NOTEBOOKS

001

METHODOLOGY USED IN HEAT PUMP STATISTICS

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STATISTICS

GOBIERNO DE ESPAÑA
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IDAE Instituto para la Diversificación y Ahorro de la Energía
AFEC Asociación de Fabricantes de Equipos de Climatización

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1 Background

The European Parliament and the Council, through Directive 2009/28/EC (RED I) of 23 April 2009, on the promotion of the use of energy from renewable sources, determines that the calculation of the share of energy from renewable sources shall take into account the ambient aerothermal, geothermal or hydrothermal energy captured by heat pumps.

Consequently, it is necessary to determine and characterise the Spanish heat pump stock, as a preliminary step to determining the renewable ambient energy contributions to be reported to Eurostat. The calculation should be based on the Commission Decision of 1 March 2013, which lays down the guidelines for the calculation by Member States of renewable energy from heat pumps of different technologies.

Among the different possible methodologies, in 2014 the IDAE chose to carry out a survey on the equipment and use of heat pumps using a representative sample of all households and establishments in Spain, which could provide answers to the different questions raised in this regard. The results of this survey can be consulted in the document Study of the heat pump fleet 2014 published on the IDAE website.

Based on the information provided by the survey carried out, other actions have subsequently been carried out to keep the data for 2014 up to date. Thus, in 2019 the IDAE signed a Collaboration Protocol with the Association of Air Conditioning Equipment Manufacturers (AFEC) to jointly update the statistics on aerothermal heat pumps by developing an ad-hoc application. This incorporates, among other information, the global data from the heat pump market statistics available to AFEC.

On the other hand, for the geothermal and hydrothermal heat pumps statistics a census approximation study was carried out, which has been completed at the beginning of 2021.The survey carried out in 2014 showed the low penetration of these technologies and justified the need to carry out a statistical operation based on a census of the existing installation.

This document sets out the methodology used for the annual compilation of the heat pump statistics in accordance with that established in RED I and following the guidelines of Commission Decision of 1 March 2013.

2 Statistical operations

The heat pump statistics are carried out following the guidelines established by the Commission Decision of 1 March 2013 according to which three types of heat pumps are distinguished: aerothermal, geothermal and hydrothermal. They are located in the two types of climate zones defined by EUROSTAT for Spain in its SHARES[1]tool, warm climate and medium climate and medium climate.

The statistics are based on the Study of the heat pump stock 2014 and the "Statistical study of geothermal and hydrothermal heat pumps 2018". The "Study of the heat pump fleet 2014" was carried out through a specific survey. The low market presence of geothermal and hydrothermal heat pumps made necessary to carry out a new statistical operation, this time of a census type, called "Statistical study of geothermal and hydrothermal heat pumps 2018" in order to adequately cover this type of technology.

Two different methods are used for the annual updates: the method based on annual equipment sales for aerothermal heat pumps and the census approach for geothermal and hydrothermal heat pumps.

The different operations and methodologies used in the framework of heat pumps statistics are described below.

2.1 Aerothermal heat pumps

This statistical operation is based on two distinct actions: the 'Study of the heat pump fleet 2014' and the annual update system designed between AFEC and the IDAE. The study investigated all heat pump technologies considered by Directive 2009/28/EC (RED I) and the Commission Decision of 1 March 2013 regardless of whether or not they could be considered as renewable. The assessment of the energy supplied by heat pumps was carried out only for those heat pumps considered as renewable, according to the criteria set by the mentioned Directive and Commission Decision.

2.1.1 Type of statistical operation

The investigation unit to which the data referred was the heat pump installation.

The reporting unit was each of the premises or establishment of public companies and public bodies together with all Spanish households.

The methodology used to collect the information was the preparation of a survey using specific questionnaires. After receiving the results of the survey, the IDAE's Planning and Studies department carried out the necessary data processing tasks to incorporate the information into the Bdfer[2] database of renewable energy installations.

1 The SHARES tool focuses on the harmonised calculation of the share of energy from renewable sources between EU Member States. The legal basis for the implementation of all calculations and methodologies is based on Directive 2009/28/CE (RED I) and also on Regulation (EC) N.º 1099/2008.

2 Bdfer: Database for the promotopn of renewable energies (Bdfer, for its initials in Spanish). This is the tool used to register renewable energy installation in Spain. This database is maintained by the IDAE in close collaboration with the Autonomous Regions.

Subsequently, the aggregated output tables were prepared and validated, in order to respect the protection of statistical confidentiality provided in Law 12/1989 on the Public Statistical Function which have been used both in the submission of the annual AIE/EUROSTAT/UNECE questionnaire on renewable energies and waste and for completing the SHARES questionnaire, as far as heat pumps are concerned, and in the publication of information on the IDAE website.

2.1.2 Sample design

The sample design for the survey had the following characteristics:

- **Spatial or geographical scope**: the entire Spanish territory segmented by SHARES and SES[3] climate zones.

- **Research technique**: multi-channel via telephone, e-mail, etc.

- **Universe**: the professional sector (industry, activities ancillary to transport and commerce-services) and the residential sector (households).

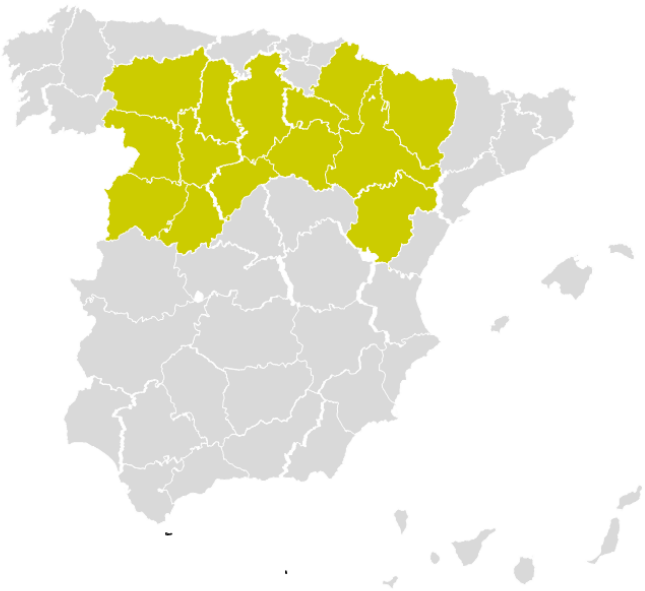
- **Information units**: each of the premises or establishments of the companies or public bodies together with the totality of Spanish households.

  For the sample units, the informants were those persons who were able to provide information on; firstly, the availability or not of heat pumps (both in the establishment and in the home) and, secondly, who had knowledge of the characteristics and use of heat pumps.

  This information, in the case of the non-residential sectors, was provided both by the organisation itself, generally through its maintenance service, and by the external company in charge of checking and maintaining the installations.

- **Sample**: application of stratified random sampling according to two axes, sectorial and geographical.
  - Sectorial axis: 4 strata corresponding to the sectors of industry (including energy), activities annexed to transport, commerce, and services and residential.
  - Geographical axis: distribution of the territory in climatic zones, on the one hand, attending to the specifications established in the EUROSTAT *SHARES Tool Manual,* which disaggregates Spain into the climatic zones of warm and medium climate, and, on the other hand, according to the specifications of the SES climatic zones, which segment Spain into the Atlantic-North, Continental and Mediterranean climatic zones.

3 The SES climatic zones are used by the IDAE's Planning and Studies department in its Sectoral Energy Monitoring studies.



Average climate	Warm climate
Avila	Alava
Burgos	Albacete
Huesca	Alicante
La Rioja	Almeria
Leon	Badajoz
Navarra	Baleares
Palencia	Barcelona
Salamanca	Caceres
Segovia	Cadiz
Soria	Castellon
Teruel	Ceuta
Valladolid	Ciudad Real
Zamora	Cordoba
Zaragoza	Cuenca
	Gerona
	Granada
	Guadalajara
	Huelva
	Jaen
	Las Palmas
	Lleida
	Madrid
	Malaga
	Melilla
	Murcia
	Orense
	Seville
	Tarragona
	Tenerife
	Toledo
	Valencia

Figure 1 SHARES climate zones: assigned provinces

ATLANTIC-NORTH	CONTINENTAL	MEDITERRANEAN
Asturias	Alava	Alicante
Cantabria	Albacete	Almeria
Guipuzcoa	Avila	Balearic Islands
La Coruña	Badajoz	Barcelona
Lugo	Burgos	Cadiz
Pontevedra	Caceres	Castellon
Vizcaya	Ciudad Real	Ceuta
	Cuenca	Cordoba
	Guadalajara	Gerona
	Huesca	Granada
	La Rioja	Huelva
	Leon	Jaen
	Lleida	Las Palmas
	Madrid	Malaga
	Navarra	Melilla
	Orense	Murcia
	Palencia	Seville
	Salamanca	Tarragona
	Segovia	Tenerife
	Soria	Valencia
	Teruel	
	Toledo	
	Valladolid	
	Zamora	
	Zaragoza	

Figure 2 SES climate zones: assigned provinces

- **Sample size**: 8,087 interviews.
- **Sampling error**: ± 1.1% for overall data, and < ± 5% per stratum at 95% confidence level and p=q= 0.5.

2.1.3 Content

The content of the operation was as follows:

- **Population**: heat pump installations throughout the country.
- **Spatial or geographical scope**: SES and SHARES climate zones.
- **Reporting period**: 2014.
- **Research variables**:
    - Heat pump capacity (power).
    - Coefficient of performance of heat pumps (COP).
    - Operating hours of the heat pumps.
    - Heat pump thermal output (Q_{usable}).
    - Estimated average seasonal performance factor of the heat pumps (SPF).
    - Renewable energy supplied by heat pumps (ERES)**.**
- **Classification variables**:
    - Type of heat pump: aerothermal, geothermal, and hydrothermal.
    - Subtype of heat pump: ground-to-air, ground-to-water, water-to-air, and water-to-water.
    - SHARES climate zones: medium climate and warm climate.
    - Sector: industry, commerce and services, activities ancillary to transport and residential.

2.1.4 Questionnaires

Two model questionnaires were used; a simpler one, aimed at users in households and small establishments, and a slightly more complex one with technical information for large establishments. Both model forms were tested to verify the appropriateness of their structure, content and size.

Both questionnaires can be found in Annex I and Annex II.

2.1.5 Validation of questionnaires

Quality control of the questionnaire models was carried out through two validation tests, one from a theoretical-technical approach and the other from a practical perspective. Specifically, a piloting and a telephone pre-test were carried out.

- **Piloting:** validation of the questionnaire from a technical point of view. It was carried out with experts in the design and processing of questionnaires and with professionals in the field of alternative energy and heat pumps. The suitability of the questionnaires to obtain information required in the research and whether the questions were appropriately designed were assessed, among others.

- **Practical pre-test**: practical verification of the interview in aspects such as effective duration, understanding by the interviewees of all the concepts and degree of participation/acceptance of the survey. The pre-test was carried out by telephone as this was the basic field data collection technique used. The pre-test was carried out separately for each of the questionnaires.

2.1.6 Cleaning baseline data

The cleaning prior to the recording of the questionnaires was carried out manually by agents trained for this purpose, in order to ensure that the questionnaires contained all the necessary information and that the information was consistent. The following controls were put in place:

- **General control of the status of the information**: to verify that the data were placed in the corresponding spaces or boxes and that they did not give rise to different interpretations.

- **Comprehension check**: verify that the different questions in the form are well understood.

- **Analysis and treatment of non-response**: together with the completeness check, non-response in the interviews was reviewed and analysed. The minimum fields considered to be compulsory were established in order to consider the information collected in the interview as valid and not to discard it due to lack of information. The minimum compulsory information considered was the surface area of the establishment or household, number of air-conditioned rooms, power and brand of the heat pump and year of purchase or commissioning.

  One of the most important activities at this point was the consultation of air-conditioning equipment sales catalogues, obtained from the manufacturers. From this consultation, complete and reliable information was obtained on the technical characteristics of the different heat pumps on the market, which complemented the information provided by the interviewees.
- **Completeness check**: to verify that all mandatory data have been answered or, if not, that there is a reason for non-completion.

On those occasions in which inconsistencies were detected in the data provided by the information unit or in situations that were considered to be of incidence, a new contact was made with the interviewee so that the information could be rectified or clarified.

The information collected was subjected to additional cleaning processes for the different profiles involved in the research in order to **ensure a high percentage of reliable data**.

The main checks carried out in this process were:

- **Area of the establishment/household**: sum of the area of the rooms not exceeding the area of the establishment/household.

- **Air-conditioned area**: not greater than the total area of the establishment's living quarters.

- **Number of individual heat pumps**: not more or less than the number of total pumps indicated.

- **Heat pump used as auxiliary heating system**: if available, the other heating system had to be indicated.

- **Hours of operation**: not having the hours of operation of the heat pump for cooling and/or heating when it was previously indicated to be used for this purpose.
- **Ratios of thermal power ratings**: both cooling and heating, considering the types of pump technologies and the sector where they are used.
- **Ratios of electrical power**: depending on the type of interviewee and heat pump.
- **Nominal COP ratios**: as a function of the collected powers.
- **Power/surface area ratio**: power per unit area in air-conditioned enclosures.

2.1.7 Validation of source information

After recording the questionnaires, the information validation process was mainly carried out automatically, although there were certain validation tasks, such as the processing of information received by fax or e-mail channels, in which validations had to be carried out manually.

The validation checks that were applied were as follows:

- **Control of the number of variables**: verification of the number of variables existing in the file; which will be made up of the original variables from the interviews plus all the secondary variables derived from the filtering and processing of information.
- **Control of the number of records**: validation of the total number of records that make up the database, which must coincide with the total number of elements interviewed and that there are no missing or surplus information units in any of the strata of the sample.
- **Range and network controls**: validation of the internal coherence of the completion and recording of the information in each questionnaire.
- **Cross-checks**: determination of the consistency of information by contrasting relationships between information from two or more fields.

2.1.8 Population-based elevation of data

For the elevation of the sample data to the population, the following methodological processes and elevation algorithms were applied.

The first of the variables considered for the elevation was the type of sampling used to obtain the sample; stratified random sampling, taking as stratification variables the climate zone, with its two types, and the sector, with 4 subsectors, resulting in a total of 8 strata:

Individual $i=1 \rightarrow i=n_h$

Stratum $h= 1 \rightarrow h=8$

The observation distribution of each sample unit would be;

$$Y_{ih} \begin{cases} 1 \text{ if individual i of stratum h has a pump.} \\ 0 \text{ if individual i of stratum h does not have a pump.} \end{cases}$$

Where:

n_h= sample size of stratum h

N_h= population size of stratum h

n sample size = $n_1+n_2+\ldots+n_8$ = n =$\sum_{h=1}^{8} nh$

N population size= $N_1+N_2+\ldots+N_8$ = $\sum_{h=1}^{8} Nh$

Firstly, the total number of establishments and households with at least one heat pump was determined and, thus, the sample proportion of establishments/households with a heat pump could be calculated for each stratum (p_h):

$$p_h=\frac{\sum_{i=1}^{n_h} Y_{ih}}{n_h}$$

And this percentage of the size of each of the population strata relative to the size of the total population was applied to estimate the percentage of establishments/households with a heat pump for the total population ($\hat{p}_{st}$).

$$\hat{p}_{st} = \sum_{h=1}^{8} \frac{N_h * p_h}{N}$$

The estimate of the total number of households/establishments with a heat pump ($\hat{s}_t$ would therefore be as follows:

$$\hat{s}_t=\sum_{h=1}^{8} N_h * p_h$$

Secondly, the average number of heat pumps per households/establishments with a pump in each of the strata was obtained ($\overline{B_h}$). From these averages, applied as a population estimator to the number of households and establishments with a pump, the heat pump fleet is estimated as follows:

Where $\overline{B_h}$ is the mean number of heat pumps in stratum h in households/establishments with a pump;

The total number of population-raised pumps ($\hat{B}_t$) would be:

$$\hat{B}_t = \sum_{h=1}^{8} \overline{B}_h * N_h * p_h$$

Therefore, the estimation of the total population of households/establishments with heat pumps, as well as the number of appliances is a result of the application of the population estimator for stratified random sampling.

2.1.9 Statistical exploitation of data

The statistical information obtained, segmented by year of commissioning, climate zone, sector, application and technologies, was as follows:

- Heat pump capacity (power).
- Coefficient of performance of heat pumps (COP).
- Operating hours of heat pumps.
- Thermal output of heat pumps (Q_{usable}).
- Estimated average seasonal performance factor of the heat pumps (SPF)
- Renewable and non-renewable heat pump fleet.
- Power of renewable heat pumps.
- Equivalent hours of operation.
- Renewable energy supplied by heat pumps (E_{RES}).

Although most of the analysis parameters are obtained directly from the survey, others are the result of a~~u~~n inference from measured values following standardised guidelines. Thus, for the determination of certain parameters (SPF and E_{RES}) external data sources were used to verify some of the information collected and to provide a standard framework for the statistical treatment of the data:

- Directive 2009/28/EC (RED I) and Commission Decision of 1 March 2013: used for the determination of renewable energy supplied by heat pumps.

  Following the provisions of both, the minimum SPF of electrically driven heat pumps to be considered as renewable energy is 2.5 and the E_{RES} calculation formula is:

  $$E_{RES} = Q_{usable}\left(1 - \frac{1}{SPF}\right)$$

  The thermal output of heat pumps (Q_{usable}) being the estimated total useful heat provided by heat pumps that exceed the above-mentioned SPF threshold.

- Recognised document RITE *Seasonal average performance of heat pumps for heat production in buildings*: this document was used to infer the SPF value from the COP reported by the interviewee as the true SPF value could not be obtained in the absence of actual SPF measurements. According to this document, the SPF is calculated by multiplying the nominal COP of each heat pump obtained in the interviews by a weighting factor (PF) and a correction factor (CF).

  $$SPF = COP_{nominal} \times PF \times CF$$

  Where:

  PF: weighting factor that considers the different climate zones of Spain established by the Technical Building Code (CTE, for tits initials in Spanish), which has been calculated with an exclusively technical methodology using objective values and existing Recognised Documents.

  CF: correction factor that considers the difference between the distribution or use temperature and the temperature for which the COP has been obtained in the test. For the purposes of the study, it is considered that there is no difference between these temperatures and, therefore, this factor is not applied.

To obtain the PF of each heat pump, the values form the above-mentioned Recognised Documents were taken and are shown below:

	Weighting Factor (PF) per climate zone				
Heat pump energy source	**A**	**B**	**C**	**D**	**E**
Aerothermal. Centralised equipment	0.87	0.80	0.80	0.75	0.75
Aerothermal. Individual split type equipment	0.66	0.68	0.68	0.64	0.64
Hydrothermal	0.99	0.96	0.92	0.86	0.80
Geothermal closed circuit. Horizontal heat exchanges	1.05	1.01	0.97	0.90	0.85
Geothermal closed circuit. Vertical heat exchanges	1.24	1.23	1.18	1.11	1.03
Geothermal open circuit	1.31	1.30	1.23	1.17	1.09

Source: Recognised Document RITE Seasonal Average Performance of Heat Pumps for Heat Production in Buildings. Table 4.1.

Table 1 Weighting Factor (WF) for heating and/or DHW systems

In addition, the following hypotheses were made:

- Climate zones A, B, C, D and E of the CTE: each province is assimilated to its province according to the CTE[4];
- For aerothermal energy, it is considered:
  - Split equipment:
    a) In the home: Less than 5 kW of power.
    b) Rest: Less than 12 kW of power.
  - Centralised equipment: Rest.
- For geothermal energy, all cases will be considered as a closed-circuit installation and vertical exchanger.

2.1.10 Dissemination of results

A Summary of the Study of the Spanish Heat Pump Fleet, with aggregated data for the SES climate zones used by the IDAE's Planning and Studies department in its research, is published on the IDAE's website.

4 *Technical Building Code. Basic Document DB-HE 'Energy Saving'. Appendix B. Climate Zones.*

2.1.11 Annual information update

Given the need for up-to-date data on the renewable contribution of the aerothermal sector, a collaboration protocol was established between the IDAE and the Association of Air-Conditioning Equipment Manufacturers (AFEC, for its initials in Spanish). This resulted in the design and implementation of an application based on a spreadsheet, called RENAERO, to estimate the amount of renewable energy used in heating mode by the fleet of aerothermal heat pumps installed in Spain. It is based on the values of the 'Study of the Heat Pumps Fleet in Spain 2014' carried out by the IDAE and the overall data obtained from AFEC's Market Statistics. An outline of the methodology implemented in RENAERO can be seen in Figure 2.3.

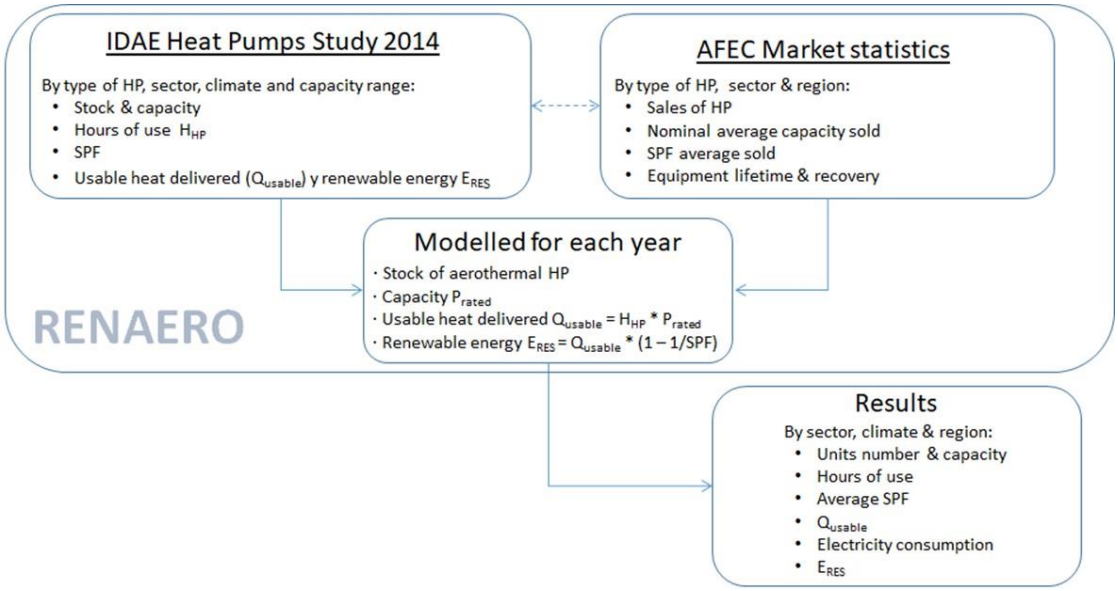


Figure 3 Methodological outline of the RENAERO tool

The method implemented in the application is based on the results of the 'Study of the Heat Pumps Fleet in Spain 2014' carried out by the IDAE, providing information on: number of units, power, annual operating hours, thermal production, COP, SPF and contribution of renewable energies, segmented by sector (residential, commerce and services, activities ancillary to transport and industry), and by SHARES climate zones (medium climate and warm climate).

The number of units in the heat pump fleet belonging to each sector is also taken from the same study, according to nominal power and type of system (air-to-air and air-to-water) in order to establish correlations between the figures for equipment placed on the market, whose values were obtained from AFEC, segmented by type and power, and the sector for which the equipment is intended.

Subsequently, coming from AFEC's annual heat pumps sales statistics, the following premises are incorporated into the application:

- Increase in the number of units installed by different segments grouped by type and power ranges. It is assumed that the units installed can be equated to the equipment sold.
- The power range and the average nominal power (PmN) of each segment. These PmN values are obtained from the average power value corresponding to the power range of the equipment in the corresponding segment, applying an estimated correcting value depending on the type of equipment and the amplitude of the range.

- SPF considered for the equipment in each segment. These values are obtained from data provided by manufacturers and correspond to values for medium climate.

- The proportion of equipment used as a heating system. The AFEC criterion is used, obtained based on the nature of the equipment and the usual use for which it is intended. This proportion corresponds to an overall coefficient of 51.2%, coinciding with the value resulting from the survey carried out by the IDAE as part of the 'Study of the Heat Pumps Fleet in Spain 2014'.

- An increase coefficient for the number of equipment sold by private labels. A 25% has been considered only in the case of equipment in the residential sector, to cover those equipment sales not included in the AFEC statistics.

- Proportion of equipment in each Autonomous Community, identified according to the type of climate; to be applied to both the number of units and the value of energy provided by the equipment.

With the aforementioned information, the fleet of equipment is established by sectors: industry, residential, commerce and services and activities ancillary to transport. This fleet, corresponding to that existing on 31st December of the year prior to that of the statistics, is calculated as follows:

$$PF_{A=PI_A+EI_A-ER_A}$$

Where:

PF_A: fleet at the end of year A
PI_A: fleet at the beginning of year A
ER_A: equipment retired in year A that becomes waste

The waste generated is obtained taking into account the useful lifetime of the equipment, estimated at around 20 years, as a proportion of the equipment fleet at the end of the previous year. For its part, the SPF value of the waste is based on information from the Study of the Heat Pumps Fleet in Spain 2014', differentiated by SHARES climate zones.

Once the increase for the fleet in each year has been determined, the annual thermal power (P_{rated}) is obtained as the product of the number of units by the average nominal power (PmN) of the equipment within each of the established segmentations.

From this point, the calculation method established in the Commission Decision of 1 March 2013 is applied to infer the thermal production (Q_{usable}) and the contribution of renewable energies (E_{RES}).

$$Q_{usable} = H_{HP} \times P_{rated}$$

$$E_{RES} = Q_{usable}\left(1 - \frac{1}{SPF}\right)$$

Where:

Q_{usable} = estimated total useful heat provided by heat pumps exceeding an SPF threshold of 2.5
H_{HP} = full load equivalent hours of operation
P_{rated} = thermal power of the installed heat pumps
SPF = estimated seasonal performance factor

2.2 Geothermal and hydrothermal heat pumps

As mentioned above, the 2014 Heat Pumps Study showed, among its results, a low penetration of geothermal and hydrothermal heat pumps in the Spanish air-conditioning systems market. This fact, together with the existence of highly atomised installations with numerous actors, justified the need to carry out a different statistical study, adapted to the situation of this type of installation. In this regard, a detailed statistical operation was carried out based on a census of the geothermal and hydrothermal heat pump installations existing in Spain.

2.2.1 Type of statistical operation

The research unit to which the data refer is the heat pump installation.

The reporting units of the installation have been:

- Renewable Energy Departments of the Autonomous Communities.
- Departments responsible for the register of installations of the Regulation on Thermal Installations in Buildings (RITE, for its initials in Spanish) of the Autonomous Communities.
- Institute for Energy Diversification and Saving (IDAE, for its initials in Spanish).
- River Basin Organisations (Hydrographic Confederations, Internal Basins) and Islands Water Councils (CCHH, OOCC and CIA).
- Actors in the geothermal and hydrothermal value chain, including:
    - Equipment manufacturers and distributors.
    - Installation developers.
- Experts from the national geothermal and hydrothermal sector and industry associations.

The methodology for compiling the information was based on the preparation of a census through the exchange of specific information with the identified reporting units. After receiving the information, the IDAE's Planning and Studies department began the activities of correcting, cleaning and validating the information, as well as the phase of claiming the information not received.

Subsequently, the aggregated output tables are prepared and validated, in order to comply with the protection of statistical confidentiality established in Law 12/1989 on the Public Statistical Function, which will be used both in the submission of the annual AIE/EUROSTAT/UNECE questionnaire on renewable energies and waste and in the publication of information on the IDAE's website.

2.2.2 Content

The content of the operation is as follows:

- Research unit: heat pump installation.
- Technological scope:

	Technology	Means of exchange-distribution
Geothermal	• Heat pump	• Ground – to – Air • Ground – to – Water
Hydrothermal	• Heat pump	• Water – to – Air • Water – to – Water

Table 2 Technological scope

- Sectoral scope: the sectors and sub-sectors established by Commission Regulation (UE) 2017/2010 of 9 November 2017 are considered:

	Description[5]
End-consumption sectors	• Industry, transport, commercial and public services, residential, agriculture-forestry and fisheries.
Consumption in the energy sectors	• Includes energy consumed by the energy sector to support transformation activities.

Table 3 Sectoral scope

- **Geographical scope**: provincial.
- **Reference period of the information**: from the starting year 1992, as this is the first year for which reliable information is available, and up to the year 2018.
- **Research variables**:
    - Type of heat pump: geothermal or hydrothermal.
    - Date of commissioning.
    - Geothermal collection field: number of boreholes and average depth.
    - Type of installation: individual, collective, heating/cooling network.
    - Use of heat pumps: heating, cooling, domestic hot water (ACS, for its initials in Spanish) or any combination of the above.
    - Support system if available: oil boiler, gas, biomass, solar thermal, other.
    - Indoor air-conditioning distribution system: underfloor heating, fan coil, radiators, other.
    - Quantity and capacity of heat pumps.

5 As laid down in the International Recommendations for Energy Statistics (IRES) of the United Nations; EUROSTAT; IEA, OECD, and UNECE.

- Operating hours of heat pumps.
- Coefficient of performance of heat pumps: COP, EER, SCOP, SEER.
- Seasonal average heat pump performance factor for the heat pump (SPF or $SCOP_{net}$).
- Thermal output of heat pumps (Q_{usable}) differentiating heating, DHW and cooling.
- Electricity consumption of heat pumps.
- Renewable energy provided by heat pumps (E_{RES}).

- **Classification variables**:
  - Year: year of commissioning of the heat pump.
  - Type of heat pump: geothermal and hydrothermal.
  - Subtype of heat pump: ground-to-air, ground-to-water, water-to-air and water-to-water.
  - Climate zones: SHARES, SES and CTE.
  - Sector: 13 industrial sub-sectors and twelve branches of various uses.

Sector	Subsectors
Industry	Non-energy extractive industries, Food, beverages and tobacco, Textile, weather and footwear, Pulp, paper and printing, Chemicals (including petrochemicals), Non-metallic minerals, Iron, steel and foundry, Non-ferrous metallurgy, Metal processing, Transport equipment, Construction, Wood, cork and furniture and other industries.
Various uses	Public administrations, Agriculture, Fishing, Commerce, Education, Hospitals, Hotels, Restaurants, Offices, Residential, other services and public services and other unspecified activities.

Table 4 Sectors and sub-sectors of classification

All the contents of the operation are defined in the Terms of reference of the IDAE's Bdfer database, which are shared with the renewable energy departments of the Autonomous Communities and Autonomous Cities.

2.2.3 Cleaning baseline data

A manual pre-cleaning is carried out to ensure the completeness and consistency of the information. The following controls are carried out:

- **Completeness check**: verification of response to all mandatory data or, if not, that there is a cause for non-completion.
- **General control of the status of the information**: to verify the data are placed in the corresponding spaces or boxes and do not give rise to different interpretations.

- **Comprehension check**: to verify that the required information is well understood. For this purpose, the contents are checked against the Terms of reference of the IDAE renewable energy database.

- **Analysis and treatment of non-response**: review and analysis of the lack of response in the required information. The minimum fields considered mandatory to consider the collected information as valid are reviewed. In accordance with the Terms of reference of the renewable energy database, the minimum mandatory information relates to both the characterisation of the installation (geographic location and year of commissioning, type and sub-type of heat pump, sector, use) and energy (power, operating hours, COP). In the absence of a technical response, air-conditioning equipment sales catalogues are consulted to obtain complete and reliable information on the technical characteristics of the heat pumps on the market, supplementing the information provided by the Autonomous Communities and Cities.

When inconsistencies are detected in the data provided by the information unit or in situations considered to be of incidence, the information unit is contacted again for the modification or clarification of the information.

The information collected is subjected to a cleaning process in order to ensure a high percentage of reliable data. The main checks carried out during the cleaning process are as follows:

- **Operating hours**: it is checked that the operating hours are within the range in line with those established in the Commission Decision of 1 March 2013, otherwise the reporting unit is contacted in order to modify them or clarify the reasons for the difference.

- **Thermal power rating ratios**: depending on the sector and the use of the heat pump.

- **Electrical power ratios**: depending on the sector and the use of the heat pump.

- **Nominal COP ratios**: as a function of the collected power ratings.

2.2.4 Systematisation of information

After analysing all the information received on geothermal and hydrothermal heat pump installations, it was systematised according to the following protocol:

- Prioritisation of the use of information from official sources.

- Cleaning up and avoiding problems of duplicity of information.

2.2.5 Cleaning of information

A debugging of completeness, consistency and coherence errors was carried out with the corresponding reporting unit providing the registers:

- Consistency check: analysis of the collected fields and checking the nature of the information (text, numeric) for each collected field (consistency of reporting in the required fields).

- Coherence check: analysis and control of numerical variables to ascertain their level of reliability. Ratios are applied to check that the values are within reliable ranges, clarifying the reasons for the difference. It is applied to:
    - Hours of operation
    - Rated thermal power ratios: depending on the sector and the use of the heat pump.
    - Nominal COP ratios: as a function of the collected powers.
- Completeness check: analysis of the number of incomplete fields and whether these are embedded in other fields relating to other variables and/or in text fields.
- General error check: whether any other category of explicit errors is detected, e.g., typographical and/or spelling errors.

2.2.6 Detection of duplication

In a second phase, and in those cases in which the information received in the same geographical unit has come from different sources, a detailed *ad hoc* analysis has been carried out to avoid duplicity of installations. In the event that there was any doubt as to the duplicity of the installation, a conservative approach has been used to avoid maximising the number of existing installations. It should be noted that in no case has a census approach been mixed with a complementary register estimated in any other way in the same sector and/or geographical unit.

In a first filter, it was observed whether the databases provided by the different sources had an excluding field (e.g., owner of the installation or address of the installation). Where this first filter could not be applied, it was necessary to develop a cross-checking methodology based on the following fields, listed in order of priority:

- Municipality: if matches are detected, the field 'year' is analysed.
- Year: in coincidences of 3 consecutive years (year ±1) the field 'power' is evaluated.
- Power: two possibilities have been considered:
    - For installations where the brand/model of the heat pump is available, the power range indicated in the technical specifications of the catalogue has been used.
    - Where the heat pump model is not available, if the source of the information reports power ratings closes to those in the catalogue, the 'sector' field has been evaluated
- Sector: two considerations have been taken into account for this field:
    - If the installation indicates as sector 'Other unspecified activities' or 'No information', the comparison has been extended to all the sectors of the other database.
    - If the installation analysed identifies the sector, it has been crossed with the installations of the other data sources coinciding in sector, power, year and municipality, as well as 'Other unspecified activities' or 'No information' to guarantee that there is no duplicity under any of the unspecified sectors.

It should be noted that where duplicate installations have been identified, information from official sources has been included in the final census.

2.2.7 Information gaps: inference and assumptions made

In order to reduce data gaps, all fields that could include extra information or even certify that the information provided is correct (i.e., the fields 'Owner', 'Facility' and descriptive text fields). In addition, where the facilities have provided the address, we have checked that they belong to the sector indicated.

However, following this review of information, it has been necessary to apply a specific methodology to infer data where gaps have remained.

Gap	Method of solution
Sub-area	Only required for geothermal heat pumps. Check the 'description' field and assign the corresponding value.
Applications	Revision of the fields 'description' and 'location'. For cases where no information could be found, heating is assumed as the application by default.
Type of work	Revision of the field 'description'. This has been inferred on the basis of the fields 'technological field', 'autonomous community' and 'sector' provided by other sources of information.
Number of floors	By default, a value of "1" is adopted for all installations that have not reported this data.
Type of system	By default, individual, although a specific review of the addresses and powers of the residential sector has been carried out, in case it could be a collective system. The inference to the heat network was discarded as there is a very exhaustive register of these installations.
Internal distribution system	Review of the 'description' field. It is inferred from the information provided by the rest of the information sources, according to the fields 'type of work', 'technological scope', 'autonomous community' and 'sector', and their distribution patterns.
Collection system	It is inferred from the information provided by the rest of the sources according to the fields 'technological scope', 'autonomous community' and 'sector', and their distribution patterns.
Application technology	Review of the description field. If the collection system is open, the application technology 'open-circuit geothermal energy' has been chosen. If the collection system is closed, the following method has been used: - If there is information on wells and boreholes of more than 3 m, it is considered 'closed-circuit geothermal energy. Vertical heat exchangers'. If there is no information on wells, it is inferred from the information provided by other sources according to the fields 'technological scope', 'autonomous community' and 'sector, for vertical and horizontal exchangers.
Support system	Classification of the installations according to their maximum thermal power with the ranges < 50 kW, ≥ 50 kW and < 100 kW, ≥ 100 kW and < 500 kW, ≥ 500 kW and< 1,000 kW, ≥ to 1,000 kW. Review of the distribution of the support systems of the installations with information according to three hierarchical levels, firstly, the sector; secondly, the power ranges and, thirdly, the climate zone. This makes it possible to determine the frequency of each support system by sector, range and zone. - For those support systems for which no information was available, a distribution proportional to the distribution of known support systems has been inferred following each of the three previous classification levels (sector, range and zone). In those sectors where there was insufficient information disaggregated by climate zone, the inference was made solely on the basis of sector and power ranges.
COP	If the pump brand and model are known, the COP is obtained from the catalogue. Where this has not been possible, the COP has been inferred from the average COP sold per year and per pump type, from the 'Study of the Heat Pumps Fleet in Spain 2014. IDAE'.
Heat power	This data has been obtained from the catalogue of the installed equipment.
Cool power	When the pump model is known, the data is obtained from the manufacturer's catalogue. If the catalogue does not differentiate between cooling and heating capacity, it is assumed that both values are equal.

Gap	Method of solution
Heat operating hours	Where this information does not exist, the estimated annual hours of heating and DHW from the 'Statistical study of biomass, biogas, and waste thermal consumption in Spain. 2009. IDAE' are assumed, depending on the sector.
Cool operating hours	Based on information from the State Meteorological Agency (AEMET, for its initials in Spanish), the cooling degree days for the summer months (June, July, August and September) were obtained. These degree days were corrected according to the basic patterns of behaviour of the different sectors: residential, commercial and industry.
DHW operating hours	Analysis of the behaviour and use of DHW in the different sectors: - Residential: DHW demands per province (in kWh/person/year) have been calculated based on technical documents used for the Technical Building Code. For the rest of the sectors, the operating hours are adjusted according to the specific behaviour patterns of the different sectors.
Air-conditioned swimming pools operating hours	2,000 h/year are assumed based on interviews with different companies in the sector covering different climate zones. -
Sector	Identification of the sector on the basis of the fields 'owner', 'address' or 'description of the installation'. Where the sector could not be identified, the installation has been allocated to 'Other utilities and services.

Table 5 Method for the gap review

It is necessary to mention that the facilities in whose fields an inference or application of any of the above-mentioned hypotheses or assumptions has taken place have been coded with the following labels, in accordance with the methodology used by EUROSTAT:

- Label 'P' when the information has its origins in the reporting units.
- Label 'E' when the information has been estimated by the methodology previously exposed.
- Label 'M' when the information does not apply because it does not apply because it does not exist.

2.2.8 Contrasting phase of the resulting census

The first version of the census of installations, as well as the main magnitudes of installed power and energy supply were sent to each of the Autonomous Communities and Cities and to different actors in the sector. These include the Spanish Geological and Mining Institute (IGME, for its initials in Spanish), the Spanish Geothermal Platform (Geoplat) and companies of this platform, with the aim of contrasting the results.

This contrast reviewed the installations in certain Autonomous Communities and Cities, and the same organisations that had reported discrepancies with the initial results were contacted again to update the information.

2.2.9 Statistical exploitation of data

The statistical information obtained, segmented by year of commissioning, climate zone, sector, application and technologies, is as follows:

- Capacity of heat pumps (power).
- Coefficient of performance of heat pumps (COP).

- Operating hours of heat pumps.
- Thermal output of heat pumps (Q_{usable}).
- Seasonal performance factor of heat pumps (SPF).
- Renewable energy supplied by heat pumps (E_{RES}).

Although most of the parameters are obtained directly from the information units, others are the result of inference from measured values following standardised guidelines. Thus, the following external data sources are used for the determination of certain parameters, which enable the verification of part of the information collected and provide a standard framework for the statistical treatment of the data:

- Directive 2009/28/EC (RED I) and Commission Decision of 1 March 2013: used for the determination of renewable energy supplied by heat pumps.

  Following the provisions of both, the minimum SPF of electrically driven heat pumps to be considered as renewable energy is 2.5 and the E_{RES} calculation formula is:

$$E_{RES} = Q_{usable}\left(1 - \frac{1}{SPF}\right)$$

  Where the heat output of the heat pumps (Q_{usable}) is the estimated total useful heat provided by heat pumps exceeding the above SPF threshold.

- Recognised document RITE *Seasonal average performance of heat pumps for heat production in buildings*: this document is used to infer the value of the SPF from the COP reported by the interviewee as the true value of the SPF cannot be obtained in the absence of actual measurements of the SPF. Thus, the SPF is calculated by multiplying the nominal COP of each heat pump obtained in the interviews by a weighting factor (PF) and by a correction factor (CF).

$$SPF = COP_{nominal} \times PF \times CF$$

  where:

  PF: weighting factor that considers the different climate zones of Spain established by the Technical Building Code (CTE, for its initials in Spanish), which has been calculated with an exclusively technical methodology using objective values and existing Recognised Documents.

  CF: correction factor that takes into account the difference between the distribution or use temperature for which the COP has been obtained in the test. For the purposes of these updates, it is considered that there is no difference between these temperatures and, therefore, this factor is not applied.

  To calculate the PF of each heat pump, the values from the recognised document mentioned below are taken:

Heat pump energy source	Weighting Factor (PF) per climate zone				
	A	B	C	D	E
Aerothermal. Centralised equipment	0.87	0.80	0.80	0.75	0.75
Aerothermal. Individual split type equipment	0.66	0.68	0.68	0.64	0.64
Hydrothermal.	0.99	0.96	0.92	0.86	0.80
Geothermal closed circuit. Horizontal heat exchangers	1.05	1.01	0.97	0.90	0.85
Geothermal closed circuit. Vertical heat exchangers	1.24	1.23	1.18	1.11	1.03
Open-circuit geothermal	1.31	1.30	1.23	1.17	1.09

Source: Recognised document RITE Seasonal average performance of heat pumps for heat production in buildings. Table 4.1.

Table 6 Weighting factor (PF) for heating and/or DHW systems

Additionally, the following hypotheses are considered:

- Climate zones A, B, C, D and E of the CTE: each province is assimilated to its capital according to the CTE[6];
- For geothermal energy, all cases will be considered as a closed-circuit installation with vertical heat exchanger.

2.2.10 Dissemination of results

The results data aggregated by the different classification variables are published on the IDAE website.

2.2.11 Annual update of the information

The annual update of the statistical information regarding geothermal and hydrothermal heat pumps is integrated into the annual operation for the statistical update of thermal renewable energies. On an annual basis, information is compiled on the geothermal and hydrothermal heat pump installations in the different Autonomous Communities and Cities, which allows new census units to be added to the annual statistics on this type of installation. This is possible since, in this statistical operation, all the fields necessary for the compilation of the renewable energy statistics are collected for each installation, coinciding with those detailed in section 2.2.9.

In the immediate future, it is planned to extend the IDAE – AFEC Collaboration Protocol to also include information on sales in order to incorporate, as in the aerothermal heat pump statistics, the part corresponding to the private markets.

In the medium and long term, a new edition of this detailed study of the geothermal and hydrothermal heat pumps statistics is planned, not only to reflect the technological advances in this type of market, but also in order to comply with the new requirements derived from the updates of the Energy Statistics Regulation, as well as the changes in the Community Directives in this area.

6 *Technical Building Code. Basic Document DB-HE 'Energy saving'. Appendix B. Climate zones.*

3 References

Renewable Energy Promotion Plan: new database for project monitoring (BDFER, for its initials in Spanish). Institute for Energy Diversification and Saving (IDAE, for its initials in Spanish). IDAE, 2001.

Directive 2009/28/CE of the European Parliament and the Council of 23 April 2009, on the promotion of the use of energy from renewable sources and amending and repealing Directives 2001/77/CE and 2003/30/CE.

Commission Decision of 1 March 2013, establishing guidelines for the calculation by Member States of renewable energy from heat pumps of different technologies, in accordance with Article 5 of Directive 2009/28/CE of the European Parliament and of the Council.

Synthesis of the Study of the Spanish Heat Pump Fleet. J.P. García Montes, C. Míguez Gómez, F. Monedero Gómez, I. Rico Arroyo, C. García Barquero, C. López Ocón. Institute for Energy Diversification and Saving (IDAE). IDAE Studies 001. Year 2016.

SHARES. *SHARES Tool Manual Version 2019.02102020*. EUROPEAN COMMISSION. EUROSTAT. 2019.

Regulation (CE) Nº 1099/2008 of the European Parliament and of the Council of 22 October 2008 on energy statistics.

Seasonal average performance of heat pumps for heat production in buildings. Recognised RITE document. Institute for Energy Diversification and Saving (IDAE). February 2014.

Royal decree 314/2006, of 17 March, approving the Technical Building Code.

Annex I

Town _____	Province: _____
Survey ID _____	Date: _____

QUESTIONNAIRE FOR RESIDENTIAL HOUSEHOLDS

1. **Does your home have air-conditioning** (for cooling or heating)**?**

   - ❑ Yes
   - ❑ No, it does not (ask up to p_4 to discard)

2. **Does your home have underground heating?**

   - ❑ Yes
   - ❑ No, it does not

3. **Does your home have another heating system?**

   - ❑ Boiler (central, biomass, gas, etc.)
   - ❑ Other (electric radiators, etc.)
   - ❑ No, it does not

4. **How do you get hot water?**

   - ❑ Central boiler
   - ❑ Individual boiler (gas, butane…)
   - ❑ Electric water heater
   - ❑ Water heater/tank whose heat is produced by another system
   - ❑ Other (indicate how):
   - ❑ It does not have hot water
   - ❑ Nr/Dk

If it is found not to have a heat pump of any kind, end of survey. If you have air-conditioning, the survey is continued.

5. **Number of outdoor air-conditioning units**

QUESTIONS ON HOUSEHOLD AIR CONDITIONING APPLIANCES *(one sheet for each outdoor appliance)*

APPLIANCE n. º: _____ (*from 1 to the total number of appliances indicated on p_5*)

6. **Date of purchase (month and year):** _____

If the device was purchased after January 2014, the device survey will not be considered valid for this device.

7. Number of rooms in which the air-conditioning operates

8. Square metres of rooms in which the air conditioner operates:

- ❑ 1: _____m^2
- ❑ 2: _____m^2
- ❑ 3: _____m^2
- ❑ 4: _____m^2
- ❑ 5: _____m^2
- ❑ _____m^2

9. Is the air conditioner used for cooling and/or heating? (multiple answer)

- ❑ Cooling (*Do 10.1*)
- ❑ Heating (*Do 10.2*)

10. Do you use air conditioning as a main or auxiliary system?

10.1 Cooling *(refers to whether there is another system for cooling and the air conditioner in question is used to support the system -in which case it would be auxiliary- or whether the air conditioner in question is mainly responsible for providing the comfort conditions*).

- ❑ Yes, main system
- ❑ Yes, Auxiliary system. Main system_____
- ❑ Not used

10.2 Heating *(refers to whether there is another system for heating and the air conditioning in question is used to support the system -in which case it would be auxiliary- or whether the air conditioning in question is responsible for providing the comfort conditions for the most part)*

- ❑ Yes, main system
- ❑ Yes, Auxiliary system. Main system_____
- ❑ Not used

11. Estimated hours of operation per year *(should be as close to a realistic estimate as possible on the basis of 1 typical year):*

MONTHS PER YEAR	COOL		HEAT	
	DAYS PER MONTH	HOURS PER DAY	DAYS PER MONTH	HOURS PER DAY
JANUARY				
FEBRUARY				
MARCH				
APRIL				
MAY				
JUNE				
JULY				
AUGUST				
SEPTEMBER				
OCTOBER				
NOVEMBER				
DECEMBER				

12. As we have indicated, the aim of this survey is to characterise the fleet of air conditioners in the national territory, as well as to identify the energy consumption produced by these appliances, so, **could you please indicate the brand and model of your air conditioner?**

Brand _____

Model_____

13. Do you have the air conditioner's brochure, instruction booklet, energy label, etc. at hand? If so, could you please provide us with the following information from this documentation?:

- Cooling Capacity (Nominal Cooling Capacity):_____
- Heating Capacity (Nominal Heating capacity): _____
- Input Power (Electrical Power): _____
- Nominal COP:_____

If you do not have it at hand right now or you cannot find the information we are requesting, **could you please send us a photograph via email of the page where this information is indicated?** (xxxx@xxxxx.xx)

In these cases, we will either take note of your email and send you exactly the page and information you need, or we will make a note in the database that this person is going to provide us the missing information.

There is also the possibility of calling you at another time when you have already been able to collect the requested data.

Please note:

_____

_____

Annex II

QUESTIONNAIRE INDUSTRY, ANCILLARY TRANSPORT ACTIVITIES AND DISTRIBUTIVE TRADES-SERVICES

The questions refer to each premises separately, irrespective of whether a company has several premises. The questionnaire is preferably requested for manufacturing/production facilities (premises).

Town _____ Province: _____
Sector of activity of the company:_____
Sector of activity of the establishment:_____
M^2 of the establishment _____

1. **Does your establishment have air-conditioning equipment (heat pumps)** (for both cooling and heating)**?**
   - ❑ Yes Nº: _____
   - ❑ No, it does not (ask up to p_4 to discard)

14. **Does your establishment have underground heating?**
   - ❑ Yes
   - ❑ No, it does not

15. **Does your establishment have another heating system?**
   - ❑ Boiler (central, biomass, gas, etc.)
   - ❑ Other (electric radiators, etc.)
   - ❑ No, it does not

2. **How do you get hot water?**
   - ❑ Central boiler
   - ❑ Individual boiler
   - ❑ Electric water heater
   - ❑ Water heater/tank whose heat is produced by another system
   - ❑ Other (indicate)_____
   - ❑ It does not have hot water
   - ❑ Nr/Dk

If we have detected that you do not have a heat pump of any kind, end of survey. We would appreciate your cooperation with us. If you have a heat pump, we continue with the survey.

3. **The maintenance service of your air-conditioning equipment is:**

- ❑ In-house (company's own)
- ❑ External (other sub-contracted company)

In case of external maintenance:

Due to the complexity of some of the data requested in the survey, we believe that it would be necessary to contact the maintainer. **Would you consent to us contacting your maintainer to request technical information regarding your air conditioning equipment?**

Name_____
Telephone number_____
Electronic mail_____

From now on, the information to be provided will be presented for each installed heat pump. The survey must be repeated as many times as you have installed heat pumps.

Device n. º: _____ (from 1 to the total number of devices indicated in p_1)

4. **Date of commissioning of the installation:** _____

5. **Area, subarea and application:**

a. **Area** ❑ Aerothermal energy ❑ Geothermal energy ❑ Hydrothermal heat

b. **Sub-area** ❑ Air –to– air ❑ Air –to– water ❑ Outgoing air –to– air
❑ Outgoing air –to– water ❑ Ground–to– air ❑ Ground–to– water
❑ Water –to– air ❑ Water –to– water

c. **Application (multiple answer):**

❑ Heating ❑ Cooling ❑ ACS ❑ Reversible

6. **Type of main or auxiliary system** (The system will be auxiliary if it is used to support the system)

8.1 Cool:

- ❑ Main system
- ❑ Auxiliary system. ***Main system***_____
- ❑ Not used

8.2 Heat:

- ❑ Main system
- ❑ Auxiliary system. ***Main system*** _____
- ❑ Not used

7. As we have indicated, the aim of this survey is to characterise the fleet of air-conditioning equipment in the national territory, as well as to identify the energy consumption produced

by these appliances, so **could you please indicate the brand and model of your air-conditioning equipment?**

Brand

Model

16. Estimated hours of operation per year *(should be as close to a realistic estimate as possible on the basis of 1 typical year):*

PER YEAR	COOL		HEAT	
	S PER MONTH	URS PER DAY	PER MONTH	RS PER DAY
Y				
ER				
ER				
R				

8. Power and performance for both cooling and heating.

	COOL	HEAT
thermal power (kW)		
power		
COP		

9. Compressor type

❑ Hermetic ❑ Semi-hermetic ❑ Open ❑ Reciprocating
❑ Rotary vane compressors ❑ Scroll ❑ Screw compressors
❑ Centrifugal

10. SPF of the installation (sonly for actual data with thermistor meters)

EPa (kWht) (Thermal energy produced annually)._____

EeCa (kWhe) (Electrical energy consumed annually by the equipment). _____

SPF = EPa / EeCa_____

For any kind of communication with us (technical data, maintenance data, etc.) we provide you with an e-mail address (xxxx@xxxxx.xx).

It is also possible to call you at another time when you have already been able to collect the requested data or to take note of your email to send you exactly the necessary page and information or we will make a note in the base that this person will provide us with the missing data.

Please note:

_____

_____

Annex III

INFORMATION EXCHANGE QUESTIONNAIRE Bdfer

MODULE 1: GENERAL DATA															
INSTALLATION CODE			INSTALLATION NAME	NUMBER OF FLOORS	TECHNICAL AREA	TECHNICAL SUB-AREA	APPLICATION	SECTOR	OWNER	RECIPIENT	PROVINCE	ACTUAL DATE OPERATION	DEFINITIVE STOP DATE	HYDROGRAPHIC CONFEDERATION	MUNICIPALITY
REPORTER	FILE	YEAR													

MODULE 2: DESCRIPCTION OF THE INSTALLATION
DESCRIPTION OF THE INSTALLATION

MODULE 3: ECONOMIC DATA					
ENERGY INVESTMENT (€)	THIRD-PARTY FINANCING (€)	ORIGIN OF THE INVESTMENT AID	DESCRIPTION OF THE LINE OF INVESTMENT AID	INVESTMENT AID (€)	TYPE OF INVESTMENT AID

MODULE 4: ENERGY DATA															
YEAR	SECTION 1: CONSUMPTION OF RENEWABLE FUEL		SECTION 2: THERMOELECTRIC PRODUCTION					SECTION 3: INSTALLED AREA OF SOLAR ENERGY	SECTION 4: PRODUCTION OF RENEWABLE FUELS				SECTION 5: HEAT PUMP TECHNOLOGIES		
	ENERGY SOURCE	CONSUMPTION (toe)	AREA	ELECTRICAL POWER (kW)	ELECTRICAL OUTPUT (MWh)	THERMAL POWER (kW)	THERMAL OUTPUT (toe)	AREA (m^2)	RAW MATERIAL USED	CONSUMPTION OF RAW MATERIAL (t)	TYPE OF FUEL PRODUCED	PRODUCTION CAPACITY (t)	OPERATING HOURS	TECHNOLOGY AND APPLICATION	COP

MODULE 5: TECHNOLOGICAL DATA				
TYPE OF EQUIPMEN	UNITS	MANUFACTURE	MODEL	UNIT CAPACITY

CLIMATE ZONE

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y Ahorro de la Energía

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