%	25%	34%	71%	45%	43%
More specialized installers	20%	20%	20%	9%	19%	18%	32%	14%	24%	25%	19%

Perception	%	Occupation				Surface				ESCO			ENERGY AUDIT		
		Below 100	100-1000	Above 1000	DK/DA	Below 1000	1000-5000	Above 5000	DK/DA	Yes	No	DK/DA	Yes	No	DK/DA
Higher initial investment	68%	69%	68%	65%	69%	70%	57%	75%	69%	69%	68%	65%	75%	64%	62%
Higher operation	14%	11%	14%	25%	11%	5%	23%	19%	11%	11%	14%	25%	19%	8%	18%
Higher savings	79%	78%	80%	75%	78%	84%	74%	83%	77%	78%	80%	75%	77%	86%	67%
More eco-friendly	92%	94%	91%	95%	94%	95%	85%	100%	90%	94%	91%	95%	94%	93%	85%
Higher working reliance	36%	44%	31%	45%	44%	43%	28%	28%	41%	44%	31%	45%	33%	36%	46%
Higher visual impact	57%	64%	54%	50%	64%	41%	57%	70%	56%	64%	54%	50%	61%	54%	51%
Safer	43%	40%	44%	50%	40%	52%	45%	34%	44%	40%	44%	50%	42%	44%	46%
More specialized installers	20%	21%	18%	30%	21%	20%	15%	11%	27%	21%	18%	30%	20%	17%	28%

Table 9. Perception of RHC attributes by sample feature. Non-residential sector.

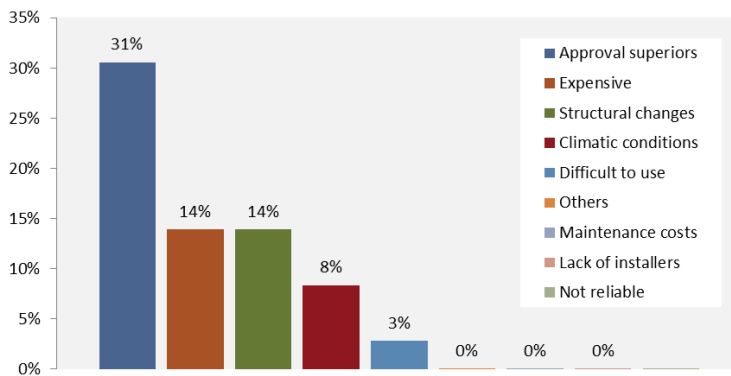
4.7 ADEQUACY OF RES

Regarding the RHC technologies adequacy, 13% of respondents who are familiarised with RHC (81%) do not support any renewable energy technology for heating and DHW systems in the building. Building features do not have a clear influence in the answer.



The main rejecting reasons for using RES for heating or DHW systems in non-residential sector are: superiors' permission (38%), structural changes required in the building (28%) and initial investment (28%). Difficulty of use and lack of installers are not rejecting reasons for RES use in Spain. Figure 20 shows the distribution of rejecting reasons for heating systems.

Figure 22 *Rejecting reasons for RES use in heating and DHW systems in the non-residential sector in Spain*



The main rejecting reasons for using RES for cooling systems in non-residential sector are: superiors' permission (31%), initial investment (14%) and structural changes required in the building (14%). Maintenance costs, lack of installers and reliability are not rejecting reasons for RES use in Spain. Figure 21 shows the distribution of rejecting reasons for cooling systems.

Figure 23 *Rejecting reasons for RES use in cooling systems in the non-residential sector in Spain*

According to the results, 69% of respondents familiarised with RHC (81%) support the installation of RES technologies for heating or DWH systems. According to the results, solar thermal energy is the preferred technology (48%), followed by biomass. Figure 22 depicts the most suitable technologies for heating and DHW systems in Spain. Solar thermal energy preference is higher in public buildings and biomass in private ones. Sport Centres are more willing to install solar thermal energy than the average, while educational centres support the use of biomass more than average.

Around 19% of respondents consider the installation of RES technologies for cooling systems. Solar thermal systems are the preferred systems for Spanish respondents (10%) following by heat pumps (5%).

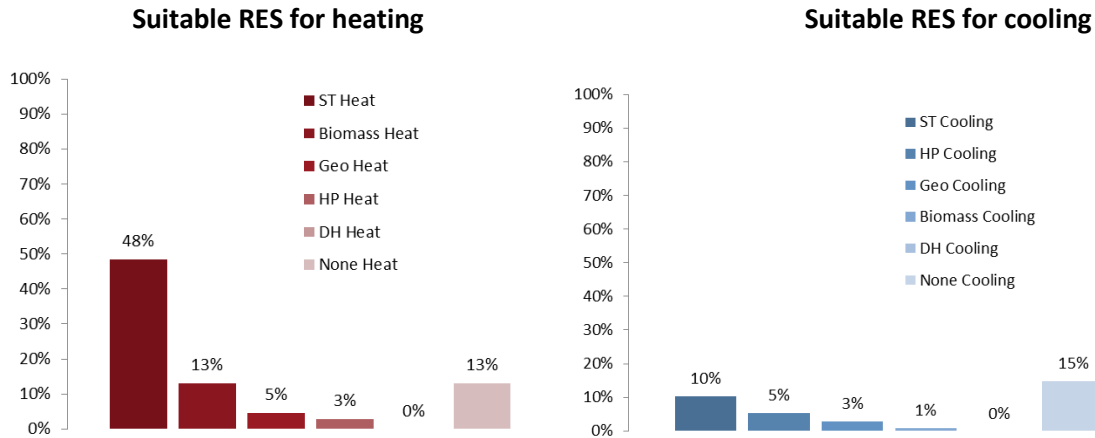


Figure 24 Considered RES technologies for heating and DHW and cooling systems.

4.1 WILLINGNESS TO PAY

According to the survey, 46% of respondents familiarised with RHC (81%) would be willing to pay more money, 42% of them would not pay more and 12% did not answer this question. Private buildings are more willing to pay more money for RES installations. By activity, hotels and sport centres would pay more for this kind of installations in Spain.

Figure 24 shows the percentage of respondents familiarised with RHC (81%) that is willing to pay more for a RHC system in non-residential sector. According to the results, none of respondents familiarised with RHC (81%) would pay up to 5% more for a RHC system, 12% would pay between 5-10%, 12% would pay between 10-25%, 5% would pay between 25-40%, 3% would pay more than 40% and 16% do not answer this question.

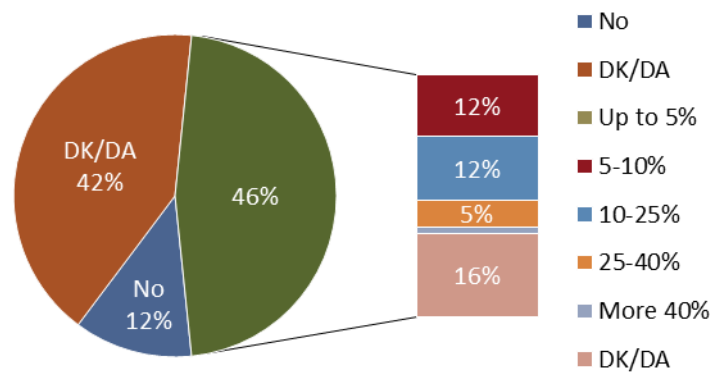


Figure 25 Willingness to pay in non-residential sector in Spain.

5. SURVEY ON INDUSTRIAL SECTOR

The survey execution flow diagrams are shown in Figures 24 and 25.

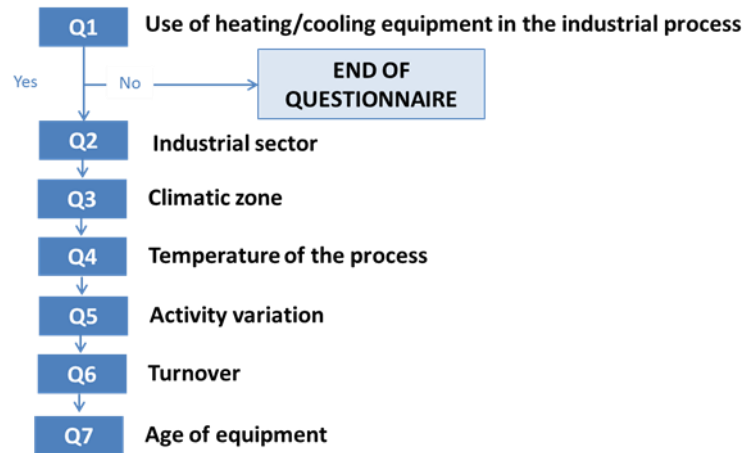


Figure 26 Characterisation of the sample

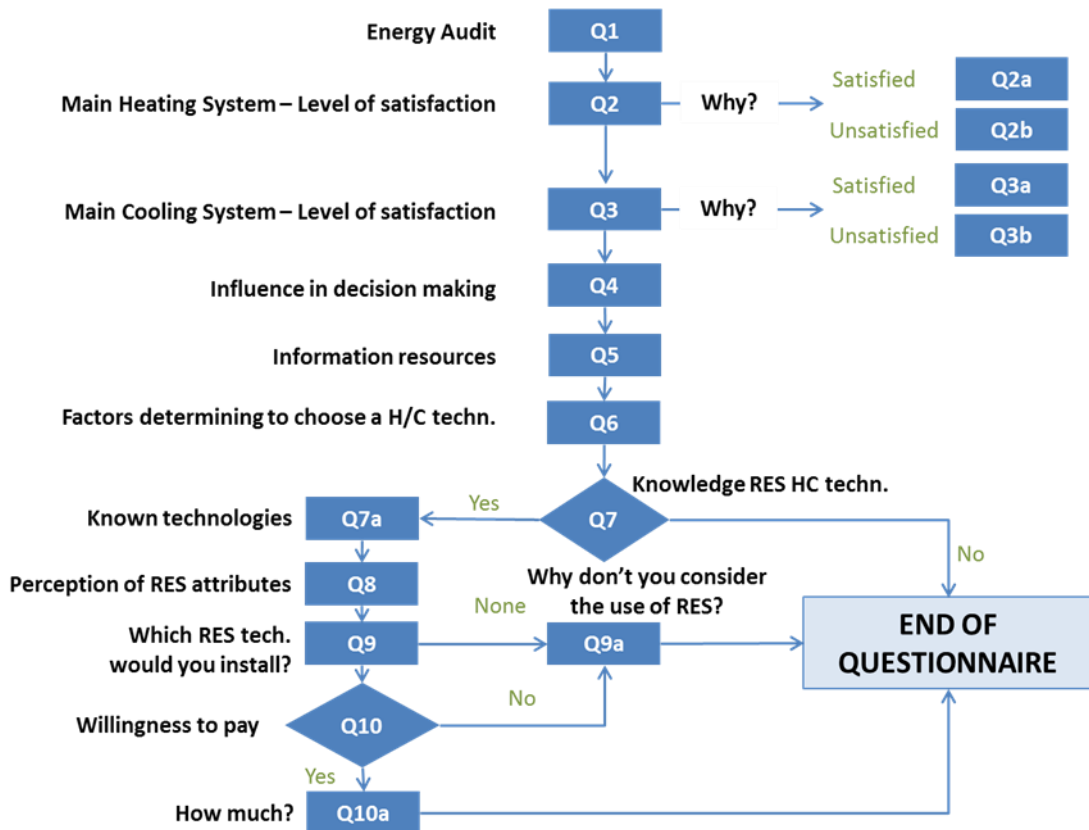


Figure 27 Flow diagram to follow in questionnaires – industrial sector.

5.1 MAIN FEATURES OF THE SAMPLE

In Spain, 250 interviews were conducted in the industrial sector. Main sample features are depicted in Figure 26. The sample is balanced (in terms of sector, occupation, turnover and energy audit) comparing with the total data of the country.

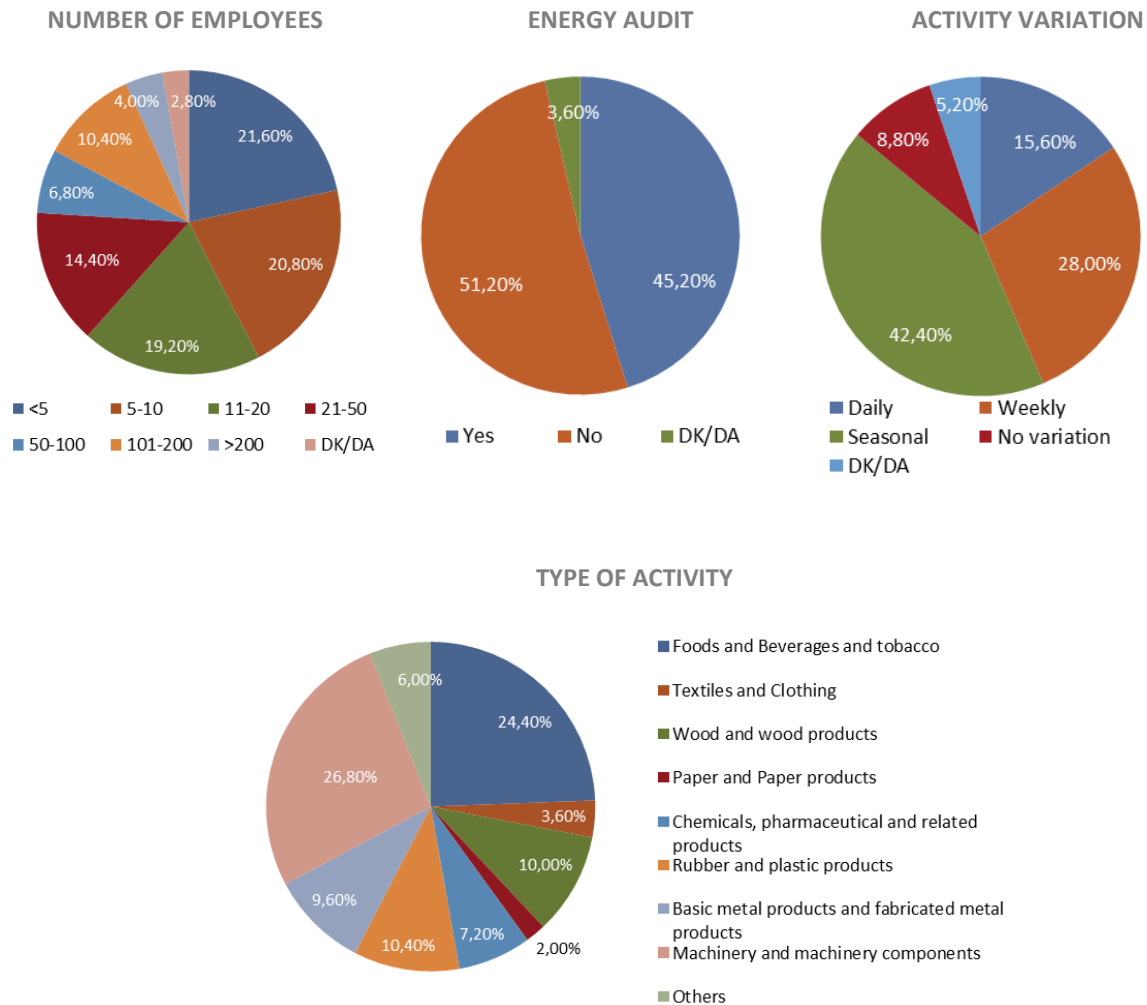
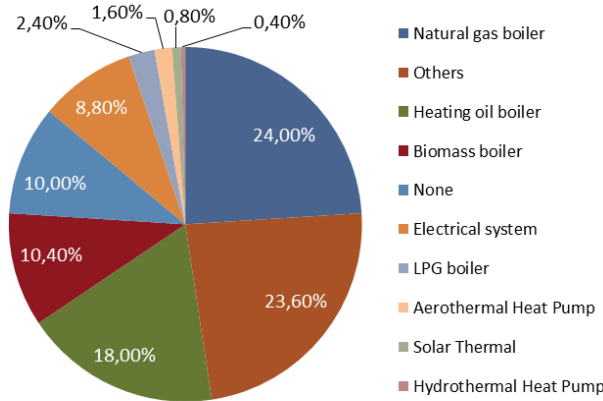


Figure 28 Characterisation of the sample in Spain. Industrial sector.

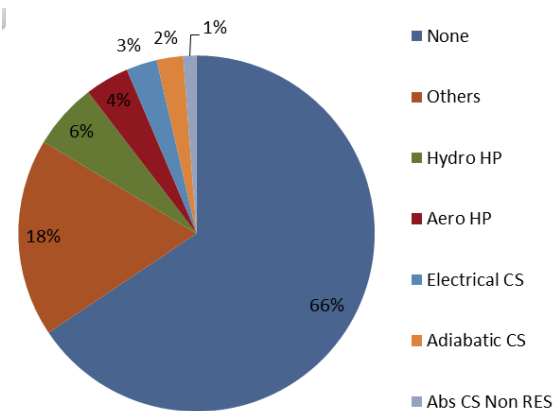
5.2 CURRENT HEAT AND COOLING SYSTEMS



The main heating system used in Spain in industrial processes is natural gas (24%) followed by other specific systems for each process and based mainly on fossil fuels (24%). Heating oil boilers are the third in the ranking. Biomass boilers are quite extended (10%), although the share of other renewable energies is negligible (1%).

Figure 29 *Distribution of heating systems in industrial processes Spain*

Heating system satisfaction is quite high (satisfied – 91%; dissatisfied: 9%). Satisfaction level is higher for natural gas and other heating systems users. For those respondents satisfied, the main satisfaction reasons are: system adaptation to the process conditions (79%) and fuel accessibility (39%). The main dissatisfaction causes are the equipment price (79%) and the fuel price (63%).



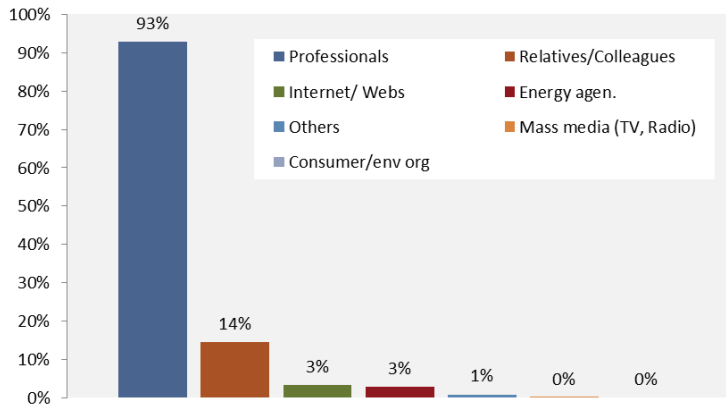
Many industries in Spain do not require cool systems for their processes (66%). The existing cooling systems for industrial process are mainly specific of the process (18%) and heat pumps – aerothermal (6%). In general, users are satisfied with their current systems (Satisfied – 91%; Dissatisfied: 9%). Satisfaction is based on system adaptation to the process conditions (86%) and ease to use (27%). The main dissatisfaction cause is investment (22%).

Figure 30 *Distribution of cooling systems in industrial processes Spain*

The main reason to use the current heat system in industrial sector is technicians’ expertise (37%). This answer is more repeated for natural gas and other specific systems users. In many cases, decision was taken by others – management reasons (34%). Other important cause is accessibility and fuel costs (32%).

Regarding the cooling systems, the more repeated reason to use the current system is technicians’ expertise (41%), followed by imposition of the management team (29%).

5.3 INFORMATION RESOURCES



Regarding the information sources for R&H equipment in industrial sector, the main source is professionals (93%): architects, specialized stores, installers, etc. Technicians from the own company is other important resource (14%). In some sectors, like chemical, this share is higher (33%).

Mass media and the Internet do not have a crucial role as information resources in the Spanish industry sector.

Figure 31 Information resources in Spain

5.4 KEY PURCHASING CRITERIA

According to this survey the key purchasing criteria (KPC) for H&C systems for the industrial sector from the five participating countries are shown in Figure 31. It is a multi-option question; it is the reason why the percentages are so high.

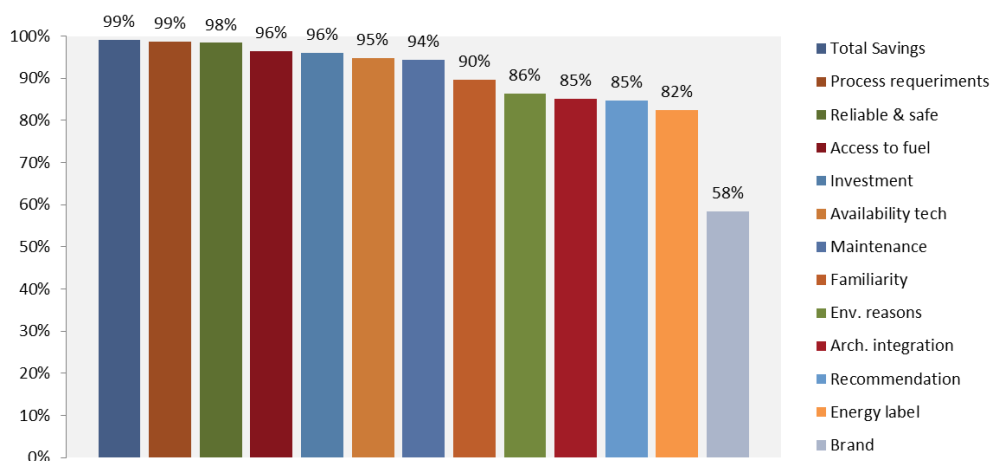


Figure 32 Key purchasing criteria in the industrial sector in Spain

Economic reasons are the most relevant to choose a system in the Spanish industrial sector – savings (99%) and initial investment (96%).

Reliability and safety is also a relevant reason to choose H&C systems (98%). Environmental reasons (86%) are not as relevant as other criteria for Spanish industrial sector. Reliable brand is not very relevant for industrial users (58%).

The following table show the key purchasing factors considering the criteria analysed in the sample. Environmental and fuel accessibility are not relevant factors for paper sector, although they are really relevant for other sectors. Reliable brand is not very important for analysed sectors, except for textile sector.

KEY DECISION FACTORS	%	Activity								
		Food	Textiles	Wood	Paper	Chemic	Rubber	Metals	No metals	Others
Savings	99%	98%	100%	100%	100%	94%	100%	100%	100%	100%
Process adaptation	99%	98%	100%	100%	100%	100%	100%	100%	97%	100%
Reliability and safety	98%	97%	100%	100%	100%	100%	100%	92%	100%	100%
Accessibility to fuel	96%	93%	100%	100%	40%	89%	100%	100%	100%	100%
Initial investment	96%	95%	100%	92%	60%	94%	100%	100%	99%	93%
Availability of the techn	95%	95%	100%	100%	100%	83%	92%	88%	97%	100%
No need of maintenance	94%	92%	100%	92%	60%	83%	100%	96%	99%	100%
Familiarity with the techn	90%	84%	100%	92%	100%	56%	92%	88%	99%	100%
Environmental reasons	86%	80%	100%	84%	60%	78%	96%	63%	97%	100%
Architectural integration	85%	87%	100%	100%	60%	89%	65%	79%	94%	53%
Recommendation in other process	85%	84%	78%	100%	80%	44%	73%	79%	100%	80%
Existence of energy labelling	82%	82%	100%	76%	60%	61%	96%	63%	88%	100%
Reliable brand	58%	56%	89%	40%	60%	28%	73%	29%	78%	53%

Table 10. Key decision factors chosen by sample feature. Industrial sector.

5.5 AWARENESS OF RHC

According to the results, 74% of respondents are familiarised with the use of RHC. The following table show the awareness about RHC, considering the sample features. The deviation of each feature compared to the total number of answers is shown:

KNOWLEDGE	%	Activity								
		Food	Textiles	Wood	Paper	Chemic	Rubber	Metals	No metals	Others
Yes	74%	72%	82%	68%	79%	56%	72%	80%	89%	54%
No	26%	28%	18%	32%	21%	44%	28%	20%	11%	46%

Table 11. List of the well-known RHC technologies. Industrial sector.

By sectors, the awareness of RHC is quite similar in all the analysed sectors, except in the chemical sector; where the awareness is lower than average.

Well-known technologies for familiarised with RHC (74%) are represented in the following table. Biomass is the well-known technology for heating and solar thermal energy for cooling:

TECHNOLOGY	HEAT	COOLING
Biomass	69%	4%
Solar Thermal	57%	20%
Heat Pump (Renewable)	11%	10%
Geothermal	10%	5%
District Heating (Renewable)	1%	1%

Table 12. List of the known RHC technologies. Industrial sector.

Data should be interpreted as the 69% of the respondents familiarised with RHC (74%) would be familiarised with biomass energy for heating uses. It means that 51% (0.69 x 0.74) of the total sample would be familiarised with biomass energy.

5.6 PERCEPTION OF RHC ATTRIBUTES

The perception of RES attributes by those survey respondents who have heard about RES (74%) is shown in the following table:

ATTRIBUTE	RENEWABLES	NON-RENEWABLES
Higher initial investment	83%	17%
Higher operation costs (maintenance and fuel)	20%	80%
Higher savings along the life expectancy of equipment	77%	23%
More eco-friendly	95%	5%
Higher working reliance	20%	80%
Higher visual impact and/or need of space to install/store fuel	80%	20%
Safer	29%	71%
More specialized installers	23%	77%

Table 13. Perception of RHC attributes by respondents. Industrial sector.

Respondents familiarised with RHC (74%) think that RHC technologies are more expensive, operation costs are lower, while the expected savings are higher. According to survey, RHC technologies are more eco-friendly than fossil fuel technologies. Respondents think that there are less specialised RHC installers and fossil fuel technologies are more reliable and safer and with less visual impact.

The attributes perception is clearly different depending on the industrial process, as it is shown in the following table:

ATTRIBUTES PERCEPTION	%	Activity								
		Food	Textiles	Wood	Paper	Chemic	Rubber	Metals	No metals	Others
Higher initial investment	83%	88%	80%	100%	100%	44%	86%	93%	83%	78%
Higher operation	20%	29%	60%	50%	75%	25%	14%	14%	2%	0%
Higher savings	77%	81%	80%	83%	100%	56%	86%	86%	74%	67%
More eco-friendly	95%	92%	80%	100%	100%	100%	93%	86%	98%	100%
Higher working reliance	20%	40%	20%	22%	0%	0%	21%	7%	14%	22%
Higher visual impact	80%	85%	80%	83%	100%	69%	57%	71%	83%	78%
Safer	29%	40%	60%	28%	0%	63%	14%	14%	17%	33%
More specialized installers	23%	42%	20%	0%	0%	44%	29%	0%	19%	0%

Table 14. List of the attributes perception for RHC technologies by industrial sector.

5.7 ADEQUACY OF RHC

Regarding RHC technologies adequacy in the industrial sector, 47% of respondents familiarised with RHC (74%) do not support the installation of any renewable energy technology for heating in their process. Respondents from metal and food industries are more reluctant or do not answer this question more often than average.

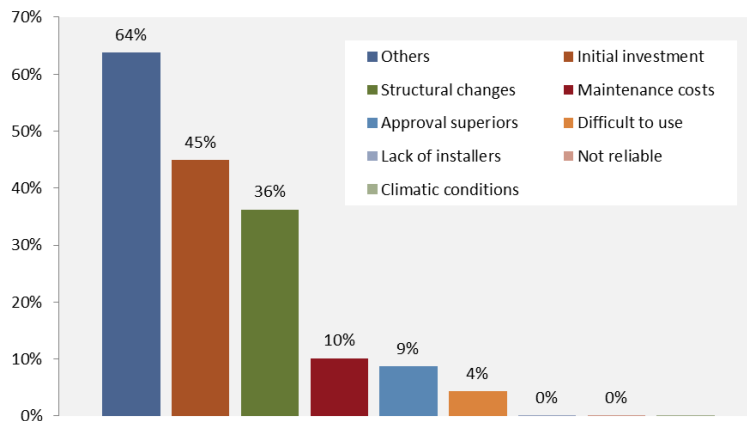


Figure 33 Rejecting reasons for using RES in heating and DHW systems in the industrial sector in Spain

Main rejecting reasons for using RES for heating or DHW systems in industrial sector are: others (64%), high investment costs (45%) and structural changes requirements (36%) Figure 31 shows the share of the rest of the reasons.

Climatic conditions, reliability and lack of installer are not rejecting reasons for using RES in industrial sector.

According to the survey, 53% of the respondents who know about RCH (74%) consider the installation of some RES technologies for heating in their industrial processes. The preferred technology is biomass (39%). Figure 26 depicted the considered technologies for heating systems in Spanish industry. The preference of biomass energy is higher wood and paper sectors. Solar thermal energy is the second technology preferred by industrial sector in Spain, mainly for chemical and rubber activities.

Only the 10% of the respondents familiarized with RHC (74%) consider the installation of some RES technologies for cooling systems. Renewable heat pumps (5%) and solar thermal systems (3%) are the preferred systems for Spanish respondents.

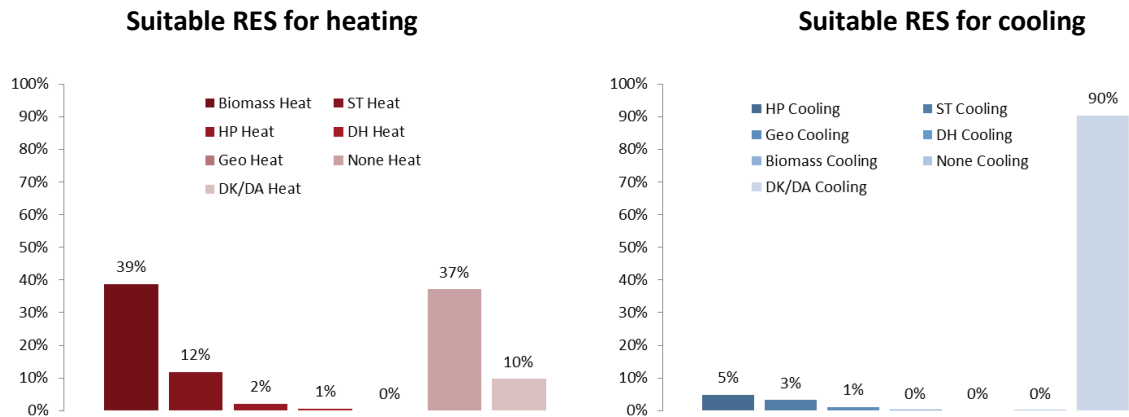


Figure 34 Suitable RHC technologies for heating and cooling in industrial processes.

5.8 WILLINGNESS TO PAY

According to the survey, 59% of respondents familiarised with RHC (74%) would be willing to pay more money, 37% of them would not pay more and 4% did not answer this question. Chemical sector is more willingness to pay than average, while metal and textile are more reluctant to pay more for RHC technologies.

Figure 35 shows the percentage of respondents familiarised with RHC (74%) that are willing to pay more for a RHC system in the industrial sector. According to the results, none of respondents familiarised with RHC (74%) would pay up to 5% more for a RHC system, 18% would pay between 5-10%, 27% would pay between 10-25%, 4% would pay between 25-40% and 10% do not answer this question.

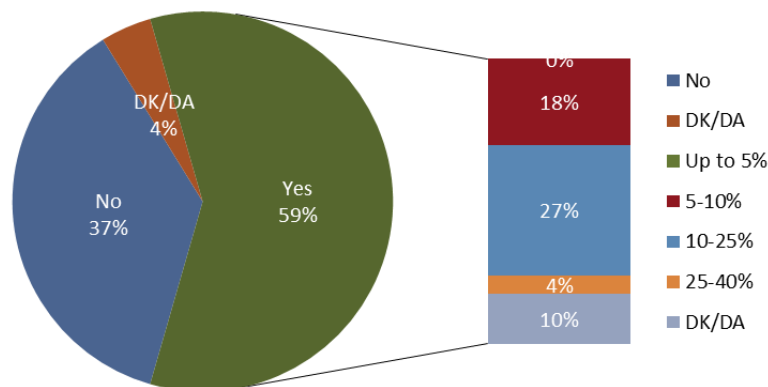
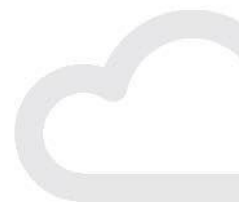
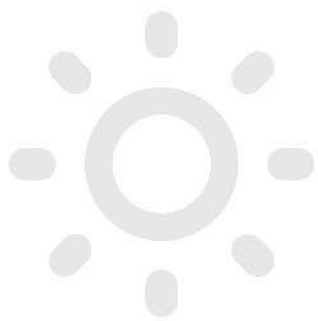


Figure 35 Willingness to pay for RHC technologies. Industrial sector.



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Co-funded by the Intelligent Energy Europe Programme of the European Union