HEAT PUMPS SKILLS FOR NZEB CONSTRUCTION (HP4ALL)

Evaluation of current public and market acceptance of HPs

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This document is a summary report from the HP4ALL Task 4.1 from Austria (AT), Italy (IT), Ireland (IE), and Spain (ES).

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Project details			
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Executive summary

The goal of Task 4.1 **Evaluation of current public and market acceptance of HPs** is to gather feedback from range of ends users in the HP market.

Each pilot region was tasked with developing a method of data collection that could be disseminated to stakeholders in the Heat Pump (HP) sector and analysed for each region report. LIT collated the results and produced this report D4.1.

There were 175 Respondents from all regions consisting of 16 interviews from Austria, 46 surveys from Ireland, and 113 surveys from Spain. The majority of Upper Austrian respondents were in the industrial sector (81%), the majority of Irish respondents were from the residential sector (78%) and the majority of Spanish respondents were from the Public Sector (75%).

Knowledge of HP in Upper Austria is good (44% rated High) and in Ireland, HP knowledge is also good (39% rated High). In Spain HP knowledge is fair to poor (36% rated average, 30% rated low). The Quality of Information available in all regions was stated as fair with Upper Austria rating good to fair (38% rated Average, 38% rated High) and in Ireland and Spain rating fair (48% rated Average).

The majority of respondents had a HP installed in their building with 116 respondents from all regions. 69% of Upper Austrian respondents, 67% of Irish respondents, 66% of Spanish respondents had HP installed in their buildings. The majority of Upper Austrian and Ireland HPs were installed between 2015-2019, and the majority of HP installed in Spain were installed pre-2010. HP Performance satisfaction amongst HP owners is high in Upper Austria (82% Extremely Satisfied), in Ireland (55% Very Satisfied), and in Spain (60% Satisfied). HP installation satisfaction amongst HP owners is high in Upper Austria (82% Extremely Satisfied), in Ireland (48% Very Satisfied), and in Spain (60% Satisfied). The Majority of HP owners would recommend a HP to others, 100% of respondents in Upper Austria and 100% of respondents in Ireland and 47% of respondents from Spain. Better information for building owners was identified as the most important action to help support HP owners (55% in Upper Austria, 79% in Ireland, and 67% in Spain).

Amongst respondents who have no HP installed in their building, in Upper Austria 40%, in Ireland 94%, and in Spain 37% of respondents were considering installing a HP in their building. The main reason for choosing HP technology was due to HP being a sustainable/renewable heating option or a respondent's interest in innovative technologies. More technical details and better information on economic aspects of HPs were identified as actions needed to help respondents decide on HP installations.

High investment costs were identified as the most significant risk to each regions HP market. In relation to the knowledge Hub all components and resources planned for the Knowledge Hub were equally chosen by all respondents as the minimum information and resources required for each HP market.

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Acronyms and abbreviations

Abbreviation	Description
ADA	Andalusian Energy Agency
AT	Austria
BER	Building Energy Rating
CTA	Corporacion Technologica de Andalucia
ES	Spain
ESV	OÖ Energiesparverband
EU	European Union
HP	Heat Pump
IE	Ireland
IERC	International Research Centre
IT	Italy
lit	Limerick Institute
Non-RES	Non-Residential
NZEB	Near Zero Energy Building
res	Residential
RINA	Registro Italiano Navale
SME	Small, Medium Enterprise

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1 Introduction

This report D4.1 is the output of Task 4.1 **Evaluation of current public and market acceptance of HPs**. The goal of this task is to gather vital information from range of ends users (residential & non-residential building owners, public and private building manager, etc) on the following areas:

- Current attitudes and opinions towards HPs.
- Real or perceived risks of using HP.
- HP ease of operation & maintenance.
- HP Installation and operating costs.
- HP Knowledge and skills availability in the market.

This end user feedback is vital for the HP4ALL project as it will inform the following tasks:

- Task 4.2: HP Knowledge Hub.
- Task 4.3 HP Performance Benchmarking Tool.
- Task 4.4 End User Awareness Campaign.

2 Methodology & limitations

Step 1 – Development of survey & interviews.

Each Region was tasked with developing a method of data collection that could be disseminated to stakeholders in the Heat Pump (HP) sector and analysed for each region report.

In Upper Austria, the HP market for small, residential applications is already quite well developed (especially in new builds). Therefore, it was decided to consult end-users of larger scale HP applications (commercial and industrial) through structured interviews as these sectors of the HP market are the main focus pursued in the HP4ALL project for the region of Upper Austria.

In Ireland, the HP market is still in its infancy with as of 2019 only 33,000 HP were installed in Ireland (EHPA, 2019). Also, with LIT connections to the residential market, the main focus was put on the residential sector. A survey was produced to capture the best insights from the end user's perspective of the HP market. The outline of the survey can be found in Annex 1.

In Spain, the HP market is well established, with Spain being the third largest HP market in Europe (EHPA, 2019). The main focus of the survey was to get a general overview of the HP market from the perspective of various end-users.

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Table 1 Region, Target Audience and Method of Collection Summary

Region	Target Audience	Method of Data Collection
Upper Austria	Large Scale HP	Structured Interviews
Ireland	Residential HP	Online Survey
Spain	Entire HP Sector	Online Survey

Step 2 – Each region carried out the survey.

In Upper Austria, the OÖ Energiesparverband carried out structured interviews to gather data on the industrial and commercial sectors of the HP market. The interviewees were selected as to represent a range of viewpoints and levels of experience with HPs.

In Ireland, an online survey was hosted on the online platform Survey Methods. Invites to take part in the survey were disseminated via LIT and HP4ALL online social media and networks. The survey was 'live' for 2 months, after which the data was then exported from Survey Methods via excel and analysed. 46 Surveys were completed during this period.

In Spain, the survey was translated into Spanish and uploaded on an online platform Survey Methods. A wide dissemination was done by CTA's and HP4ALL's social medias and networks. It was also supported by the Andalusian Energy Agency (Spain) who disseminated the questions to more than 6,000 end users from HP sector. These questions were available for 3 weeks after which the data was then exported from Survey Methods via excel and analysed. 113 Surveys were completed in this period.

Step 3 – Region report created.

Each region created a region report using specific headings to summarise the results. The headings of the report were discussed amongst the consortium and decided upon (See Annex 2 for details).

After all data was collected and analysed, each region reported on their findings (See Annex 3,4,5)

Step 4 – Collation of region reports and Final reporting.

After region reports were completed, all region reports were sent to LIT to compile into this report. A Master Excel file was created with data from all regions was examined and processed. To summarise and compare answers from each region, the results are shown as a percentage of total respondents per region as opposed to number of respondents. This provides a clearer view of results from each region.

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3 End User Profile

The following section outlines the sector and roles of the respondents from all three regions.

There were 175 Respondents from all regions consisting of 16 interviews from Austria, 46 surveys from Ireland, and 113 surveys from Spain.

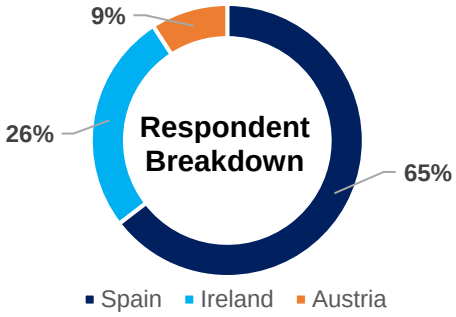

Figure 1 Respondent Breakdown

Respondents were categorised by 2 distinct HP building categories, residential and non-residential, for each region. Respondents were then categorised by sector (residential, commercial, public, industry and other). Other sectors mentioned were an amalgamation of 2 or more of the mentioned sectors. Each HP sector has its own varying barriers and drivers and the end-users in each will have varying opinions that must be acknowledged. From the survey and interviews it is clear that each region has focused on the building category, and sector that was planned. Austria primarily focused on Industry (Non-residential), Ireland focused on Residential and Spain focused on the Public sector (Non-residential) (See Figure 2 & 3).

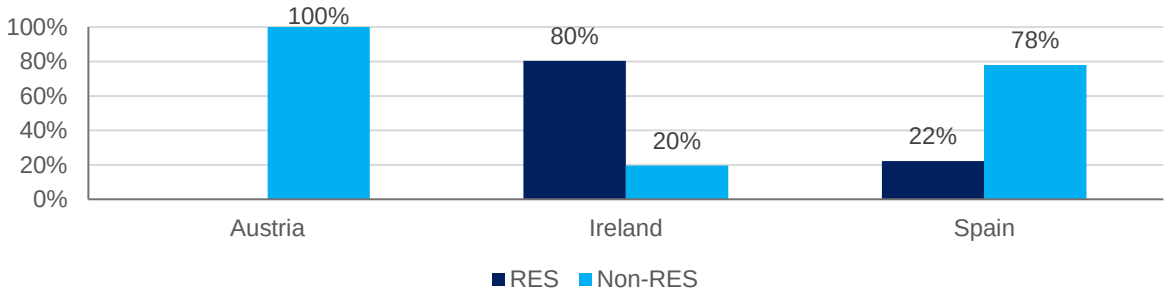

Figure 2 Building Category Breakdown

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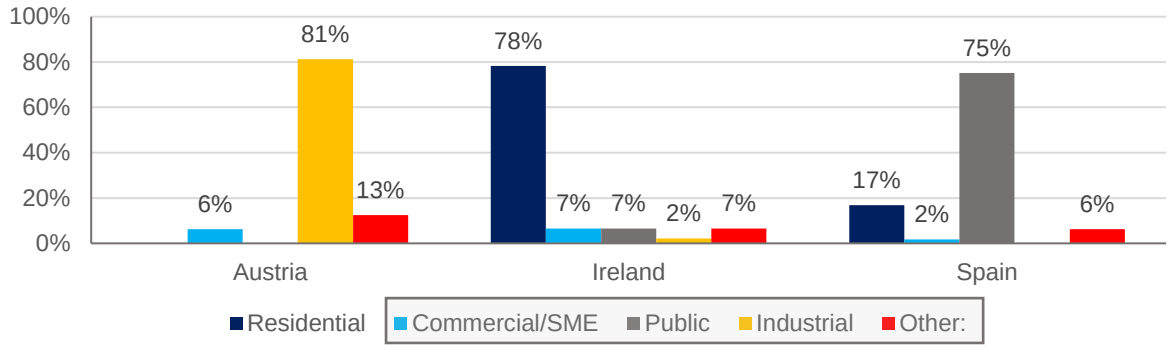

Figure 3 Sector breakdown by region (Non-Residential Sectors in Grey

Respondents were further categorised by roles within each sector to fully understand the target audience. Other roles not mentioned were administrative roles within commercial settings, educational bodies or institutions and consultancy firms. Residential tenants and residential building managers were not so heavily targeted by any region, further communication with this area of the HP market could grant some insights into the mindsets of rented accommodation from the perspective of the tenant and the landlord.

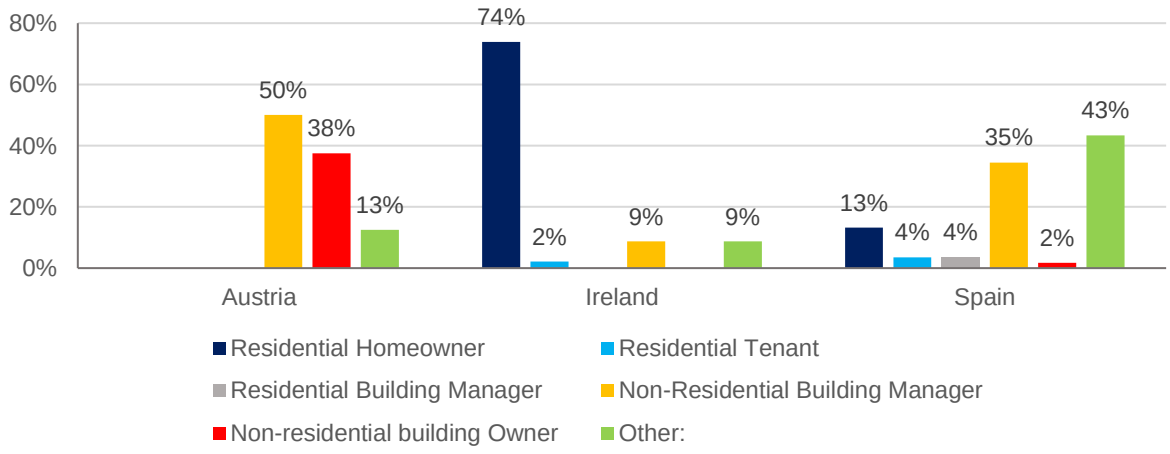

Figure 4 Role breakdown by Region

4 End Users Perceptions

This section looks at quantifying the perceptions of the HP market from each region by the end user's knowledge of the HP market, technology, system, the information available in the region, and the opinion of HP being a cost-effective measure.

Upper Austria respondents have good knowledge of the HP market, technology, and systems This is partly due to the well-established HP market, and the fact that respondents

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are stated to be "early adopters" in the field of large-scale HPs. Irish respondents have a fair to good knowledge of the Heat pump market, technology & systems. This could be in response to the majority of respondents from Ireland having already installed HP. Heat pump knowledge amongst Spanish respondents was poor. With nearly half of respondents having low or very low knowledge of the HP market, technology, and systems (See Figure 5).

The Quality of information available in each region can have an effect on HP knowledge in each region. In Upper Austria and Ireland, the high to average HP knowledge corresponds to the high to average quality of information available. The fair quality of information available in Spain is relative to the fair HP knowledge witnessed (See Figure 5 & 6).

Along with boosting HP knowledge the quality of information can be linked to the end users seeing HP as a cost-effective technology, with the results closely mirroring the HP knowledge. The perception of cost-effectiveness amongst end-users is a major driver in HP installations, as through 'word of mouth' or case studies, the positive impacts of HP can be used to incite more interest in the HP market (See Figure 7).

Awareness campaigns and a centralised knowledge hub can support each region boost end-user HP knowledge. It is essential for the growth of the HP market to have an online database of information, case studies, and tools that can be easily accessed by end-users to boost their understanding of the HP market and technology. The hope would be to conduct a similar survey after the Knowledge Hub is operational to see if HP Knowledge can be boosted in each region.

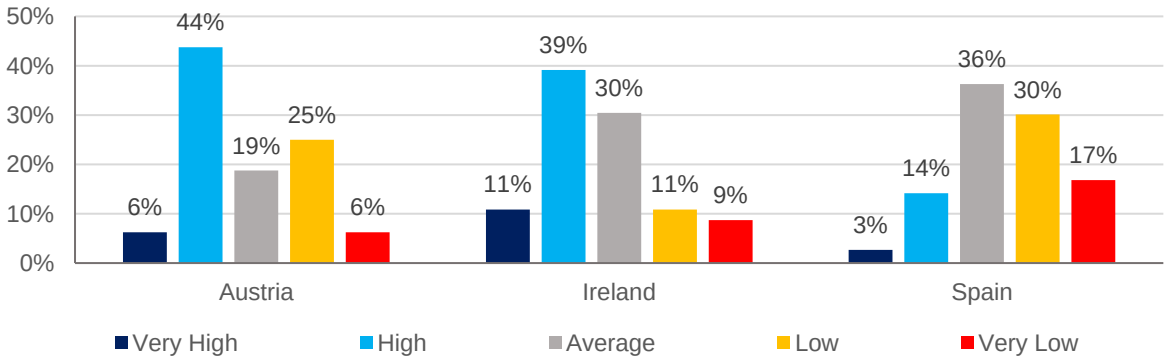

Figure 5 HP knowledge amongst each Region

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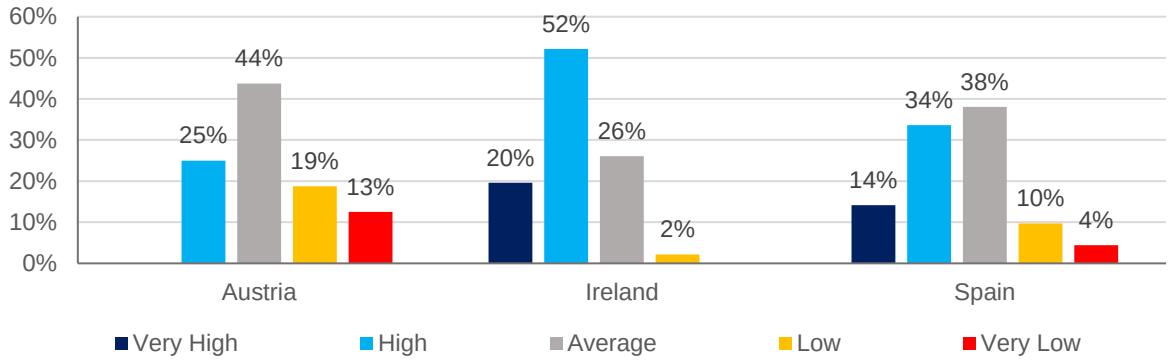

Figure 6 Quality of Information available in each Region

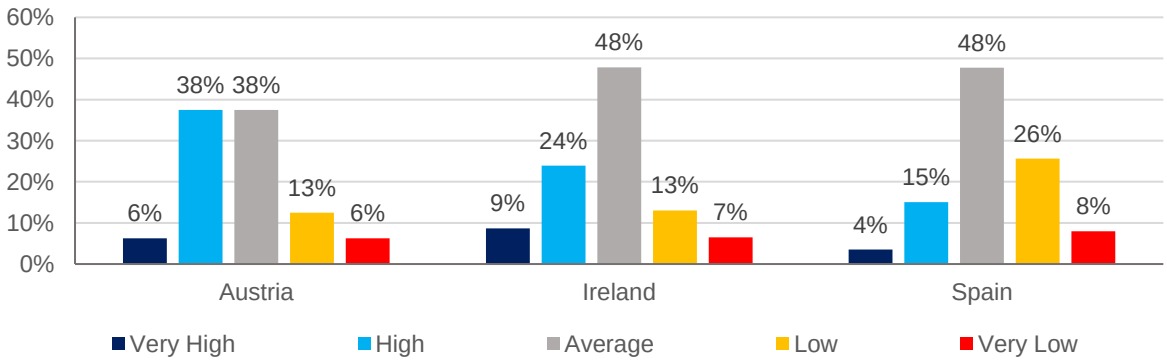

Figure 7 HP cost effectiveness in each Region

5 With Heat Pump Installed

This section looks at quantifying the perceptions of the HP owners in each region, by understanding their concerns, their experiences, and their opinion of HP.

66% of all respondents had a HP installed in their building, the majority of which were in the non-residential sector (45%). There were similar numbers of respondents with HP in each region with HP compared to those who do not. When comparing residential HP installations to non-residential HP installations it is clear to see that the results are in line with the targeted audience of each region.

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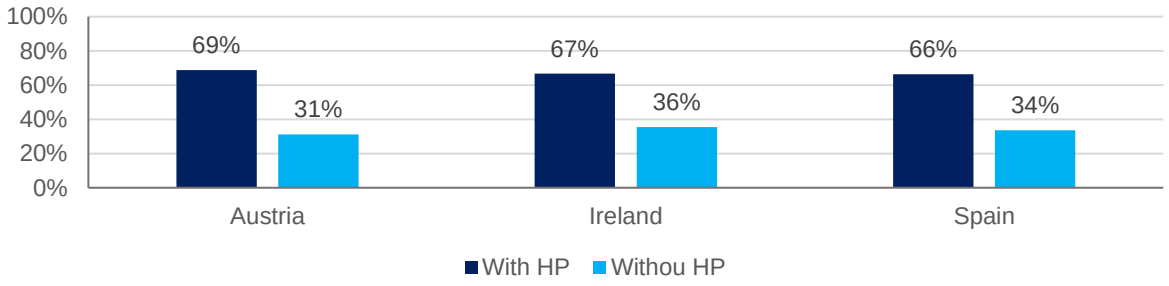

Figure 8 HP Installations in Each region

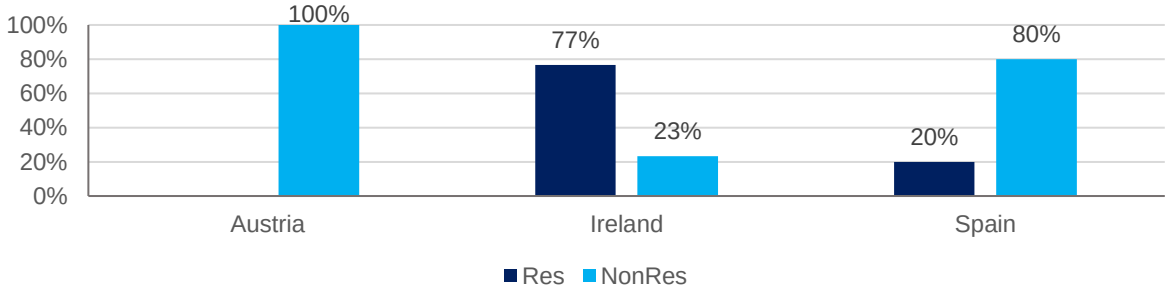

Figure 9 Residential vs Non-residential HP installation

The age of each installation was summarised into 5 main time periods (<2005, 2005-2010, 2010-2015, 2015-2019, 2020). The age of a HP can have an effect on HP perception, with older units being less efficient than modern HP. In Spain in particular there were numerous HP from the 1980s and 1990s, while in Ireland the earliest HP installation was 2002 (See Figure 10).

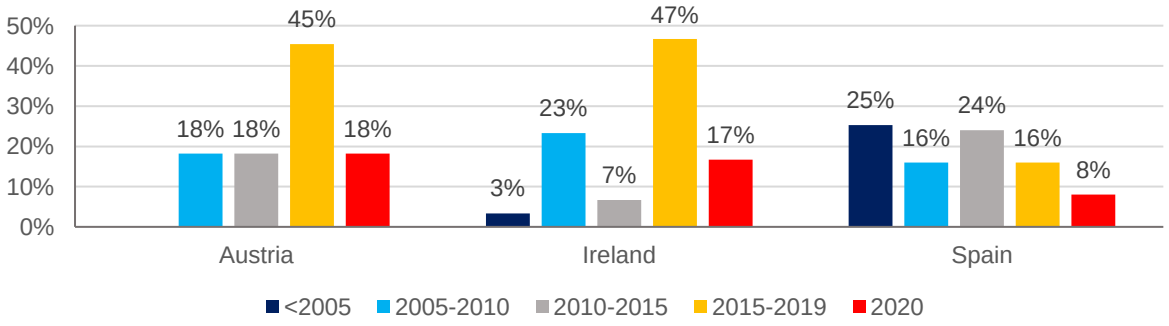

Figure 10 HP Installations per year

It is also important to understand the perceived requirements of HP in each region. From the respondents it is clear that heating is the main function throughout all regions, with hot water provision being a secondary function in Ireland and cooling In Austria and Spain (See Figure 11). HPs providing Process or other heating is severely lacking in all regions.

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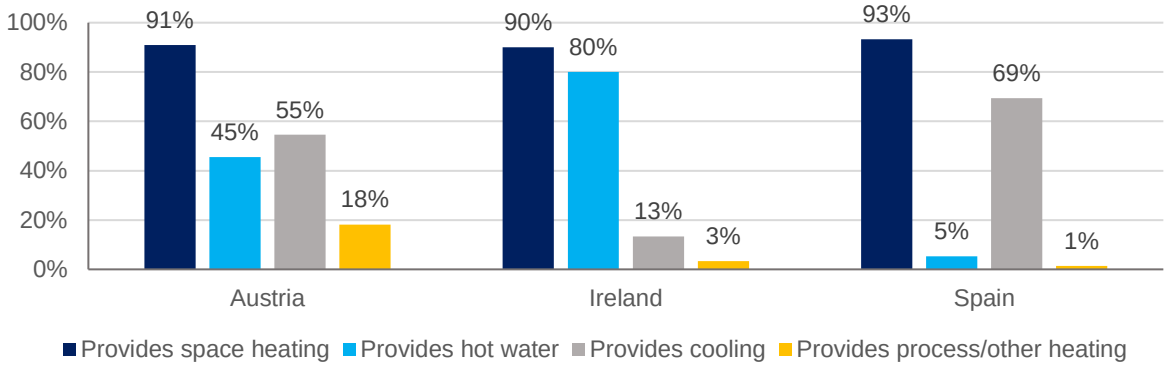

Figure 11 Service provision from HP

From surveys and interviews, it can be said HP are well received across all Regions with a very high satisfaction rate for performance and installation. HP performance is heavily influenced by the competency of designers, installers, and commissioners which could explain the group of HP owners that are not satisfied with the performance of their HP, the more transparent the exchange of information between designers/installers and end-users can relate to the satisfaction of the performance of the HP and the installation. There are more people dissatisfied with their HP installation than dissatisfied with the performance of the HP, this is attributable to other issues with the installation, i.e., noise pollution, maintenance, or installation costs (See Figure 12 & 13).

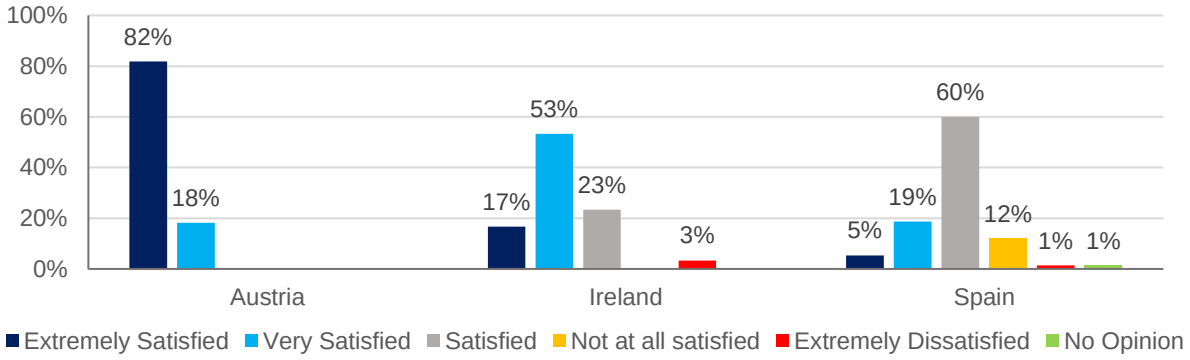

Figure 12 HP Performance Satisfaction

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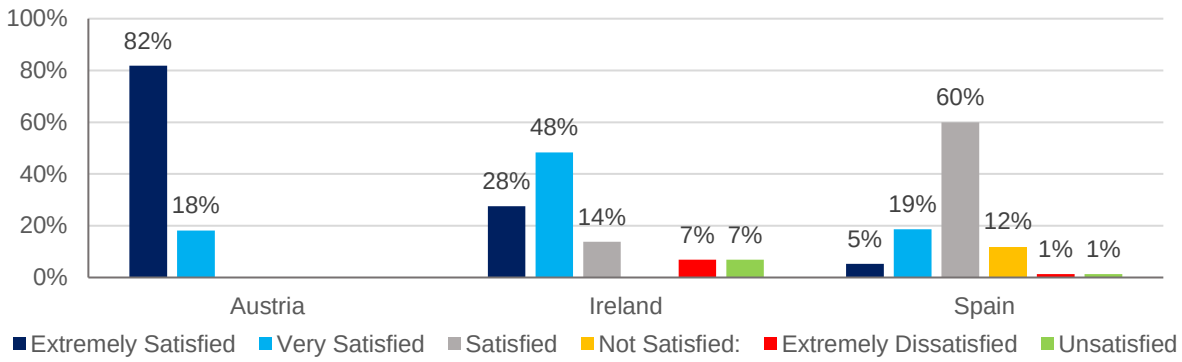

Figure 13 HP Installation Satisfaction

The satisfaction of HP performance and installations is having a positive effect on the market. As all respondents from Austria and Ireland and the majority from Spain would recommend installing HP to others (See Figure 14). This 'snowball' effect can explain the increase in market demand year on year in each region. Taking this into account, the need for competency in designers/installers is paramount to the success of the HP market. Another positive effect brought on by HP installation is the reduction in energy costs, and from respondents it seems that to be the case for the majority of respondents (See Figure 15).

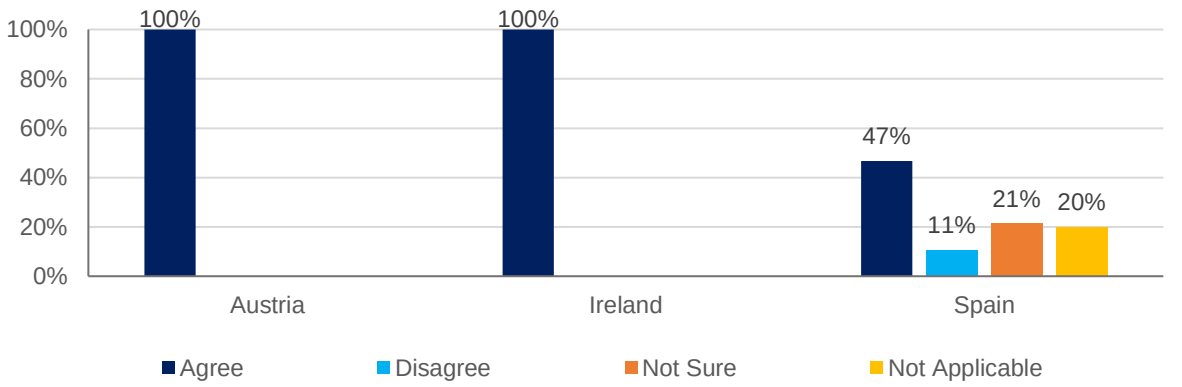

Figure 14 Would Recommend HP to Others?

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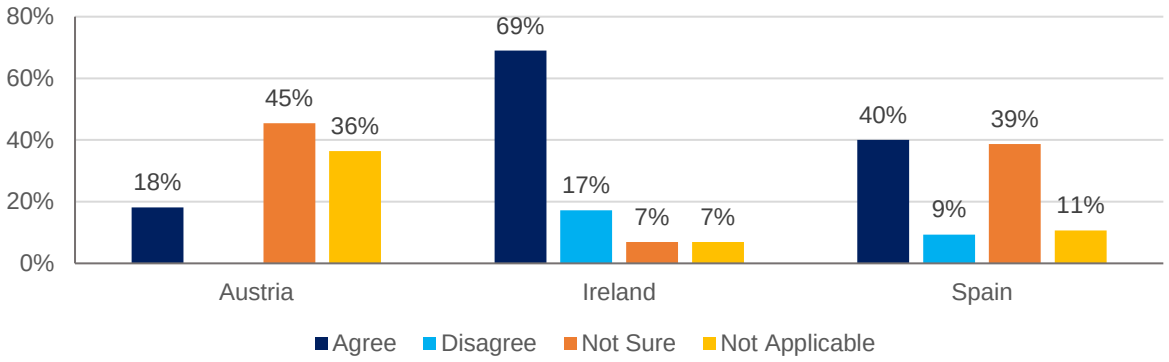

Figure 15 HP has reduced Energy Costs?

Another positive effect brought on by HP installation is the increased interest in the renewable energy or energy efficiency within buildings (See Figure 16). A residential new build or retrofit HP installation require a fabric first approach to buildings in order for HP to be successful, i.e., air tightness, insulation, and zoning. However, a HP installation can used as the first 'steppingstone' to an energy efficient building, by saving energy costs to help with further upgrades. The awareness and interest evolved from HP installation can help people recognise the energy used by buildings in Europe. Respondents were asked if they regret installing a HP in their building a resounding no was the answer. To note that in Spain 7%did regret installing a HP in their building, further action could help identify why this is the case (See Figure 17).

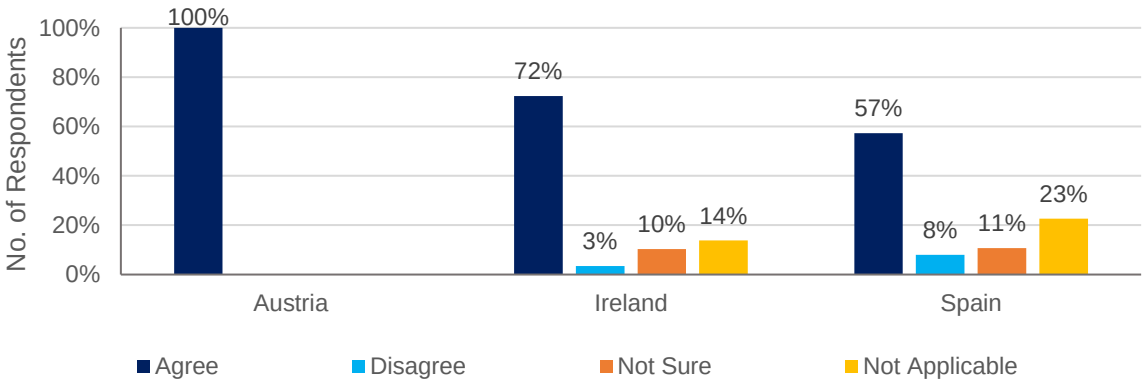

Figure 16 Considering additional energy efficiency or renewable energy upgrades?

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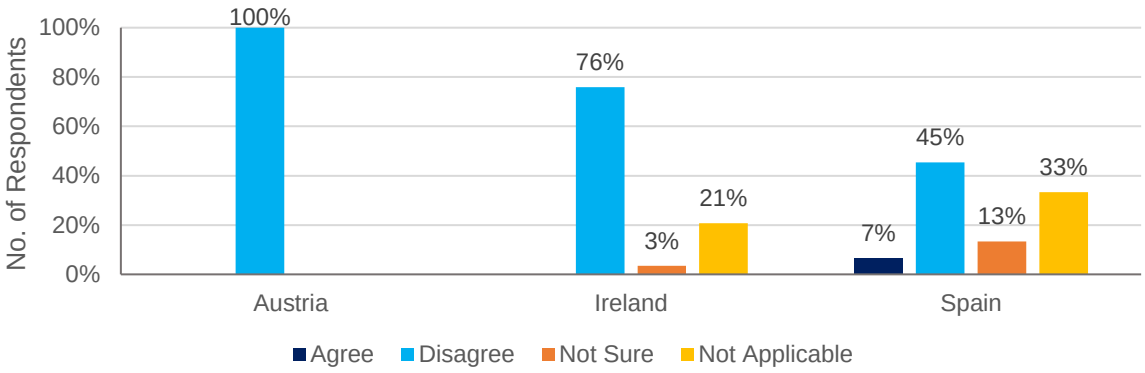

Figure 17 Do you regret installing a HP.

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The main drivers and barriers to growth in the HP market were identified from the end-user perspective. The most important action needed to support building owners is the provision of better information. This is evident across all regions and is practical for both residential and non-residential (See Figure 18) In the Irish residential HP market, incentives (grants, supports) and regulations are the major drivers for market expansion, as well as training for installer and raising awareness among the general population. Incentives that subsidise feasibility studies for larger HP systems (such as market development funding and subsidies for feasibility studies) would help overcome some of the early market barriers. It would not be necessary to continue these as the market matures.

Large-scale HPs have a high technical potential. At the early-market stage in Austria, it is very important to raise awareness on the range of application areas where HPs are already economically feasible. There is a large need for communication tools like case studies, best practices, information brochures, HP checklist for companies, information on planners and suppliers etc.

For Spain, a well-established HP market, the incorporation of large-scale HP applications and upgrading of older units are very important to maintaining the colossal HP market, and instil even more confidence in the technology.

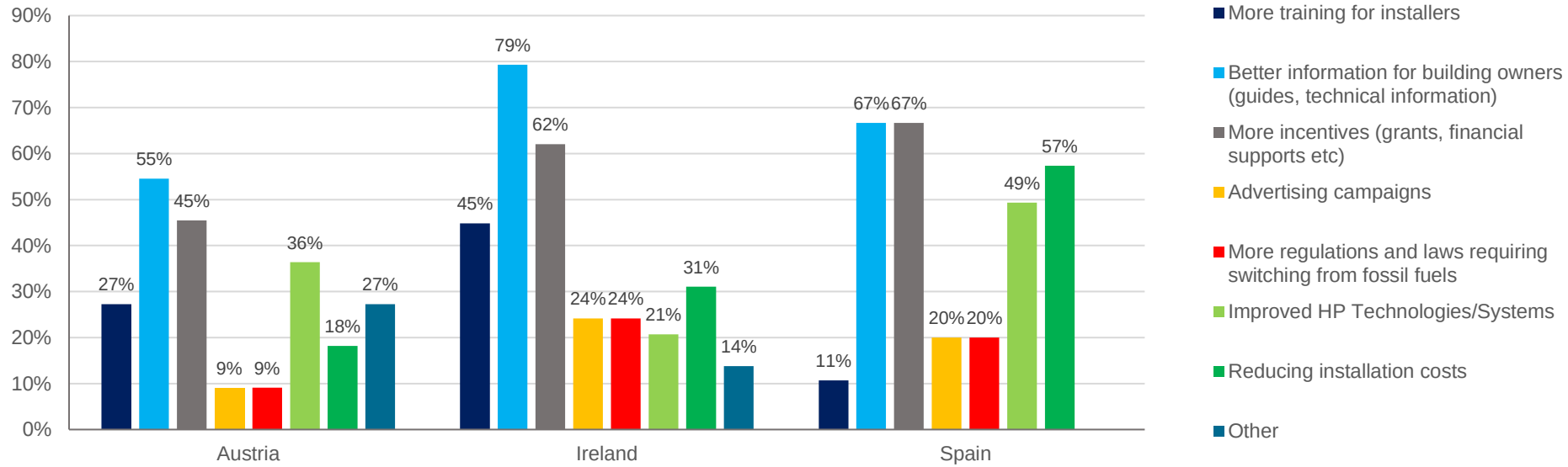

Figure 18 Most important actions for Building Owners

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The most positive aspect of HPs realised across all regions is the high efficiency and comfort levels associated with a HP. Sustainability and renewable energy supply is noted as one of the major aspects of a HP, as well as the lack of fuel deliveries required. There is also an interest within the market for change from fossil fuels to renewable/sustainable energy sources. (See Figure 19)

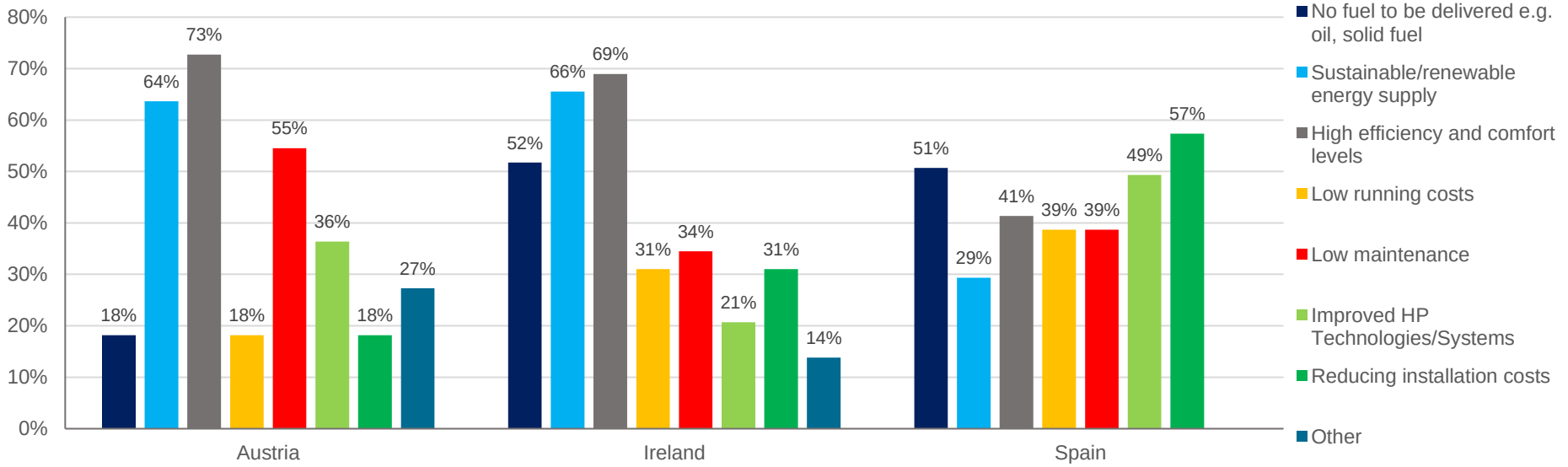

Figure 19 Most Positive aspect of owning HP.

Concerns amongst end-users vary from country to country. In Austria where the focus was on large-scale heat pumps, a non-residential early-stage market, the main concerns were heat availability when facilities are closed and the CO2 neutrality of electricity supply. In Ireland and Spain, the main concern is in regard to competency of designers and installers. The reasoning for Austria not having the same concerns is the high competency of installers due to greater training and certification programmes available in a very well-established domestic heat pump market.

Another major concern for the Irish and Spanish HP market is the installation, maintenance and running costs being too high. Better competency of designers and installers would lead to better certainty regarding running and maintenance costs but should not have a significant impact on installation costs.

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6 Without Heat Pump Installed

This section looks at quantifying the perceptions of the building owners without HP in each region, by understanding their concerns, their experiences, and their opinion of HP. Over one third of respondents in all three regions do not have HP installed in their building. Nearly half of which are not considering installing a HP in their building (see Figure 20). Interestingly, in Spain (the 3rd largest HP market in Europe) has more respondents that are not interest in installing a HP. Awareness campaign and the Knowledge Hub could be used to change the mind-set of these individuals and other alike, by providing clear information on HP.

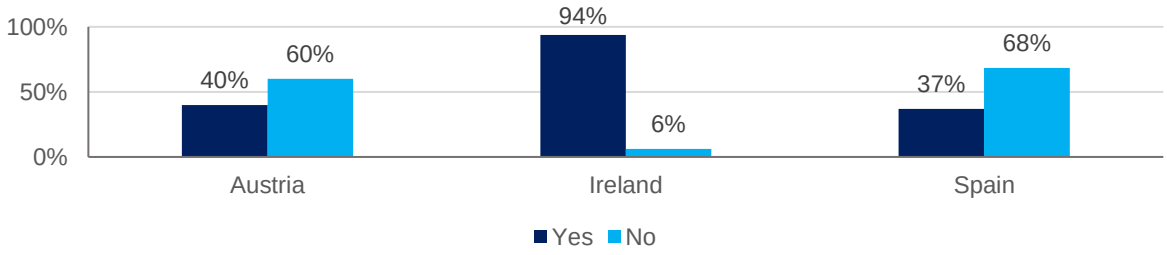

Figure 20 Considering HP installation

The following results refer to all survey respondents who are currently thinking of installing a HP in their building. Space heating provision is the most desirable function of a HP in all three regions. Interestingly, in Austria providing process and other heating was very favourable. With Industrial applications of HP, the economic efficiency of large-scale HPs is often more favourable when several sources (ex: groundwater, process waste heat) and sinks (i.e., application areas such as heating, hot water, air conditioning, cooling) are used, as well as when operating hours are high. In Ireland, hot water is considered the second most favourable provision of a HP this is in part due to the survey sample being primarily residential. In residential applications, the replacement of oil or gas fired boilers is the key selling point for HP, so the provision of hot water and space heating is a must. In Spain, cooling is the second most favourable provision of a HP and is in part due to the Spanish climate (See Figure 21). The more provisions a HP offers the more economically viable it is, it also increases the complexity of the system. Complex HP systems require competent and skilled installers and designers to make the HP efficiencies realised. Thus, training for HP installers and designers is essential for large-scale HP applications and complex HP systems.

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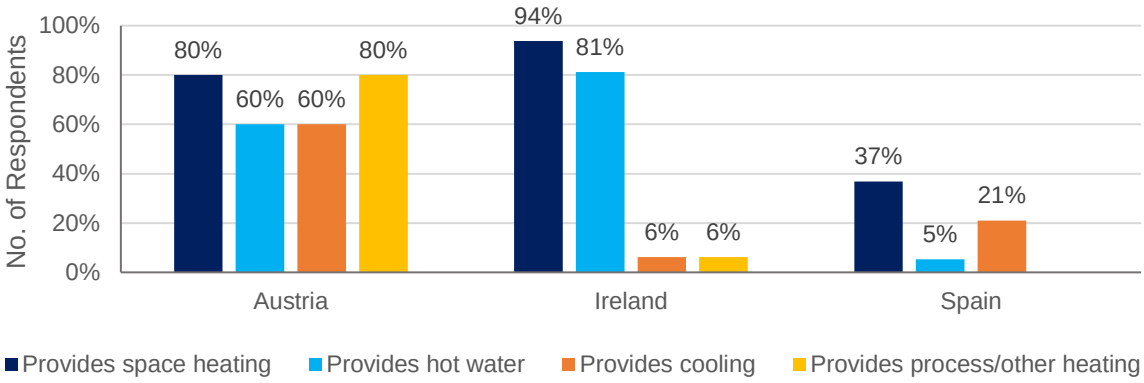

Figure 21 Provision of Hypothetical HP

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When asked for the reason behind the respondent's choice of installing a HP, there is trend in overall interest within renewable technologies and innovative technology. Upgrading or renovation is a major reasoning in Austria and Ireland, this coincides with building regulations having pushed for increase building energy ratings in older buildings and the push for sustainable buildings (See Figure 22). Note that respondents could chose multiple answers.

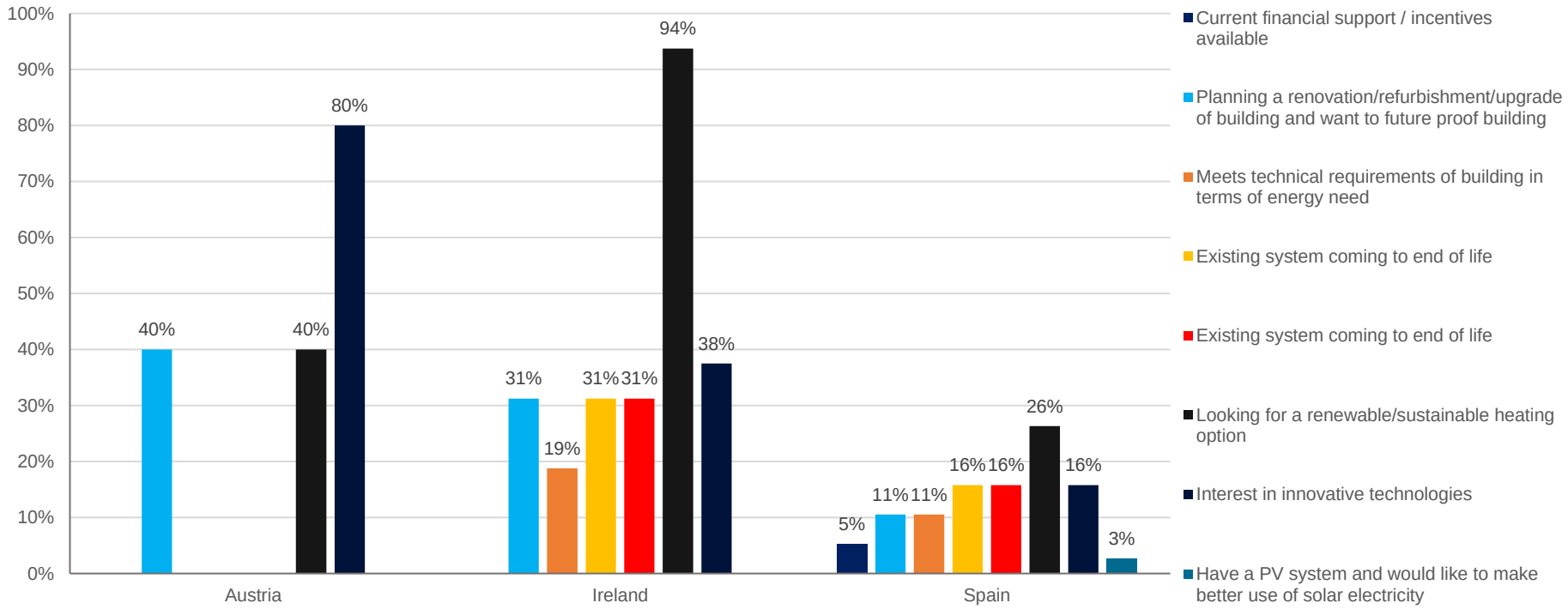

Figure 22 Reasons behind considering HP installation.

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When asked for the most positive aspect of owning a HP, the overall trend points to sustainable/renewable energy supply and high efficiency and comfort levels. Interestingly, in Ireland there were no respondents who chose Low maintenance and is relatively seen in the other regions. This could be another factor of bad designing and installing of HP, which again brings up the need for proper training of installers. Air Quality was not as popular amongst respondents, this could be an avenue of online resources that go into the health benefits attributed to HP (no combustion, air quality, etc).

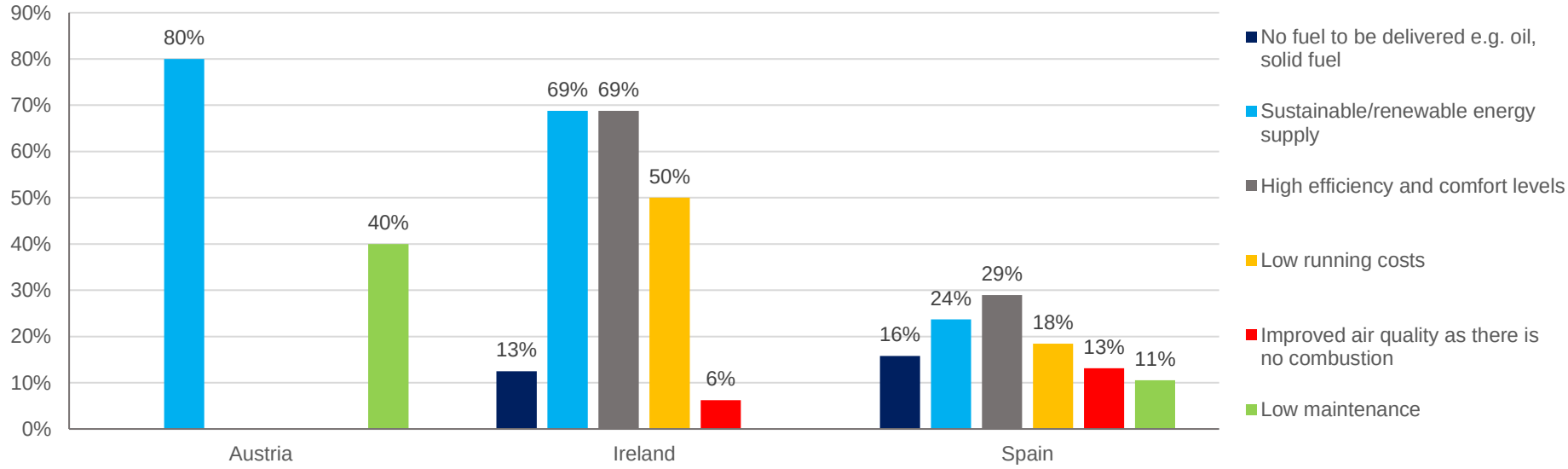

Figure 23 Most Positive Aspect of HP.

Investment costs were seen as a major concern in all regions, in Ireland due to the residential homeowner, in Austria due to industrial stakeholders, and in Spain due to the majority of respondents being either residential homeowners or non-residential building managers. Predicted performance was another major concern for Irish and Spanish respondents, indicating that performance was over sold to them or

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the performance of the HP installation is lacking due to other issues like designing, installation and commissioning. The HP Knowledge hub can be used to provide a better estimate for HP performance and also identify competent installers for those considering a HP installation. In Austria, the main concerns amongst the large-scale HP applications are investment costs and operation and maintenance costs. The Knowledge Hub can mend this with case studies and online resources that can put industrial stakeholders at ease, with proven savings from well designed, well planned, and well installed Large scale HP applications.

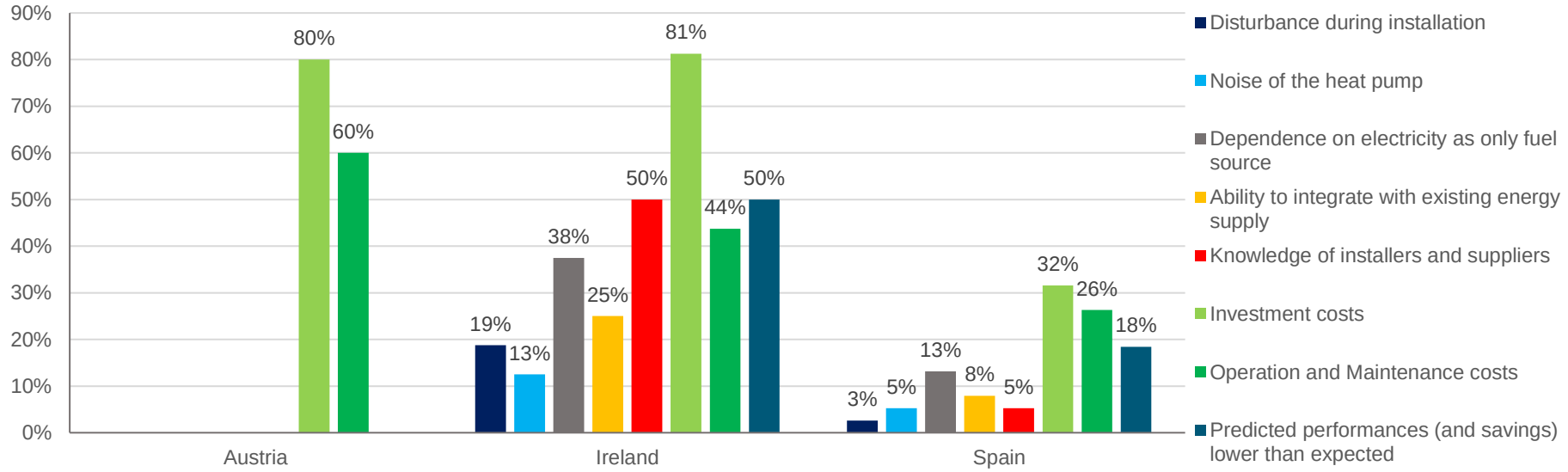

Figure 24 Main Concerns on HP Installation

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The Key take away from people considering a HP installation is that there is not enough information on HP market, technology, or systems. It can be said that all additional information stated in Figure 26 are a must for the HP knowledge Hub, with all statements receiving ample attention.

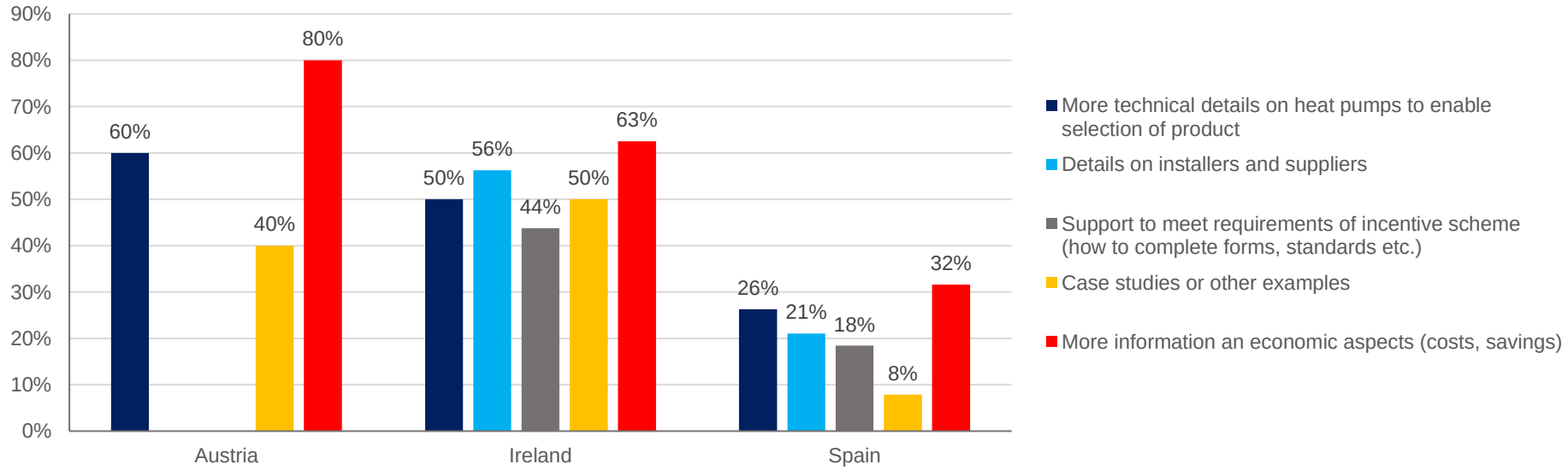

Figure 25 Additional Information required to make decision.

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7 Future Needs and Knowledge

This section looks at quantifying the risks and future needs of the HP market in each region. A risk assessment was carried out by all respondents, ranking statements by risk (Low to High). The statements included are:

1. Energy Bills will increase: (Figure 26)
2. Gases in heat pump can cause other environmental problems: (Figure 27)
3. No heating if power cuts: (Figure 28)
4. Installers are poorly trained: (Figure 29)
5. Not enough companies supplying technology: (Figure 30)
6. Systems are too complicated: (Figure 31)
7. Insufficient technicians available to respond to faults: (Figure 32)
8. Systems perform poorly in very cold weather: (Figure 33)
9. Investment costs are high: (Figure 34)

In Upper Austria, investments cots being high is the only high risk to this region, with every other statement having no risk in the eyes of respondents. High Investment costs can be reduced with the help of government incentives. In Austria, the large-scale HP application is at an early stage and could be boosted by government incentives to encourage installations. Interestingly, installers being poorly trained and systems being too complicated were perceived as no risk to the HP market by almost every respondent. This is partly due to the residential HP sector is well established and there is quality training available for HP installers.

In Ireland, high investment costs and increases in energy bills were seen as major risks to the HP market. With oil and gas prices well below electricity, it may seem that HP will be more expensive than older heating systems, while high efficiencies from competent design are not considered. An awareness campaign to raise public awareness of HP and disseminating quality, correct information to the public to encourage further HP installations. High Investment costs can be cut by government incentives, in Ireland, SEAI provide energy efficiency grants with only 1,200 HP grants in 2019, this is severely lacking due to the complicated grant application scheme. The grant and subsidies need to be streamlined to encourage increase market growth. Interestingly, gases from heat pump can cause other environmental problems was perceived as a low risk, some refrigerants are not environmentally and the views that this is low risk again can be related to lack of quality of information.

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In Spain, medium risk was given to all statements, from high investment costs, higher energy bills, non-environmentally friendly gases and refrigerant, etc. This can be attributed to the large and diverse target audience that have voiced their concerns about the HP market. The plan for HP4ALL is to target all issues related to the statements. Installer training can prevent higher maintenance costs and frequency, increased energy efficiency and more competent installers. The HP knowledge Hub will direct end users to competent installers, provide high quality information, and decision-making tools to help with concerned end users considering HP installation.

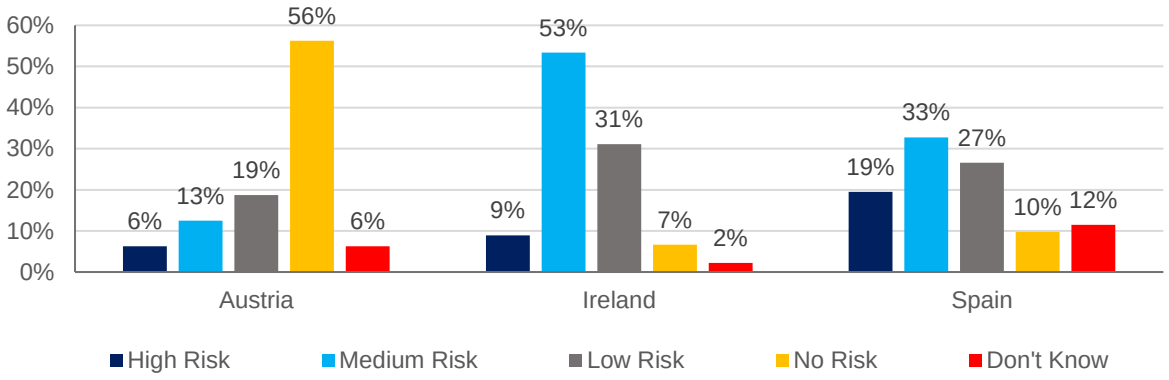

Figure 26 Energy bills will increase:

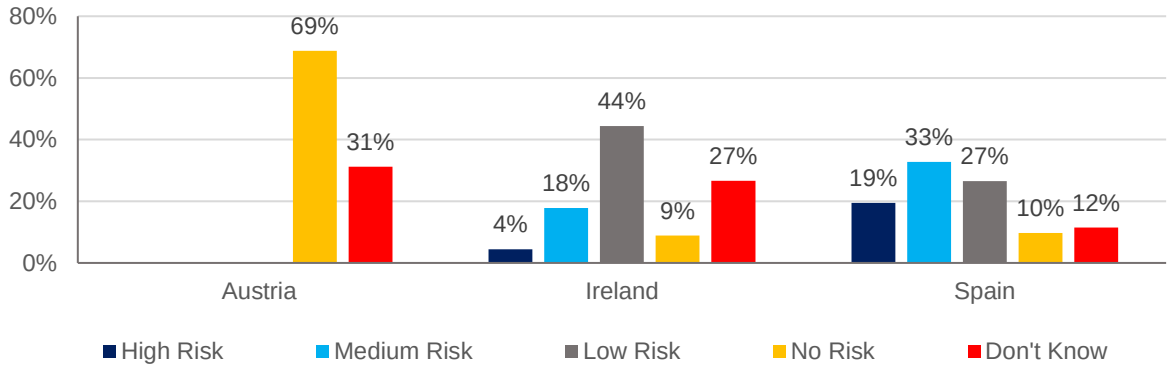

Figure 27 Gases in heat pump can cause other environmental problems:

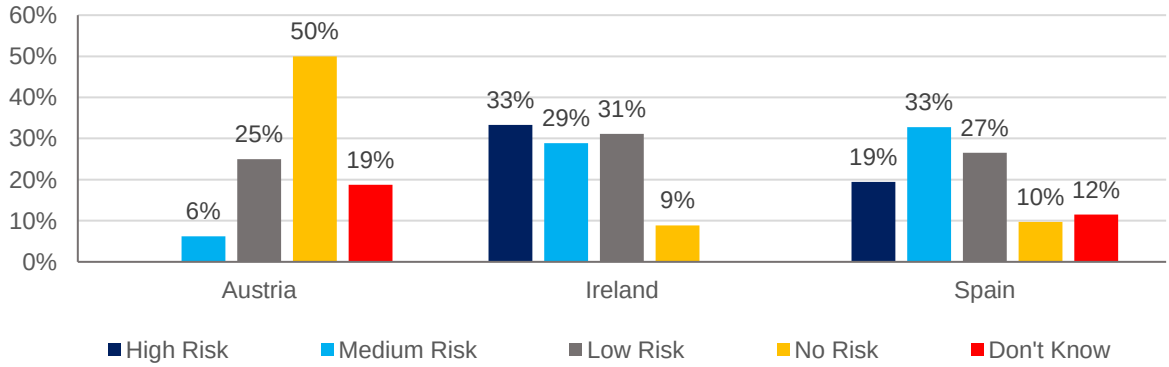

Figure 28 No heating if power cuts:

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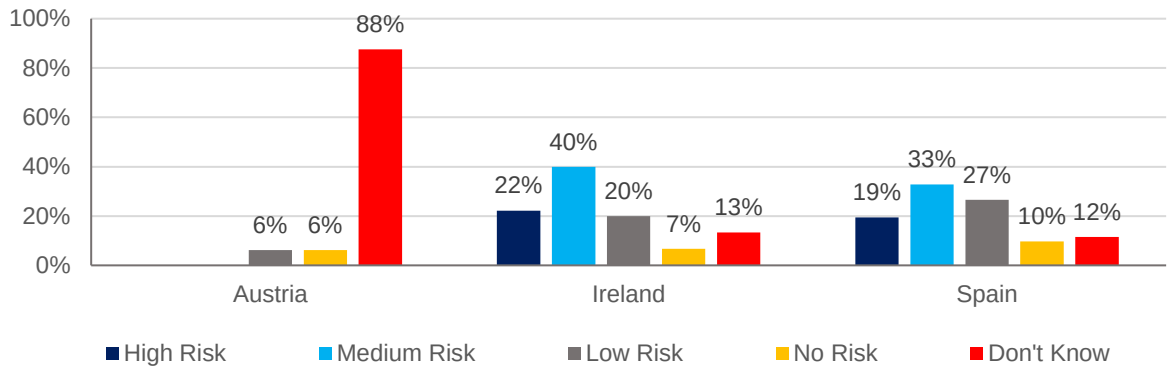

Figure 29 Installers are poorly trained:

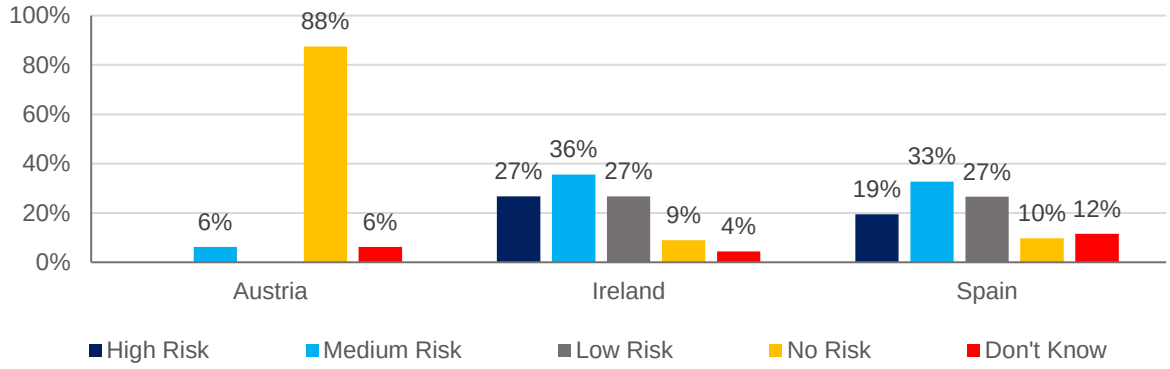

Figure 30 Not enough companies supplying technology:

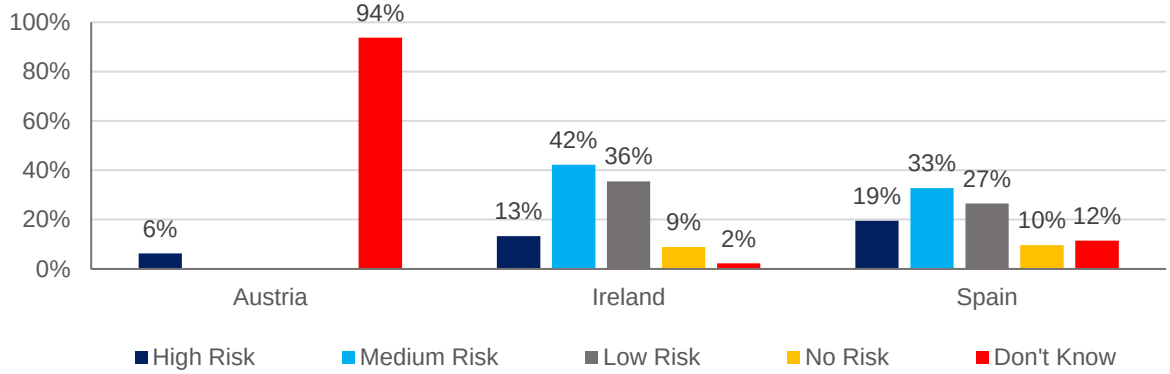

Figure 31 Systems are too complicated:

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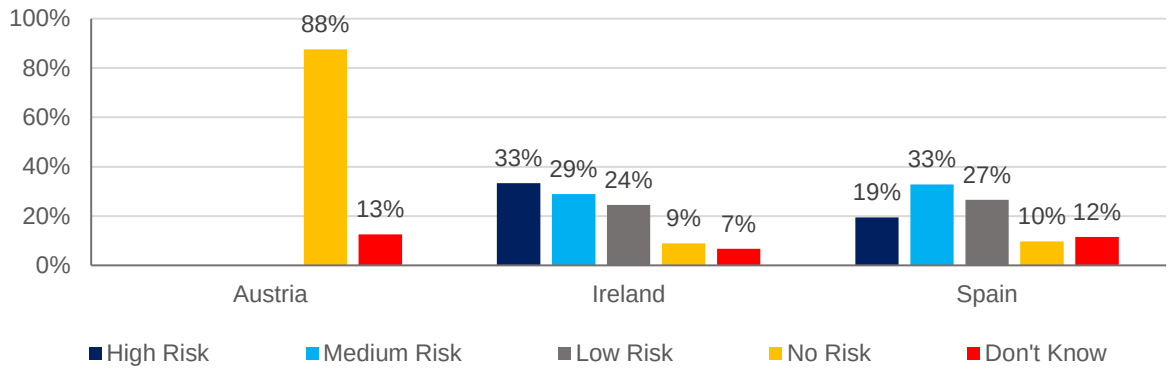

Figure 32 Insufficient technicians available to respond to faults:

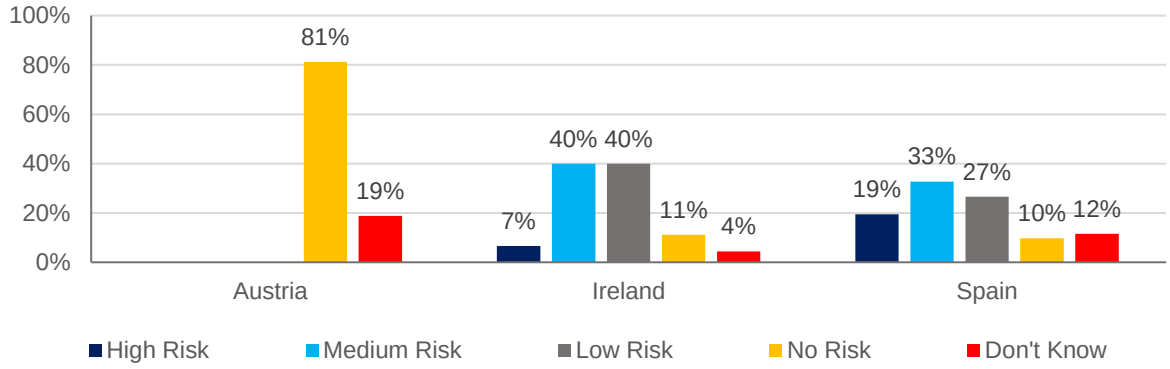

Figure 33 Systems perform poorly in very cold weather:

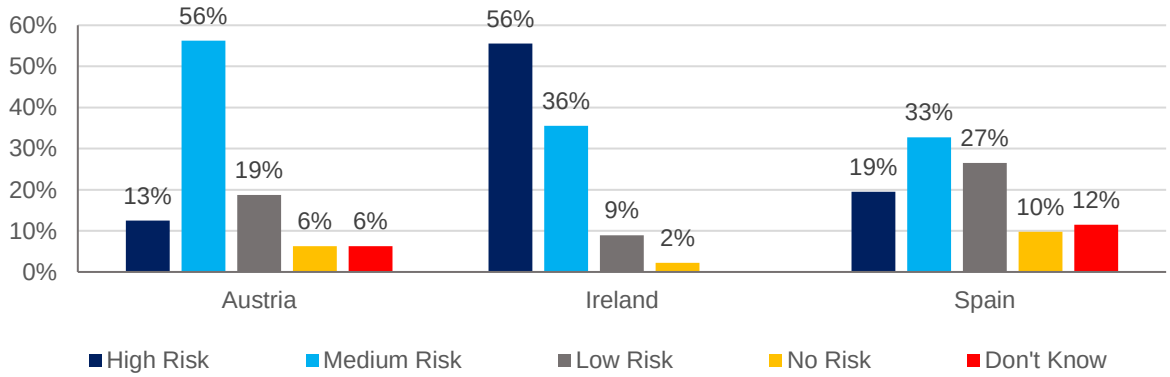

Figure 34 Investment costs are high:

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Figure shows the resources planned for the HP knowledge Hub, all respondents were asked which tool or resource would be beneficial for end users considering HP or own HP. There is a mutual agreement amongst all respondents that all resources are needed to benefit each sector and each end user. To note the other categories that were not considered by HP4ALL were: Sample Videos of controlling a HP, maintenance support, latest and future technology newsletter, grant application training, case studies that show issues with HP and lessons learned, investment comparison and cost benefit analysis tool against gas, oil, and LPG systems. All other resources are duly noted and are being considered for the HP Knowledge Hub (See Figure 35).

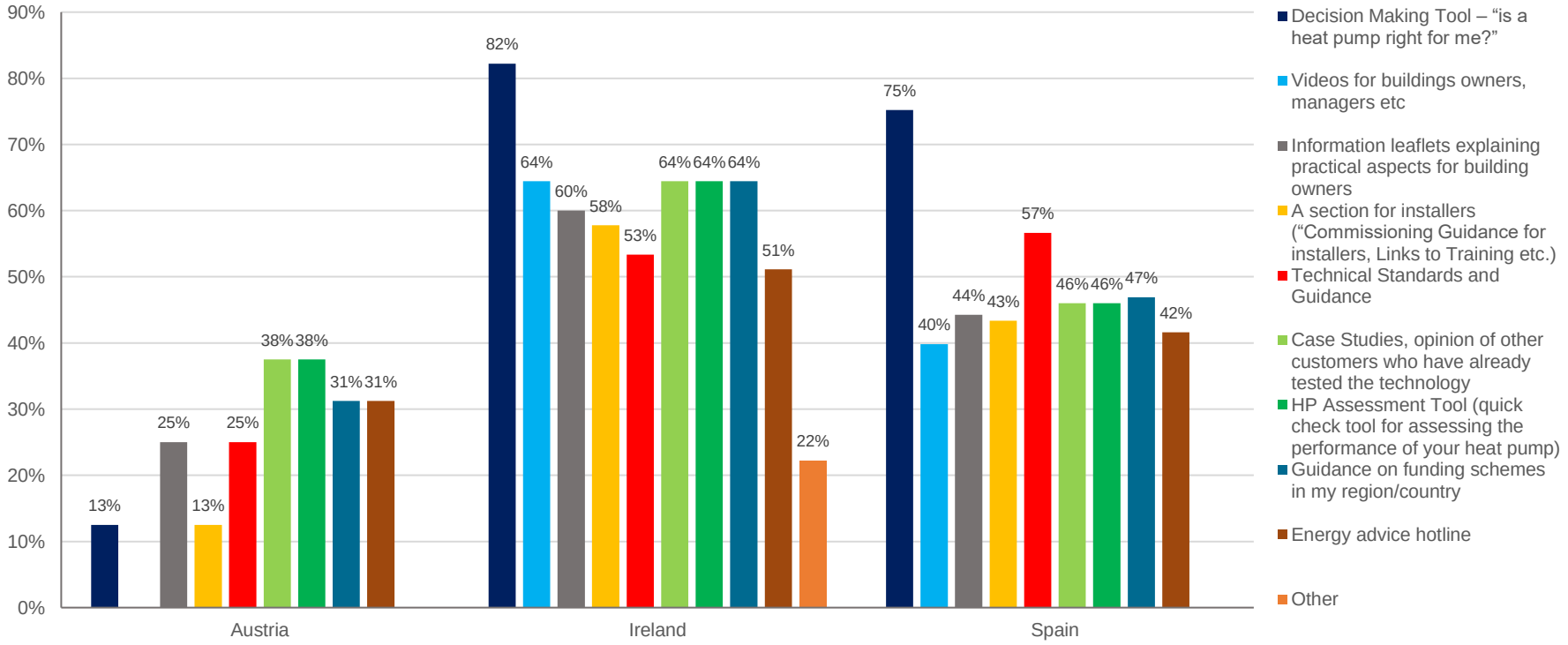

Figure 35 Knowledge Hub Resource

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8 Conclusion

This survey and report were directed at end-users from 3 pilot regions where each region has its own barriers and drivers within the HP market. The Survey and interviews identified the main areas of concern from the perception of the end user in each region. High investment costs, lack of competency training for installers and lack of quality information for end users are the main areas of the HP market requiring attention. As part of the HP4ALL project, awareness campaigns, installer training schemes, a benchmarking tool and a Knowledge Hub will be used to address these concerns and raise confidence in the HP market in each region.

Upper Austria

Upper Austria has a well-established residential and non-residential heat pump market. This interview survey was focused on Large Scale heat pump systems and so the majority of respondents were from the industrial sector and had a good knowledge of heat pumps. To make large scale projects financially feasible, respondents felt it would be necessary to include a mix of uses (heating, cooling and hot water) and a mix of energy sources for the heat pumps. Outside of the normal sources of air, ground and water, waste heat is seen as an untapped resource although challenges exist if this source is unavailable at certain times, i.e., at weekends when industrial processes are not operating.

The main barriers identified were the need for case studies, access to financial incentives and concerns about operating and maintenance costs. These could be addressed through provision of information to building owners and operators on all aspects of project planning and funding with an emphasis on case studies from successful projects.

Ireland

Most of the respondents to this survey were heat pump owners from the residential sector who had systems installed between 2015 and 2020 for space heating and hot water. The majority of these end-users found heat pumps to be cost effective and were satisfied with their installation although some had problems with evaporator ice build-up on air source heat pumps and other commissioning related problems.

Interest in heat pumps stemmed from concerns for efficiency and using sustainable and renewable energy but barriers exist in obtaining good information on operating setup, economic aspects, and real-world performance data. Concerns exist regarding installer competency and related lack of maintenance support and a lack of credible case studies. A decision-making tool was the main resource that these end users would like to see.

Spain

Respondents to the Spanish survey were from both the residential and non-residential sectors, mostly from the public sector. Heat pumps are used for cooling in daytime and heating at night-time with not much focus on the production of domestic hot water, a possible area for future development. It was recognised that because a significant proportion of heat pumps were installed pre-2005, the buildings involved are mostly in need of energy retrofitting to reduce their cooling and heating loads. Furthermore, some respondents felt that existing heat pumps were old, noisy, and inefficient and that

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renovation or replacement was desirable. Operating cost and the possible impact of refrigerants on the environment were also of concern.

These end users had considered heat pumps because of their efficiency, the fact that they use renewable energy and that no fuel other than electricity is required. However, to increase uptake of heat pump installations, they felt that improved and additional incentives for renewable energy sources are required. In the HP4ALL Knowledge Hub, these end-users would also see value in a decision-making tool to aid people making decisions on installing or upgrading heat pump systems.

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ANNEXES

Annex 1 Survey Questions

Section 1: Initial Profile (all mandatory)

1. Building Category

a. Residential

b. Non-Residential

2. Sector

a. Residential

b. Public

c. Commercial/SME

d. Industrial

e. Other (Specify)

3. Role

a. Residential Homeowner

b. Residential Tenant

c. Residential Building Manager

d. Non-Residential Building Manager

e. Non-Residential Building Owner

f. Other

4. Knowledge of Heat Pump Market, Technology & Systems (Please rate your responses to the following questions from 1 Very Low to 5 Very High)

a. Please rate your knowledge of the HP Market, Technology & Systems

b. Please rate your overall opinion of heat pumps as a cost-effective technology

c. Please rate your opinion of the quality of information available about heat pumps

Section 2: Heat Pump Experience

Do you have a Heat Pump Installed in your building (Y/N) (mandatory)?

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If Yes continue If No Go to Question 8

Section 2a: Have a heat pump in building.

1. What year was your HP installed? (Include a don't know option) (Mandatory)

2. What does your heat pump do in the building (tick all that apply) (Mandatory)

a. Provides space heating

b. Provides hot water

c. Provides cooling

d. Provides process/other heating

3. Rate your satisfaction with the overall performance of the heat pump in your building – Not at all satisfied (1) – Very Satisfied (5), No Opinion (Mandatory)

4. Indicate your agreement with the following statements (Agree, Disagree, Not Sure, Not Applicable)

a. I have recommended a HP to others

b. The HP has contributed to reducing energy costs in the building

c. I regret that I have a HP in my building

d. I'm considering additional energy efficiency or renewable energy measures in the building

5. Rate your satisfaction with the installation of the heat pump in your building – Not at all satisfied (1) – Very Satisfied (5), No Opinion

a. If Unsatisfied then please indicate what you were unsatisfied with.

6. Based on your experience, which of the following actions do you think are important so that building owners can be supported to install heat pumps (Please Rank your top 3) (Mandatory)

a. More training for installers

b. Better information for building owners (guides, technical information)

c. More incentives (grants, financial supports etc)

d. Advertising campaigns

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e. More regulations and laws requiring switching from fossil fuels

f. Improved HP Technologies/Systems

g. Reducing installation costs

Other (please specify)

7. What is the most positive aspect about using a heat pump for heating supply (Rank your answers) (Mandatory)

a. No fuel to be delivered e.g., oil, solid fuel

b. Sustainable/renewable energy supply

c. High efficiency and comfort levels

d. Low running costs

e. Improved air quality as there is no combustion

f. Low maintenance

8. Are there any concerns or negative impacts which you would like to raise in relation to heat pumps?

Section 2b: Considering heat pump in building.

9. Are you considering the installation of a heat pump for your building (Yes/No)

a. If Yes continue if No go to Section 3

10. What do you plan to use the heat pump for in the building (tick all that apply) (Mandatory)

a. Provide space heating

b. Provide hot water

c. Provide cooling

d. Provide process/other heating

11. What are the reasons behind you considering the installation of a heat pump (Please Rank your top 3) (Mandatory)

a. Current financial incentives/supports available

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b. Planning a renovation/refurbishment/upgrade of building and want to future proof building

c. Meets technical requirements of building in terms of energy need

d. Existing system coming to end of life

e. Looking for a renewable/sustainable heating option

f. Interest in innovative technologies

g. Have a PV system and would like to make better use of solar electricity

12. Based on what you know so far about heat pumps what is the most positive aspect about using a heat pump (Rank your answers) (Mandatory)

a. No fuel to be delivered e.g., oil, solid fuel

b. Sustainable/renewable energy supply

c. High efficiency and comfort levels

d. Low running costs

e. Improved air quality as there is no combustion

f. Low maintenance

13. What are your main concerns about installing a heat pump in your building (Rank your answers) (Mandatory)

a. Disturbance during installation

b. Noise of the heat pump

c. Dependence on electricity as only fuel source

d. Ability to integrate with existing energy supply

e. Knowledge of installers and suppliers

f. Investment costs

g. Operation and Maintenance costs

h. Predicted performances (and savings) lower than expected

14. What additional information do you need to help you make your decision

a. More technical details on heat pumps to enable selection of product

b. Details on installers and suppliers

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c. Support to meet requirements of incentive scheme (how to complete forms, standards etc.)

d. Case studies or other examples

e. more information an economic aspect (costs, savings)

Section 3: General Questions (Mandatory)

15. We would like you to indicate if you think any of the following are particular risks to consider in relation to heat pumps (1 No Risk; 5 High Risk, 0 Don't know)

a. Energy bills will increase

b. Gases in heat pump can cause other environmental problems

c. No heating if power cuts

d. Installers are poorly trained

e. Not enough companies supplying technology

f. Systems are too complicated

g. Insufficient technicians available to respond to faults

h. Systems perform poorly in very cold weather

i. Investment costs are high

16. We are planning to create a Heat Pump Knowledge Hub for end users, building owners, installers etc. This Knowledge Hub will at a minimum be a digital resource but may also be a specific service, information resource available in your region. Tick those resources which you think would be of benefit to host on this Hub.

a. Decision Making Tool – "is a heat pump right for me?"

b. Videos for buildings owners, managers etc

c. Information leaflets explaining practical aspects for building owners

d. A section for installers ("Commissioning Guidance for installers, Links to Training etc.)

e. Technical Standards and Guidance

f. Case Studies, opinion of other customers who have already tested the technology

g. HP Assessment Tool (quick check tool for assessing the performance of your heat pump)

h. Guidance on funding schemes in my region/country

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i. Energy advice hotline

j. Other (please specify)

Annex 3 Upper Austria Report

Summary Report for Upper Austrian Region (AT)

Upper Austria

Introduction

In Upper Austria, the OÖ Energiesparverband carried out structured bi-lateral interviews with 16 end-users. The interviewees were selected as to represent a range of viewpoints and levels of experience with HPs. The interviews allowed for gathering quality input, especially regarding open questions where respondents could express their thoughts in more depth.

In Upper Austria, the heat pump market for small, residential applications is already quite well developed (especially in new builds). Therefore, for this survey, it was decided to consult end-users of larger scale HP applications (commercial and industrial), since developing this market is a main focus pursued in the HP4ALL project for the region of Upper Austria. This should be kept in mind when comparing the results to those obtained in the other two pilot regions.

Section 1: Initial Profile

All survey respondents are end-users of non-residential buildings. 81% represent industry, 6% the commercial/SME sector and 13% other sectors (hospitality sector and social organisation).

Half of the people interviewed are non-residential building managers, a little more than a third are non-residential building owners, and 13% hold other roles in the building (such as looking after aspects of health & safety, quality assurance and operational energy management).

This profile shows the emphasis that was put on consulting users of larger-scale HP systems for industrial and commercial applications.

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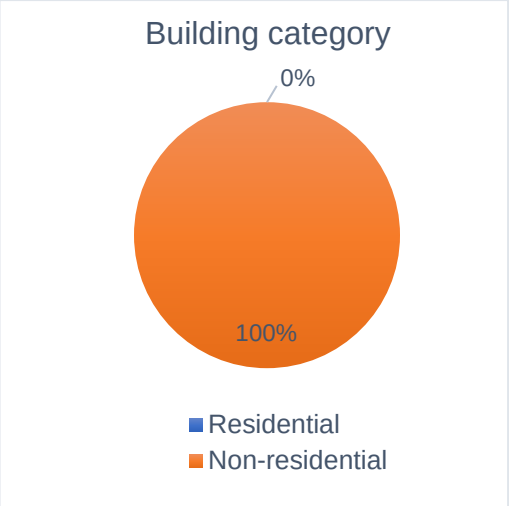

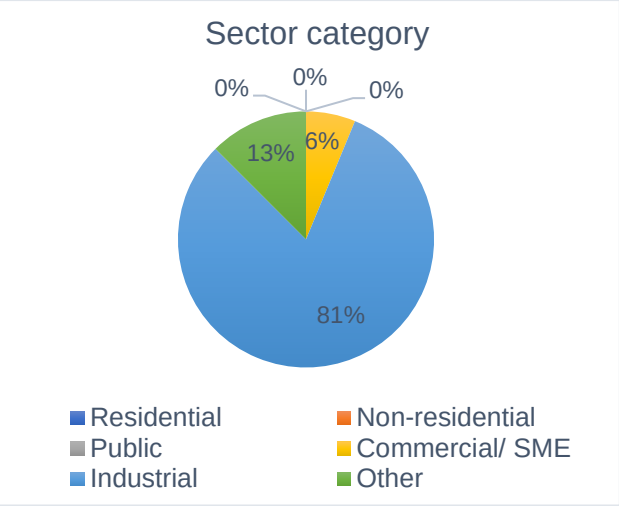

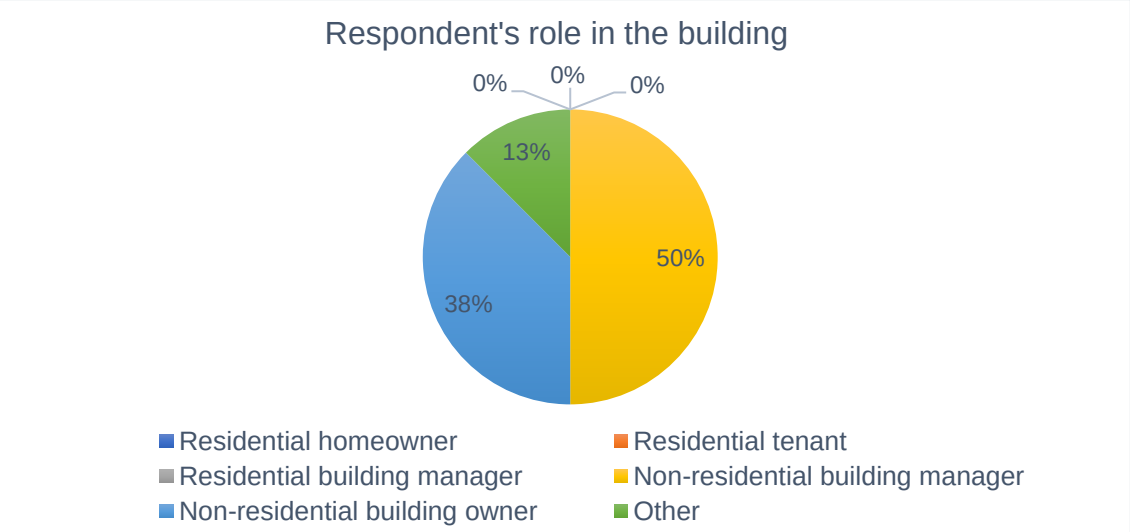

Half of the end-users surveyed consider their knowledge of the HP market, technology, and systems as high or very high, the others as only average or below. This could be explained by the fact that a number of the persons interviewed are "early adopters" in the field of large-scale HPs.

Only 25% see HPs as cost-effective technology. A third perceive the cost-effectiveness as low or very low. More than 50% see the quality of the information available about HPs as average or below.

The large-scale HP market is still at a relatively early stage in Upper Austria and is faced with the related challenges. One of the most significant of these is the low level of awareness of promising and economically feasible application possibilities among planners and users. As with other energy transition technologies, investment costs also present a challenge (especially compared to gas).

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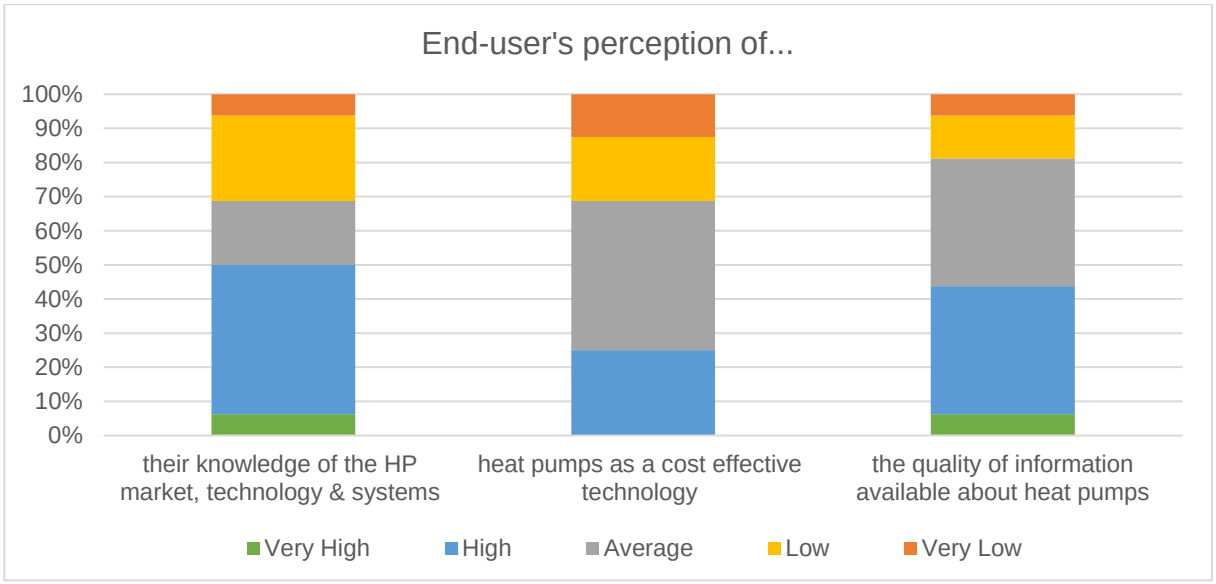
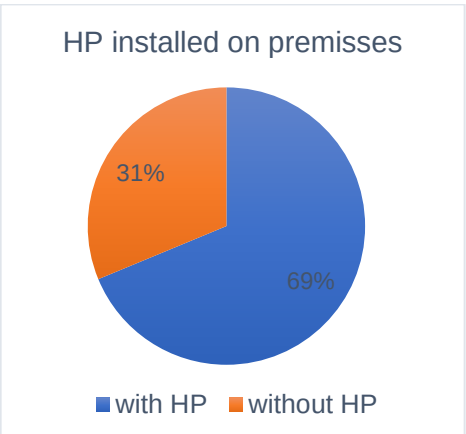


Section 2: Heat Pump Experience

The interviewees were selected as to represent a range of viewpoints and HP experience. Around 70% of the people surveyed have a HP installed on their premises (some of them have a number of HPs); 30% do not. To capture a fair understanding from both heat pump owners and those who do not own heat pumps the surveys were put into 2 categories: 'with HP' and 'without HP'.



Section 2a: Have a heat pump in building

46% of the HPs owned or operated by the interviewees were installed between 2015-2019. 23% were installed between 2010-2014. 15% were installed in the last year.

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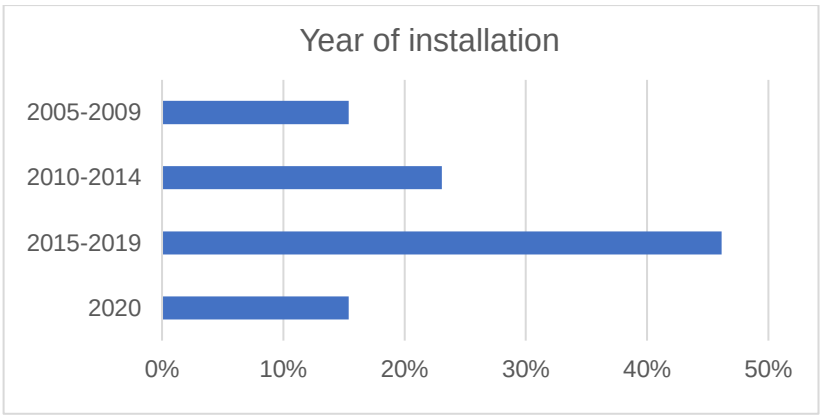
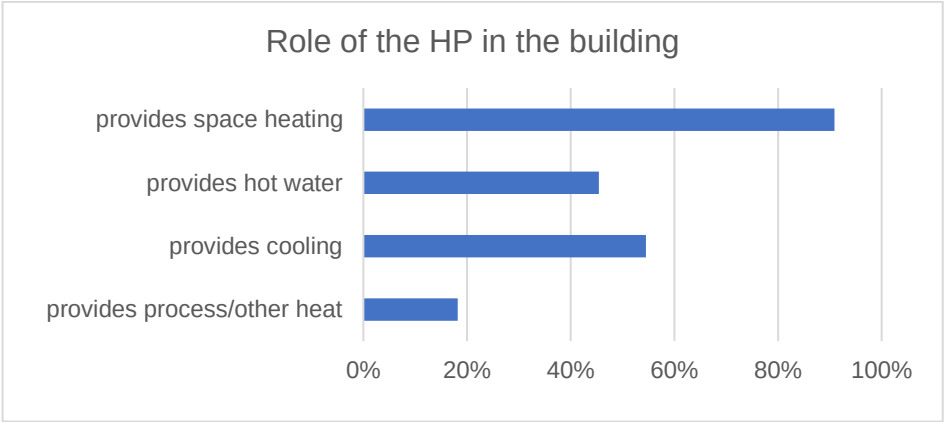


The large-scale HPs systems represented in this report are predominantly used for space heating (91%). Around half of them provide cooling (55%) and/or hot water (45%). 18% are used to provide process or other types of heat. Almost three quarters of the time, the HP provides at least 2 of these services. In a few situations, they provide 3 or even all 4.

In the case of large-scale HP solutions, economic efficiency is often more favourable when several sources (ex: groundwater, process waste heat) and sinks (i.e., application areas such as heating, hot water, air conditioning, cooling) are used, as well as when operating hours are high.



All respondents reported that they are satisfied (18%) or even very satisfied (82%) with the overall performance of their HP. Similar answers were given when asked about their level of satisfaction with the installation of the HP.

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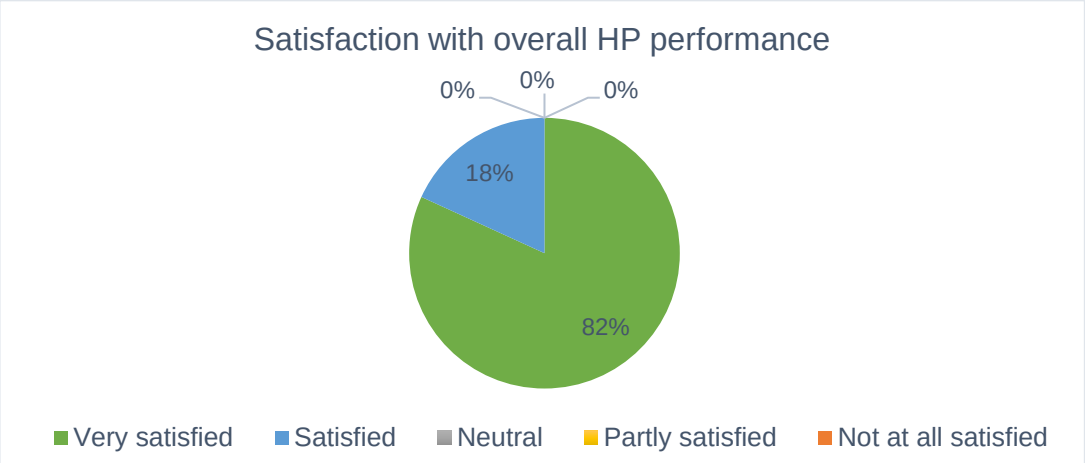
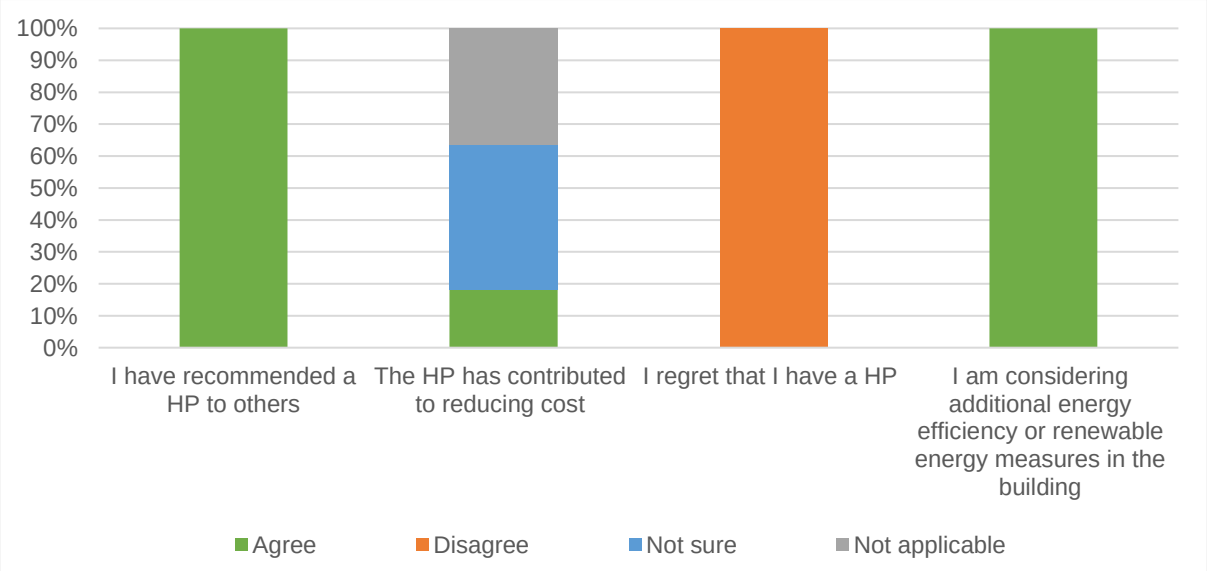


This high level of satisfaction is confirmed by 100% of respondents with HPs stating they have recommended a HP to others. None of the surveyed individuals regret having installed a HP in their building. However, all are considering (or already implemented) additional energy efficiency or renewable energy measures.



Based on their own experience, the interviewees indicated which actions they feel are most needed to better support building owners in installing HP systems. The most frequently mentioned aspects are: "better information for buildings owners (such as guides and technical information)", "additional measures to help reduce overall investment costs", and "improved HP technologies/systems".

Large-scale HPs have a high technical potential. At this early-market stage, it is very important to raise awareness on the range of application areas where HPs are already economically feasible.

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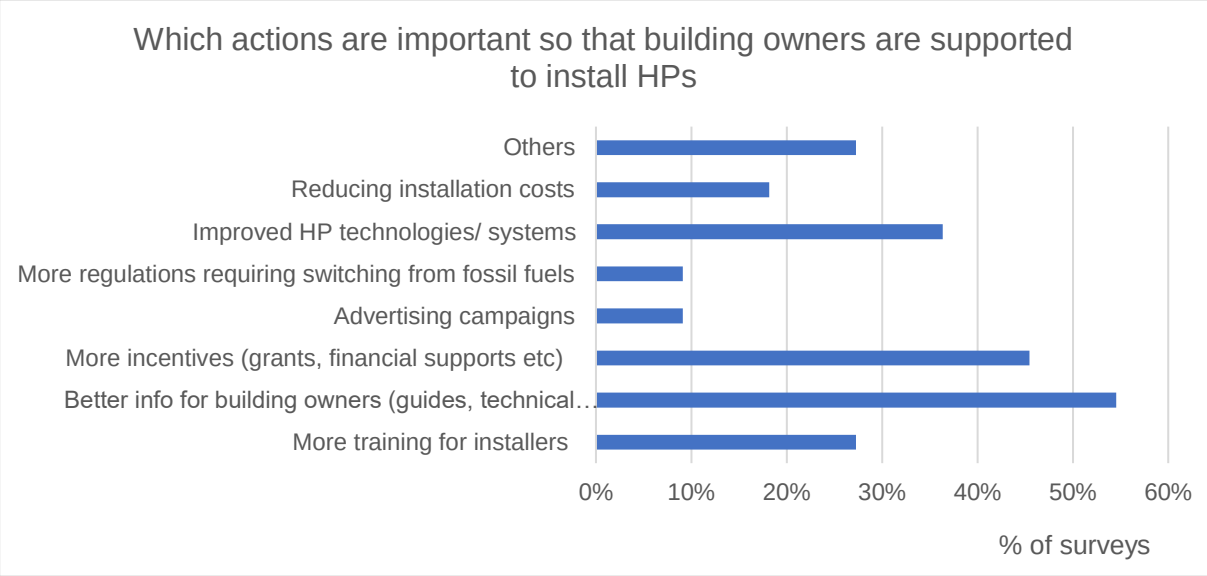
There is a large need for communication tools like case studies, best practices, information brochures, HP checklist for companies, information on planners and suppliers etc.

Better incentives that increase the economic feasibility of installing HP systems (such as market development funding and subsidies for feasibility studies) would help overcome some of the early-market barriers.



When asked about the most positive aspects about using a HP, the surveyed end-users mentioned the high efficiency and comfort levels (73%), the sustainable/renewable energy supply (64%) and the low maintenance efforts (55%).

The interest in using a sustainable/renewable energy supply is partly driven by the regional government's decarbonisation target (which includes eliminating oil and gas heating). The policy framework that is put in place to achieve these goals (ex: strict efficiency standards) supports the development and implementation of high efficiency and renewable solutions – including heat pumps.

In addition, the interviewees mentioned the possibility of using HPs for cooling and for using waste heat as important positive aspects that drove their decision towards this technology.

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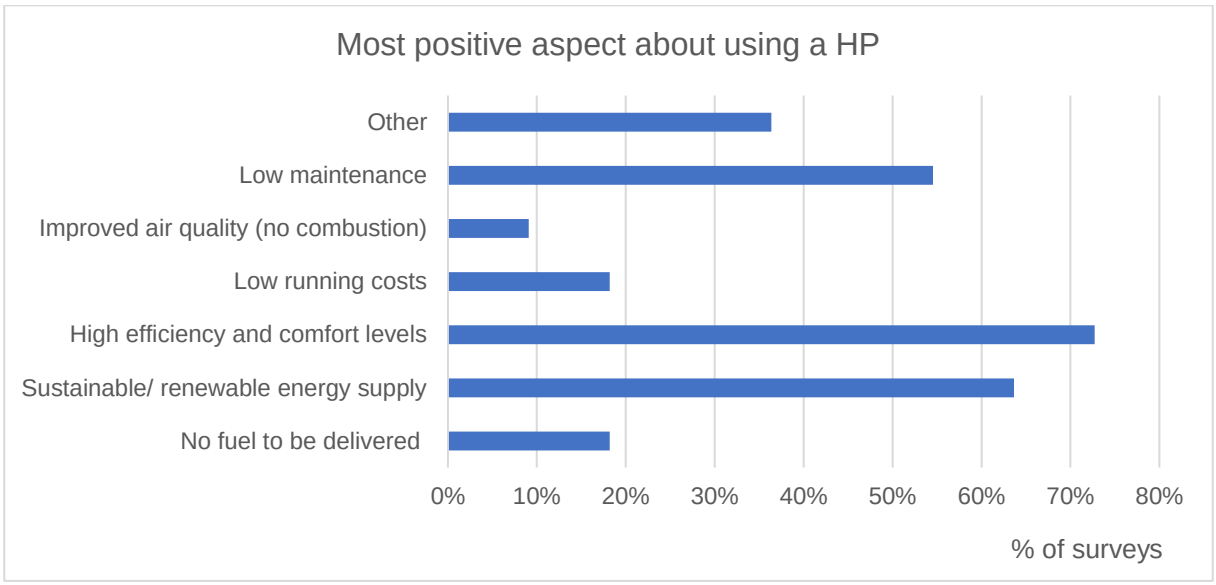


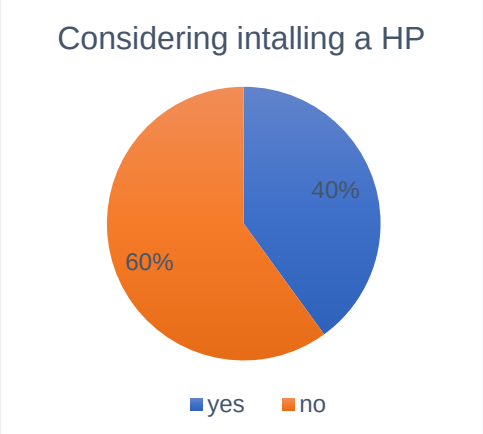
In Upper Austria, HPs are already seen as a favourable and interesting technology, particularly for new builds. For new residential and commercial buildings, they can be a suitable and economically feasible solution, especially when there is demand for both heating and cooling and flow temperature are low.

The end-users express few concerns towards HP systems. The main concerns or negative impacts in relation to large-scale HP systems mentioned are:

- the lack of waste heat available for the HP if a production facility is closed for a longer period of time (weekend, holidays).
- the importance of ensuring the electricity is CO_2 neutral.

Section 2b: Considering heat pump in building.

30% of the end-users surveyed do not have a HP in their building. Of these, 40% are considering installing one; 60% are (currently) not.



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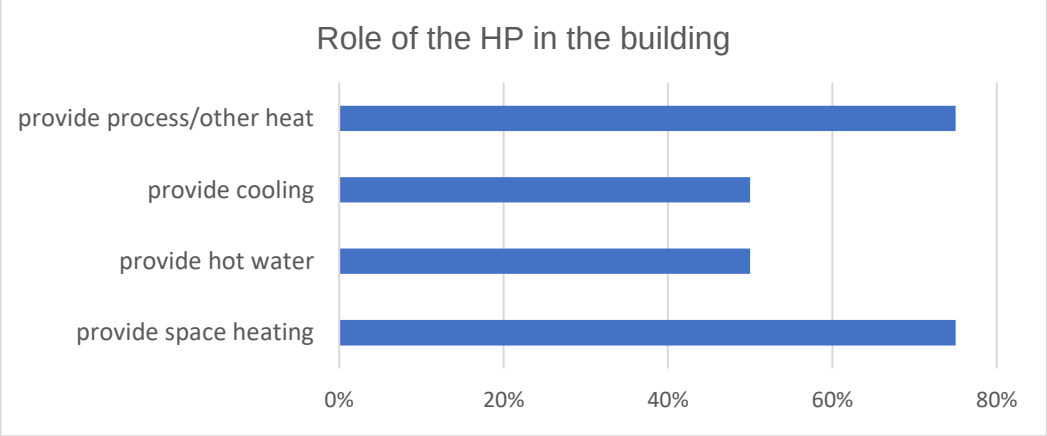
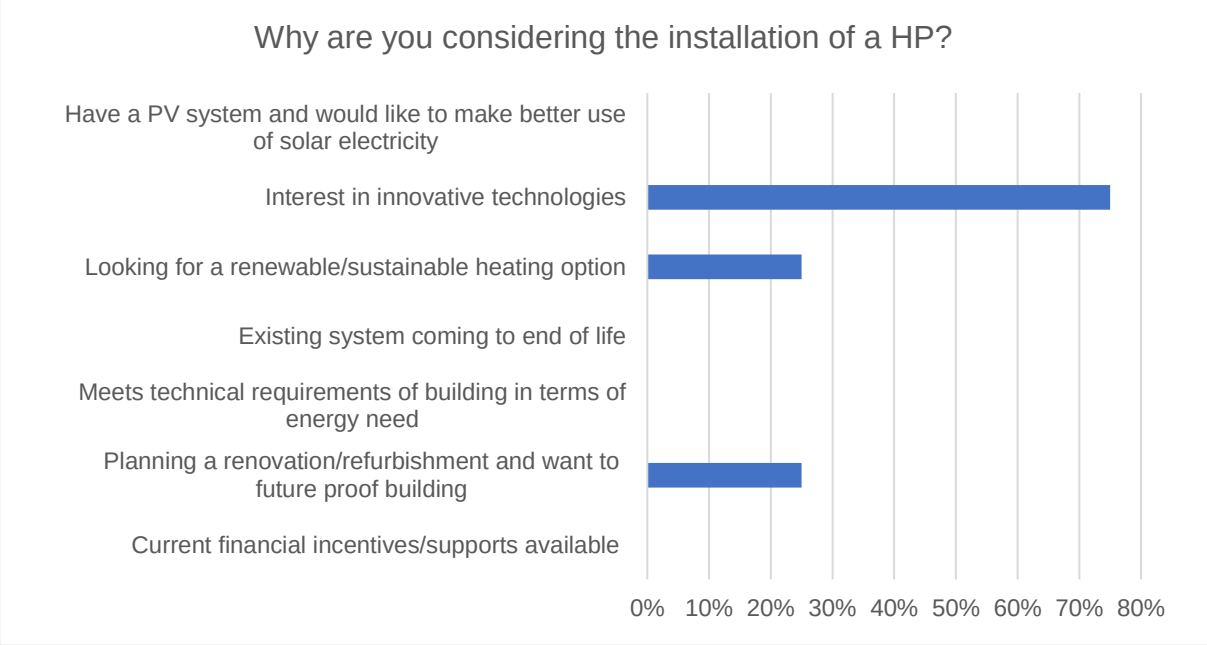
Also, a few of the respondents who already have a HP are considering installing further HP systems. The following results refer to all survey respondents who are currently thinking of installing a HP in their building.

The end-users are considering HPs for a combination of different services. In most cases, the HP should provide more than one service, and sometimes 3 or all 4 of the services mentioned in the graph below. This is in line with the fact that the economic efficiency of large-scale HPs is often more favourable when several sources (ex: groundwater, process waste heat) and sinks (i.e., application areas such as heating, hot water, air conditioning, cooling) are used, as well as when operating hours are high.



The main reasons the respondents are considering HPs over other technology options are:

- they are interested in innovative technologies.
- because they are looking for a renewable/sustainable heating option.
- because they are planning a renovation and HPs allow to future proof the building.



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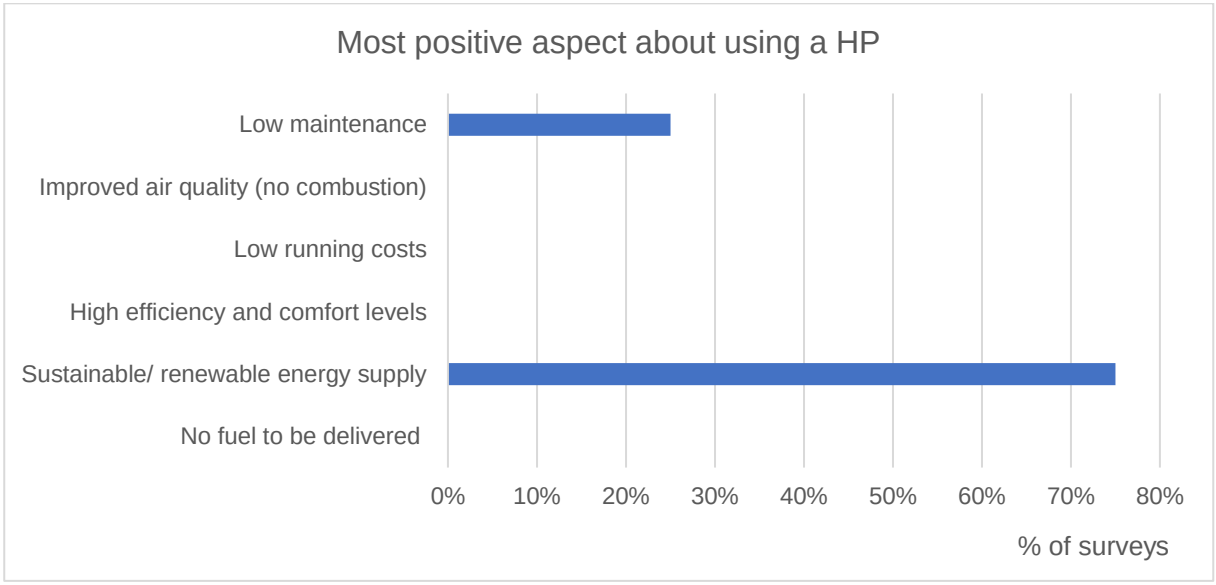
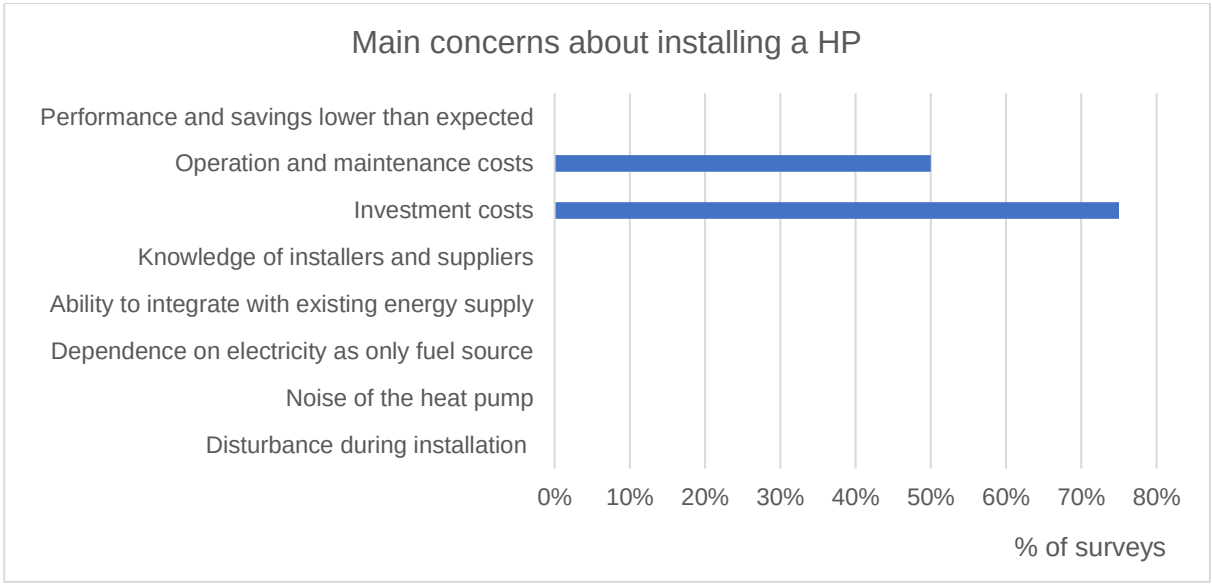
75% of respondents consider the sustainable/renewable energy supply offered by HPs as the main positive aspect guiding their choice towards this technology. Low maintenance requirements are another appreciated aspect.



In Upper Austria, HPs are recognised as a suitable technology for many applications. End users express few concerns towards HP systems. High investment costs seem to be the main concern when it comes to HPs. Operation and maintenance costs associated to HP systems was also mentioned.



In terms of which additional information would help them in their decision-making process on installing an HP, the respondents first mentioned more information on the economic aspects of HPs, followed by more technical details on HPs (to assist in the selection of product) and case studies or other examples.

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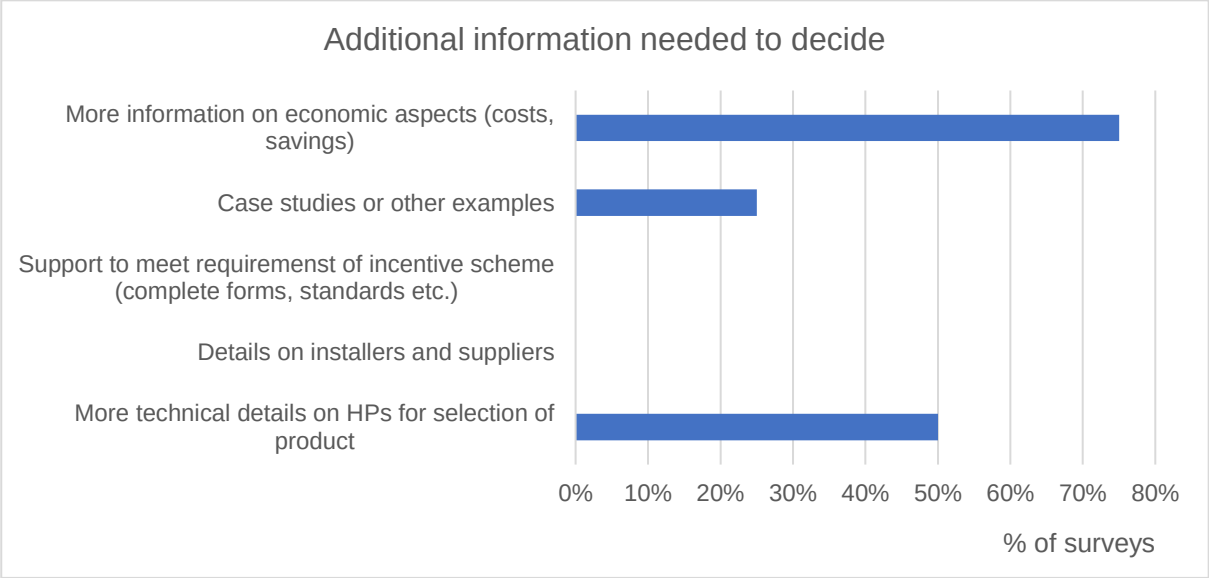
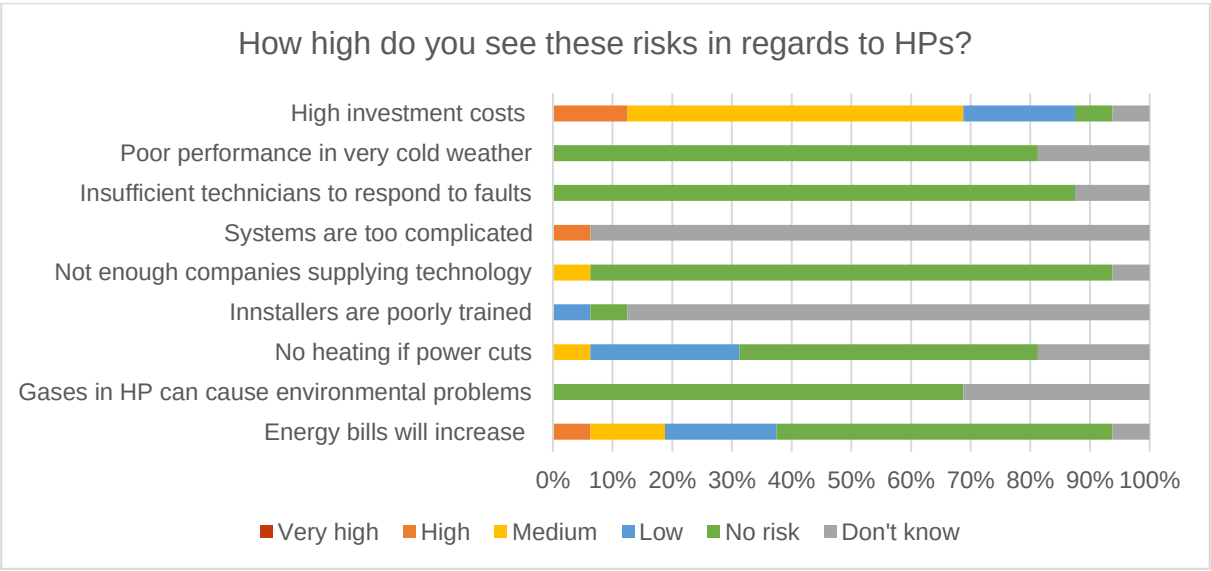


Section 3: General Questions

As mentioned above, in Upper Austria, HPs are recognised as a reliable technology. In general terms, end-users consider the level of risk regarding HPs as overall very low. The only mentionable aspect arising from the survey is the potential of high investment costs – perceived as a "medium to high risk" by 69% of the respondents. The increase of energy bills and no heating if the power is cut are seen as minor risks.



When questioned on which resources would be most suitable and helpful for an HP knowledge hub, survey respondents most often mentioned:

- case studies and opinions from other customers who have already tested the technology.

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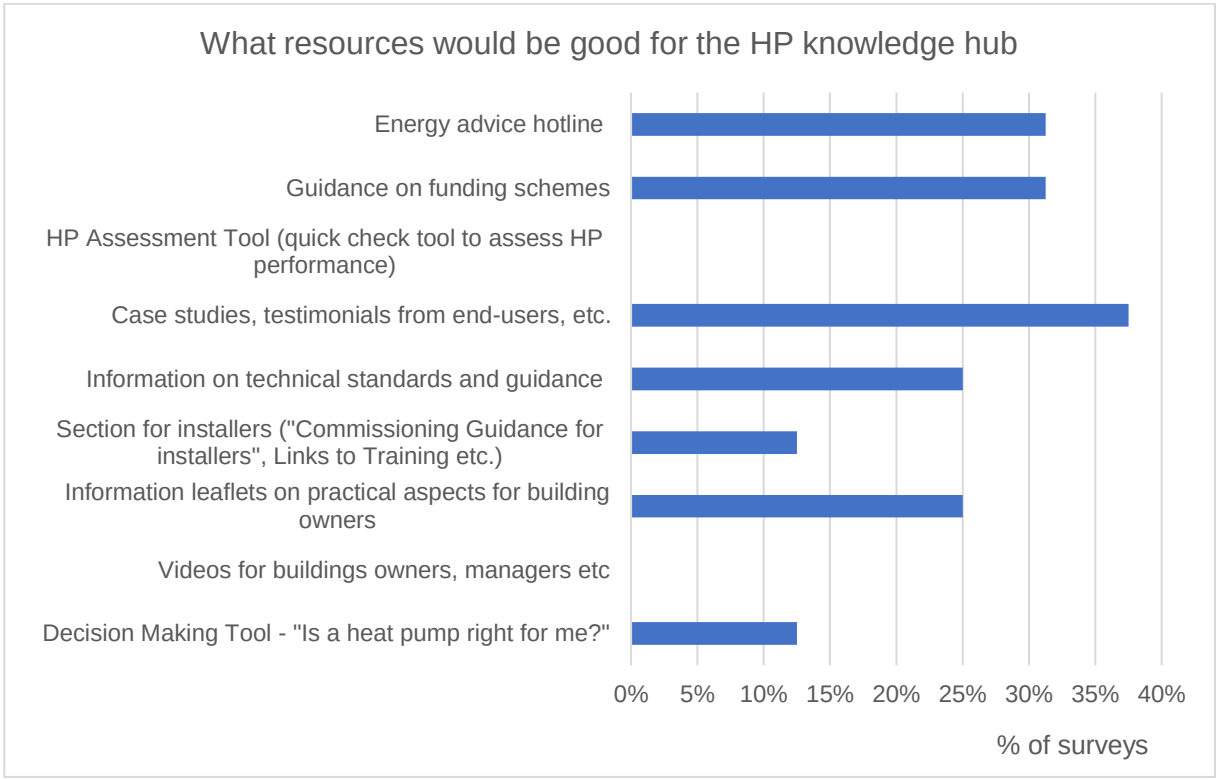
- an energy advice hotline
- guidance for funding schemes
- information on technical standards and guidance
- information on practical aspects for building owners

This is in line with the overall results of the survey, which underline the need for awareness and communication activities aiming at increasing end-user knowledge on HPs and where they can be used as well as support for end-users in assuring the economic feasibility of their project and accessing incentive schemes.



Conclusion

In Upper Austria, the survey was targeted at end-users of larger scale HP applications (commercial and industrial).

Most of the time, the HPs provide 2 or more services (ex: space heating, hot water, cooling, process/other heat), since the economic efficiency is often more favourable when several sources

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(ex: groundwater, process waste heat) and sinks (i.e., application areas such as heating, hot water, air conditioning, cooling) are used, as well as when operating hours are high.

HP owners report being quite satisfied with the overall performance and installation of their system. They consider the main positive aspects about using a HP to be high efficiency and comfort levels, the sustainable/renewable energy supply, the low maintenance efforts, and the possibility of using HPs for cooling and for using waste heat.

In Upper Austria, HPs are recognised as a suitable technology for a range of applications. There were only few concerns expressed towards large-scale HP systems and, in general terms, the level of risk regarding HPs is seen as low. The main concerns and risks mentioned are the high investment costs and the operation and maintenance costs associated to HP systems (increase of energy bills).

The decision to install a HP system is mainly driven by:

- end-users looking for a renewable/sustainable heating option.
- low maintenance requirements of HPs.
- end-user interest in innovative technologies;
- a renovation is planned, and HPs allow to future proof the building.

According to the interviewees, better information for buildings owners (on technical and economic aspects of HPs), additional measures to help reduce overall investment costs, and improved HP technologies/systems are the elements that are most needed to better support building owners in their decision-making process.

At this early-market stage or large-scale HP market development, it is very important to raise awareness on the range of application areas where HPs are already economically feasible. Information and communication tools (ex: case studies, best practices, technical information, HP checklist for companies, information on planners and suppliers), exchange and further training along the entire value chain (from professionals to end-users) are needed and would contribute to increasing awareness, generating end-user trust, creating both market push and demand and ensuring high-quality planning and implementation of projects.

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Annex 4 Ireland Report

Summary Report for Ireland Region (IE)

This template is to be used by LIT/IERC; ESV, RINA and CTA to compile the results from the engagement with 15-30 end users in each country. The structure of the template should be followed as closely as possibly to enable the results to be compiled for comparison across the regions and to reflect on overall trends and needs from end user's perspective.

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Partners are required to keep records of the surveys in appropriate formats and these should be retained by the relevant partner in an appropriate format e.g., digital record of on-line survey, notes on interviews.

Introduction

HP4ALL is a Horizon 2020 research and innovation project. Aims to enhance, develop, and promote the skills required for high quality, optimised HP installations within residential and non-residential buildings, bring Europe to the forefront of the climatization sector.

Key objectives:

- Design HP competency & excellence skills framework.
- Increase the number of skilled workers.
- Enable end users / clients to demand high quality solutions – HP knowledge hub.

An online survey was hosted on the online platform Survey Methods. Invites to take part in the survey were disseminated via LIT and HP4ALL online social media and networks. The survey was 'live' for 2 months, after which the data was then exported from Survey Methods via excel and analysed. 46 Surveys were completed during this period.

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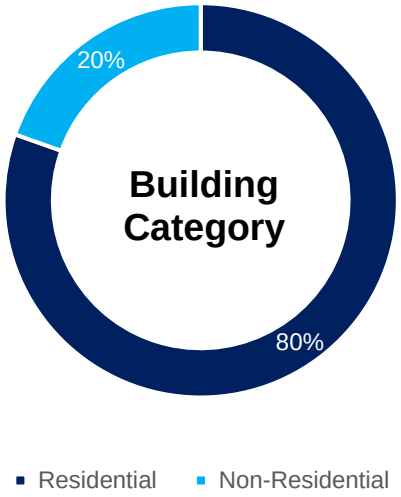
Section 1: Initial Profile

There were 46 Surveys analysed, all 46 surveys were from Ireland. Most surveys were from residential buildings (37 surveys, 78%), with the remaining 9 being from the non-residential buildings. 78% of surveys stated they were in the Residential sector. The non-residential buildings owners were broken down by sector, 6% were from the Commercial/SME sector, 7% were from the Public sector, 2% were from the industrial sector, and 7% for Other: Creche, Energy Advisors, and Residential and Offices Sectors.



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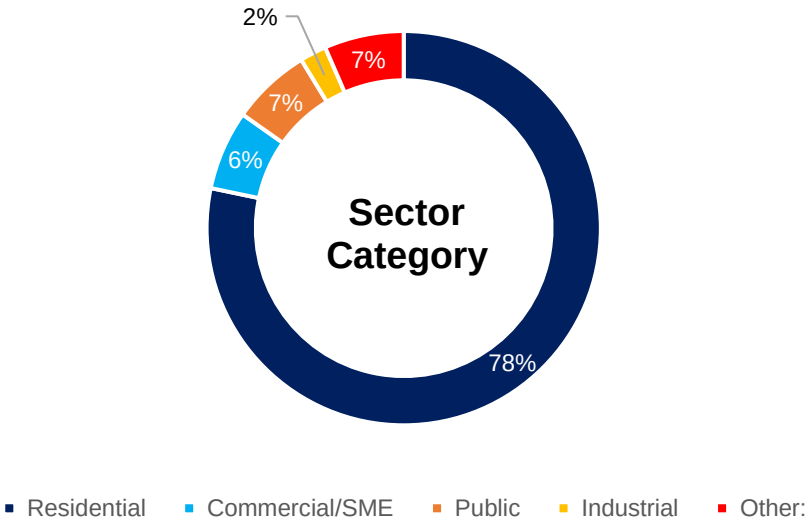
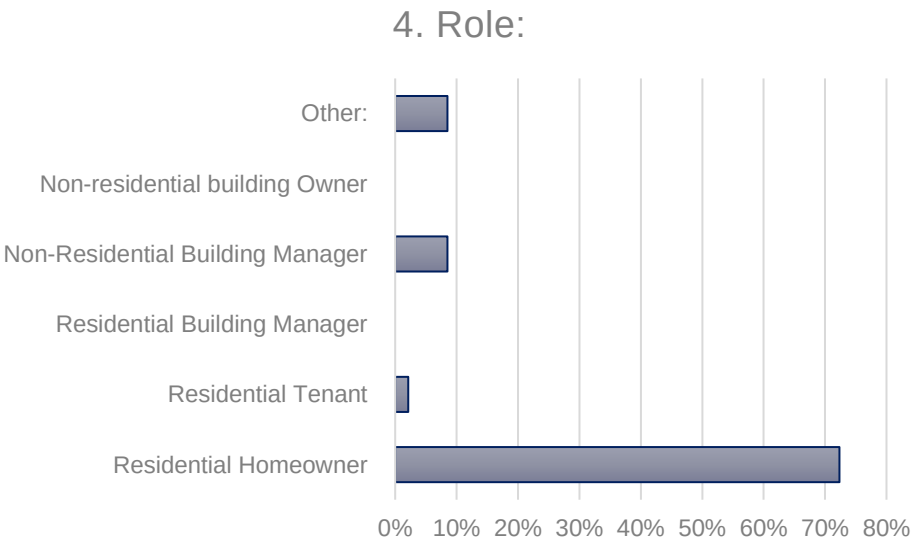


Other answers include: Creche, Energy Advisors, and Residential and Offices owners. Industrial Heat Pump owners only accounted for 2% of all surveys.

The surveys were asked their specific roles within each sector. 72% of surveys were residential homeowners. Other answers include Residential Homeowner and Non-residential building owner, Consultant & ESCO, Energy Consultant and Operations Manager.



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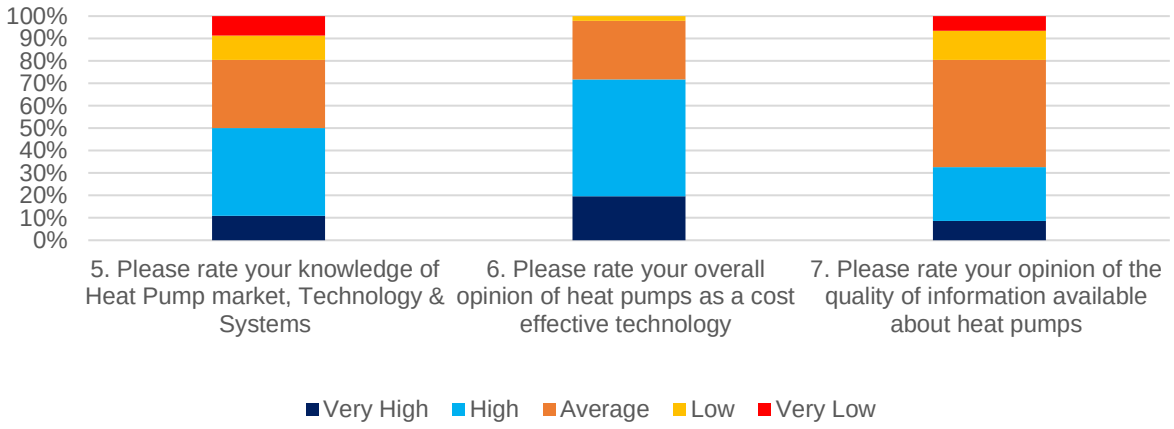
Section 2: Heat Pump Experience

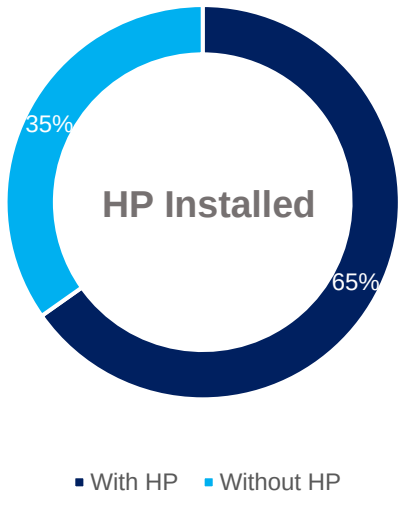
Heat pump knowledge was predominantly good, with 80% rating their knowledge average or higher. 9% of surveys stated they had very little knowledge of Heat pumps.

72% of surveys rated, Opinion of Heat pumps as a cost-effective technology, average or higher.

In relation to information available, the survey was asked to rate their opinion on the information available for Heat pumps, which resulted in 68% of people stating average (48%) or worse (20%).



Over 60% of surveys completed had a Heat pump installed on their premises. To capture a fair understanding from both heat pump owners and those who do not own heat pumps the surveys were put into 2 categories, With HP and Without HP.



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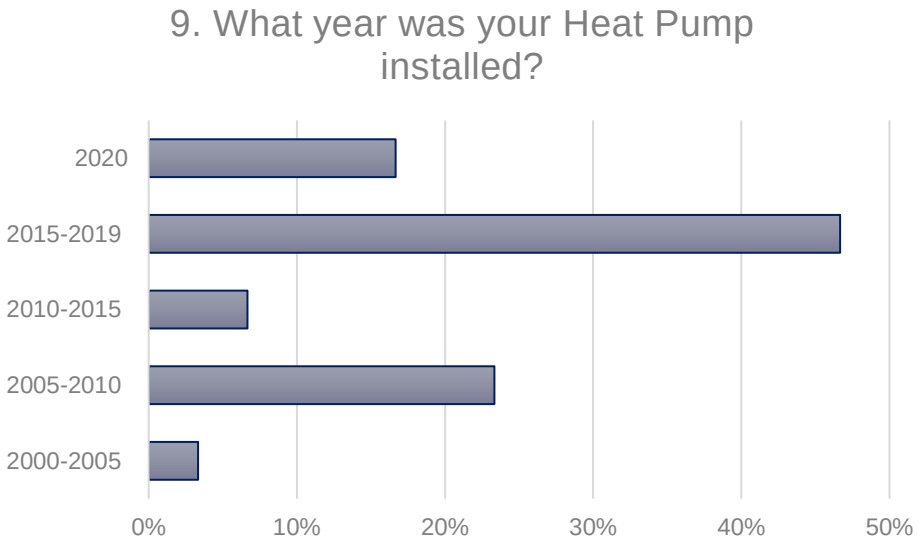
Section 2a: Have a heat pump in building.

29 out of 46 surveys admitted to having a HP installed. HP owners were asked when their HP was installed. 47% stated their HP was installed between 2015 and 2019, and 17% have had a HP installed in the last year.



HP Owners were asked what role does their HP play in their building. 90% stated it provided space heating to the building, 80% stated that their HP provided hot water. Only 13% of HP owners have cooling capabilities.

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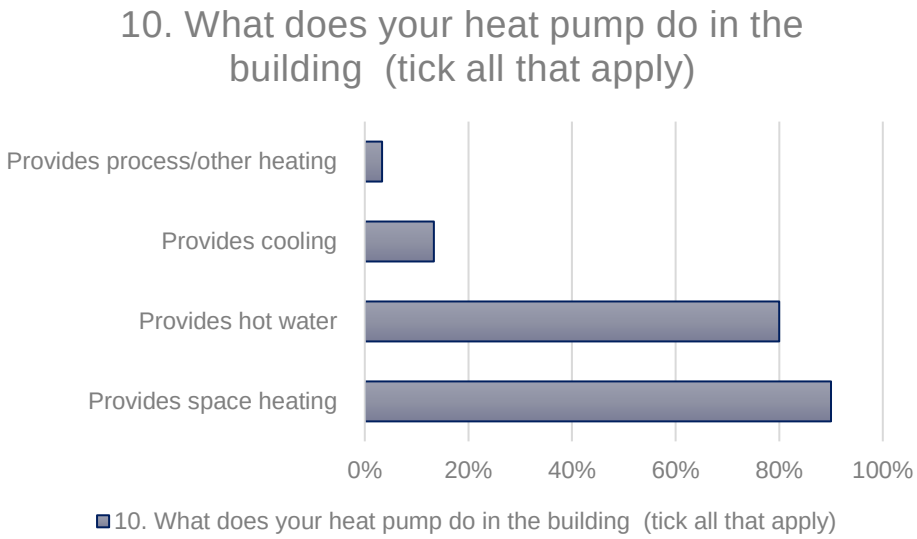
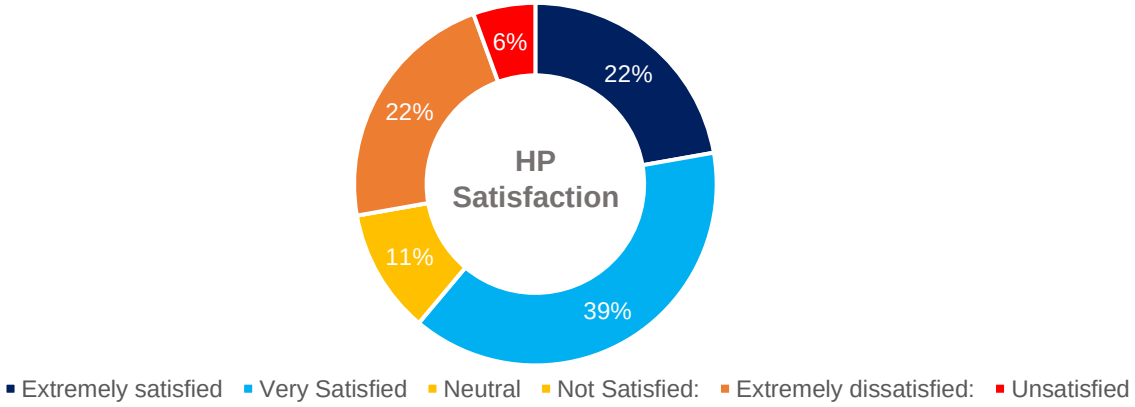


76% of HP owners have stated they are neutral to extremely satisfied with their HP (Very to Extremely Satisfied). There were 2 surveys that stated they were unsatisfied and gave the following explanation why:

- Constantly icing up.
- I Don't believe the commissioning of the system was great, I think that the system could be even more efficient that currently running.



100% of surveys with HP said they would recommend a HP to others, 69% of surveys agreed that a HP contributed to reducing energy costs. 76% do not regret installing a HP and 72% are considering additional energy efficiency.

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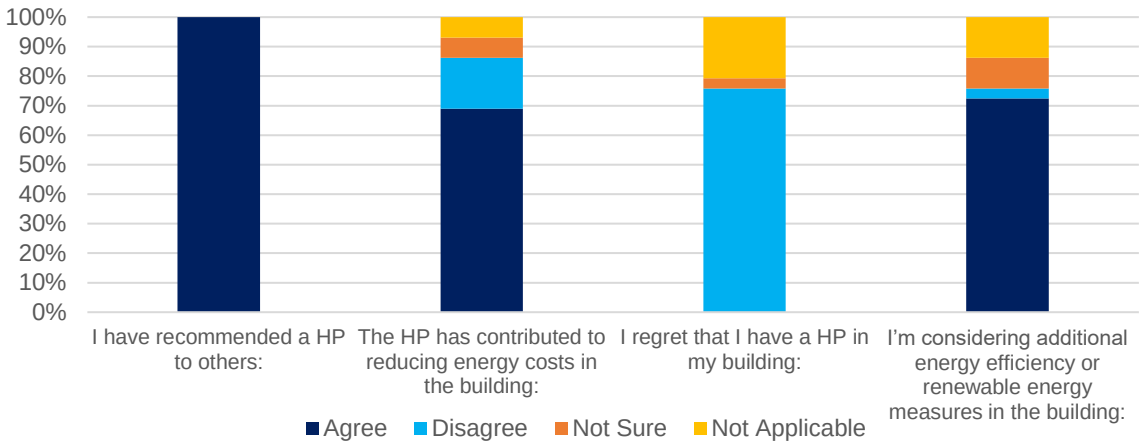
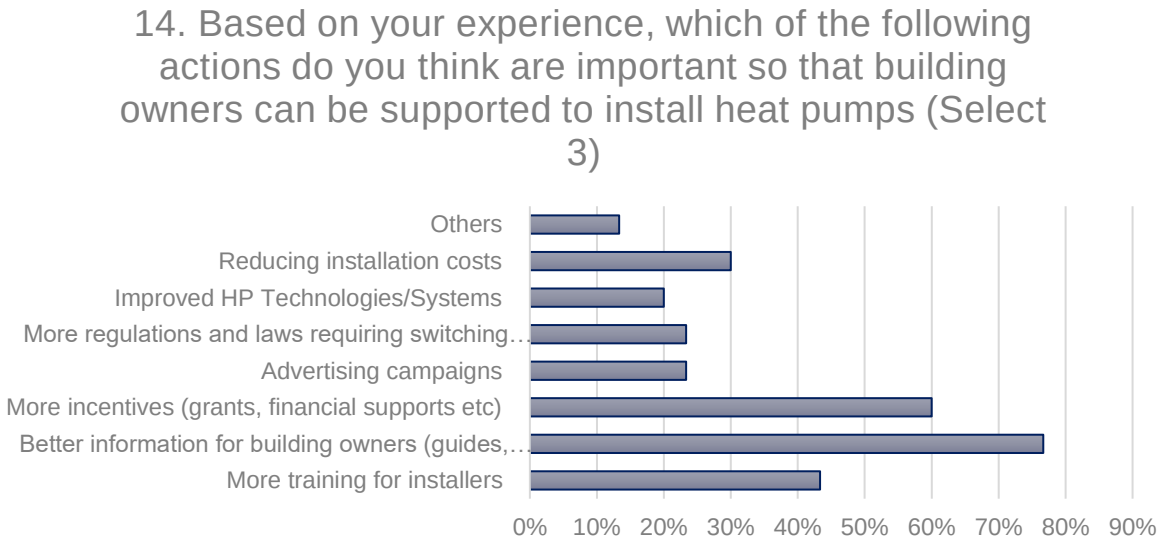


Based on HP owners experience, the following actions were stated to be important so that building owners can be supported to install heat pumps. 43% of HP owners agreed that more training is needed for installers, and 77% agree that better information for end-users is needed.



There were 4 other actions not listed and they are listed below:

- better training on how to use the system.
- easy access to real time power consumption of the HP.

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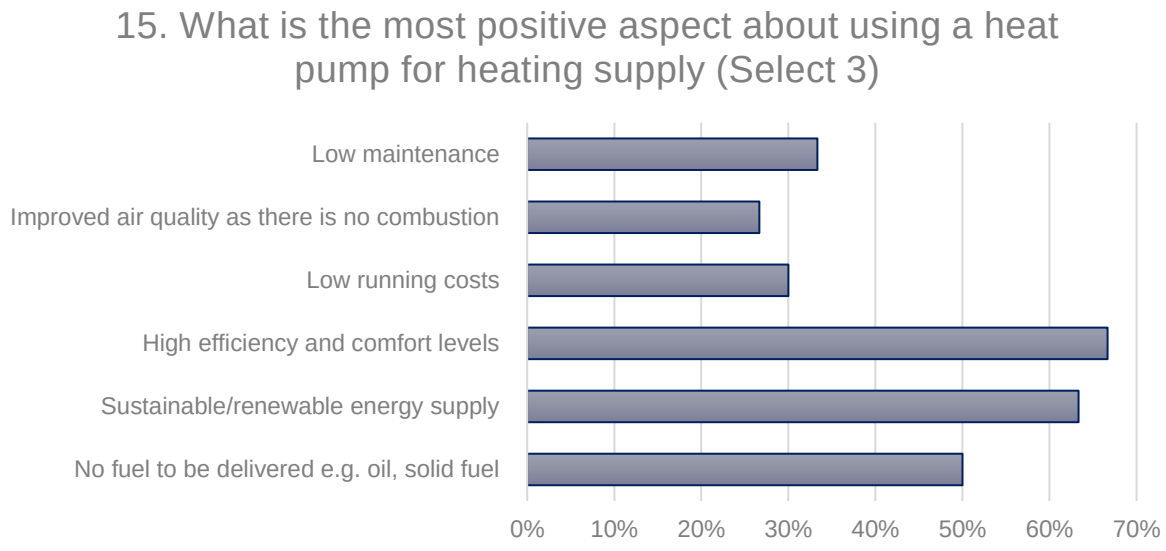
- There is very poor information available on retrofitting a heat pump to properties and the other work required to make them efficient. This makes the decision to install more difficult.
- Single stage HP with high SCOP at 60degC flow temperature.

HP Owners were asked “What is the most positive aspect about using a heat pump for heating supply? (Select 3)”.

67% stated that high efficiency and comfort levels was the most popular positive aspect, with 63% said because it is a sustainable/renewable energy supply being the second. The least popular positive aspect was improved air quality at 27%.



The final HP owner-based question “Are there any concerns or negative impacts which you would like to raise in relation to heat pumps?”. The answers of which can be summarised into 6 categories, each response can raise multiple concerns:

- 9 surveys responded with No concerns.
- 5 surveys responded with concerns with Install, Operating & Maintenance Costs.
- 3 surveys responded with concerns with Noise Pollution.
- 3 surveys responded with Lack of Information as a major concern.
- 5 surveys responded with Customer interface & Control concerns.

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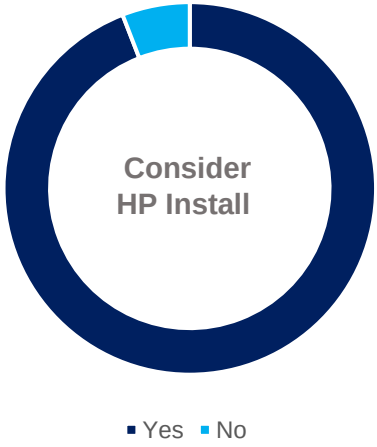
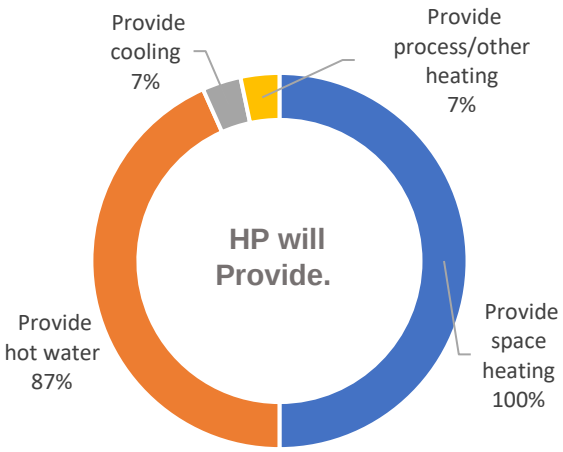
- 11 surveys responded with Design issues & Installer Issues being a major concern.

All survey responses are listed in appendix A.

Section 2b: Considering heat pump in building.

16 out of 46 surveys stated they did not own a HP, with 94% saying they would consider a HP installation. 50% of which, plan to use the HP for heating, 44% for Hot Water and 6% for Cooling and process/other heating.





The next question for people without HP “What are the reasons behind you considering the installation of a heat pump? (Select 3)”. 100% of surveys stated they were looking for a renewable/sustainable heating option. 0% of surveys owned a PV array. 40% of surveys had an interest in innovative technologies.

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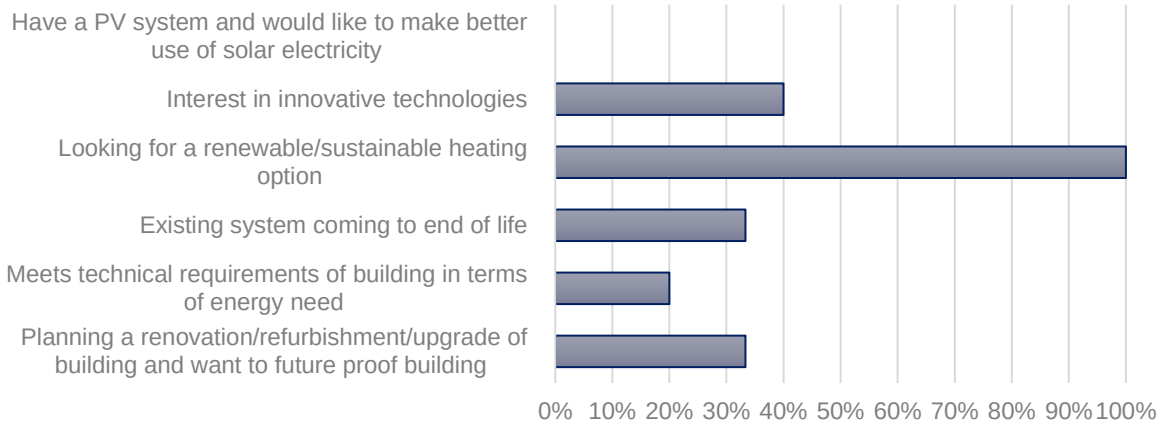
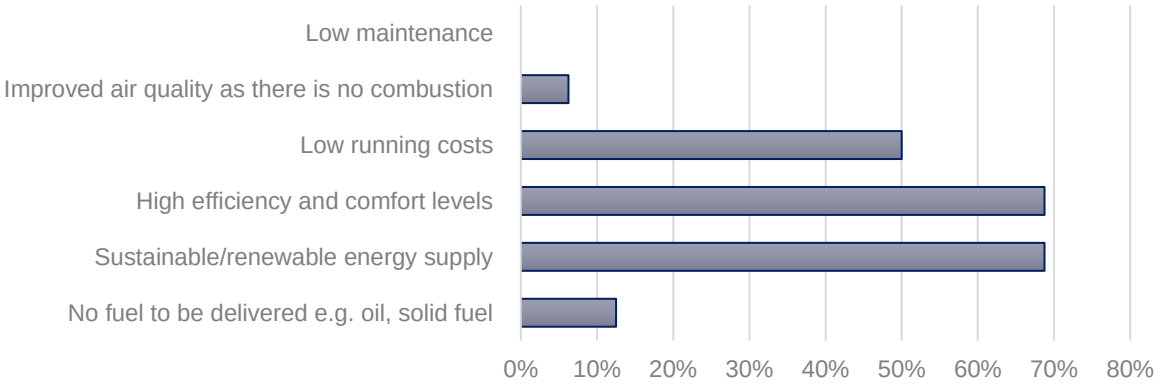
19. What are the reasons behind you considering the installation of a heat pump? (Select 3)



The next question for people considering a HP installation “Based on what you know so far about heat pumps what is the most positive aspect about using a heat pump (Select 3)”. 69% of surveys stated high efficiency and comfort levels were the most positive aspect, 0% of surveys stated low maintenance was the most positive aspect of owning a HP.

20. Based on what you know so far about heat pumps what is the most positive aspect about using a heat pump (Select 3)



Surveys were asked “What are your main concerns about installing a heat pump in your building (Select 3)”. 81% state that investment costs are the major concern, and noise of heat pump (13%) is the least concern.

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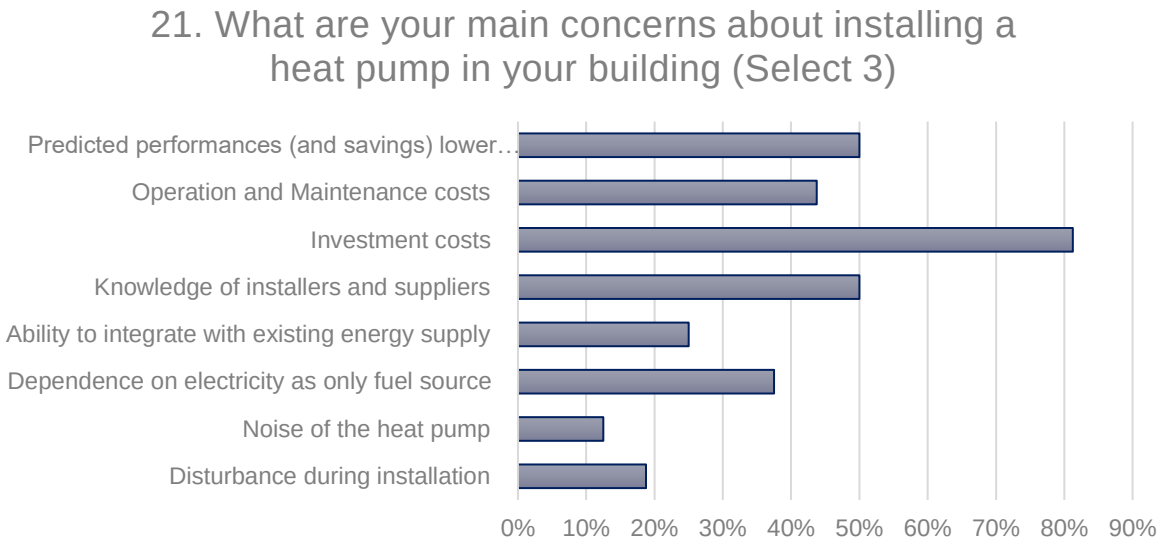
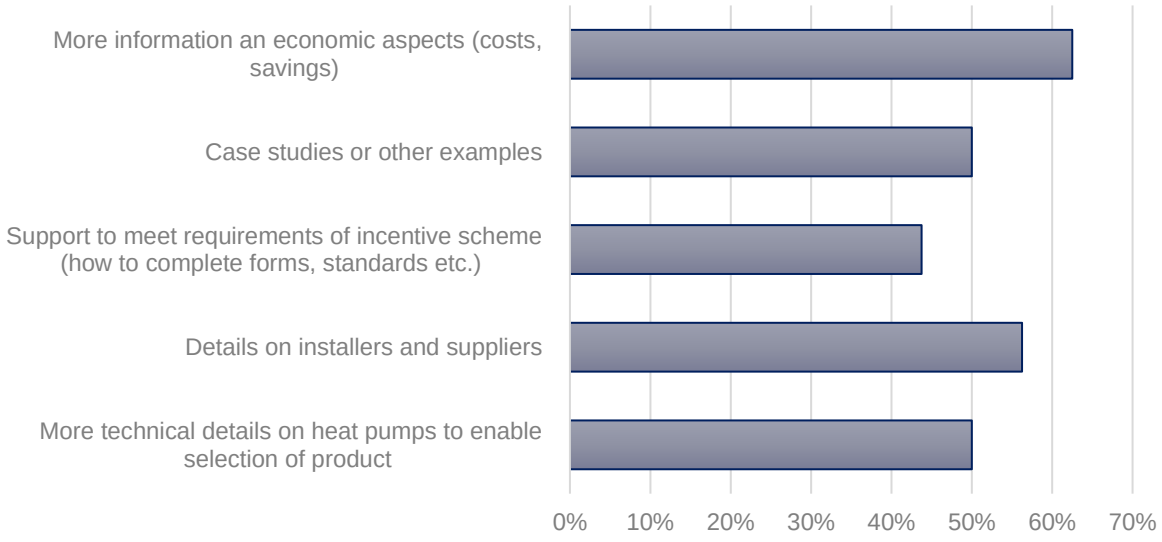


Surveys were asked “What additional information do you need to help you make your decision?”. The most popular answer was more information on economic aspects (63%) and the least popular was Support to meet requirements of incentive scheme (44%). There were equal concerns across all listed additional information.



Section 3: General Questions

All participants were asked 2 questions regarding future needs and knowledge these questions are shown below:

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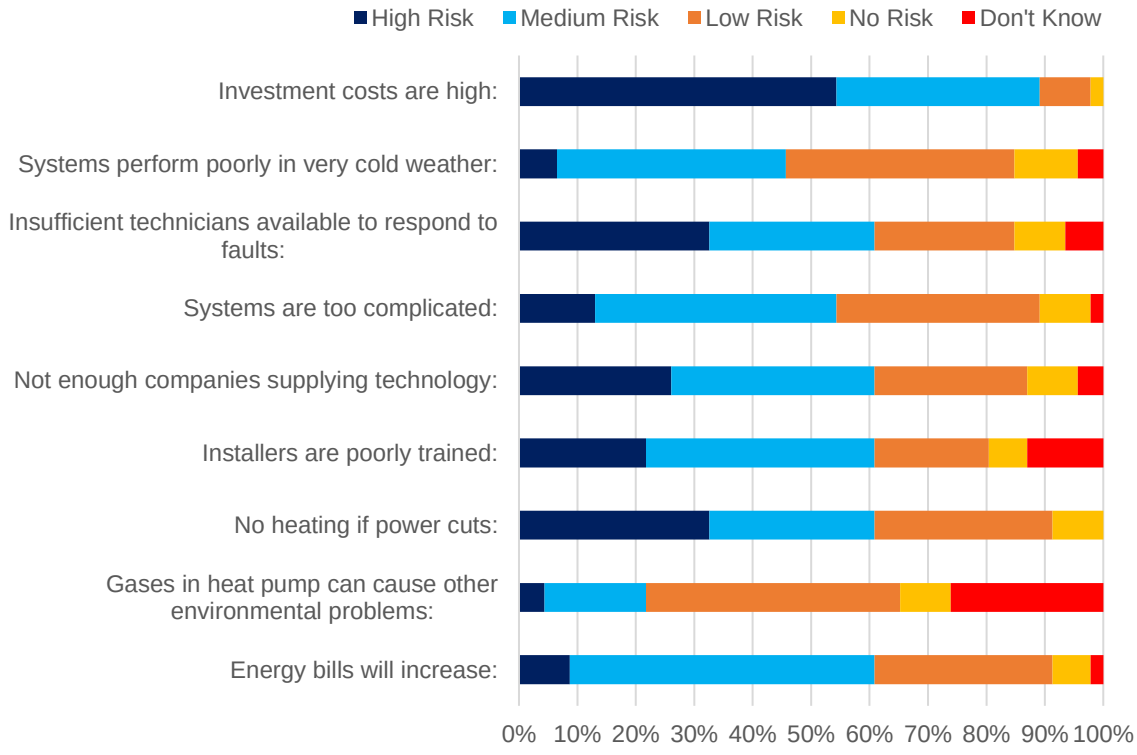
“We would like you to indicate if you think any of the following are particular risks to consider in relation to heat pumps.”

Investment cost has been identified as the highest risk to consider in relation to heat pumps. with 54% deeming investment costs being high as a high risk and 35% deeming as a medium risk.

Gases in heat pump can cause other environmental problems was identified as the lowest risk to HP installation, with 43% deeming low risk and 9% deeming as no risk.



“We are planning to create a Heat Pump Knowledge Hub for end users, building owners, installers etc.

This Knowledge Hub will at a minimum be a digital resource but may also be a specific service, information resource available in your region, through your Energy Agency or other relevant body.

Tick those resources which you think would be of benefit to have available via this Hub.”

A Decision-Making Tool was identified as the most important resource that would benefit the Knowledge Hub (80%), followed by 4 options (63% each) Case Studies, Guidance on Funding, HP Assessment, Videos for building owners.

Other resources listed were:

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- simple video on how to use the various menus for a Nibe HP.

- maintenance support.

- I find it hard to know what the latest technology is. I would like an independent body to give a review of latest tech out there.

- Video describing process to avail of incentives for installation- i.e., need to pay registered SEAI assessor €00s before you can determine if your property qualifies for grant- not a great process!

- In the video for homeowners explaining about how to set HP at right temp, and not to be constantly changing temps. Also, how to keep doors and windows closed to reduce cycling.

- Case studies should include both good and poor outcomes and information on different diverse households that have done it with the narrative beginning from their considerations, finances, lessons.

- Information on options to replace existing 24kw Gas Boiler with HP with minimum of disruption.

- Total life cycle (energy & maintenance) and also assurance around service disruption risk - resilience & breakdown response.

- investment comparison against gas, oil & LPG systems. Predicted life cycle costs comparative also.

- Cost benefit analysis tool incorporating whole life cycle costing that proves that the decision to switch makes financial sense.

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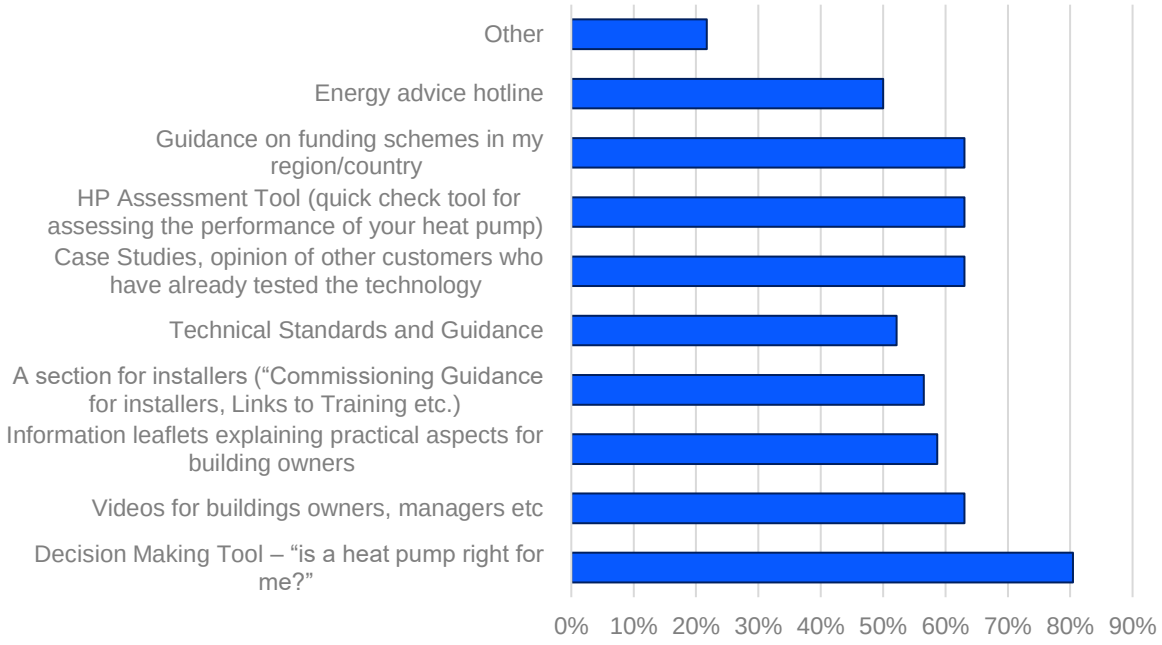

Conclusion

The majority of surveys for Ireland were mainly from people within the Residential sector (78%), are residential homeowners (72%) and own Heat Pumps (65%). The majority of HP installations took place between 2015-2020 (64%).

From the survey, perceptions of Heat pumps in Ireland are generally good, with 50% having fair to good knowledge of Heat pumps, and generally rate Heat pumps highly as a cost-effective technology

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(71% High>Very High). Every survey with a HP stated that they would recommend installing a HP to others.

The main role for a HP based on survey results is heating and cooling. For HP owners 90% used HP for heating, 80% used HP for hot water. 100% of surveys considering installing a HP want the HP to provide heating and 87% want the HP to provide Hot water. The cooling aspect of HP is very unpopular, with 3% of HP owners having cooling capabilities. 7% of surveys considering installing a HP wish to have cooling capabilities.

70% of People with HP are considering installing more energy efficiency upgrades and have said that their HP has contributed to reducing energy costs. The main drivers for HP owners are high efficiency (67%) and renewable energy source (63%). The main barriers for HP owners are lack of information for homeowners (77%) and more incentives (60%). Installer and designer issues were the main concern for HP owners (37%) while 30% of HP owners had no major concerns.

94% of surveys without a HP are considering installing a HP. 100% of surveys considering installing a HP are looking for a renewable/sustainable heating solution, and rate high efficiency (69%) and sustainable/renewable supply (69%) as the main drivers for installing a HP. The main barriers to HP installation are investment costs (81%), knowledge of suppliers and installers (50%) and Predicted performances (and savings) lower than expected (50%). 63% of surveys considering installing a heat pump state that they require more information on economic aspect of HP to help make their decision, 56% stated that they would need details on installers and suppliers to help make their decision.

Both surveys (With HP, without HP) were asked to provide a risk assessment of HP, 89% rated investment costs as a medium-high risk, followed by 5 options rated at 61% Medium to High Risk:

1 Energy bills will increase, 2 Insufficient technicians available to respond to faults, 3 Not enough companies supplying technology, 4 Installers are poorly trained, 5 No heating if power cuts.

A Decision-Making Tool was identified as the most important resource that would benefit the HP4ALL Knowledge Hub (80%), followed by 4 options (63% each) Case Studies, Guidance on Funding, HP Assessment, Videos for building owners.

The survey is skewed towards the residential homeowner who identify, more information, better trained and verified installers and suppliers as 2 major concerns for market comfort. The Knowledge Hub can be used as a platform to connect HP installers and homeowners, provide information to homeowners and installers alike.

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Annex 5 Spain Report

H2020 Work Programme

D4.1 – End User Survey
Task Leader: LIT
Author(s): CTA

Date: 08/02/21

This document is the summary report from the HP4ALL Task 4.1 from CTA (Spain)

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Executive summary

HP4All brings together leading experts across Europe to enable capacity and skills development within the Heat Pump sector and to ensure that the energy efficiency gains afforded by heat pumps are realised. HP4All, following a holistic, systemic point of view, will work both with the supply side (manufacturers, SMEs, installers etc) and demand side (building owners, public sector etc.). This way, the project will enhance, develop, and promote the skills required for high quality, optimised Heat Pump (HP) installations within residential/non-residential buildings bringing Europe to the forefront of the climatization sector.

Acronyms and abbreviations

HP	**HEAT PUMP**
SME	Small or Medium Enterprise
IE	Ireland
ES	Spain
IT	Italy

Introduction

HP4All aims to target end users across different categories (residential, non-residential; building owners, building managers; public, private etc.). Each will have their own specific influences and demands on the market for skills and quality. This task will examine the readiness of end users to accept HP implementation. LIT, with assistance from IERC and RINA-C, will develop tools and resources e.g., interview questions, online surveys (by M2) to be used with end users in each pilot country that will evaluate their current attitudes and opinions towards HPs. These questions will cover: the real or perceived risks of using HPs,

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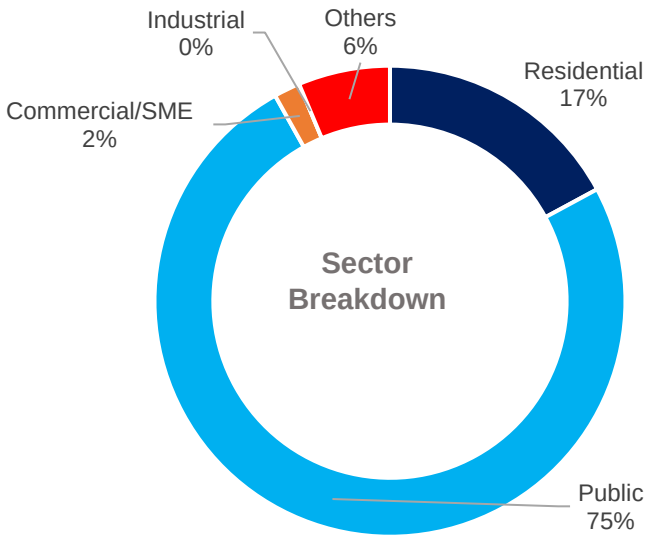
opinions on ease of operation & maintenance, perception of installation and operating costs, suitability for use in different situations, knowledge of how/where to find information about HPs, new innovations, and emerging solutions etc. A particular focus will be placed on knowledge and skills within the market, and end users' perceptions and expectations in this regard. Each region will select and apply appropriate tools to gather the data and identify critical trends and issues to be addressed for end-users. The consortium will use their respective networks to facilitate participation from 15-30 building owners/end users in each region. LIT will collate the results from the survey into a report (D4.1), by M4.

The questions were translated into Spanish and uploaded on an online platform with the support of LIT. These questions were available for about 3 weeks until the KPI of 15-30 answers was achieved.

A widely dissemination was done by CTA's and HP4AL's social medias and networks. It was also supported by the Andalusian Energy Agency (Spain) who disseminated the questions to more than 6,000 end users from HP sector.

End User Profile

There are 111 Surveys analysed and all from Spain. The majority of surveys were from non-residential end users 86 surveys (79%), with the remaining 25 surveys (22%) being the residential sector. Below shows the survey split by sector and roles:



The other sectors mentioned were educational, administrative, institutional and hospitality.

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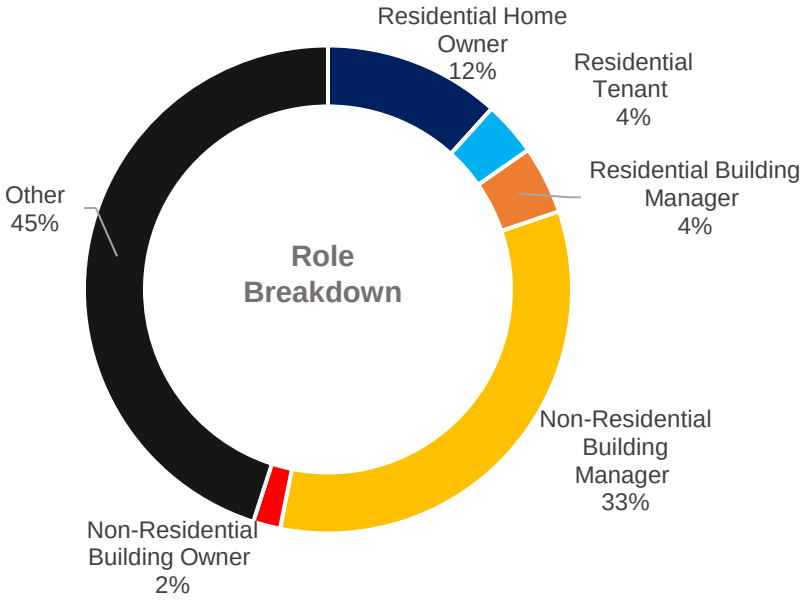

End Users Perceptions

Heat pump knowledge was predominantly good, with 62% being average or above, 38% having very little knowledge of Heat pumps. Opinions on Heat pumps being a cost-effective technology is quite good, with 86% being average or above. In relation to information available, the survey asked to rate opinions on the information available for Heat pumps, which resulted in a resounding 47% of people stating average and with 34% in low or worse.

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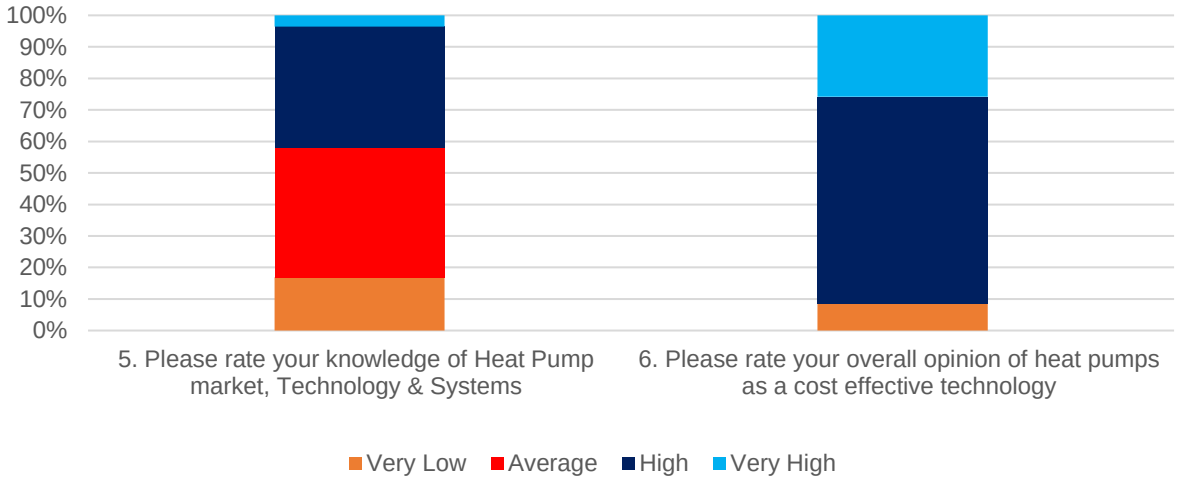
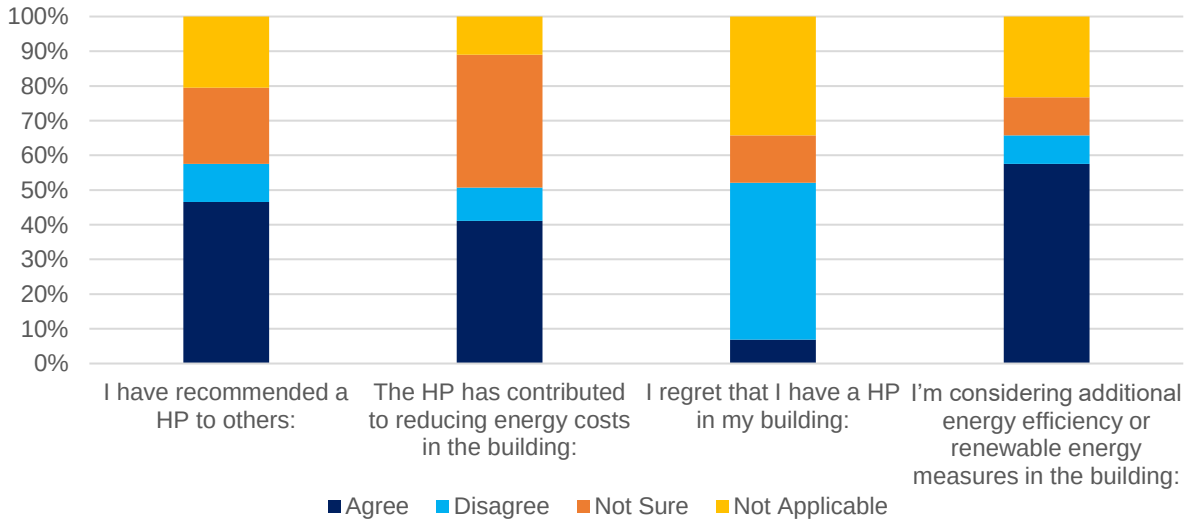


Over 68% of surveys completed had a Heat pump installed on their premises. To capture a fair understanding from both heat pump owners and those who do not own heat pumps the surveys were put into 2 categories, With HP and Without HP.

With HP

73 out of 111 surveys admitted to having a HP installed. Only the 48% of surveys with HP said they would recommend a HP to others. The 41% of surveys agreed that a HP contributed to reducing energy costs and the 38% said that they are not at all satisfied. 45% do not regret installing a HP and 57% are considering additional energy efficiency.



49% of HP owners have stated they are neutral with their HP, and 35% of HP owners have stated they are very satisfied. There were **4 surveys** that stated they were unsatisfied and gave the following explanation why:

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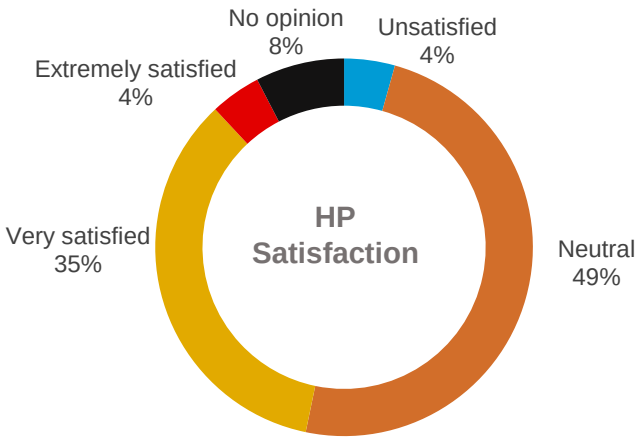
- Expensive and inefficient
- Old equipment works badly in heating mode and is noisy.
- They have to be checked constantly because they do not heat up from time to time.
- The installation is very old, needs renovation.



Based on HP owners experience, the following actions were stated to be important so that building owners can be supported to install heat pumps. 45% of HP owners agreed that more training is needed for installers, and 79% agree that better information for end-users is needed.

With 68% and 67% of HP owners, respectively, are agree that more incentives (grants, financial supports, etc) and better information for building owners (guides, technical information) are needed, following by reducing installation costs with 59%.

There were 3 other actions not listed and they are listed below:

- Support systems for renewable energy production.
- Reducing installation, maintenance, and consumption costs.
- Improving the procurement procedure of the Public Administration.

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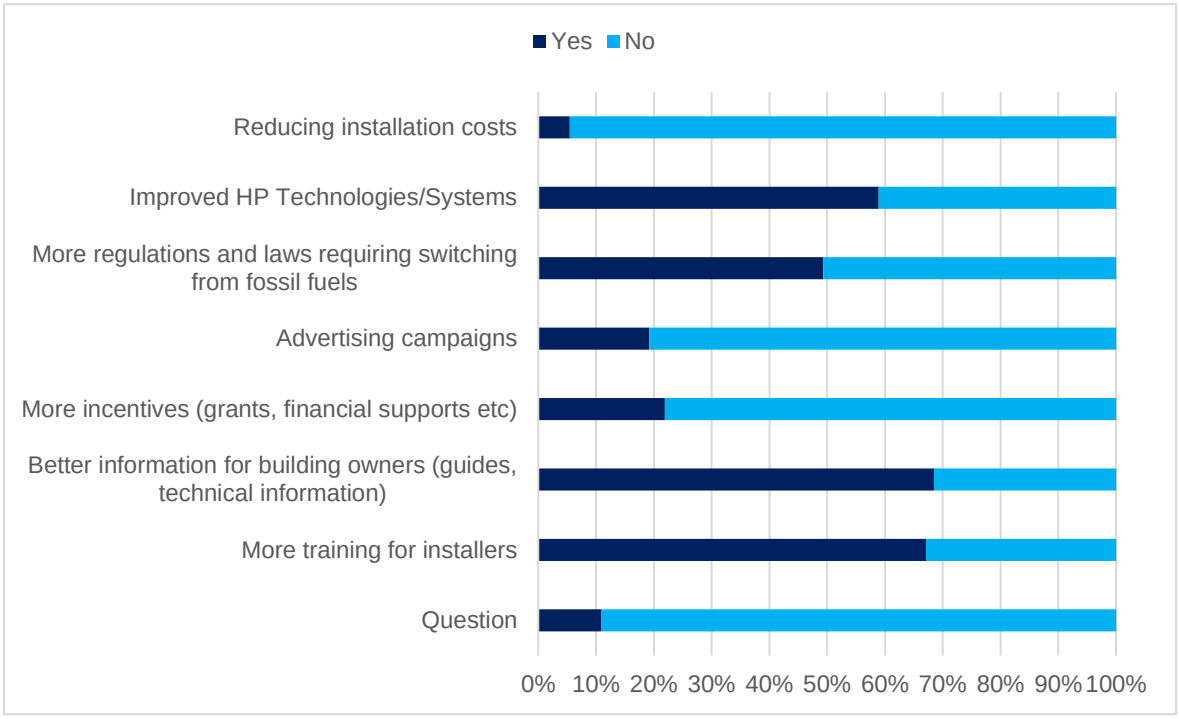

HP Owners were asked "What is the most positive aspect about using a heat pump for heating supply? (Select 3)".

52% stated that no fuel to be delivered e.g., oil, solid fuel was the most popular positive aspect, with 41% and 40% (each one) said because it is a low maintenance and high efficiency and comfort levels being the second and third. The least popular positive aspects were improved air quality as there is no combustion with 26%.

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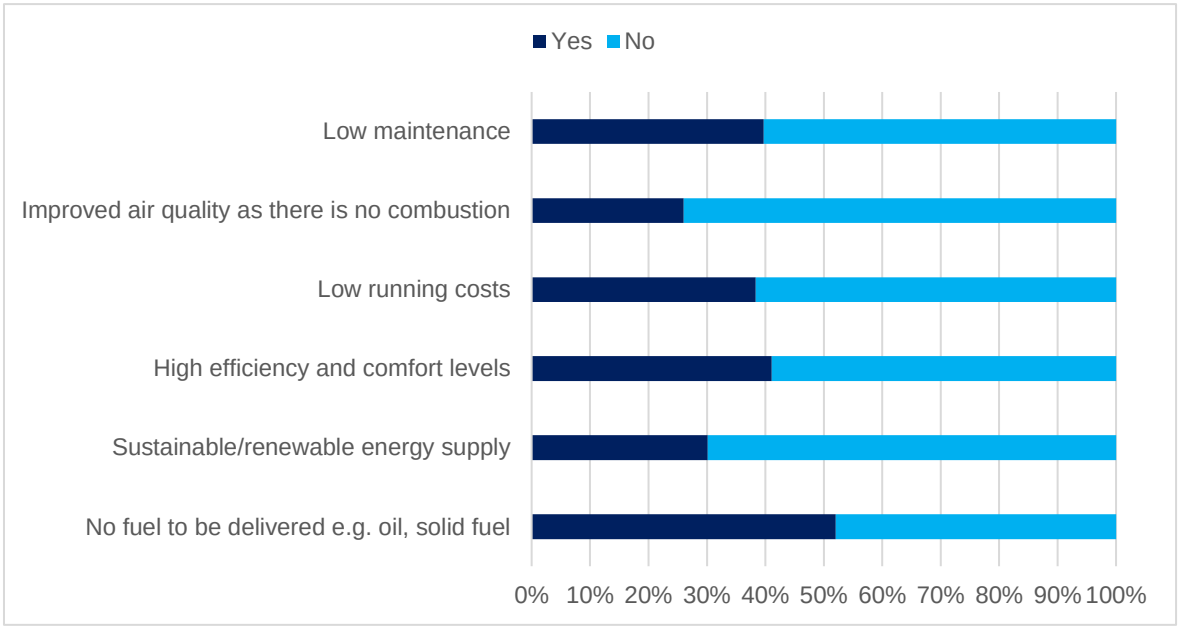

The final HP owner-based question "Are there any concerns or negative impacts which you would like to raise in relation to heat pumps?". The answers of which can be summarised into **6 categories**, each response can raise multiple concerns:

- 26 surveys responded with No concerns.
- 3 surveys responded with old buildings. The energy efficiency of the buildings must be improved in parallel, otherwise the installation of the HP will not be appreciated.
- 4 surveys responded with air renewal. Purifying filters should be installed, if not could be high risk of infection (COVID19).
- 4 surveys responded with refrigerants high costs.
- 6 surveys responded with not comfort status. Hot gases weigh less and tend to rise (hot upper zone and cold lower zone). Low efficiency.
- 5 surveys responded with greenhouse effect. Negative environmental impact of refrigerant gases (greenhouse effect).

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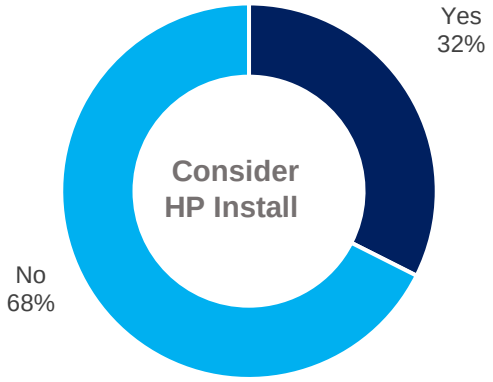
Without HP

38 out of 111 surveys stated they did not own a HP, with 32% saying they would consider a HP installation. 57% of which plan to use the HP for heating, 33% for Cooling, 10% for Hot Water and 0% for process/other heating.



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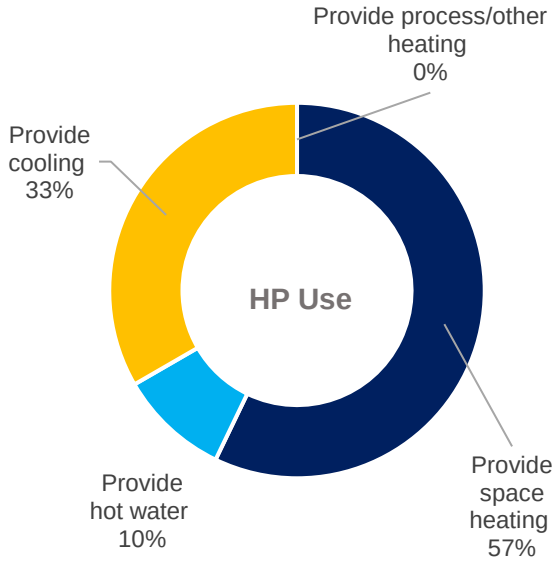
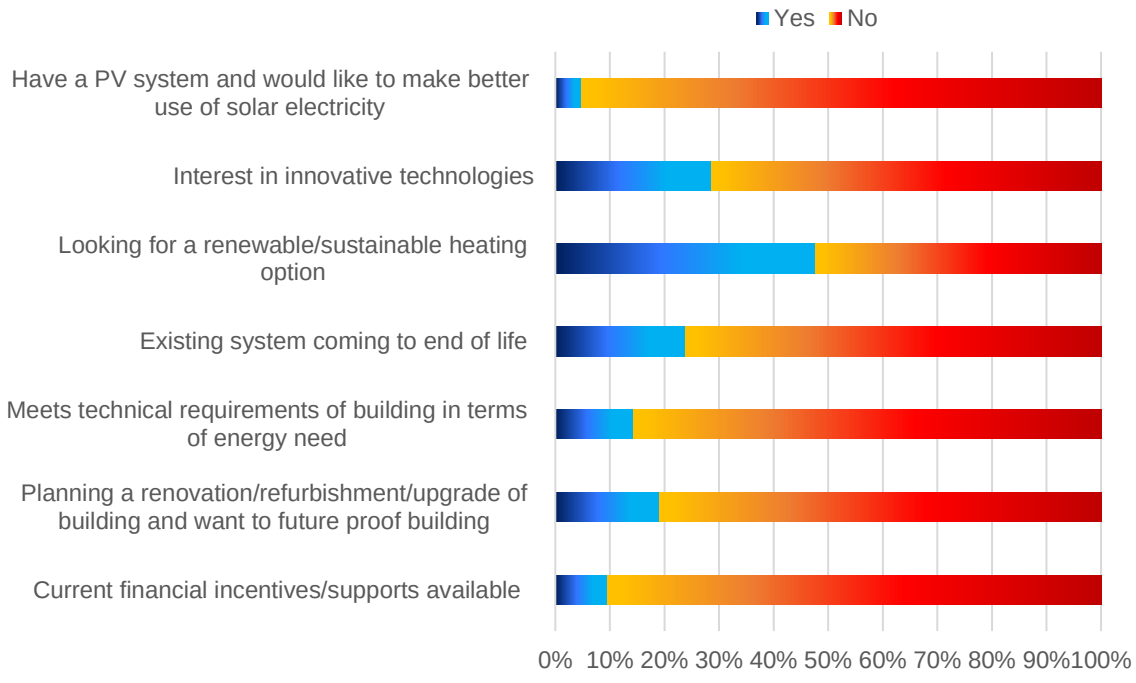


The next question for people without HP "What are the reasons behind you considering the installation of a heat pump? (Select 3)". 48% of surveys stated they were looking for a renewable/sustainable heating option. 1% of surveys owned have a PV system and would like to make better use of solar electricity.



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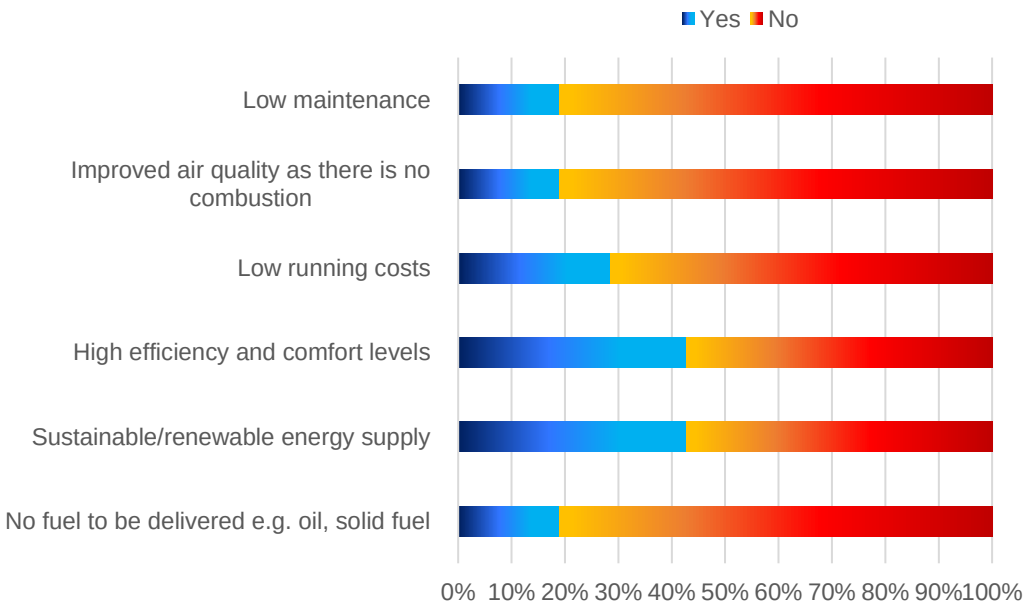
The next question for people without HP “Based on what you know so far about heat pumps what is the most positive aspect about using a heat pump (Select 3)”. 43% of surveys stated high efficiency and comfort levels, and sustainable/renewable energy supply were the most positive aspect, 19% of surveys stated No fuel to be delivered e.g., oil, solid fuel, improved air quality as there is no combustion and low maintenance were the minor positive aspect of owning a HP.



Surveys were asked “What are your main concerns about installing a heat pump in your building (Select 3)”. 85% state that investment costs is the major concern. Noise of heat pump and disturbance during installation (8%) are the least concern.

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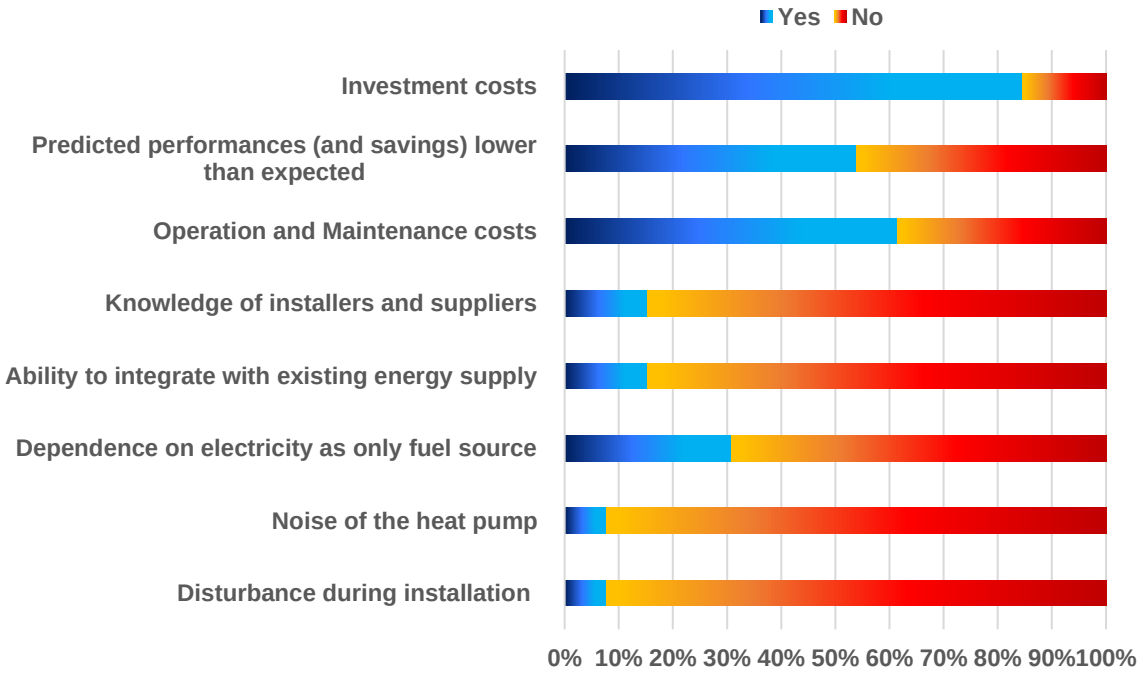

Surveys were asked “What additional information do you need to help you make your decision?”. The most popular answer was more information on economic aspects (92%) and the least popular was case studies or other examples (25%).

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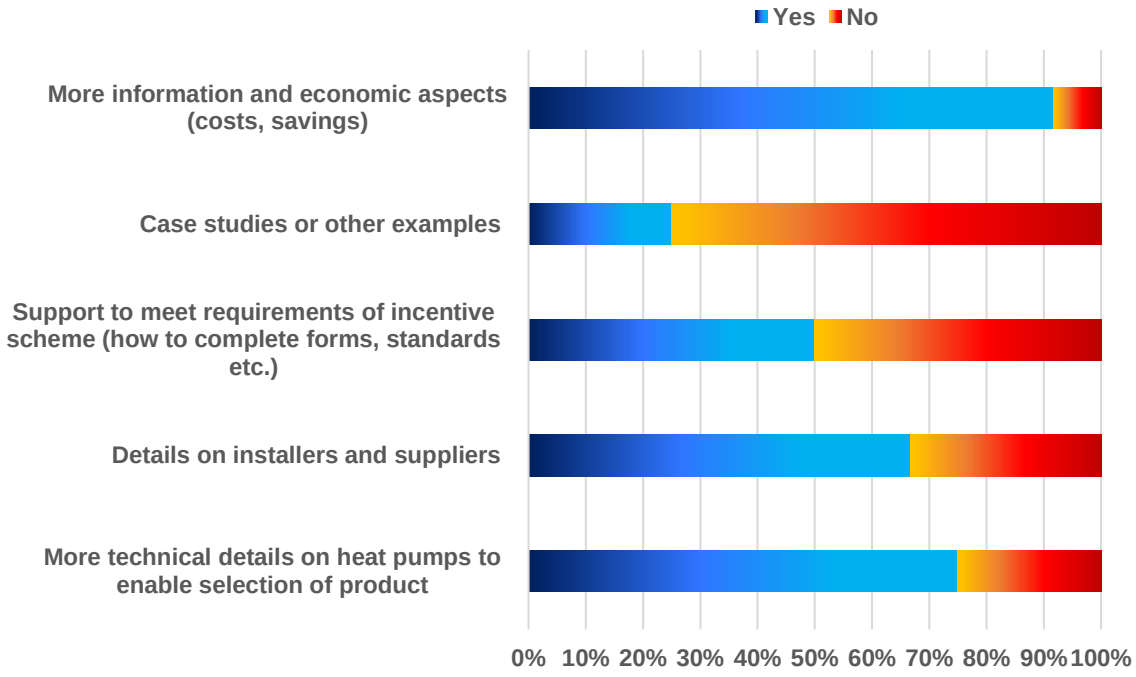

Future Needs and Knowledge

All participants were asked 2 questions regarding future needs and knowledge these questions are shown below:

“We would like you to indicate if you think any of the following are particular risks to consider in relation to heat pumps.”

With 39% no heating if power cuts have been identified as the highest risk to consider in relation to heat pumps and with 37% investment costs are high as a medium risk.

System are too complicated was identified as the lowest risk to HP installation, with 27% gases in heat pumps can cause other environmental problems and not enough problems as no risk.

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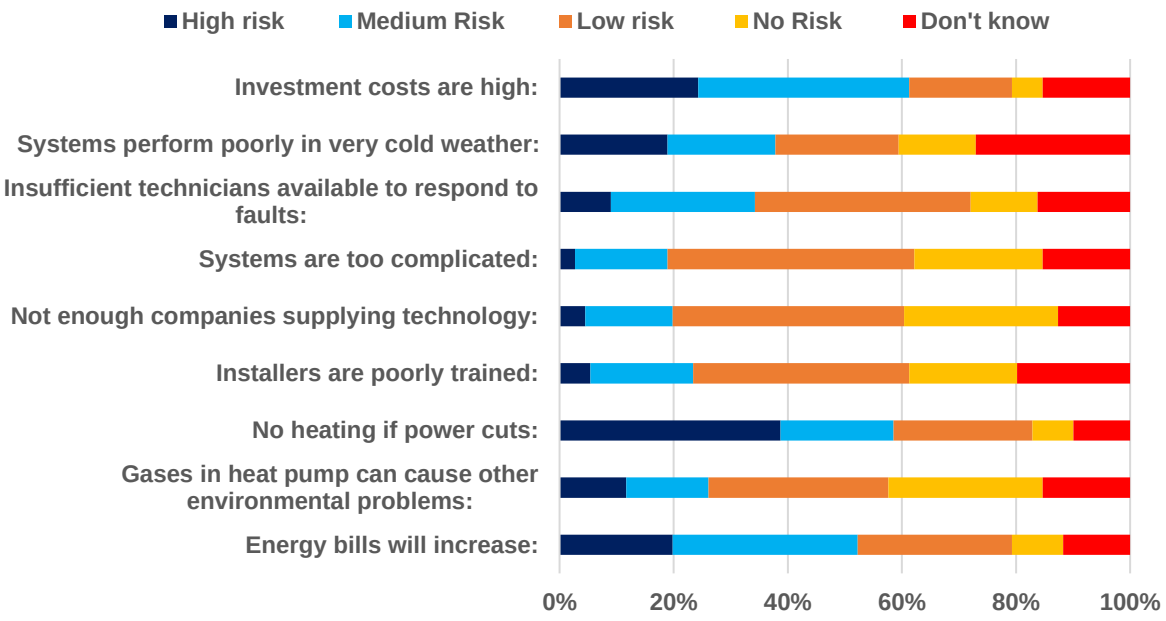

“We are planning to create a Heat Pump Knowledge Hub for end users, building owners, installers etc.

This Knowledge Hub will at a minimum be a digital resource but may also be a specific service, information resource available in your region, through your Energy Agency or other relevant body.

Tick those resources which you think would be of benefit to have available via this Hub.”

A Decision-Making Tool was identified as the most important resource that would benefit the Knowledge Hub (76%), followed by Technical Standards and Guidance with 57%, HP Assessment Tool (quick check tool for assessing the performance of your heat pump) with 53%, and Guidance on funding schemes in my region/country with 48%.

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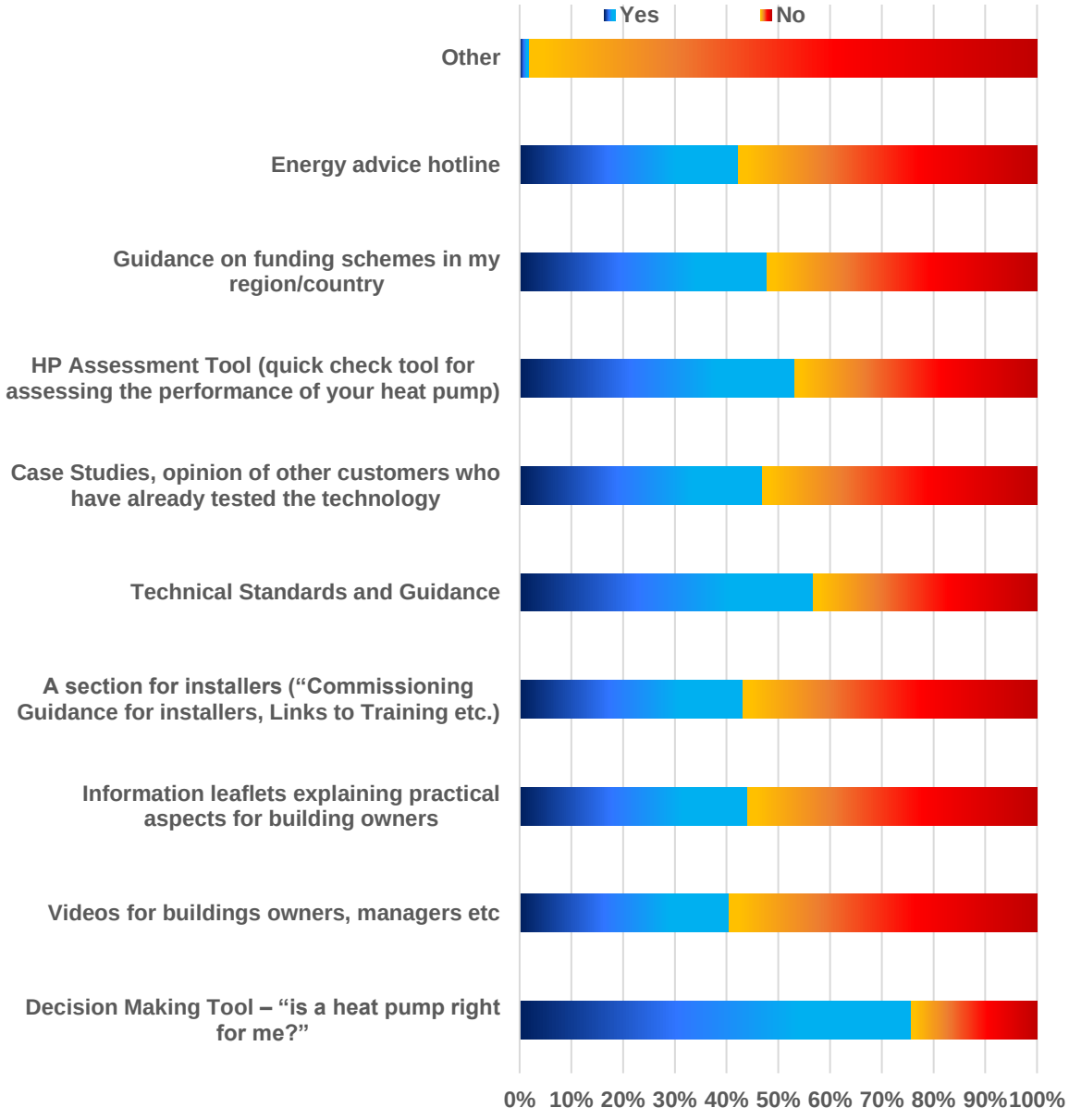

There were 2 other resources mentioned in some surveys listed below:

- Incentives.
- Offers.

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Annexe 1 – Full answers for question "Are there any concerns or negative impacts which you would like to raise in relation to heat pumps?"

Answers
I do not know how to keep warm
Cost
I am concerned about all the regulations associated with greenhouse gas emissions, and the cost associated with changing refrigerants. The use of heat pumps with natural refrigerants such as propane and especially geothermal should be encouraged.
SOLVE THE ISSUE OF ENVIRONMENTAL DRYNESS
The air heat goes to the upper part and makes the machine have to work longer to have a comfortable feeling.
NOT NOW
Refrigerant gas. Possible leaks.
No importance is given to maintenance, there is no noise control and due to the COVID-19 air conditioning is not recommended as there are no adequate filters installed and there is no outside air supply. In general, the equipment is very old.
The problem of refrigerant gases.
In heating these systems do not provide high levels of comfort (the upper part of the room is hot and the lower part cold).
When consumption I am not clear about the origin of the electrical energy.
Absence of ventilation in many installed HP systems. Along with the installation of an HP air-conditioning system, it must be ensured that the required indoor air quality is met in the premises, which is not always the case.
The non-renewal of air and therefore the ease of infection in cases of infection.
For heating, these are usually installations with a low degree of comfort, due to their installation in the upper zone. This results in a significant stratification of the environment.
It is not the best heating solution as it heats the upper air instead of the lower air.
If decentralised and renewable electricity production is not promoted at the same time, the negative effects of losses due to energy transport or fossil fuel-based production are maintained.
air purification filters should be installed
Disadvantages of installation in existing spaces
None in particular

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the absurd limitations on the quantity of refrigerant per installation in VRV typology that limit the total capacity instead of limiting per subsystem, assuming that all independent circuits are going to "break" at the same time.
Discomfort at very low outdoor temperatures in some cases.
Little information is available
High installation cost
In parallel to the installation of heat pumps, policies are needed to improve the energy efficiency of public buildings: improved insulation, improved joinery, control installations...
none
Poor performance in extreme temperature environments
Long-term operation of this type of machines
Do not work well in extreme temperatures (hot and cold).
Can't think of any
There is still equipment with refrigerant gas that has a negative impact on the environment. The electrical energy they consume does not always come from renewables, but from a plant that burns fossil fuels (let's not fool ourselves), but it is a first step to replace gas or diesel boilers with these (Not in a hospital, where all the air must be outside, and the HP performance is not sufficient for the flow of outside air blown)...
Help...public subsidies to renovate old heat pump equipment.
Nothing to consult
The many different problems with refrigerant gases and their development
The difficulty of contracting heat pump systems from the public administration.
Aerothermics is improving on this system and when prices come down it will probably be more efficient than this one.
Energy efficiency and cost
None
In educational establishments, the environment is too dry and the air quality in the rooms needs to be improved.
landscape impact on buildings
We do not have any

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