HEAT PUMPS SKILLS FOR NZEB CONSTRUCTION (HP4ALL)

Regional Implementation Report – Pilot Regions

Lead Contractor: OÖ Energiesparverband (ESV)

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This document reports on the implementation of the regional development plans in each of the pilot regions.

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1 Executive Summary

This document presents the action plans that were developed for each of the three HP4ALL pilot regions (Upper Austria, Ireland, and Andalusia/Spain) and reports on their implementation. The regional reports offer a brief background of the heat pump market at the starting of the HP4ALL project, define the pilots in terms of their scope and key objectives, and present the target groups and stakeholders engaged, activities carried out, tools used, communication strategy, and main outcomes.

The pilot regions aim to address different HP market sectors, applications, and technology solutions. Each pilot region took specific approaches to the roll out of targeted activities and materials, and the development and promotion of HP Skills depending on different market scenarios in each country.

Irish Pilot:
The Irish pilot primarily has focussed on local authorities and their respective heat pump installations, with a secondary focus on large scale heat pump installations and private domestic heat pump installations. HP4ALL has provided training to Local authorities in a first attempt to provide the staff that will be responsible for installations the information they need and also a source of further information if required.

Upper Austrian Pilot:
The Upper Austrian pilot activities has aimed, among others, at developing the market for mid-/large-scale HP applications (commercial and industrial) in the region. Material was developed and activities were organised to overcome current challenges, namely low levels of awareness of promising application possibilities among planners and users, and the lack of required skills by planners and installers.

Andalusian/Spanish Pilot:
The pilot activities in Andalusia aim at untapping the potential of the public sector as an outstanding driving demand force, as a public promoter and as a key market influencer through legislative, administrative, and financial initiatives. They have focussed primarily on public buildings (residential and non-residential) at local & regional level.

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2 Introduction

The overarching objective of the HP4ALL project is to enhance, develop and promote the skills required for high quality, optimised Heat Pump (HP) installations within residential/non-residential buildings. The project 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. Following a comprehensive, systemic point of view, both the supply side (manufacturers, SMEs, installers etc) and demand side (building owners, public sector etc.) are engaged.

A core element of the project is the application of activities in 3 pilot regions aiming to address different HP market sectors, applications, and technology solutions. A range of measures were applied in Upper Austria, Ireland, and Andalusia/Spain. Each pilot region took specific approaches to the roll out of targeted activities and materials, and to the development and promotion of HP skills depending on the different market scenarios in each country.

The following document presents the customised action plans that were developed for each of the pilot regions and reports on their implementation. It consists of a compilation of the three pilot regions reports. Each regional report offers a brief background of the heat pump market at the starting of the HP4ALL project, defines the pilot in terms of its scope and key objectives, and presents the target groups and stakeholders engaged, activities carried out, tools used, communication strategy, and main outcomes.

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3 Pilot Region of Ireland

Background / starting point

Country Specifics

Ireland is an island nation with a temperate climate with a major climatic influence coming from the Atlantic Ocean. According to Eurostat as of January 1st, 2022, the population of Ireland is 5,060,005 across 4 regions Munster, Leinster, Connacht, and Ulster or 26 counties[1]. Each County has its own Local Authority and are aptly named County Councils, there are also a LA for cities i.e., Dublin City Council. There are 31 local authorities in the Republic of Ireland. The Local authorities are responsible for a range of services which include Planning, Housing, and environmental protection. Each Local Authority are required to produce a development plan that sets out a strategy for planning and sustainable development in the area up until 2030[2] and comply and adhere to policy coming from the European Commission and the Irish Government. This obligation to adhere to policies as outlined below and the low-medium understanding of heat pump systems in Local Authorities provided TUS with the perfect stakeholder group for pilot activities. It was also helpful that Technological University of the Shannon (TUS) is well known to some of the Local Authorities thus allowing for rollout of training and capacity building events.

Policy affecting heat pumps

In the Climate Action Plan 2019 and further built upon in the Climate Action Plan 2021, the Irish government has committed to a detailed plan of actions to achieve a 51% reduction in overall greenhouse gas emissions by 2030 and setting us on a path to reach net-zero emissions by no later than 2050. One such action in this detailed plan is Action 211 which aims to launch a new Sustainable Energy Authority of Ireland (SEAI) National Retrofit Scheme (One Stop Shop Service) to drive the delivery of B2 retrofits with heat pumps and facilitate year-round working. The Irish Government have invested €8bn in the National Retrofit Programme, announced in February, aims to carry out 500,000 deep retrofits with heat pumps, or around 30% of Ireland's housing stock, with different grants.by 2030. In 2022 the number of retrofits carried out by the National Retrofit Programme was short of its predicted target with the SEAI director of research Margie McCarthy saying that over 36,000 applications for various grant funding have been received and around 28,800 homes being retrofitted[3]. In short, the number of retrofits being completed in Ireland is too low to reach the 2030 targets and the main reason for this is lack of expertise in the area of retrofit and lack of workforce based on the conversations TUS has had with leading experts in retrofit and energy efficiency throughout the hp4all project timeframe. For these very reasons Action 222 in the Climate Action Plan 2021 outlines a plan to Deliver the necessary increase in upskilling, reskilling and apprenticeship supports for residential retrofitting which include development and roll out of contractor courses, reduce Covid-19 related backlogs in apprenticeships, the introduction of 5 centres of retrofit excellence (training facilities) and expand the apprenticeship programs. Action 222 also outlines a blended approach to learning and training to allow for greater flexibility and reach of the training[4].

The blended approach to training and for greater flexibility and reach was incorporated into the Irish pilot region activities, along with a focus on the entire retrofit process instead of focusing on heat pumps only.

Another policy affecting heat pump deployment in Ireland is the ‘Housing for All - a New Housing Plan for Ireland’. This is the Irish government’s housing plan to 2030. It is a multi-annual, multi-billion-euro plan which will improve Ireland’s housing system and deliver affordable, high standard and energy efficient housing for Irish citizens. A significant part of this plan is for the provision of 90,000 social homes by 2030, including retrofitting of existing

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social housing and an average 9,500 new builds per year. Local authorities own and manage social housing homes which are currently around 140,000 homes in the Republic of Ireland[5].

Local authorities have an important role in the deployment of heat pumps and for this reason TUS choose Local Authorities as the main stakeholder for pilot activities.

There are significant regulations for new builds and for retrofits in Ireland, which outline minimum energy requirements for buildings. These regulations are outlined in the 'Technical Guidance Document L - Conservation of Fuel and Energy - Buildings other than Dwellings Regulations'.

TGD Part L sets out requirements for new builds and retrofits where:

- application of a methodology for the calculation of the energy performance of buildings
- setting of minimum energy performance requirements for buildings and the application of these requirements to new buildings to achieve Nearly Zero Energy Buildings (NZEB);
- ensuring that when dwellings undergo major renovation, the energy performance of the building or the renovated part thereof is upgraded in order to meet the minimum energy performance requirements in so far as is technically, functionally, and economically feasible;

TGD Part L does not specifically mention heat pumps in new builds, however with the tight regulation on energy performance the industry norm is to use heat pumps to achieve minimum energy requirements of both new builds and deep retrofits for both domestic and non-domestic settings.

In the spring of 2021, a standard for Heat pump installations was published by the National Standards Association of Ireland (NSAI) in conjunction with Sustainable Energy Authority Ireland (SEAI) and the Heat Pump Association of Ireland (HPAI). The SR50-4 standard gives guidelines for the design, installation, commissioning, and maintenance of heat pump systems with an effective rated output up to 70 kW in new and existing dwellings. Prior to this standard, there were no standard practices for installing heat pumps, meaning there were no standardised target efficiencies for installations to adhere to.

Training in Ireland

Currently, heat pump installers in Ireland do not have to register with an industry body in the same way as gas (RGI) oil boiler (OFTEC) or electrical (REC) installers do. Training courses are available for installers either as an add-on module to existing apprenticeship level qualifications such as plumbing or allied trades, as a separate course operated by dedicated bodies or by manufacturers.

In the mid to late 2000's, Sustainable Energy Ireland ran a grant scheme for domestic heat pumps and an associated training course was developed by a collaboration of SEAI, Arsenal Research and training providers in Ireland and Northern Ireland. The Renewable Energy Installers Academy (REIA) was a pilot project funded under the INTERREG programme and was developed in response to the recognition that the lack of trained installers and specifiers is one of the critical barriers to the development of a northern Irish and Irish renewable energy market. The end of the grant scheme and the drop in heat pump installations caused by the global financial crash of 2008 led to a fall in demand and eventual closing of these training courses around 2012.

A new heat pump grant in 2018 required an updated training course (Course Code C30263). Content was developed by a collaboration of SEAI, training providers, the Irish Heat Pump

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Association and other industry parties, however if an individual training provider wishes to run the training course, they must achieve their own Further Education (FE) or Higher Education (HE) certification for this training by complying with Quality and Qualifications Ireland (QQI) standards. Currently there are 3 training providers in Ireland and a further 3 training providers coming online in 2023, the following table shows an overview of each course.

Completing any of these courses (along with manufacturer specific training) and after a review by SEAI can qualify an installer to become an SEAI Registered Installer and can work on SEAI grant funded installations.

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Table 1 Overview of heat pump training in Ireland

Organisation	Midland Energy Training and Assessment Centre	Dundalk Institute of Technology	ECAC	BallyFermot Training Centre	Waterford Wexford Education Training Board	Atlantic Technological University / Unitherm
Location	Laois	Louth	Louth (Also might be done in WWETB)	Dublin	Wexford	Galway
Course Title	Domestic Heat Pump Systems	Heat Pump Installer	Domestic Heat Pump service, maintenance & diagnostics training	Domestic Heat Pump Installation Course	Domestic Heat Pump Installation Course	Higher Certificate in Heat Pump Installation, Commissioning, Maintenance and Servicing
Duration	5 Day	10 Weeks, additional 30 hours of independent study required.	3-5 days	2 Weeks	2 Weeks	16 Weeks, Part Time
Cost	€1,000 Subsidised Cost: €297	€50 Application fee (non-refundable) €100 Accept Offer fee (non-refundable) Balance of €450 payable by 28th February Total fee = €600	-	€1,000 Subsidised Cost: €700	€1,000 Subsidised Cost: €700	€2,200, €800 Subsidised by DASBE

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Organisation	Midland Energy Training and Assessment Centre	Dundalk Institute of Technology	ECAC	BallyFermot Training Centre	Waterford Wexford Education Training Board	Atlantic Technological University / Unitherm
Trainee Profile	Level 6 National Craft Certificate or Advanced Craft Certificate in Plumbing, Electrical, Refrigeration, Fitters or equivalent.	Level 6 Advanced Craft Certificate in Plumbing or equivalent.	-	National Craft Certificate as Plumber, Refrigeration Craftsperson, Electrician, or Fitter, or a Diploma/Degree in Architectural Studies or Building Services Engineering or equivalent.	National Craft Certificate as Plumber, Refrigeration Craftsperson, Electrician, or Fitter, or a Diploma/Degree in Architectural Studies or Building Services Engineering or equivalent.	Level 6 Advanced Craft Certificate in Plumbing or equivalent.
Awarding Body	FETAC (Further Education)	Higher Education	City & Guilds	FETAC	FETAC	Higher Education
Certification	QQI 6N5646 Component Award in Domestic Heat Pump Systems Level 6	This is a single standalone module worth 5 Credits at QQI Level 6.	-	Domestic Heat Pump Systems (6N5646)	Domestic Heat Pump Systems (6N5646)	20 Credit Special Purpose Award

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Scope and key objectives

The Irish pilot will primarily focus on local authorities (LA) and their respective heat pump installations, with a secondary focus on large scale heat pump installations and private domestic heat pump installations. Local Authorities are the primary focus as they provided TUS and the HP4ALL project with good access to a variety of stakeholders in the heat pump market, and have control over more heat pumps than if TUS were to target individual homes or individual developers.

The design and installation of residential new build with a heat pump (that are not in receipt of grant funding) is not specifically overseen, commissioned or requires the installer to be certified. All heat pumps should have the electrical works commissioned by a Registered electrical contractor (REC) and if it is a split heat pump system it should require commissioning by qualified Refrigeration, air conditioning (RAC) personnel, this is usually seen as the norm as it effects the households' insurance and equipment warranty if there is a problem with the system, however it is not compulsory. The building regulations state that a building must comply with energy standards, but ultimately commissioning by competent personnel is up to the building owner or the contractor.

Evidence from our work throughout the HP4ALL project shows that the standards of design, installation and hand-over vary across the market. As in the case in the Irish context, there is a huge number of planned installations from now until 2030, this situation has the potential for large numbers of under-performing heat pump installations.

HP4ALL also actively engaged with all actors in the supply chain and with end users to develop an understanding of the key weaknesses in project delivery mechanisms and develop together education and training materials. As independent brokers, HP4ALL could engage with the suppliers of large heat pumps through our contact with the Heat Pump Association of Ireland. From these conversations issues that are surrounding the deployment of large-scale heat pumps were discussed.

Target groups and stakeholders

Table 2 Overview of Targeted Stakeholders in Irish Pilot

Target group / stakeholder	Why they are important	How they will be engaged
Local Authorities / County Councils	To build knowledge and engage in producing a national handover guide for county councils and homeowners	Guides, Hand over events, Interviews, Webinars, and training events
Housing Authorities	To better understand the development process and tendering process for procuring HPs, help build up knowledge and competencies.	Interviews and webinars

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Department of the Environment, Climate and Communications	Help to gain a better understanding of the roadmap set out in action 66 of the climate action plan and how HP4ALL can support these activities	Interviews & collaboration events
Training Providers	We want to improve the teaching and learning experience, the uptake of training, and increase the provision of training	Interviews and webinars
Consulting Engineers	To help get a better understanding of the design, procurement, and commissioning processes	Interviews
Developers	To better understand the development process and tendering process for procuring HPs, help build up knowledge and competencies.	Interviews and webinars
Homeowners	Heat pump day to day users with little understanding of the units	Guides, knowledge hub and hand over events.
Social Housing	Heat pump day to day users with little understanding of the units	Guides, knowledge hub and hand over events.
Heat Pump Association of Ireland	Have extensive knowledge in the field of HPs and also have a website with a lot of resources	Interviews
Sustainable Energy Authority Ireland	The main grant scheme for HPs in Ireland is through SEAI	Interviews
HP manufacturers	To gain a better understanding of the supply side and also market ability to commit.	Interviews

Activities and tools

TUS have been working with 9 LAs and a list of homes with heat pumps that are in planning or currently controlled by the LAs is shown below. TUS has provided heat pump and procurement training to local authority staff and ran promotional events at local authorities to improve the understanding of the LA staff that are directly responsible for new-builds and retrofits and the installation of heat pumps. The full breakdown is shown below:

Table 3 Irish Pilot Local Authorities overview

County Council Name	Number of in-house staff to be trained	Number of Contractor companies	Number of Heat Pump Installations current planned up until end-2023
Carlow	11	4	355
Kilkenny	12	3	519
Cork	20	-	-
Roscommon	21	-	192
Offaly	-	-	-
Galway	-	10	148

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Laois	21	3	35
Tipperary	19	4	63
Clare	16	6	74
SUM	**120**	**30**	**1386**

The first step of engagement with LA's always started with training of internal staff, before contacting their contractors or tenants. This provided a good understanding of heat pump design, installation, maintenance, and homeowner hand-over. The training also engaged in procurement and tendering, with a particular focus on skills, certification, and qualifications to bear in mind throughout the public tendering process. TUS had created a 4-hour training programme that began with a presentation by TUS followed by a physical demonstration by a heat pump supplier that was contacted through the Heat Pump Association of Ireland. The HP4ALL has trained 120 LA staff to date.

Figure 1 Local Authority Training Photos

The second step of engagement either looked for further internal staff events such as Climate Action days or end-user events such as Estate events. Climate Action days consisted of various organisations in the energy, climate, or environmental sectors to provide the most up to date information to general staff of the local authorities, it was at these events that dissemination materials such as the homeowner leaflet were distributed. The estate events are events that take place in the recently developed housing estate and a walk around and proper hand over is given by the contractor, designer (usually the supplier of heat pump), HP4ALL rep and the LA staff to the end-user. 2 Climate Action days were conducted, and 1 estate events conducted (all estate events were stopped by October 2022, due to weather), with more estate events planned for February 2023 and beyond the project lifetime.

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Figure 2 Climate Action Day Photos

The third step of engagement is contacting the contractors that are being used by the LA, this in some case can be 5-6 large contractor companies with access to a various and large volume of working professionals. From conversations with contractors, on-site training or training at a facility was deemed out of scope, time and the missed opportunity of income were the main barriers. In order to combat this short online training were created and circulated to LA's, their contractors and heating and cooling professionals. A similar approach was used when offering information to homeowners, short online learnings were used. All training and materials would be made openly available on the HP4ALL website (www.hp4all.eu) and the TUS Research, Development, and Innovation YouTube page: (www.youtube.com/channel/UCh4kmrVj3PC73XGn1Ds3jTw)

There was a total of 14 installer training webinars with 282 attendees and 8 homeowner webinars with 119 attendees.

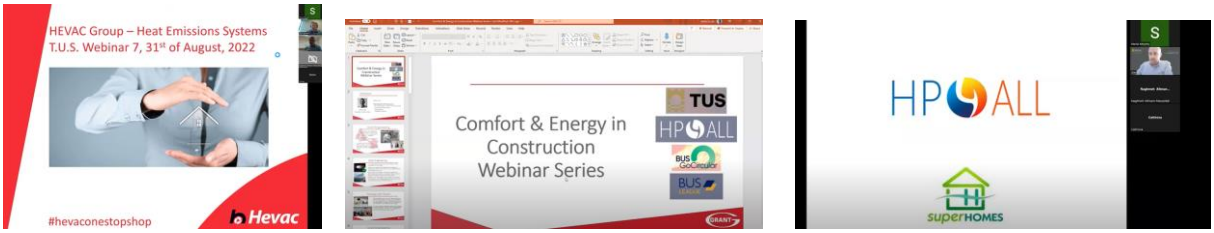

Figure 3 Training Webinars Screenshots

HP4ALL also engaged with a number of training providers, policy makers (SEAI Retrofit grants), specifiers, consulting engineers and installation companies to learn more about their perspective on the matter with the aim of highlighting the strengths and weaknesses of the current approach in relation to its effect on operating efficiency and the level of understanding of these systems enjoyed by their end-users. From these conversations the learning outcomes of the online training was created and rolled out.

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HP4ALL also actively engaged with all actors in the supply chain and with end users to develop an understanding of the key weaknesses in project delivery mechanisms and develop together education and training materials. As independent brokers, HP4ALL could engage with the suppliers of large heat pumps through our contact with the Heat Pump Association of Ireland. From these conversations the issues that surround the large-scale heat pump deployment is that architects, consulting engineers do not have the knowledge in order to consult with designers and Mechanical and Electrical installation contractors do not have the expertise to carry out the works this leads to the large-scale heat pump installations are primarily done by RAC companies and some heat pump suppliers that cannot keep up with the growth of the market.

The deployment of non-domestic heat pumps also faces significant challenges in public buildings. Heat pumps are supplied with comprehensive control systems that are capable of managing a wide range of equipment within the setting of small to medium non-domestic buildings. These control systems are often under-utilised or worse, over-ridden by inappropriate or incorrect integration with Building Management Systems or hydraulic arrangements that may also involve fossil fuel boilers. The task is further complicated when projects require public procurement as the design documentation cannot specify any particular manufacturer or installation company.

Communication strategy and channels

As a third level education organisation, TUS has a very good connections with industry, whether it be from past students to former research and development projects with industry leaders, TUS has a large and passionate network of professionals in the built environment / construction sector.

TUS is a trusted source of training in many fields including sustainable energy and the energy transition, with multiple courses and special purpose awards ranging from level 6 to PhD.

The main communication channels used in the context of the pilot activities were:

Table 4 Communication Channels in Irish Pilot

Which channel	How were they used
TUS website, RDI department	dissemination of the project and knowledge hub
HP4ALL website	Knowledge Hub (updated throughout the project), promotion of events
Targeted mailing to Industry and Local Authorities	reaching specific target groups with relevant information and training opportunities

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Word of mouth	Local Authorities would recommend TUS to other Local Authorities to receive the heat pump training we created.
Tradeshows, CLIMATE Action Days and Estate events	dissemination of the Homeowner HP leaflet, advice service, information on subsidies, presentations on heating and cooling with HPs, subsidies, etc.

Main outcomes and outlook

From the Irish pilot it is clear to see that public bodies such as local and regional authorities have a huge part to play in ensuring the energy efficiency of heat pumps is realised. As the mass deployment of heat pumps coming from the public sector is more easily influenced than that of the private sector, however the influence the public sector on the private sector cannot be understated. Local and regional Authorities through their procurement and tendering processes can influence the workforce by creating a demand for qualified installers. The first step to ensuring that improved skills are introduced into the procurement and tendering processes is by educating the local and regional authorities to an adequate level and to inform them of the latest developments in the sector through regular training and energy advice. HP4ALL provided training to Local authorities in a first attempt to provide the staff that will be responsible for installations the information they need and also a source of further information if required.

For large scale heat pump installations, the market is still in its infancy and the skills required to design install and deploy these systems on a larger scale will require more in-depth upskilling and re-skilling opportunities, which include training facilities that can cater to larger installations.

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4 Pilot Region of Upper Austria

Background / starting point

Austria:
The HP market in Austria started taking off in the 1980s and has experienced steep growth since the turn of the century – in parallel with the introduction of energy-efficient buildings with low heat demand. In 2021 (around the starting of the pilot activities), there were over 350,000 HPs in operation. Almost 32,000 new systems were installed in 2020, a growth of 8% compared to 2019. Of these systems, 78% are used for space heating, 21% for hot water, 1% for room ventilation and less than 1% in industry. The strongest growth is seen for HPs for space heating up to 10 kW – which currently account for about 40% of new systems installed each year. Overall, the HP sector in Austria (including production, trade, installation, and monetary value of heat) represents a market of 870 million Euro/year, provides over 1,700 full-time jobs and exports more than 15,000 HPs annually (Source: Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology, Report "Innovative Energietechnologien in Österreich Marktentwicklung 2020").

Upper Austria:
Upper Austria is the most industrial of Austria's 9 regions and is responsible for 25% of the country's exports. It covers an area of ca. 12,000 km^2 and is home to 1.5 million inhabitants. Since the mid-90s, the regional government, supported by the regional energy agency OÖ Energiesparverband (ESV), has been following a strategic and long-term vision in the face of the changing global energy world. Well-established policy structures to tackle the energy transition are already in place. The region's multi-faceted approach is based on a combination of regulatory measures ("sticks"), financial incentives ("carrots") and information and training activities ("tambourines").

In Austria, due to the country's federal structure, building legislation and the implementation of the European Buildings Directive are regional matters. This offers the regions flexibility in choosing which measures to apply to achieve energy and climate targets. In Upper Austria, legislation for buildings and heating and cooling systems are strategically used to drive innovation by regularly updating them towards higher efficiency and lower emissions. Funding programmes that target the various steps of the innovation process are also strong tools. Different programmes support R&D, market introduction of new technologies and their subsequent mass deployment.

As a result of these measures, already 71% of the electricity, 60% of all space heating and 31% of the primary energy in the region come from renewables. Through significant increases in energy efficiency and renewable energy, greenhouse gas emissions from buildings have been reduced by 39% in 10 years.

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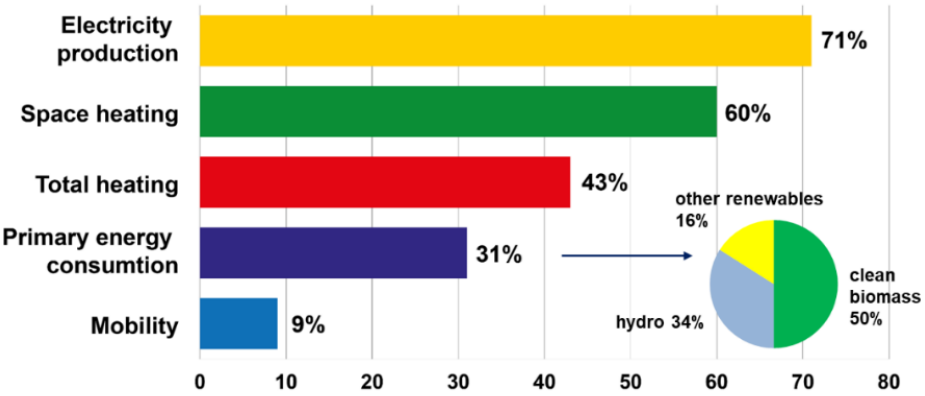

Figure 4 Renewable shares in sectors in Upper Austria (Source: OÖ Energiesparverband)

The heat pump market for small, residential applications is already quite well developed. Around 11% of Upper Austrian dwellings are equipped with heat pumps, and the trend is increasing. New HP trends that have emerged in recent years include combined systems (heating and cooling) and hybrid systems (biomass and heat pump systems).

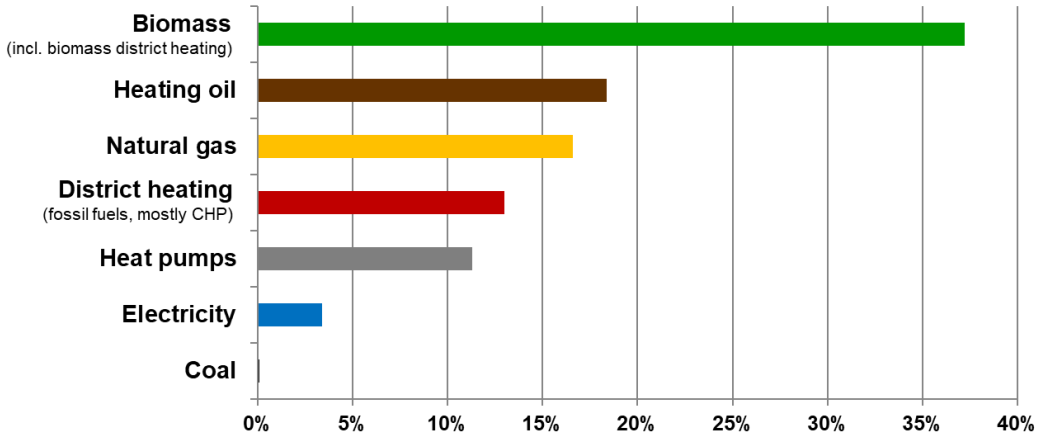

Figure 5 Heating % of all dwellings in Upper Austria (Source: OÖ Energiesparverband)

Scope and key objectives

The Upper Austrian pilot was primarily, but not exclusively, focussed on developing the market for mid-/large-scale HP applications (commercial and industrial) in the region. This market was and is still at a relatively early stage in Upper Austria and faced with the related challenges. These include especially low levels of awareness of promising application possibilities among planners and users, and the lack of required skills by planners and installers. There are currently very limited information activities on larger-scale HPs.

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The main objectives of the pilot activities included:

- boost demand for mid-/large-scale HPs for companies
- awareness raising of promising and economically feasible application possibilities (among planners and users) and related skills
- increased information activities and training on larger-scale HPs

The overall scope of the pilot was to provide options for phasing out fossil-fuels in companies through the up-take of other renewable energies, such as HPs. Since Upper Austria has a long tradition in biomass technologies, project activities targeted both solutions.

Additionally, some activities focused at supporting HP innovations and the upskilling and demand for skills in the residential sector. This was based on ESV's experience and portfolio of information and awareness raising activities.

The pilot's focus and activities were developed to make best use of current "opportunities" in the region. The government's decarbonisation target (which includes eliminating fossil-fuel heating) is a key driver for the HP market. The activities and policy framework put in place to achieve these goals support the development and implementation of high efficiency and renewable solutions – including heat pumps. Additionally, increased prices and fossil fuels drove market development.

Several funding programmes are presently available for the residential and non-residential sector. This is quite helpful for market development. Strict efficiency criteria in funding programmes ensure that only high-quality technologies are installed and that the further development of the HP sector contribute to energy efficiency and renewable goals. Efficiency criteria include:

- performance requirements, based on a seasonal efficiency calculation
- strict noise limits for air-source HPs
- refrigerant Global Warming Potential (GWP) must be below 1,500; maximum flow temperature of the heat distribution system: 40°C
- must be combined with 3 kW PV, 4 m² solar thermal or green electricity contract.

Up-skilling of planners and installers in the HP sector is important to keep up with technical innovations and overall increase in demand for HP, as well as to ensure the quality of new installations.

Companies have been showing increased interest in the energy transition and in using sustainable/renewable energy supply in recent years – partly driven by the government's decarbonisation target. Also, the possibility of using HPs for cooling and for using waste heat are important positive aspects for many companies. Among others, the pilot activities aimed at showing where and how this can be done and at increasing the uptake of HP technologies for these purposes.

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Target groups and stakeholders

The Upper Austrian pilot activities reached out to the following key target groups and stakeholders along the HP value chain.

Table 5 Targeted stakeholders in Upper Austria

Target group / stakeholder	Why they are important	How they were engaged
Companies	They are potential users of mid-/large-scale HPs. Finding forerunners and guiding them through their HP projects is key to getting the market going.	• awareness raising activities, training seminars and information events • energy advice and guidance in designing and implementing their HP projects. • information materials • existing installations used as best practice case studies
Planners, installers	Qualified professionals are crucial for achieving high-quality HP installations. Since the market for mid-/larger-scale HPs is still at an early stage, it is pivotal to increase knowledge and skills of these systems among planners and installers. Also, up-skilling professionals on small-scale systems is still important due to innovations in technologies.	• targeted training seminars • technical trainings for certified HP planners and installers • information materials
Energy advisors	Energy advisors are key actors in driving the energy transition in Upper Austria. They have direct contact with end-users and are a trusted source of information on technologies and energy efficiency solutions. Companies have access to subsidised energy advice services for decision making on energy projects. Homeowners have access to free energy advice services for their new build or renovation project. Energy advisors need to be well-informed about HP technologies and applications so that they can communicate this information to the end-users.	• targeted training seminars and continued education • information materials

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HP end-users for residential buildings	Residential HPs for space heating make up a large percentage of HP systems in Upper Austria. Increased knowledge and interest in HPs could help increase the number of systems even more.	• awareness raising activities and information events (ex: building and renovation tradeshows). • information materials • HP4ALL benchmarking tool

Activities and tools

Events:
Numerous awareness raising and training activities were organised with the aim of increasing knowledge and skills along the HP value chain. In addition to adding HP content to its current information services, ESV developed new events (e.g. in its Energy Academy), cooperated with organisations in the HP sector, and looked for and utilised synergies with already existing events. The initial targets of the pilot activities (5 events and 200 people trained) were significantly surpassed. Over 780 people (mostly professionals along the HP value chain, and end-users in companies) attended the events organised by the ESV, of which 285 people were trained. Additionally, over 10,000 private building owners received information on sustainable heating systems at the ESV's stands at 3 tradeshows.

Trainings held:

Table 6 Overview of Training held in Upper Austria

Description of event	Attendees	Date
Multi-day training course to become a certified HP planner and installer (together with AIT and Wärmepumpe Austria)	planners, installers, providers of building technology, property developers; 40 participants in total	3 courses: Nov.-Dec. 2020, Nov. 2020-Jan. 2021, Nov. 2022
Training on larger-scale HPs for professionals: a session organised by ESV in the context of a conference for the DACH region (Germany/Austria/ Switzerland) by Wärmepumpe Austria	manufacturers, planners, public bodies; 150 participants	16 September 2021
Training course on climate-friendly heating systems for residential buildings, with a focus on HPs	planers, installers, property developers, providers of building technologies, architects, energy advisers; 16 participants	11 November 2021
Training course on HPs for professionals in the construction sector	planers, installers, property developers, providers of building technologies, architects, energy advisers; 28 participants	1 February 2022

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Training course on renewable process heat for industry	energy managers in companies, facility managers, energy auditors, planers, installers, suppliers of energy products and services for industry; 19 participants	17 May 2022
Multi-day training of energy advisers (including a heat pump training session)	person interested in becoming energy advisers; 20 participants	June-July 2022
Training course on climate-friendly heating systems for residential buildings, with a focus on HPs	planers, installers, property developers, providers of building technologies, architects, energy advisers; 12 participants	22 September 2022

Awareness raising activities:

Table 7 Awareness Activities held in Upper Austria

Description of event	Attendees	Date
Workshop for companies on process heat and cold including presentations and interactive exchange	companies that already use or are potential users of HPs for process heat and cold; 15 participants	23 March 2021
Innovation forum on renewable heat	All stakeholders along the HP value chain; 178 participants	1 June 2022
Participation in tradeshows: dissemination of material and information, technical presentations	mainly for residential end-users and building owners; very high number of visitors, energy advice sessions carried out, and information brochures distributed: • overall 10,700 private building owners received information on sustainable heating systems at the ESV stands • over 300 people attended the 8 technical presentations on heating and cooling with HPs, organised by ESV at the tradeshow from 6-10 April 2022	3 tradeshows: 5-7 Nov. 2021, 6-10 April 2022, 4-6 Nov. 2022

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Figure 6 Photos from ESV training and events (© OÖ Energiesparverband)

Materials and tools:
A range of resources were developed, made available and disseminated to support the objectives of the pilot.

Table 8 Materials and Tools used in Upper Austria

What	For whom
Knowledge Hub: compilation of links to relevant existing information materials and tools, on HP4ALL and ESV website, including: – AdieuÖl campaign and related resources (Upper Austrian campaign on eliminating oil heating and switching to renewable heat) – Information guides on HPs, energy labelling of heating systems, NZEB new builds and refurbishment, building performance certificate, etc. – Information on subsidies available in Upper Austria – Best practice examples in companies, municipalities, and residential buildings	primarily targeted towards building-owners and end-users in the residential and non-residential sectors, planners, and installers

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Renewable process heat guide: guide with comprehensive HP information, case studies on renewable process heat, and guidance on energy efficiency; 3,000 copies printed (status Dec 2022: layout in progress) and electronic version available on the ESV website and HP4ALL Knowledge Hub	building owners and potential buyers and users of mid-/large-scale HP systems, mostly in companies and industry, planners, installers
Case studies: 11 best practice case studies (partly included in the HP guide) were developed and published, including 7 case studies on HPs in residential buildings	primarily targeted towards end-users in the residential and non-residential sectors, planners, and installers
Benchmarking tool: tool to calculate the "in-situ annual performance factor" for domestic units. Results as a scale green to red.	end-users of residential HPs
Residential HP Guide: in the context of the pilot activities, ESV reviewed and updated its information brochure on HPs in residential buildings; 6,000 copies printed and distributed and electronic version available on the ESV website and HP4ALL Knowledge Hub	end-users of residential HPs

Communication strategy and channels

As regional energy agency, the ESV has a very good understanding of the energy and business landscape in Upper Austria and is well placed to work across the value chain (from manufacturers to end-users). It has an extensive database of companies and their CEOs and facility managers. In addition to its wide portfolio of services to private households and actors in the residential sector, the ESV also has existing services for companies. These services were strategically used to support the objectives of the HP4ALL pilot.

In addition to being a trusted source of information on sustainable energy and the energy transition, the ESV manages funding programmes for the regional government. It has extensive experience in market transformation and with information campaigns, training, and in offering energy advice and facilitation services.

The main communication channels used in the context of the pilot activities were:

Table 9 Communication channels used in Upper Austria

Which channel	How were they used
ESV's own website	dissemination of the guide, information materials and benchmarking tool, promotion of events
HP4ALL website	Knowledge Hub (updated throughout the project), promotion of events

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ESV newsletter	dissemination of the guide, promotion of events, of ESV advice services and of available subsidies
targeted mailing to ESV's extensive database	reaching specific target groups with relevant information
ESV's existing services for companies: • energy advice services for companies • competence centre for funding programmes and information hub on ESV's website • Energy Academy	reaching building owners and potential buyers and users of mid-/large-scale HP systems, mostly in companies and industry, promotion and carrying out of trainings, dissemination of the guide, information materials and information on subsidies
communication through the business network Cleantech-Cluster (250+ energy and environment companies): website, newsletter	reaching companies in the energy and environment sector, promotion of trainings, dissemination of the guide, information materials and information on subsidies
tradeshows	dissemination of the Residential HP Guide, advice service, information on subsidies, presentations on heating and cooling with HPs, subsidies, etc.

Main outcomes and outlook

The Upper Austrian pilot activities aimed, among others, to develop the market for mid-/large-scale HP applications (commercial and industrial) in the region. Material was developed and activities were organised to overcome current challenges, namely low levels of awareness of promising application possibilities among planners and users, and the lack of required skills by planners and installers.

High-quality materials were produced and distributed (e.g., Renewable Process Heat Guide, case studies, Residential HP Guide). Around 15 events with 780 participants, of which 285 were trained, were held. Additionally, over 10,000 private building owners received information on sustainable heating systems at the ESV's stands at 3 tradeshows, and several thousands more through the ESV's energy advice services. This significantly surpasses the initial targets for the pilot.

The efforts put into the pilot activities will continue to positively impact the HP market in the region:

- The Renewable Process Heat Guide fills a large need by offering information on mid-/large-scale HP applications. Distribution will be continued in the future by ESV and its energy advisers for companies.
- Some of the new training events developed during HP4ALL are being offered again in the Energy Academy course programme 2022-2023

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- ESV will seek to continue its collaboration with AIT and keep offering the multi-day training course to become a certified HP planner and installer in Upper Austria
- Printed information material and the content of the training courses have been updated and improved, thus ensure continued high-quality information and training in the future
- The attractive case studies will continue to be distributed and serve as inspiration for replication in the residential and non-residential sectors

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5 Pilot Region of Andalusia/Spain

Background / starting point

General information:

a) **Area & population**: Spain is a sovereign transcontinental country and a member of the European Union. Its territory, with a total surface area of 505,944 km^2 and 47,450,795 population, is divided into seventeen autonomous communities, made up of fifty provinces, and two autonomous cities (Ceuta and Melilla). Spain is located both in the south of Western Europe and in North Africa, occupying most of the Iberian Peninsula in Europe.

b) **Weather**: Spain has a very diverse climate throughout its territory. The Mediterranean character predominates in almost all its geography: mild temperatures and abundant rainfall almost all year round except in summer. As one moves towards the centre and north of the country, the climate becomes more extreme: low temperatures in winter, high temperatures in summer and irregular rainfall (depending on geographical position). In general, the western communities receive more precipitation than the eastern ones. The north has an oceanic climate, characterised by abundant rainfall throughout the year, especially in winter, and cool temperatures.

c) **State of building stock**: according to the Recovery, Transformation and Resilience Plan published by June 2021, in Spain, around 45% of the buildings are pre-1980, a percentage that rises to 50% in the case of residential buildings, and a figure of 9.7 million houses. At the same time, it is estimated that around 1 million houses are in a poor, bad, or dilapidated state.

   Likewise, if the quality of existing buildings is analysed based on energy ratings, more than 81.0% of existing buildings are classified as E, F or G, in terms of emissions, with this percentage increasing to 84.5% of buildings in the case of energy consumption, which shows the significant potential for the energy refurbishment needed in Spain.

Spanish HP Market context:

According to the HP Eurobarometer (EurObservER, 2018) the Spanish HP Market is the third largest in Europe. In 2015, more than 35% of Spanish households and facilities were equipped with HPs with an average COP of 3.5. 95% of the HPs were used to provide both heating and cooling with the remaining 5% providing cooling only. Nearly 90% of units installed were in domestic settings whilst industry and commerce are lagging.

The Spanish climatization market experienced a turning point between 2014 and 2017, with 71% reported cumulative increase in HPs installed, and an 85% increase in RES share (Spanish Association of HP Manufacturers -AFEC Online Yearly Report 2019). From 2017 onwards the climatization market levelled off overall and the HP market continued to grow.

The year 2020 experienced a sharp reduction in HP installations (-19.5%) due largely to the COVID-19 outbreak. Installations decreased by a relatively modest 13% in the domestic

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sector, but the impact has been more severe in the industrial sector, which saw a 27% decline, and the commercial sector, which saw a 29% drop in installations. (AFEC Online Yearly report 2019).

According to the Spanish Institute for Energy Savings and Diversification (Spanish HP Market Report 2018), there is a clear untapped potential for HP usage in providing sanitary hot water applications and the use of geothermal RES to supply both residential and tertiary applications. Currently, the projected HP market share by 2030 ranges from 10% to 70% depending on the type and region of application. However, the political HP deployment targets for 2030 (reflected in the Spanish Strategy for Energy Efficiency in Buildings) are currently under revision and are likely to be more ambitious in the context of the renewed EU Commitments relating to climate change and the energy transition.

Scope and key objectives

The main goal of the Spanish pilot has been twofold:

- To untap the potential of the public sector as an outstanding driving demand force as a public promoter and as a key market influencer through legislative, administrative, and financial initiatives.
- To increase HP manufacturers competitiveness through a robust public sector influenced (launching customer) demand.

The target sectors were HP manufacturers, installers & public sector.

The scale of implementation were mainly public buildings (residential and non-residential) at local & regional level.

Challenges addressed and target groups:

- Facilitate the uptake of advance heat pump technologies by public authorities or public building owners as launching customers, as well
- Encourage product development by manufacturer clusters aligned with public bodies.
- Make more transparent the advantages and opportunities of heat pump technologies to public promoters, public authorities, installers, and citizens

Current "opportunities" to make use of:

The mobilisation of *Next generation EU funds* particularly through the *Renovation Wave* Initiative and related national schemes, particularly the *Housing Rehabilitation and Urban Regeneration Plan* with an associated budget of 6.280 M€, which also address the increase in the housing stock for social rent in energy-efficient buildings, contributing to the activation of this sector and the generation of employment and activity in the short term.

As a specific objective, The Plan sought to achieve energy rehabilitation rates significantly higher than the current ones that will allow to advance the fulfilment of the rehabilitation objectives contemplated in the Spanish Integrated National Energy and Climate Plan (PNIEC) and in the Long-term Strategy for Energy Rehabilitation in the building sector in Spain (ERESEE).

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These measures have an enormous potential in Spain due to the age and overall state of the public and private building stock, as well as for their capacity to decarbonize the economy, innovation in financial instruments and job creation, social cohesion, and urban and rural impact.

More specifically, relevant measures featured in the Plan included:

- *Rehabilitation Offices* ("one-stop shop") through the establishment of a regulatory framework to facilitate the management of aid, financing, and taxation, accompanying throughout the rehabilitation process.

- Improvement of the financing of rehabilitation actions through a *regulatory reform* and application of *specific financial instruments* to improve the financing of rehabilitation interventions, especially in neighbourhoods.

- *Strategic Rehabilitation Programmes* for economic and social recovery in residential environments that will consist of large-scale rehabilitation, regeneration, and urban renewal operations, in neighbourhoods or areas delimited according to their income level and that will have a special impact on vulnerable groups, included in the National Strategy against Energy Poverty.

- *Programme for the construction of social rental housing in energy-efficient buildings* that aims to support the development of a set of measures developed by the different public administrations to substantially increase the supply of housing for rent at an affordable price, with the collaboration of the private sector.

- The *Energy Rehabilitation Programme for buildings* (PREE), which promotes the energy rehabilitation of existing residential buildings and other uses, through energy saving and efficiency actions and the incorporation of renewable energies.

- *Regeneration and Demographic Challenge Programme*, aimed at public and private projects in municipalities and nuclei of less than 5,000 inhabitants to promote and deploy energy efficiency measures and technology investments in buildings and households, self-generation and consumption of renewable energies and deployment of electric mobility.

- *Programme for the Rehabilitation of Public Buildings (PIREP)*, which pursues the sustainable rehabilitation of the institutional public owned / rented building stock at state, regional and local level, with a clear exemplary and signposting vocation and the integrated character demanded by the Spanish Urban Agenda and the new European Bauhaus (sustainability, inclusion, and aesthetics), without losing sight of the main objective of energy saving.

- Programme for the design and implementation of *local action plans pilot projects* within the frame of the Spanish Urban Agenda to promote the approval of local action plans that, in addition to allowing the effective implementation of the Spanish Urban Agenda, exemplify, as pilot projects, the methodology, the process followed and the result to guide other local entities to make their own

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In addition, it is also noteworthy refer to the enforcement of both the new *Building Technical Code* and the *Technical Regulation for Thermal Installations*.

Target groups and stakeholders

The target groups and stakeholders for the Spanish pilot were mainly public bodies and professional associations (researchers, manufacturers, designers, promoters, constructors, installers) whom CTA is in contact because of its recurrent activities as cluster, interface organisation, private funding body and RTDI promoter and performer.

Table 10 Targeted Stakeholders in Spanish Pilot

Target group / stakeholder	Why they are important	How they were engaged
Regional / local public housing promoters owning /renting social housing residential buildings	The *Andalusian Housing and Rehabilitation Agency* is the biggest public promoter in Spain (more than 86.000 households) and a key prescriber; its initiatives trigger off very important effects into the supply chain. Likewise, public province and local housing agencies and firms in the 8 provinces of Andalusia play a key role at such level	The HP4ALL package was presented, promoted and discussed in a dedicated session in Granada at the **ISVIS 2021 Congress on Social housing innovation and sustainability in November 2021** organised by the *Andalusian Housing and Rehabilitation Agency*.
Regional/local public entities owning / renting non-residential buildings	Energy efficiency measures adopted by these bodies have got a strong replication and prescription potential	The HP4ALL package was presented, promoted, and discussed in a dedicated high-level policy and institutional event held by CTA on **Opportunities and needs in sustainable building stock energy supply - the role of HPs** in Seville in May 2022
Policy makers (State & Regional Ministries and Local Departments)	Policy makers set the financial, administrative, and legal context, provide relevant information, and have decision making power	
Professional Associations and key representative entities thereof: - Promoters - Constructors - Researchers - Manufacturers - Installers/technicians	Value chain segment prescribing and leveraging aggregated effect	The HP4ALL package was presented, promoted and discussed in three dedicated professional sector led events and sessions: -**Joint CTA/AFAR (Andalusian Heat Pump Manufacturers Association) event in Lucena (Cordoba) in May 2022**

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		-**Rehabiliving Congress in Seville in October 2022** **-II Spanish Heat Pump Forum in Cordoba in October 2022, specifically focused on education, training and skills opportunities and needs.**

Activities and tools

In addition to the abovementioned 5 events (2 oriented mainly to the public demand side and 3 to the value chain as planned), 3 yearly bilateral meetings -9 in total- (last quarter of 2020, 2021 and 2022) have been held with each one of the following professional associations to get feedback on the knowledge hub, benchmarking tool and awareness campaign materials:

- *AFAR (Andalusian Heat Pump Manufacturers Association)*
- *ATEAN (Andalusian Heat pump Designers and Technicians Association)*
- *FADIA (Andalusian Heat Pump Installers Association)*

Communication strategy and channels

The communication and dissemination activities have been conducted mainly through:

- HP4ALL's official website and social medias.
- CTA's official website and social medias.
- Targeted mailings: CTA's network and newsletter (reaching more than 2000 registrants).
- Press work: related articles published by CTA on social medias and press release prepared by HP4ALL communication leader.
- Dedicated events (see above)

Main outcomes and outlook

- Andalusian public administration more aware of HPs opportunities and advantages and more prone to include HP specifications / demand in public buildings investments and acquisitions (non-residential), promotions (residential) and subsidies (for private investment), particularly through green and innovation procurement bids benefitting from NGEU funds co-financing.

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- Andalusian HP value chain -including the public sector- more committed to reinforce, give visibility and coordinate its education, training and upskilling / reskilling efforts as well as more integrated and proactive in view of the HP life cycle (promotion, manufacturing, design, procurement, installation and maintenance), as expressed from their side in the different events, roundtables, sessions and bilateral meetings held.

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