FROnT
FAIR RHC OPTIONS AND TRADE

Recommendations for promoting transparency of energy costs

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EXECUTIVE SUMMARY

The purpose of the FROnT (Fair RHC Options & Trade) project is to provide a better understanding on how to deploy renewable heating and cooling (RHC) systems in the market. FROnT is improving transparency about costs of heating and cooling options (using RHC or fossil fuels), RHC support schemes and end-users key decision factors.

The report is addressed to a wide spectrum of end-users. These could be targeted directly or indirectly via different institutions, communities, and authorities. The results of the FROnT project have shown that professionals play an essential role as the most reliable source of information concerning different RES heating and cooling systems. Their knowledge on RHC in this aspect is crucial, as they are also able to compare RES systems with fossil fuels based solutions. These professionals are gathered in different communities, realising investments supported by environmental protection programmes. It is important to show them different aspects of RES utilisation as to enable them the consideration of all the pros and cons and provide end-users with credible information. Such knowledge should also be available for investors (end-users) cooperating with professionals.

The recommendations are based primarily on the results of national surveys, which sought to identify end-user key decision making factors when purchasing RHC technologies and the analysis of integrated support schemes.

The report presents a framework for and the elements which are useful for promoting the transparency of energy costs. Specific elements such as different fuel costs vary between countries. These specific circumstances should be examined and considered accordingly in each country's case. Also with regard to the specific target groups, some elements should be pointed out accordingly suggestions in the report.

The goal of the FROnT surveys was to identify end-users decision making factors for heating and cooling systems in countries participating in the FROnT project (the Netherlands, Poland, Portugal, Spain and the United Kingdom).

The surveys sought to identify general key purchasing criteria for H&C systems in three sectors: residential, no-residential and industry. They also provided information about the "Willingness to pay", including environmental and social parameters. The surveys (5,676 interviews) have been carried out in each partners'countries.

FROnT project identified the most promising sectors and target groups for wide RES deployment. These were identified by project partners via separate, internal questionnaires rising this point. The chosen sectors determine the target groups to which message on RES costs should be addressed first.

The message on RES costs and circumstances, which influences RES deployment, should be effectively distributed to various stakeholders groups.

The main group are the end-users in all sectors of economy: residential, non-residential and industry. While possibilities of addressing final consumers are increasing, the utilisations of different kind of associations, societies, NGOs will strength the message.

There are also institutions which possess the power to develop RES utilisation, the process of which follows political will, primarily obligations coming from international and national targets. All these groups are recipients of the FROnT message, including cost related information.

The stakeholders' knowledge, engagement and power to act in RES-H developing differs significantly inside countries and among countries also in some extent. Regarding the knowledge on RES-H technologies the lowest level refers to potential buyers, building administrators and financial institutions, excluding environmental protection funds. Such groups should be addressed by basic factsheets info, FAQs. Usually knowledge on economic issues is similar as technical, except financial institutions. RES associations and manufacturers could be characterised by good knowledge on RES-H/C technologies and their economic and they are of low power to affect towards RES-H/C deployment. Architects could be characterised by medium level on knowledge, engagement and power, however their role is highly important. In some extent that concerns building developers, despite their engagement is less than architects. The ESCO companies and building administrators have moderate power to promote RES-H/C technologies. The great power to deploy RES-H/C on larger scale have for sure potential buyers, building developers, state, local and regional governments and installers. End user surveys indicated installers as very influential on individuals' decisions. The increase of knowledge of different stakeholders is a precondition for effective engagement in RES-H development and utilisation of existing power to effectively promote RES-H/C technologies.

Most important elements of the message to be provided to stakeholders and end-users are determined. The message should contain in particular: info on benefits coming out from utilisation of on Levelised Cost Evaluation Methods (LCOE); cost comparison between different fuels, possibilities of RES financing and support. The key message of the FROnT project is RHC's profitability. Even though building or renovating a house or a flat using RES technologies may be more expensive than standard methods, these additional costs may be quickly balanced by lower bills. LCOE calculations should prove it, if the case.

Additional profits are as follows:

→ comfort: naturally heated and cooled buildings do not require any compromise in comfort or architectural aesthetics,

→ health: RES heating technologies create healthy indoor environments with minimal pollutants (e.g., reduced product emissions),

→ energy security: renewables relieve some need for imported fossil fuels, and reduce dependence on foreign sources,
→ environment: renewables contribute to resolving environmental issues, including global climate change,
→ employment: there are important job creation benefits from the development of RES; employment is created at different levels, from research and manufacturing to services (installers, distributors).

To achieve the main purposes of the FROnT initiative (to improve the understanding of the end-users decision making process with regard to heating and cooling systems), good and effective means of promotion are needed. There are many ways to communicate with end-users and stakeholders. The Internet seems to be the fastest one, as it is widely available and information can be quickly updated. This form of communication may be the most useful in the case of Residential Sector. The message can be shared via the following websites:

→ FROnT website,
→ governmentally owned and managed web portals,
→ energy branch websites and portals,
→ internet social media (e.g. Facebook, Twitter),
→ uploading short instructional videos (e.g. Youtube, Vimeo),
→ portals and websites of stakeholders,
→ portals relevant to RES.

Message can be disseminated through more “traditional” ways, such as brochures, leaflets or articles in technical magazines and in the common press which may be the most useful for Industrial and Non-residential Sector.

Nevertheless, the most effective and most powerful mean of promotion seems to be organization of lectures, fairs and conferences and workshops concerning RHC which are essential for all sectors. Direct contact is the most beneficial to both stakeholders and Project partners. Such conclusion comes from surveys, which indicated professionals as the most influential group regarding end-users choices.

The message should informational-educational rather than purely technical. Information has to come from a reliable source, be authentic and credible, and indicate RHC as a modern and promising solution, without promoting specific products or brands. One of the main goals of disseminating this information is to interest users in the subject of RHC and to persuade them into further search for information.

The FROnT project found huge profits of Capacity Building actions that could be trainings of different stakeholders groups: staff of local/regional energy agencies or information sessions to industry, authorities and other stakeholders.

CONTENTS

1. BACKGROUND INFORMATION

1.1 PROJECT FRONT AS THE BASE FOR "RECOMMENDATIONS FOR PROMOTING TRANSPARENCY OF ENERGY COSTS" (RECOMMENDATIONS)

The purpose of the **FROnT** (Fair RHC Options & Trade) project is to provide a better understanding on how to deploy renewable heating and cooling (RHC) systems in the market. FROnT is improving transparency about costs of heating and cooling options (using RHC or fossil fuels), RHC support schemes and end-users key decision factors. This knowledge helps developing Strategic Policy Priorities for RHC to be used by public authorities in designing and implementing better support mechanisms. FROnT supports the industry in engaging more effectively with their prospective clients.
The main objective of FROnT is improving the understanding of the end-users decision making process by identifying key decision factors in the selection process of RHC systems. Based on this understanding, Front aims to develop tailored strategies enabling end-users to make informed decisions based on a transparent overview of the available options and their cost.
More information concerning FROnT activities and results can be found on project's website: http://www.front-rhc.eu/about/.

FROnT follows European climate and renewable energy policy. Different policy papers have begun to enhance the deployment of renewable energy solutions (RES). All relevant policy documents and regulations can be found on the European Commission's website: http://ec.europa.eu/priorities/energy-union-and-climate

1.2 OBJECTIVES OF THE REPORT

The report is addressed to a wide spectrum of end-users. These could be targeted directly or indirectly via different institutions, communities, and authorities. The results of the FROnT project have shown that professionals play an essential role as the most reliable source of information concerning different RES heating and cooling systems. Their knowledge on RHC in this aspect is crucial, as they are also able to compare RES systems with fossil fuels based solutions. These professionals are gathered in different communities, realising investments supported by environmental protection programmes. It is important to show them different aspects of RES utilisation as to enable them the consideration of all the pros and cons and provide end-users with credible information. Such knowledge should also be available for investors (end-users) cooperating with professionals.

The idea behind the report is to present RHC costs issues within the wider context, as an approach which increases transparency. The issues raised in the report are, among many others, standardization of the cost calculation methodology, the presentation of needs and factors influencing consumer behaviour identified by FROnT.
The recommendations are based primarily on the results of national surveys, which sought to identify end-user key decision making factors when purchasing RHC technologies, estimates of RHC energy costs and the analysis of integrated support schemes.
The report presents a framework for and the elements which are useful for promoting the transparency of energy costs. Specific elements such as different fuel costs vary between countries. These specific circumstances should be examined and considered accordingly in each country's case. Also with regard to the specific target groups, some elements should be pointed out accordingly suggestions in the report.
Over recent years, the European energy market has changed considerably and undergone many alterations. Any kind of recommendations should be updated in the future and track the changes.

1.3 END USER'S KEY DECISION FACTORS BASED UPON THE RESULTS OF NATIONAL SURVEYS

The goal of the FROnT surveys was to identify end-users decision making factors for heating and cooling systems in countries participating in the FROnT project (the Netherlands, Poland, Portugal, Spain and the United Kingdom).
The surveys sought to identify general key purchasing criteria for H&C systems in three sectors: residential, no-residential and industry. They also provided information about the "Willingness to pay", including environmental and social parameters. The surveys have been carried out in each country as listed above: overall 5,676 interviews have been carried out (4,195 in the residential sector, 896 in the non-residential sector, and 585 in the industrial sector).

1.3.1 AWARENESS ABOUT RHC

The survey asked end-users if they have ever heard of heating/cooling technologies which use only renewable energy and if so, which of the following renewables they have heard of. The surveys' results and conclusions are distinguished between three sectors as outlined above.

Residential sector

According to the results, only 65% of survey respondents in the five participating countries are aware of the use of RHC systems. Accordingly the specific features of the sample, differences occur. Men are more aware of RHC than women as 73% of the men and 58% of women have heard of RHC technologies respectively.
Solar thermal energy is the most well-known RHC technology, followed by biomass and heat pumps, but their differences are significant. 96% of the respondents familiar with RHC (65%) are aware of solar thermal energy heating uses. This means that 62% of all respondents are familiar with solar thermal energy. For biomass and heat pump these values are respectively 49% of the respondents familiarised with RHC (32% of the total sample), and 42% of the respondents familiarised with RHC (27% of the total sample).

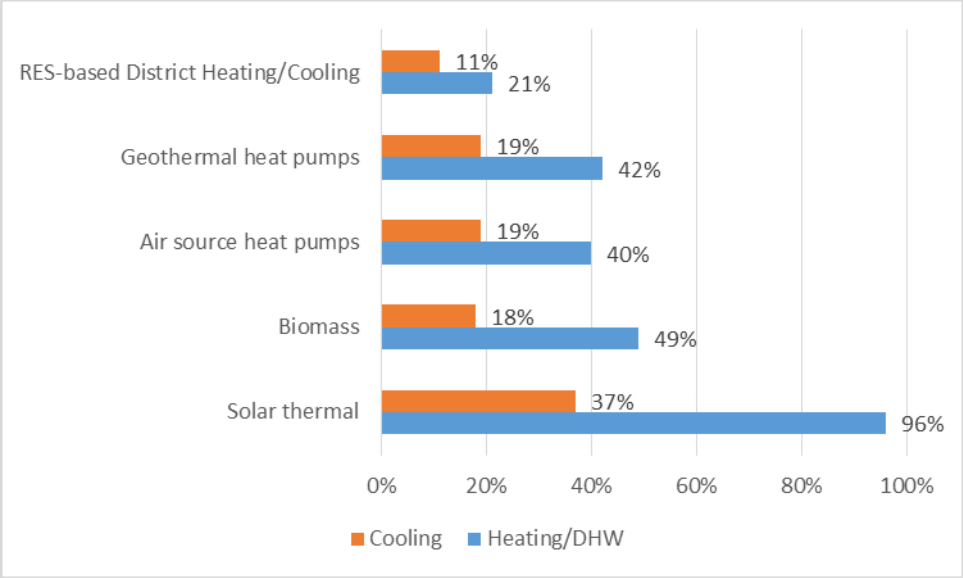

Figure 1. Known RHC technologies. Residential

Non-residential sector

88% of survey respondents in all of the participating countries are aware of the use of RHC technologies, which is definitely a much better result than that of the residential sector. Solar thermal energy is the most well-known technology, followed by biomass and heat pumps, and while the differences between them are still significant, they are smaller than in the previous sector. 89% of the respondents familiarised with RHC (88%) are familiar with solar thermal energy for heating uses. It means that 78% of the total sample are familiarised with solar thermal energy. For biomass and heat pump these

values are respectively 57% (50% of the total sample), and 46% (40% of the total sample).

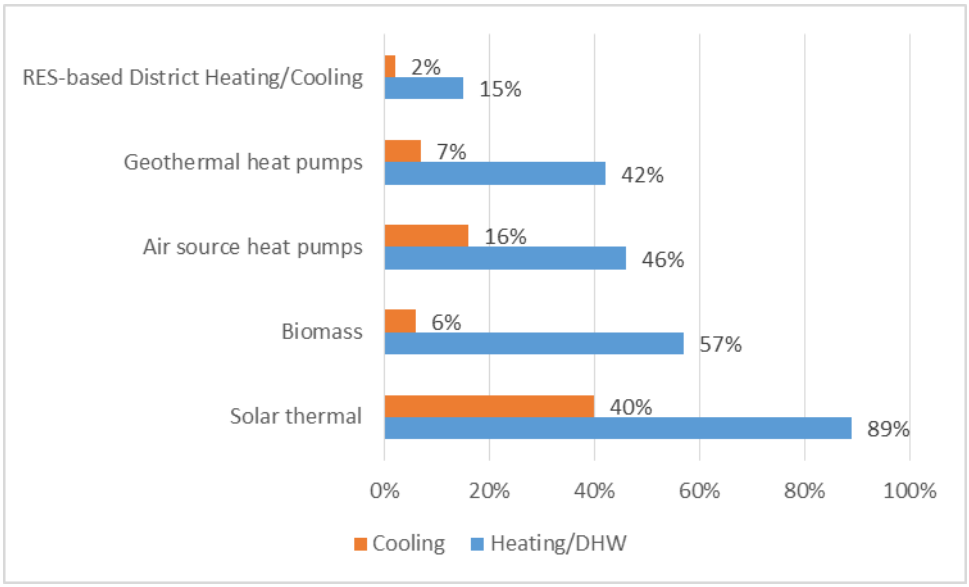

Figure 2. Known RHC technologies. Non-residential

Industry

76% of survey respondents in all of the participating countries are aware of the use of RHC technologies for industrial processes. Solar thermal energy is, as in the previous sectors, the most well-known technology, followed by biomass and heat pumps, but the differences are not as significant as in previous cases. 79% of the respondents familiarised with RHC (76%) are familiar with solar thermal energy for heating uses. It means that only 60% of the total sample are familiar with solar thermal energy which is the lowest value in comparison with the other sectors. For biomass and heat pumps these values are respectively 70% (53% of the total sample) and 57% (45% of the total sample) In contrast with solar thermal energy these are the highest values among all the sectors.

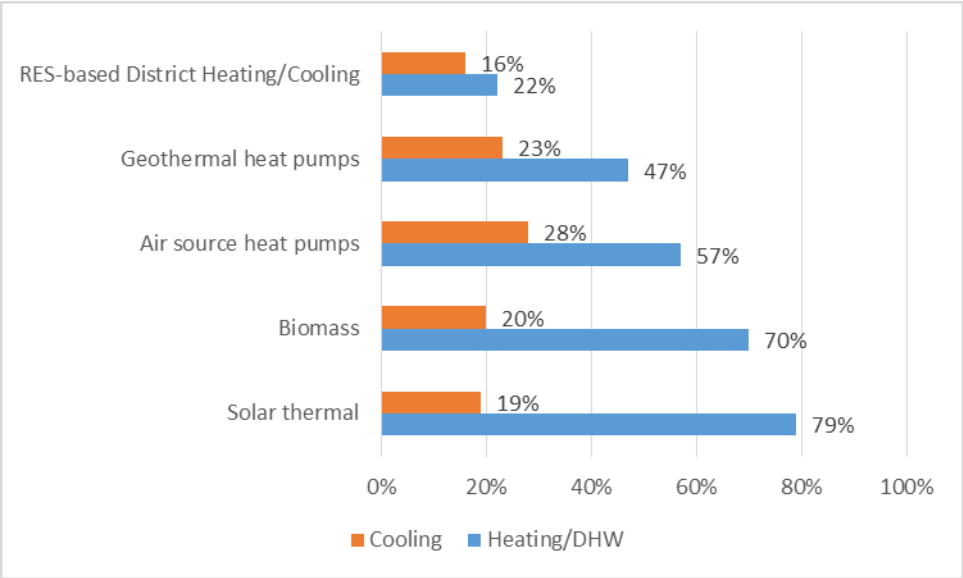

Figure 3. Known RHC technologies. Industry

General conclusions

Solar thermal energy is the most well-known technology, both for heating and for cooling systems. The second best well-known technology is the use of biomass (particularly in industry). The use of heat pumps and geothermal energy both take third place among known RHC technologies.
There are differences between countries. Concerning the residential sector, 63% of respondent are aware of RES in Spain, in Poland 74%. The opposite situation is true in industry: 81% in Spain, 71% in Poland. Therefore information on RES should be addressed to industry in Poland, and to individuals in Spain.

Generally awareness is lower in the residential sector than in any other investigated sectors. The message regarding RES costs should be more effectively aimed at individuals to equip this group with enough information for making the decision.

1.3.2 PERCEPTION OF RHC ATTRIBUTES

The perception of RHC attributes of those survey respondents familiar with RES (70%) is shown in Fig. 4, 5, 6 below (for each sector). Respondents were to compare renewable and non-renewable technologies with special attention given to the attributes listed.

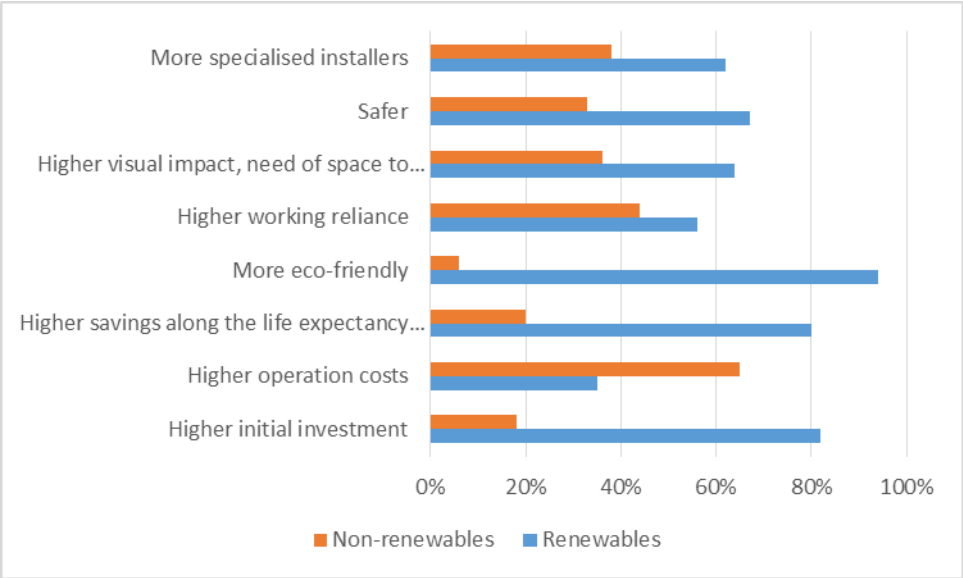

Figure 4. Perception of RHC attributes by respondents. Residential

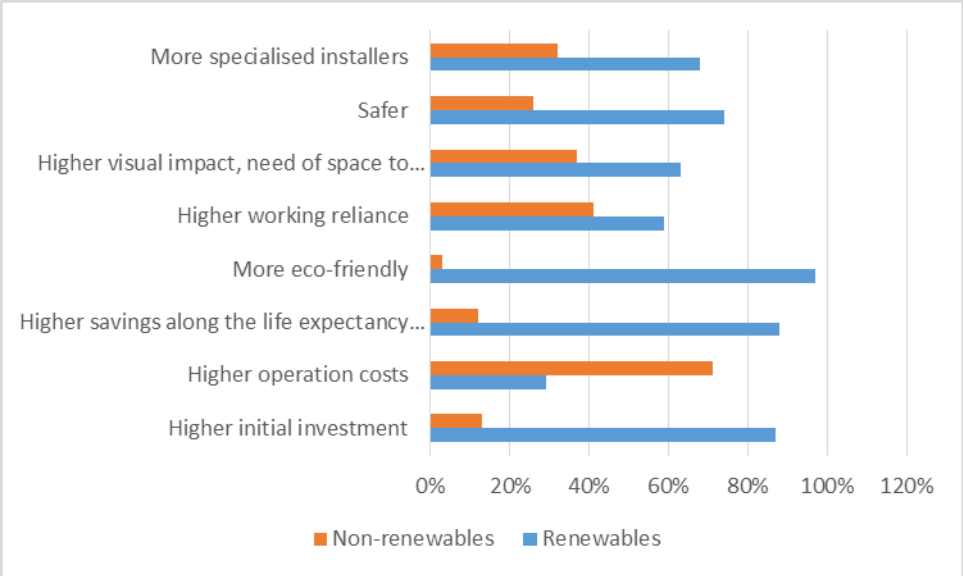

Figure 5. Perception of RHC attributes by respondents. Non-residential

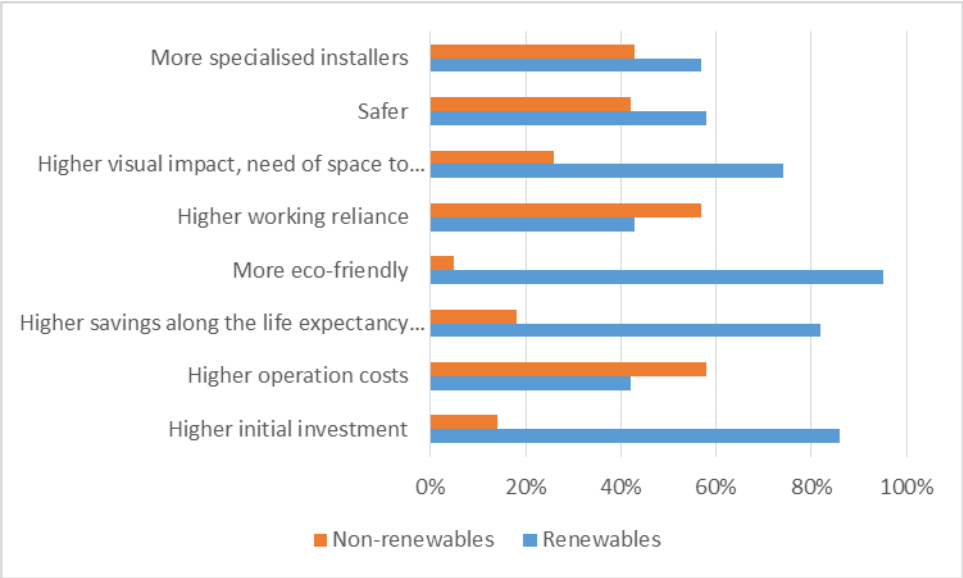

Figure 6. Perception of RHC attributes by respondents. Industry

Most of the respondents of the residential sector believe that RHC are more environmentally friendly and more expensive than non-renewable technologies. However, they are aware that RHC imply more savings, less operation costs and higher safety compared with fossil fuel technologies. Moreover, respondents think that RHC system installers are more specialised. Regarding reliance, the survey shows that the perception of RHC and non-renewable technologies in this aspect is very similar.

The impact of the sample's features (gender, age, etc.) are not clear. Men's opinion is that RHC technologies are slightly more expensive compared to women. Those with primary education think that RHC technologies are more reliable although they involve more operating costs.

Respondents of the non-residential sector believe that RHC are more respectful with environment and more expensive than non-renewable technologies. They also believe that RHC technologies imply more savings, less operation costs, higher safety and visual impacts. Moreover, respondents say that RHC installers are highly specialised and that these installations are more reliable.

The influence of the general features of buildings on the perception on RHC attributes is not clear. Analysis of the results from particular countries shows that the perception of initial RHC investment is above the average in Portugal and Poland. In Spain and the Netherlands respondents consider that RHC installers are much less specialised than installers of non-renewable

technologies. RHC safety results are also below average in these two countries. The remainder results are quite aligned for all countries.

All industrial respondents familiarised with RHC (76%) think that RHC are more environmentally friendly and more expensive than non-renewable technologies. They also believe that RHC imply more savings, less operation costs, higher safety and visual impacts. Moreover, the respondents think that RHC installers are highly specialized and these installations are more reliable.

There is a significant influence of this sector's RHC perception. For instance, textile industries declare that operation costs for RHC facilities are high; however this sector also supports RHC reliability. In fact, textile industries results for these two criteria are above the average.

Analysis of the results obtained in particular countries shows there is a perception of high RHC initial investment is in Portugal and Poland (it is above the average). Spain and the Netherlands results show that RHC maintenance costs, safety and installers' specialisation are below the average.

Overall most of the respondents believe that RHC are more environmentally friendly than non-renewable technologies. Even though RHC are perceived to have higher initial investment costs, they imply more savings, less operation costs and higher safety compared with fossil fuels technologies. Both RHC and non-renewable technologies are perceived to be equally reliable.
Taking into account the survey's results presented above, end-users should be encouraged to pay more attention to the calculation of energy costs (LCOE) and more attention should be drawn to the different benefits of RES.

1.3.3 KEY PURCHASING CRITERIA

RES are competing with fossil fuels. Consumers take into account many factors. Over ten factors were presented in the questionnaire. Respondents were also allowed and encouraged to add their own. In summary each criterion was chosen by over 50% of respondents as a key purchasing factor. Fig. 7, 8, 9 below show the importance of all of them. The message to consumers should not be limited to only one or few factors but should include criteria covering a wide spectrum of issues (technical, economic, environmental, etc.).
The most important key purchasing criteria are as follows:

- → total savings,
- → initial investment,
- → reliability and safety,
- → comfort levels,

→ process requirements,
→ architectonic integration.

The importance of KPC in each of investigated sectors is presented below.

Residential

According to this survey, the key purchasing criteria (KPC) identified for H&C systems in the five participating countries are:

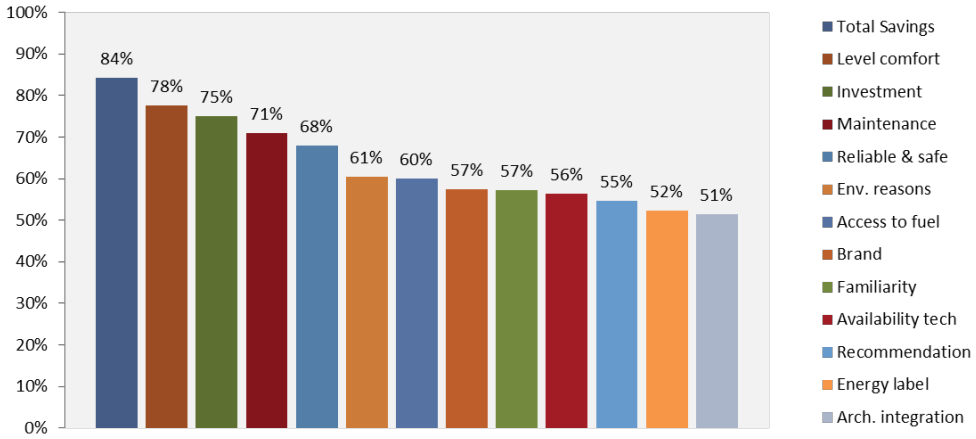

Figure 7. Key purchasing criteria in the participating countries. Residential sector

Total savings is the most important criterion in choosing H&C systems followed by comfort level (78%). Initial investment is also important (75% of respondents).

Total savings is the most important criterion in Poland. Comfort level is the most important factor in Spain, the Netherlands and Portugal (followed by total savings in all three countries). Reliability and safety is the major factor in the United Kingdom and total savings is the most relevant criterion for Polish respondents.

According to the specific feature of the sample, differences occur. In general, architectonic integration and environmental reasons are more relevant for women than for men. Savings, investment and maintenance are more important for respondents between 41 and 59 years of age than for younger respondents. With regard to the level of education, the importance of savings and relatives recommendations for those who have primary education (higher than the average) is worth attention.

Non-residential

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

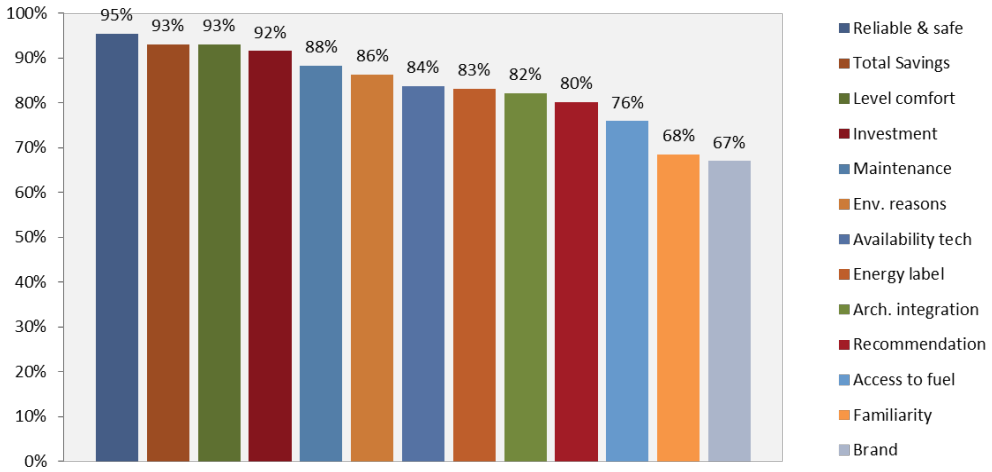

Figure 8. Key purchasing criteria in the participating countries. Non-residential sector

It is a multi-option question; the percentage corresponds to the number of answers compared with the total sample. Reliability and safety is most common criterion for choosing heating and cooling (H&C) systems, followed by total savings and comfort levels (93%). Initial investment is also important (92% of respondents). Total savings and initial investment are the most relevant criteria in Poland. Reliability and safety is the most common factor in Spain and the United Kingdom. Finally, maintenance, comfort levels and environmental reasons are the most relevant criteria in the Netherlands while in Portugal it is initial investment.

According to the specific feature of the sample, differences occur. For instance, investment is a relevant factor for 92% of the sample. 95% of office buildings chose this option and 85% of educational centres. Therefore, the activity of the building is influential for this key decision factor.

Industry

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 Fig. 9. It is a multi-option question; it is the reason why the percentages are so high.

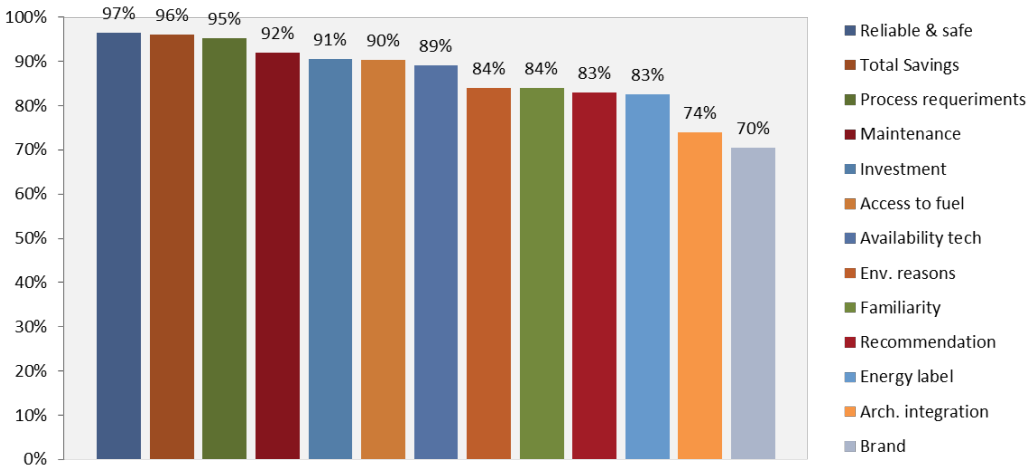

Figure 9. Key purchasing criteria in the participating countries. Industry

Analysing the responses obtained in all countries, almost all the purchasing criteria are very important for the industrial sector. Reliability and safety are the most relevant criterion (97%), followed by savings (96%) and process requirements (95%). Architectonic integration and brand are the least important criterion for industrial respondents (74% and 70%, respectively).

The following tables show the key purchasing factors considering the different sample criteria analysed. The first column (%) shows the answers average in the total sample, while the rest of columns show the answers average related to each feature. For instance, initial investment is a relevant factor for 91% of the sample. 100% of textile industries chose this option and 77% of paper industries. Therefore the particular industry of the respondent is influential for this key decision factor and investment is more relevant for textile industries than for paper industries.

Overall for the industrial and non-residential sectors a wider spectrum of factors is more important than for households. Messages addressed to non-residential and industry should be broader, presenting a wider context of RES deployment.

1.3.4 WILLINGNESS TO PAY

Residential

Considering the total sample as the respondents who are familiar with RHC (65%), 50% of them would be willing to pay more, 39% would not pay and 11% did not answer this question. Fig. 10 shows the percentage of respondents familiar with RHC (65%) who are willing to pay for a RHC system.

According to the results, 12% of respondents would pay up to 5% more for a RHC system, 15% would pay between 5 and 10%, 12% would pay between 10-25%, 6% would pay between 25-40% and 5% did not answer this question.

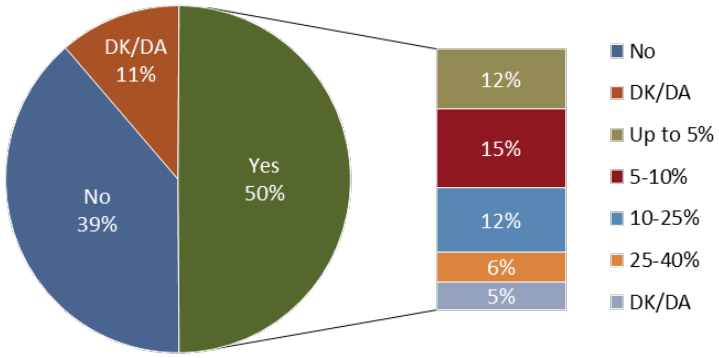

Figure 10. Willingness to pay for RHC technologies. Residential sector

In general, men, young people and those with university education are more willing to pay more for a RHC system than the rest. This trend is also visible in people who live in the countryside. The willingness to pay is lower in Portugal than in the rest of countries (28%).

Non-residential

42% of respondents familiar with RHC (88%) would be willing to pay more, 26% of them would not pay more and 32% did not answer this question. People are more willing to pay in the Netherlands, Spain, Poland and the United Kingdom and less in Portugal, where only 18% of respondents would pay more for RHC systems.

Fig. 11 shows the percentage of respondents familiar with RHC (88%) that is willing to pay more for a RHC system in the non-residential sector. According to the results, 8% of respondents familiar with RHC (88%) would pay up to 5% more for a RHC system, 13% would pay between 5-10%, 11% would pay between 10-25%, 5% would pay between 25-40% and 5% did not answer this question.

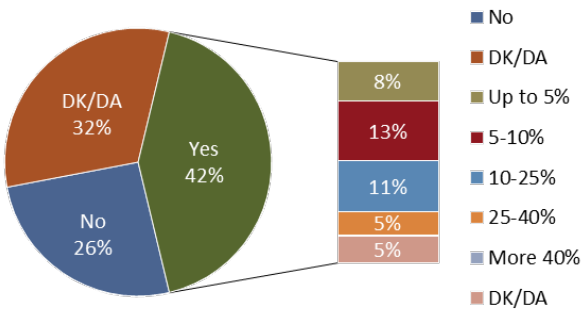

Figure 11. Willingness to pay for RHC technologies. Non-residential sector

Industry

50% of respondents familiar with RHC (76%) would be willing to pay more, 32% of them would not pay more and 18% did not answer this question. The industrial sector is more willing to pay in the Netherlands, Spain and Portugal. In Poland only 30% of respondents familiar with RHC would pay more for RES heating and cooling systems.

Fig. 12 shows the percentage of respondents familiar with RHC (76%) that are willing to pay more for a RHC system in the industrial sector. According to the results, 10% of respondents familiar with RHC (76%) would pay up to 5% more for a RHC system, 15% would pay between 5-10%, 16% would pay between 10-25%, 4% would pay between 25-40% and 5% do not answer this question.

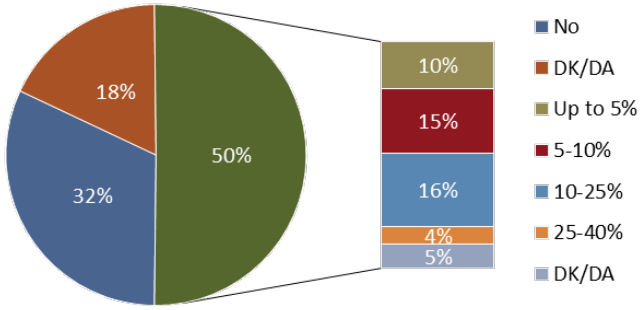

Figure 12. Willingness to pay for RHC technologies. Industry

Summary

Considering all respondents who were recorded as being 'familiar' with RHC technologies (70%), 48% of them would be willing to pay more money than for conventional sources, 36% would not pay more and 16% did not answer this question.

According to the answers, 23% of respondents who are familiar with RHC (70%) would be willing to pay 5% more money for a RHC system, 30% would pay between 5-10% more than for fossil fuels, 25% would pay 10-25% more and 12% would be willing to pay 25-40% more for a RHC system. 10% of the respondents did not answer this question.
As roughly half of respondents familiar with RHC are willing to pay more, it is important to: 1) provide to them and to others information on LCOE; 2) show financial support possibilities; 3) show other RHC benefits. To other benefits category is constituted of the environmental protection aspect, and the social effects of RES deployment: increase in employment, growth of local economies, security of supply, reducing energy dependence on imported fuels. It has to be stated that RES is the energy supply of the future.

1.3.5 ADEQUACY OF RHC

With regard to the question about the most suitable renewable energy technology to be incorporated in dwellings, 28% of respondents familiar with RHC (70%) consider there is no renewable energy technology suitable for heating and DHW systems.
The main reasons for rejecting the use of RES for heating and cooling are high initial investment and structural changes required in buildings. All three sectors shared the same answers to this question (chapter 2).

2. CHARACTERISATION OF TARGET GROUPS

FROnT project identified the most promising sectors and target groups for wide RES deployment. These were identified by project partners via separate, internal questionnaires rising this point. The chosen sectors determine the target groups to which message on RES costs should be addressed first.

2.1 HOUSEHOLDS

According to the survey answers, target groups are:

- → individuals planning modernisation, buying or building houses, flats,
- → newly build houses,
- → owners of all kinds of houses,
- → registered social landlords,
- → housing associations.

With regards to the question about the most suitable renewable energy technology to be incorporated in their dwellings, 27% of respondents who are familiar with RHC (65%) consider there is no renewable energy technology suitable for heating and DHW systems. Women and those who live in the city centre and in multi-family dwellings are more reluctant to install RHC than the rest of the sample. Income does not seem to be a factor which influences the decision to install a RHC system. The percentage influence of income is above average in Spain and Poland (34% and 36% of respondents, respectively).

On the other hand, 39% of respondents who are familiar with RHC (65%) do not support any incorporation of renewable energies in cooling systems. In this case, women, people below 40 years-old, people over 60 years-old and those whose income is below the average are also more reluctant to install any cooling system. Reluctance is above the average in Poland (63%), the Netherlands (51%) and Portugal (47%).

The main reasons for rejecting the use of RES in heating or DHW systems are: initial investment (42%) and structural changes required in dwelling (35%). Fig. 13 shows the answer distribution for all the reasons.

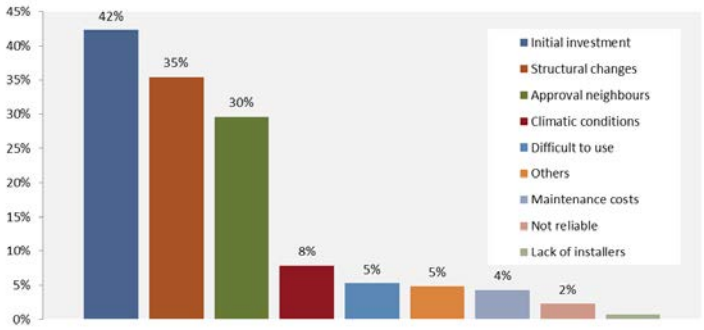

Figure 13. Rejection reasons for using RES in heating and DHW systems in participating countries. Residential sector

The main reason for rejecting the use of RES in cooling systems are also initial investment (26%) and structural changes required (19%). Fig. 14 shows the distribution of the rest of the reasons. The lack of installers is not a significant RES rejection reason in Europe. Its result is negligible.

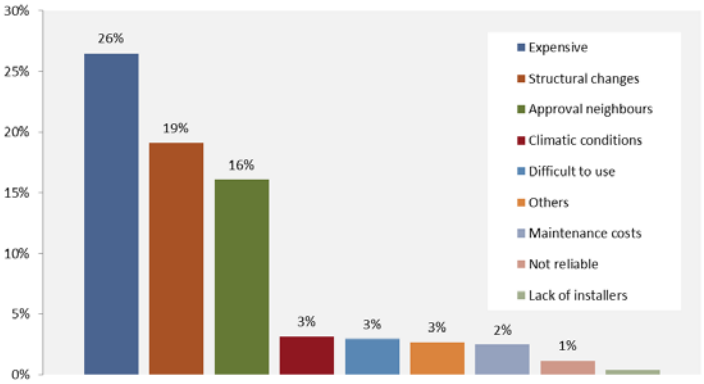

Figure 14. Rest rejection reasons for using RES in cooling systems in participating countries. Residential sector

71% of respondents who are familiar with RHC (65%) support the installation of some RES technologies for heating or DWH systems (2% of respondents did not answer this question). According to the results, the preferred technology to be used is solar thermal energy (56%).

Fig. 15 depicts the most contemplated RES technologies for heating and DHW systems in Europe. Solar thermal energy is preferred in detached and big dwellings (more than 4 bedrooms). Biomass and geothermal energy are preferred by people in rural areas. People who live in the city centre and those with low income are more reluctant to install any RHC.

35% of respondents who are familiar with RHC (65%) support the installation of RES technologies for cooling systems. Solar thermal energy is the most common response (24%). Again, people with low income are more reluctant to install any RHC technology.

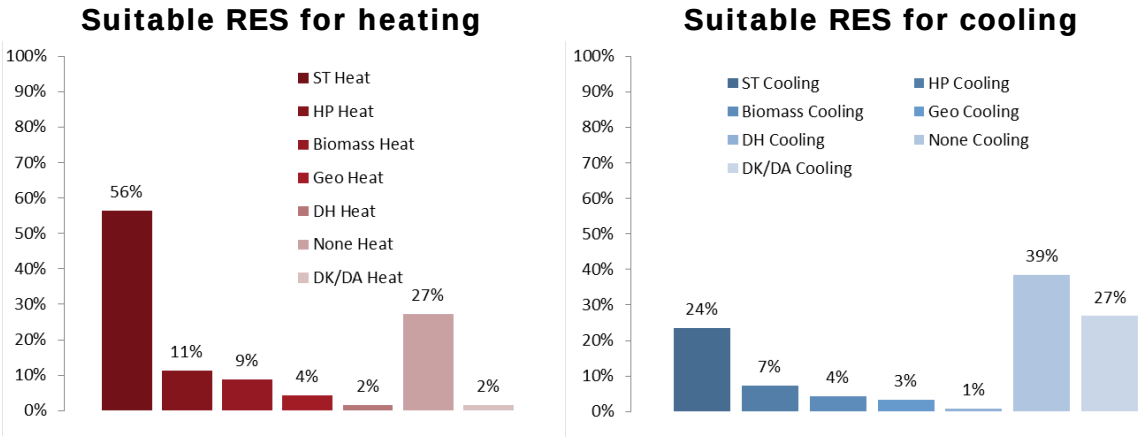

Figure 15. Suitable RHC technologies in participating countries. Residential sector

2.2 NON-RESIDENTIAL

As reported by respondents, the most promising subsectors are:

→ schools,
→ office buildings,
→ buildings of authorities,
→ hospitals,
→ swimming-pools, pavilions and other sport facilities,
→ hotels and other tourism facilities,
→ purpose community buildings.

Regarding the adequacy of RHC technologies in non-residential buildings, 25% of respondents who are familiar with RHC (88%) do not think that any of them are adequate for heating or DHW systems. In general, managers of public buildings, offices, commerce, those without any energy audit and those who did not receive any service from an energy service company (ESCO) are more reluctant to install RHC technologies. This percentage is above the average in Poland, Portugal and the United Kingdom (28%, 32% and 36% of respondents, respectively). Regarding the incorporation of renewable energies in cooling systems, 25% of the all respondents do not support any. In this case, managers of public buildings are the most reluctant. Rejection is above the average in Poland (26%) and Portugal (42%).

The main reason for rejecting the use of RES in heating or DHW systems are: initial investment (41%) and structural changes required in buildings (38%). Fig. 16 shows the distribution for all the reasons.

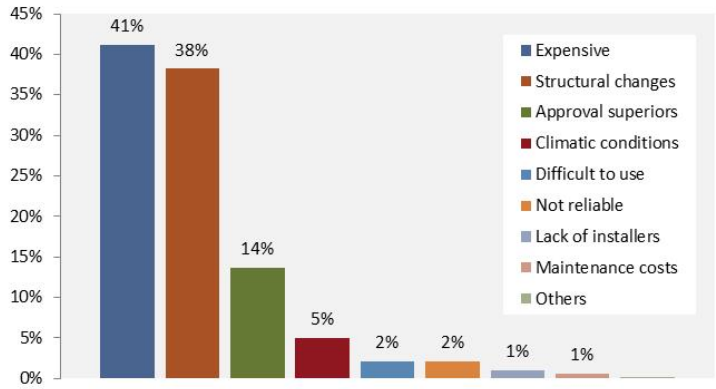

Figure 16. Rejection reasons in heating and DHW systems in participating countries

The main reason for rejecting the use of RES in cooling systems are also initial investment (32%) and the structural changes in buildings (19%). Fig. 17 shows the distribution of the all the reasons.

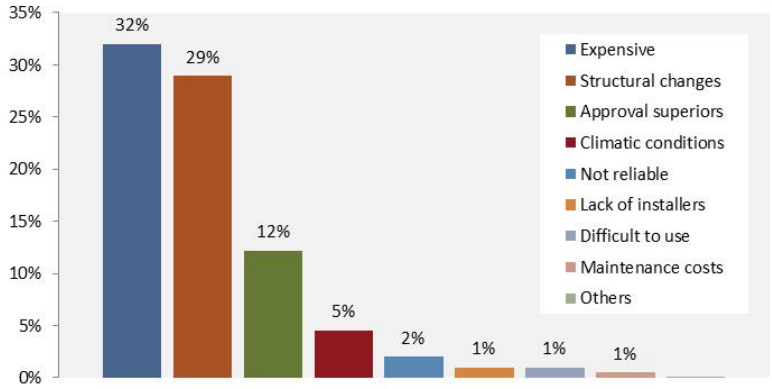

Figure 17. The rest of rejection reasons in heating and DHW systems in participating countries

83% of respondents familiar with RHC (88%) support the possibility of using these technologies in heating and DWH systems. According to the results obtained, the favourite technology for all countries is solar thermal energy (43%). Fig. 18 shows the most suitable RHC technologies for heating and DHW systems in Europe. Solar thermal energy is preferred by educational and sport centres. Biomass, it is preferred by educational centres. On the other hand, solar thermal energy's suitability is above average in Spain, Portugal

and the United Kingdom and heat pumps are the most suitable in the Netherlands and Poland.

32% of respondents familiar with RHC (88%) think about the possibility of installing RES technologies in cooling systems. Solar thermal systems are the preference for respondents (20%). Solar thermal energy is more popular in Portugal, while heat pumps in the Netherlands.

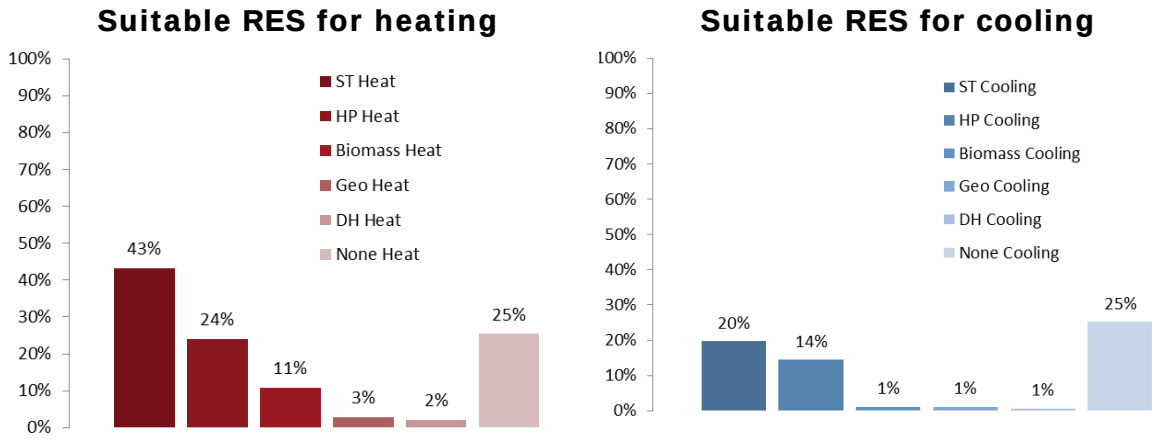

Figure 18. Suitable RHC technologies in participating countries. Non-residential buildings

2.3 INDUSTRY

As stated in the answers provided by FROnT partners, the most promising subsectors specified are:

- → food industry,
- → textile industry,
- → factory buildings,
- → chemical industry - cleaning, drying, bleaching, cooling and paper products.

Regarding the adequacy of RHC technologies in the industrial sector, 37% of respondents familiar with RHC (76%) do not support any of them for heating systems and 8% did not answer this question. In general, respondents from the chemical and metal industry are more reluctant to install RHC technologies for heating applications. This percentage is above average in the United Kingdom (67% of respondents who are familiar with RHC in this country).
With regards to the incorporation of RES in cooling systems, 25% of respondents familiar with RHC (76%) do not support any of them and 49% did

not answer this question. In this case textile, paper, chemical and metal industries are more reluctant than the average. Rejection is above the average in the Netherlands (36%), Portugal (42%) and the United Kingdom (70%).
The main reason for rejecting the use of RES for heating in industrial processes are: initial investment (44%) and structural changes required (22%). Fig. 19 shows the distribution of all the reasons for rejection.

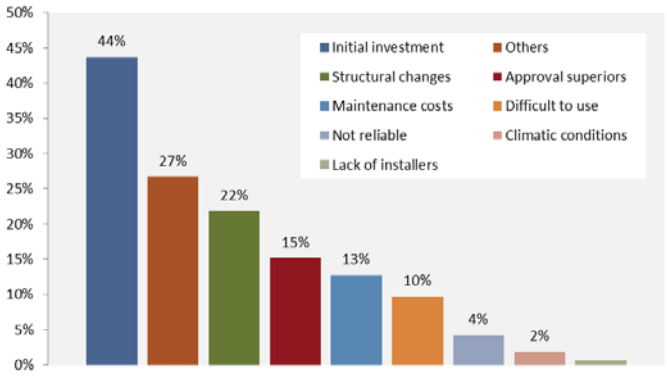

Figure 19. Reasons for rejecting the use of RES for heating in industrial processes in participating countries

The main reason for rejecting the use of RES for cooling in industrial processes are: initial investment (39%) and the need for approval by superiors (19%). Fig. 20 shows the distribution of all the reasons for rejection.

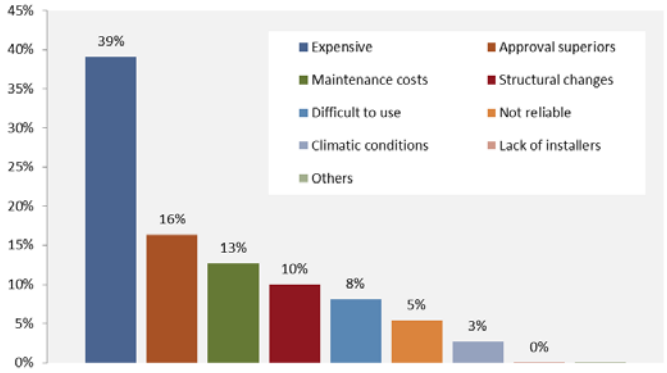

Figure 20. Other reasons for rejection of the use of RES for heating in industrial processes in participating countries

55% of respondents familiar with RHC (76%) think of the possibility of installing RES technologies for heating in their industrial processes. According to the results, the favourite RHC technology to be used is solar thermal energy

(24%), followed by biomass (23%). Fig. 21 shows the suitable RHC systems in the European industry. Solar thermal facilities are preferred by textile industry while biomass is preferred by wood and machinery sectors. In Portugal, the suitability result of solar thermal energy is above average, while in Spain biomass is the preferred RHC source.

26% of respondents familiar with RHC (76%) think of installing RES technologies for cooling systems. Overall, heat pumps are the preferred systems (16%), mainly in the Netherlands, Poland and Portugal. Solar thermal and geothermal energies are also popular among all industrial respondents.

Suitable RES for heating **Suitable RES for cooling**

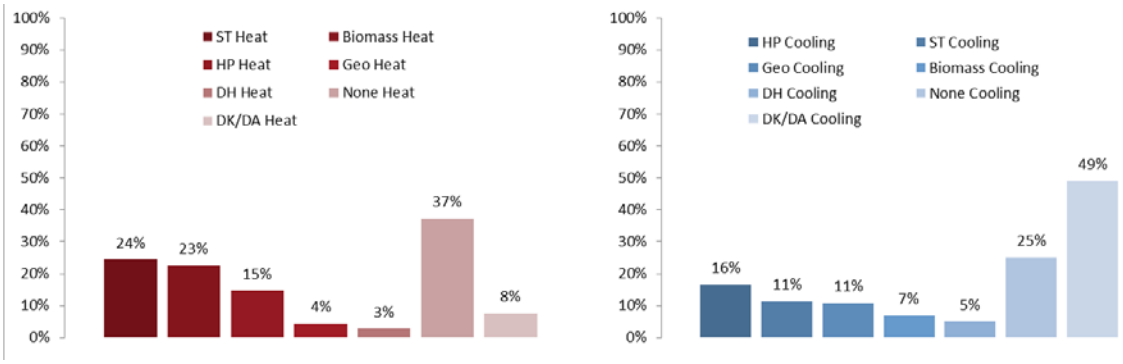

Figure 21. Suitable RHC technologies for heating and cooling in industrial processes

3. ROLE OF STAKEHOLDERS

The message on RES costs and circumstances, which influences RES deployment, should be effectively distributed to various stakeholders groups. The main group are the end-users in all sectors of economy: residential, non-residential and industry. While possibilities of addressing final consumers are increasing, the utilisations of different kind of associations, societies, NGOs will strength the message.
There are also institutions which possess the power to develop RES utilisation, the process of which follows political will, primarily obligations coming from international and national targets. All these groups are recipients of the FROnT message, including cost related information. The stakeholders are listed and categorised as below. The stakeholders with significant power and different level of knowledge with regard to RES should be addressed by very precise and deep knowledge, to facilitate and speed up RES deployment. Additional message content is more appropriate for less knowledgeable stakeholders.

The main recipients, according to FROnT partners' opinion, of the message on energy costs are:

- → Authorities (municipal, regional, national): state and regional governments, planning departments, communication departments;
- → Financial institutions;
- → ESCOs;
- → NGOs;
- → Associations (Construction, Heating/Cooling Systems Producers, End-users, consumer associations);
- → Universities;
- → Industry: RES manufacturers, technicians, marketing departments;
- → National trade associations;
- → Consumer bodies;
- → Others: building administrators, engineers, architects.

The stakeholders listed above might be able to be engaged in promoting the transparency of energy costs. Their relative importance depends on the country's specifics.

The table of stakeholders' analysis below illustrates the effectiveness of stakeholders' involvement in the RES-H: their power to act towards RHC deployment, engagement and their technical and economic knowledge on RES-H/C.

Stakeholders	Technical knowledge	Economic knowledge	Engagement	Power to affect
Potential buyers	-	-	-/+	+
Installers	-/+	-/+	-	+
Building developers	-/+	-/+	-	+
Architects	-/+	-/+	-/+	-/+
ESCOs	+	+	+	-/+
State and regional governments	+	+	-/+	+
Local governments	-/+	-/+	-/+	+
Financial institutions	-	-/+	-	+
Consumer associations	-/+	-/+	+	-/+
RES associations	+	+	+	-
RES manufacturers	+	+	+	-
Building administrators	-	-	-/+	-/+

- Low
-/+ Medium
+ High

Figure 22. Table on stakeholders' analysis

The stakeholders' knowledge, engagement and power to act in RES-H developing differs significantly inside countries and among countries also in some extent. Regarding the knowledge on RES-H technologies the lowest level refers to potential buyers, building administrators and financial institutions, excluding environmental protection funds. Such groups should be addressed by basic factsheets info, FAQs. Usually knowledge on economic issues is similar as technical, except financial institutions. RES associations and manufacturers could be characterised by good knowledge on RES-H/C technologies and their economic and they are of low power to affect towards RES-H/C deployment. Architects could be characterised by medium level on knowledge, engagement and power, however their role is highly important. In some extent that concerns building developers, despite their engagement is less than architects. The ESCO companies and building administrators have moderate power to promote RES-H/C technologies. The great power to deploy RES-H/C on larger scale have for sure potential buyers, building developers, state, local and regional governments and installers. End user surveys

indicated installers as very influential on individuals' decisions. The increase of knowledge of different stakeholders is a precondition for effective engagement in RES-H development and utilisation of existing power to effectively promote RES-H/C technologies.
The info on RES-H costs and comparison with conventional, could be disseminated via local governments and consumer associations.

4. SPECIFIC CONTENT OF THE MESSAGE TO BE PROVIDED TO STAKEHOLDERS AND END-USERS

The aim of this chapter is to indicate the wider context of the message of RES costs.

4.1 INFORMATION ON LEVELIZED COST EVALUATION METHODS (LCOE)

Short information explaining LCOE (Levelised Cost of Energy) will enable the end-user to understand the overall methodology behind the FROnT tool.

LCOE is one of the utility industry's primary metrics for the cost of energy produced by a generator. The basic formula is shown on the Fig. 23 below.

Main parameters within LCOHC

Nomenclature	Unit	Meaning
t	-	Year t
r	%	Discount rate (WACC)
I_t	€	Investment in year t
DEPt	€	Depreciation of fixed assets
Ct	€	Operating costs on year t (O&M, insurance, fuels, as applicable)
TR	€	Corporate tax rate
T	Years	Economic lifetime of the investment
St	€	Subsidies and other incentives
RV	€	Residual value
Et	kWhth	Energy generated on year t

LCoHC equation (illustrative)

$$LCoHC = \frac{I + \sum_{t=1}^{T} \frac{C_t(1-TR) - DEP_t \times TR - S_t - RV}{(1+r)^t}}{\sum_{t=1}^{T} \frac{E_t}{(1+r)^t}}$$

- All parameters have to be input to the model or calculated within.
- Consistency among technologies must be assured, but there are slight differences due to their particularities.
- The following Slides explain how the Excel model works so you can check it and propose corrections and improvements.

Figure 23. LCOE calculation method

4.2 INFORMATION ON THE FRONT CALCULATION TOOL AND ITS AVAILABILITY

Making decisions about installing and replacing parts of heating and cooling systems can be difficult, so the FROnT project prepared a tool which assists end-users in making these choices. The tool is based on studies of what are the most important factors for consumers, and presents information in a clear and simple way. The FROnT tool allows users to estimate costs, payback period, return of investment (RoI) and the environmental benefits of different Heating and Cooling options.

The tool is available on the project's website http://www.front-rhc.eu/tools/. The tool is accompanied by an exhaustive Guideline. Its use is strongly recommended as an easily available and friendly tool for decision making by authorities, technicians, and industry. The output of the tool consists of three parts: LCoHC calculations, Financial and Environmental outputs.

4.3 INFORMATION ON CALCULATION TOOLS AND THEIR AVAILABILITY

The targeted end-users may be aware of other calculation tools than that created by FROnT and presented above. These could be utilised for comparison (in some extent) and be useful by taking into account very specific local/national circumstances, if necessary.
There are a number of calculation tools available for online use, e.g.:

- governmental websites:
  - UK Government https://www.gov.uk/renewable-heat-incentive-calculator,
- RES chambers' websites:
  - Biomass Energy Centre http://www.biomassenergycentre.org.uk/portal/page?_pageid=77,363178&_dad=portal,
  - http://www.therhicalculator.com/
- producers and installers' websites:
  - Treco Green Heat http://www.treco.co.uk/renewable-heat-incentive/information/commercial-rhi-calculator
- Consumer protection agencies: http://www.verbraucherzentrale.de/Interaktiver-Heizsystemvergleich

4.4 COMPARISON BETWEEN DIFFERENT FUELS

RHC technologies are currently available as cost-effective means of reducing both carbon dioxide (and other dangerous substances, like NO_x) emissions and fossil fuel dependency under many circumstances[1].

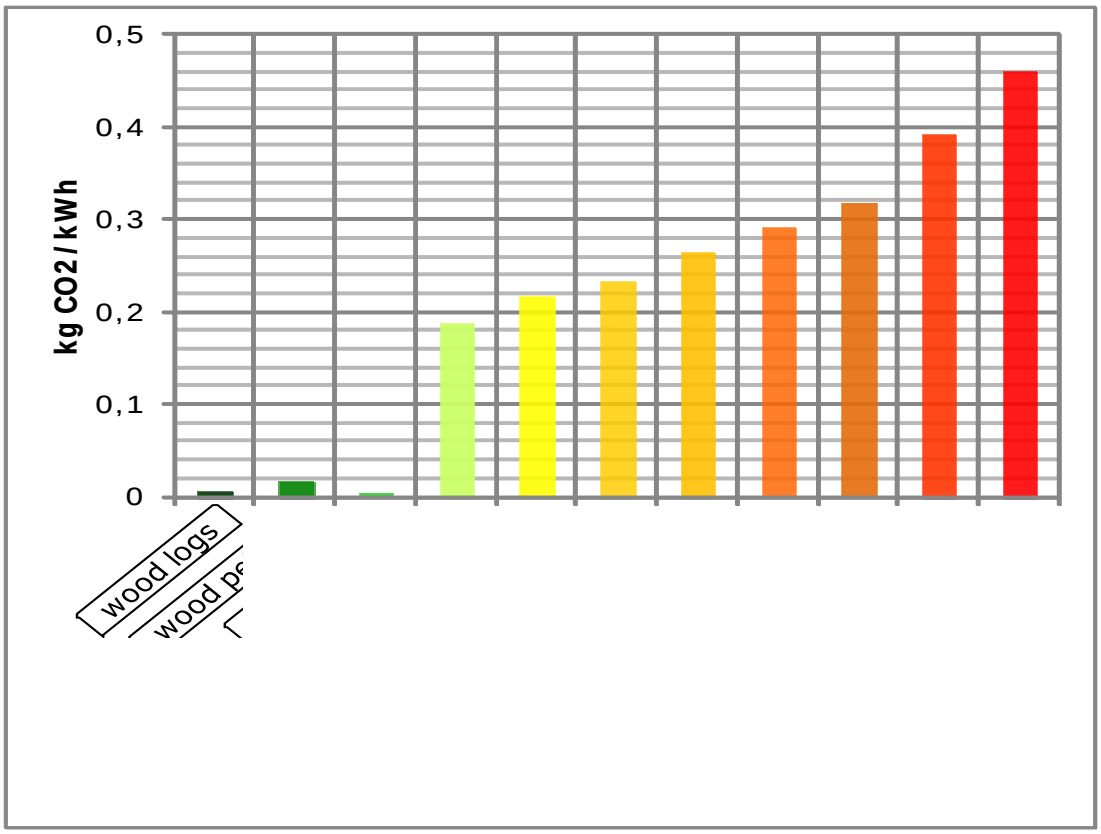

Figure 23. CO_2 emissions of different types of fuels[2]

Fossil fuels are also considered to be reliable, comfortable and often have lower maintenance costs. In the case of RES promotion of their specific individual benefits is necessary, including promoting lower costs per kWh (if the case), as RES are also environmental friendly, reliable and comfortable. Fig. 24 shows the cost per kWh for different fuels (figures from 2010). The prices vary by country to country or from region to region. Each case should be prepared and presented separately.

[1] Source: http://www.iea.org/publications/freepublications/publication/renewable_heating_cooling_final_web.pdf

[2] Source: http://www.stovesonline.co.uk/fuel-CO_2-emissions.html;

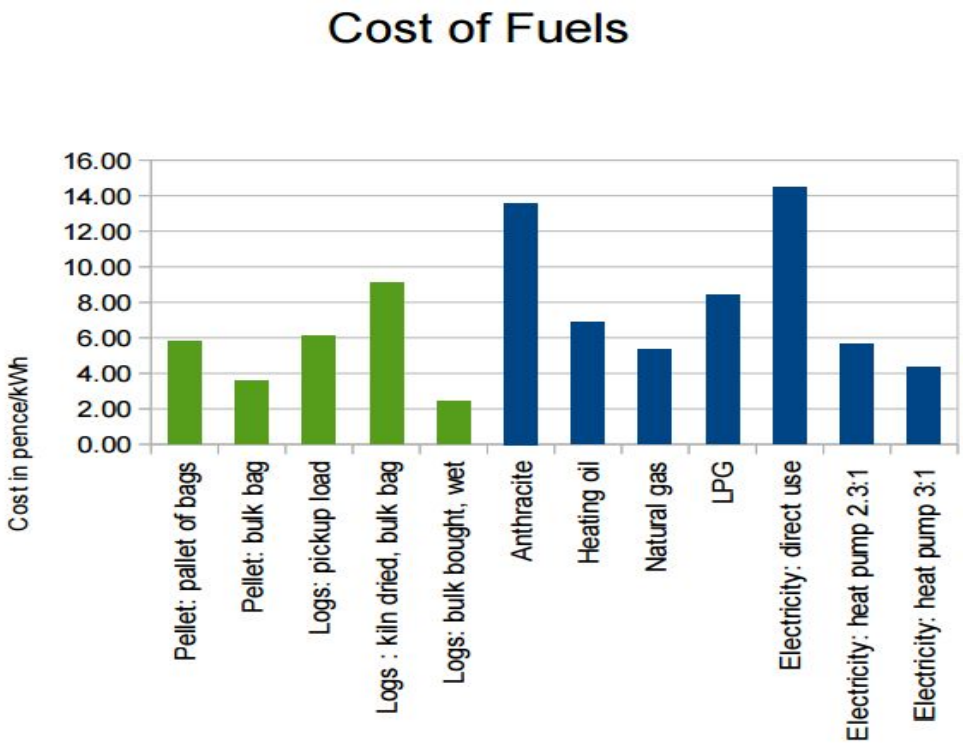

Figure 24. Costs of fuels[3]

Changing the habit of using fossil fuels for the production of thermal energy on the local level, can affect the environment globally. If renewables would be able to supersede fossil fuels worldwide, it would have an enormous effect on the whole planet.
More information about the benefits of switching to renewables can be found on FROnT project's website http://www.front-rhc.eu/library/.

4.5 RES FINANCING AND SUPPORT

Despite the fact that a significant share of European primary energy use is for heating, most of the incentives provided is for the production of electricity. Support for renewable heat in Europe has been mainly concentrated on selective, local support policies, which were often based on local policy objectives, combining financial support or employment opportunities with promoting policies for renewable heating. The table below shows examples of these schemes from all over Europe.

[3] Source: http://www.stovesonline.co.uk/stove-chimney-documentation/Stovesonline-Compare-Cost-of-Fuels.pdf

List of Support Schemes	Country
▪ Renewable Heat Incentive (DOMESTIC)	UK
▪ Non-Domestic Renewable Heat Incentive	UK
▪ SDE+	Netherlands
▪ tax shift in NL (+5ct /m3 of gas; -2ct per kWh/electricity	Netherlands
▪ Medida Solar 2009	Portugal
▪ Promotion of Solar Collectors in Households Sector	Poland
▪ PROSUMENT - grant for micro-installations	Poland
▪ Bocian, Ryś, Kawka	Poland
▪ SOLCASA, BIOMCASA II, GEOTCASA	Spain
▪ Solar thermal - solar thermal large plants	Austria
▪ Energie Contracting Programm Oberösterreich	Austria
▪ Erp Loan, Loan Guarantee for investments in Environmental protection	Austria
▪ Conto Termico	Italy

There are websites that allow one to find and compare information about different support schemes in Europe (first link) and worldwide (second link). These are complete and updated sources of reliable information.

- http://www.res-legal.eu/
- http://www.iea.org/policiesandmeasures/renewableenergy/

4.6 BENEFITS OF RHC

The key message of the FROnT project is RHC's profitability. Even though building or renovating a house or a flat using RES technologies may be more expensive than standard methods, these additional costs may be quickly balanced by lower bills. LCOE calculations should prove it, if the case.

Additional profits are as follows:

→ comfort: naturally heated and cooled buildings do not require any compromise in comfort or architectural aesthetics,

→ health: RES heating technologies create healthy indoor environments with minimal pollutants (e.g., reduced product emissions)[4],

→ energy security: renewables relieve some need for imported fossil fuels, and reduce dependence on foreign sources,

→ environment: renewables contribute to resolving environmental issues, including global climate change,

[4] Source: https://sustainabledevelopment.un.org/content/documents/1851FINAL%20APPROVED%20WEB%20Energy%20is%20a%20health%20issue%20flyer%20MAY%202013.pdf

→ employment: there are important job creation benefits from the development of RES; employment is created at different levels, from research and manufacturing to services (installers, distributors).

This there are many benefits not often quantitatively presented in costs/benefits analyses.

5. EFFECTIVE MEANS OF PROMOTION

To achieve the main purposes of the FROnT initiative (to improve the understanding of the end-users decision making process with regard to heating and cooling systems), good and effective means of promotion are needed. There are many ways to communicate with end-users and stakeholders. The Internet seems to be the fastest one, as it is widely available and information can be quickly updated. This form of communication may be the most useful in the case of Residential Sector. The message can be shared via the following websites:

- → FROnT website,
- → governmentally owned and managed web portals,
- → energy branch websites and portals,
- → internet social media (e.g. Facebook, Twitter),
- → uploading short instructional videos (e.g. Youtube, Vimeo),
- → portals and websites of stakeholders,
- → portals relevant to RES.

Message can be disseminated through more “traditional” ways, such as brochures, leaflets or articles in technical magazines and in the common press which may be the most useful for Industrial and Non-residential Sector.
Nevertheless, the most effective and most powerful mean of promotion seems to be organization of lectures, fairs and conferences and workshops concerning RHC which are essential for all sectors. Direct contact is the most beneficial to both stakeholders and Project partners. Such conclusion comes from surveys, which indicated professionals as the most influential group regarding end-users choices.

The message should informational-educational rather than purely technical. Information has to come from a reliable source, be authentic and credible, and indicate RHC as a modern and promising solution, without promoting specific products or brands. One of the main goals of disseminating this information is to interest users in the subject of RHC and to persuade them into further search for information.

An important element of the FROnT survey was a question concerning information sources, which are the basis for decision on energy carriers. Divided among sectors, the conclusions are gathered below.

Residential

In all of the participating countries, the main information source is professionals (49%) followed by the Internet (29%) and relatives and colleagues (25%). Consulting professionals is the preferred source in Spain and the Netherlands, the Internet is the preferred in the United Kingdom and Poland. Lastly, sales agents are the preferred source in Portugal.

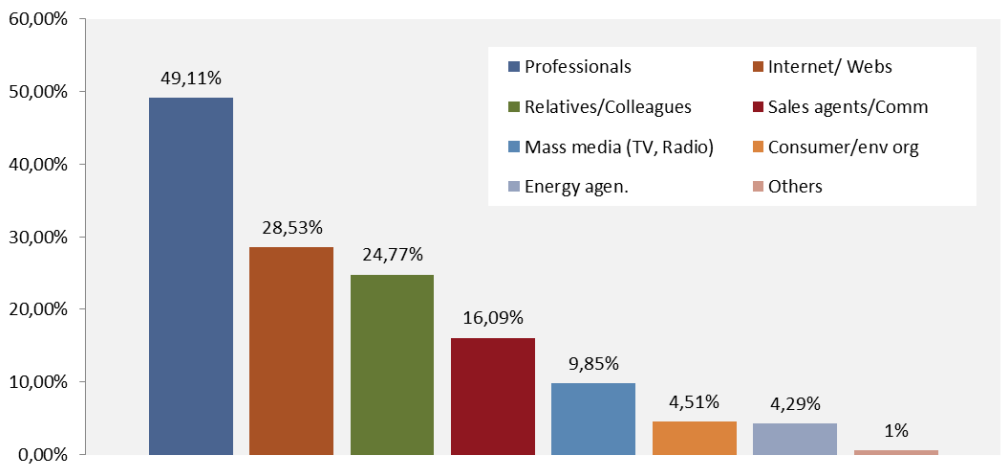

Figure 25. Information resources in participating countries. Residential sector

In relative terms, men use the Internet more than women, while women rely on the opinion of relatives and colleagues. People between 41 and 59 years of age tend to consult professionals while young people and people with a high level of education prefer using the Internet. People from rural areas rely on professional and sales agents' opinions rather than the Internet. Those with income above the average prefer professional opinions and the Internet.

Non-residential

In all of the participating countries, the main information sources are the professionals (74%) followed by the Internet (30%) and energy agencies (23%).

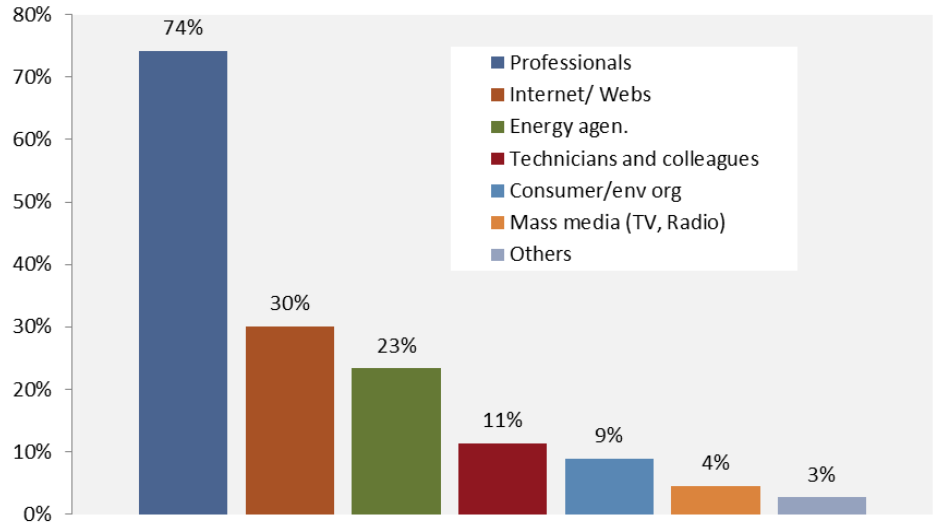

Figure 26. Information resources in participating countries. Non-residential sector

In relative terms, public buildings prefer energy agencies and the Internet as information sources.

Industry

In all of the participating countries, the main source of information is professional opinions (75%) followed by colleagues and technicians opinions (25%) and the Internet (17%). Professionals are the preferred information source in all of the participating countries.

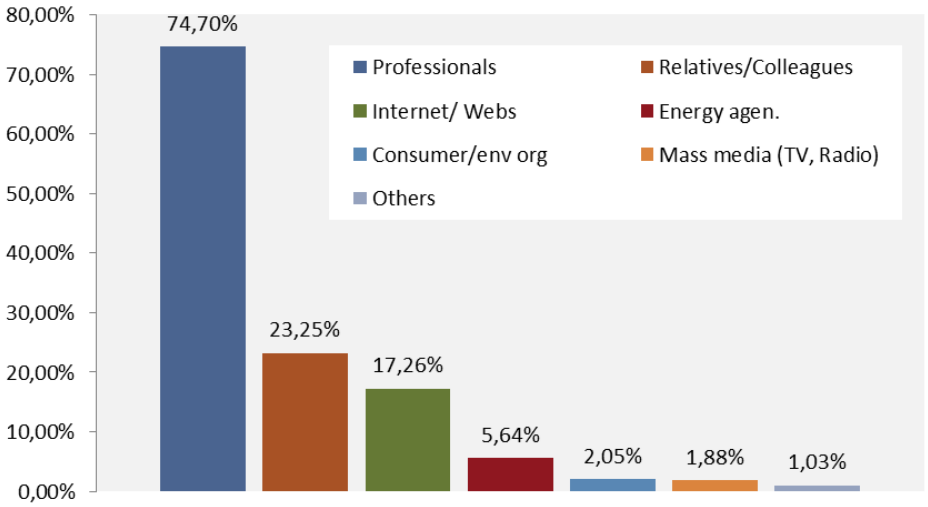

Figure 27. Information resources in participating countries. Industrial sector

In relative terms, professionals are consulted more often by the rubber and plastic sector, while colleagues (other technicians) are preferred by the machinery sector. Energy audits and occupation are not influential for the preference of any specific information resource.

As professionals are the main sources of information, they are key target groups for message and deeper information on cost transparency.

The FROnT project found huge profits of Capacity Building actions that could be trainings of different stakeholders groups: staff of local/regional energy agencies or information sessions to industry, authorities and other stakeholders. More specifically, there are four groups that might be the recipients of the capacity building actions:

1) Policy-makers at the national, regional or local levels: the capacity building sessions will aim to raise awareness of politicians at different levels, of the strategic policy priorities for the RHC sector in Europe and the key success factors for RHC integrated support schemes.
2) Technical staff and energy experts (architects, engineers working, training and teaching about heating and cooling systems, energy consultants, ESCOs, companies involved in refurbishing and professionals and professional organizations related to the heating and cooling sector): these sessions will aim to raise awareness about RHC and to present the common methodology for estimating the value of energy supplied by RHC systems (solar, heat pumps, biofuels) and the assessment of the costs for heating and cooling, and to present and discuss the key decision factors of end-users and the tools tailored to empower them.
3) Industry: manufacturing companies and manufacturing industrial organizations. These capacity building sessions will aim to raise awareness of industry on energy costs savings and other features of RES such as their safety and in some cases appropriate for industrial processes.
4) Consumer and environmental NGOs at the national, regional and local level, energy agencies (management level): the capacity building sessions will aim to present and discuss key decision factors of end users and the tools tailored to empower them. They will also include the presentation of the common methodology for estimating the value of energy supplied by RHC systems and the assessment of levelised costs for heating and cooling.

These Capacity Building actions will also address communication strategies aimed at assisting the RHC sector to streamline their messages to end-users. Environmental and financial benefits should be explained as well.

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