Heat pumps Danfoss assembly plant in Arvika (Sweden)

THERMIA/DANFOSS

+20%

the increase of the heat pump market in the EU between 2014 an 2015

HEAT PUMPS BAROMETER

A study carried out by EurObserv'ER.

The heat pump (HP) sector had an excellent year in 2015. Appliance sales taking all heating and cooling market technologies into account, increased by 20% from 2 212 898 units in 2014 to 2 655 331 units in 2015. The emerging trend over the past few years specific to the HP segment for water-borne systems is that air-source HPs are clearly gaining market shares to the detriment of the ground-source HP market, while reversible HPs using air as their vector are taking advantage of record temperatures that have given a boost to the cooling market.

8.8 Mtoe

the estimate renewable energy provided by heat pumps in the European Union in 2015

29.5 million HPs

total number of heat pumps in operation in 2015

If we are to grasp how the market is developing, we must identify the various types of heat pumps (HPs). They are differentiated both by the energy source used (ground, water, air), by the types of heating unit used (fan-coil unit, underfloor heating, low- or high-temperature radiators), and also their application. Heat pumps can be used solely for heating purposes, but if they are reversible, can expel a dwelling's heat to cool it down. Moreover, some dual-purpose HPs are also designed to produce hot water, while others only produce hot water, yet not all of them meet the European Directive's energy performance requirements (see below).

Heat pumps are generally grouped into three main categories, namely ground source heat pumps (GSHPs), which extract heat from the ground (via horizontal or vertical sensors), hydrothermal HPs, that draw heat from water (the water table, rivers or lakes), and air source (ASHPs), whose heat source is air (outside, exhaust or indoor air). We have amalgamated the hydrothermal and ground source HP statistics for the sake of convenience.

Underfloor piping or low- or high-temperature radiators are favoured for heat distribution with GSHPs; they are referred to as HPs with hydronic systems. ASHPs use several distribution methods. Some distribute the heat through water, and are called air-to-water HPs, while others have systems that blow out hot air and are known as air-to-air HPs.

The individual European Union HP markets differ considerably and accordingly so do HP technologies' penetration rates, for while HPs are popular in Northern Europe, they still have considerable growth potential in many European countries – particularly in major economies such as the UK where the penetration rate is low.

Climate largely dictates the use made of HPs. In the north, centre and east of Europe, HPs are basically used for heating. In areas where the climate is temperate to hot, namely the Western and Southern regions (Italy, Spain and France), the reversible HP market is bigger, as is the use of the cooling function. In some part of Southern Europe, the demand for cooling in summer easily outstrips the demand for winter heating. Therefore the technologies and nominal ratings of the reversible HPs sold in those regions are geared to cooling rather than to heating needs. This state of affairs raises problems when making statistical comparisons between the various European Union markets, especially as reversible air-to-air HPs are also in high demand in heating mode in Northern Europe, Sweden, Denmark and Finland.

The European Heat Pump Association (EHPA), which defends the HP industry's interests, publishes the annual European Heat Pump Market and Statistics Report, in which it incorporates only part of the reversible air-to-air HP market statistics for the climate zones where they are installed. This choice is justified by its desire to monitor the market of HPs primarily used for heating and thus distinguish it from the market of HPs primarily used for cooling. In particular, EHPA considers that reversible air-to-air HPs are in the main used for heating in countries with cold climates (Estonia, Denmark, Finland, Lithuania, Sweden, etc.). However it has applied a 10% correction factor to its market data to exclude appliances used exclusively for air-conditioning. The association has chosen not to incorporate air-to-air HPs in temperate zone countries (Belgium, the Netherlands, Poland, etc.). It argues that there is not enough information to distinguish actual heating use from use for air-conditioning. With regard to countries with hot climates (South of France, Italy, Portugal and Spain), it only takes into consideration a small proportion of air-to-air HP sales, (actually 9.5%) which it reckons is actually used for heating needs.

The EurObserv'ER approach is different in that it is based first and foremost on the questionnaires filled in by the statistics offices of the ministries that individually choose the appliance base for inclusion in their target calculations for the European Renewable Energy Directive (see methodology).

For example, countries such as France, the

Methodology

The technologies included in this study extend to all ground source and air source HPs when they are solely used for home heating. Reversible HPs that additionally offer a cooling function are included while reversible HPs primarily used for cooling are also included if the systems meet EU Directive requirements, although they produce much less renewable energy. This principle also applies to exhaust air HP technology that harvests heat from exhaust air as it is expelled from dwellings.

It should be pointed out that the various types of HP at the same rating produce different amounts of renewable energy. The governing factors are the energy source harnessed, the heat-carrying fluid, their operating mode and the surrounding climate conditions. The European Commission published a methodology guide in March 2013 to help the countries measure the renewable energy output of their HP bases. It sets out guidelines for calculating the renewable energy share produced from heat pumps for the various technologies as stated in article 5 of the 2009/28/EC directive. The renewable energy taken into account differs with the technology and climate zone (cold, temperate and hot) of the heat pump installation site. For example the quantity of renewable energy of a reversible air-to-air HP installed in a hot climate area will be much lower because its seasonal performance factor (SPF) will be lower; its use for heating needs will be much more limited in time while it will be much longer in use for its cooling function.

The guide specifically cautions that heat pumps installed on air source hot water heaters only exceptionally achieve seasonal performance factors above the minimum threshold that make them eligible for inclusion as renewable energy producers. Therefore, EurObserv'ER has excluded from this study the specific thermodynamic hot water heater technology that uses air as its heat source.

Netherlands, Italy and Spain incorporate a high proportion of reversible air-to-air HPs in their statistics, arguing that they consider that they meet the performance criteria set out in the European Directive. To date, others such as Belgium, Germany, Austria and Portugal have excluded this type of HP from their official statistics. The issue of whether or not they should be included could come up when they conduct detailed surveys of their installed HP base, following Spain's example, which in 2014 started to factor them in.

THE EUROPEAN MARKET ENJOYS NEW MOMENTUM

AIR-SOURCE TECHNOLOGIES DOMINATE THE MARKET

If we consider the market as a whole, 2015 was a very good year for the heat pump sector. According to EurObserv'ER, an impressive 2 655 331 units were sold taking all technologies into account – which amounts to 20% growth.

In 2015, air-to-air HPs led sales in the European market with 2 325 625 units **(table 1)** or a 21.6% increase. Lower installation costs and easier installation make them more suitable for the renovation segment and form the basis for this major market share.

Nowadays most of the air-to-air HPs sold in the European market are reversible and cooling needs also have a hand in the strong demand for them. Market sales were boosted by high summer temperatures in Italy, in France, Spain and Portugal. The air-to-air HP market was also very buoyant in parts of Northern Europe, such as Sweden and Denmark by offering products perfectly suited to cold climates. Sales of HPs drawing on exhaust air, whose market is limited to a few countries – essentially Finland, Sweden and Germany – increased by 4.1% with 28 123 units sold.

The HP market for hydronic systems (ie GSHP and air-water heat pumps) has also increased sharply. It has taken advantage of the revival of the new build home construction sector in a number of countries, where most of the sales are concentrated and where new energy efficiency promotion policies are in force such as Germany. This market picked up 10% in 2015, with almost 300 000 units sold in Europe. The air-to-water HP market segment has the biggest share with 219 090 units sold in 2015 equating to 14.5% growth. The ground-source HP market at last appears to be stabilizing after several years of declining sales. It fell by only 0.3% in 2015 with 82 493 units sold (a 7.3% fall in 2014 with 82 744 units sold) **(table 2)**. The air-to-water HP market's increased share of 72.6% in 2015 compared to 69.8% in 2014 marks a strong trend in the market for water-borne systems **(graph 1)**.

FOCUS ON A FEW OF THE REPRESENTATIVE MARKETS

The construction market is putting the bounce back into Sweden's HP sales

Sweden's heat pump sales soared in 2015. According to SKVP, which in May 2014 brought the Swedish heat pump association (SVEP) and Kyl & Värmepumpföretage (the refrigeration and heat pump

association) together under one roof, almost 100 000 heat pump units were sold in 2015 (99 985 to be precise), which indicates a 19.6% rise over 2014. All the HP technologies benefitted from the market's growth with ASHPs coming first. The air-to-water segment increased by 26.5% with 8 040 units sold, the exhaust air segment by 25% with 13 568 units and the air-to-air segment by 20.9% with 52 000 units sold. The GSHP market segment increased by 12.9% with 26 377 units sold. According to SKVP, the construction market for individual family homes performed well, and as HPs are now commonly installed in new build, their sales took off. There are pointers that growth should continue throughout 2016. The market continued on its upward trend in the first quarter of 2016 on a year-for-year basis, with an 18% rise for air-to-water HPs and a 10% rise for exhaust air HPs. However ground-source HPs are dogged by a slight downturn (of 1%). The industry explains that this lacklustre performance is down to the 30% reduction in the ROT tax deduction rate for private home owners (ROT is the home renovation tax allowance) that penalises the more expensive heating solutions, namely GSHPs.

Air-to-water HPs enjoy positive growth despite Finland's depressed market

Statistics released by SULPU (the Finnish heat pump association) suggest that the HP market as a whole contracted by 12.6%, achieving sales of 58 725 units in 2015 down from 67 194 in 2014. The sharpest falls were felt in the air-to-air segment (by 15% to 45 027 units) and the GSHP segment (by 17% to 9 210 units). The only good news came from air-to-water segment that almost doubled its HP sales in 2015 (by 83%, or 2 704 units). SULPU explains that air-to-water HPs are primarily used in Finland's renovation sector to replace electric or oil-fired heating systems. The segment's strong showing is a good indicator of how well these appliances perform in the renovation market. The association attributes the general slump in the HP market to the sluggish family home construction

Tabl. n° 1

Market of aerothermal heat pumps ***in 2014 and 2015* (number of units sold).***

Country	2014				2015			
	Aerothermal HP	of which air-air HP	of which air-water HP	of which exhaust air HP	Aerothermal HP	of which air-air HP	of which air-water HP	of which exhaust air HP
Italy	863 000	845 000	18 000	0	997 200	972 000	25 200	0
Spain	506 618	500 129	6 489	0	742 999	734 199	8 800	0
France	353 250	287 100	66 150	0	405 680	332 110	73 570	0
Portugal	56 840	56 379	461	0	77 591	77 132	459	0
Sweden	60 213	43 000	6 355	10 858	73 608	52 000	8 040	13 568
Germany	52 903	0	39 503	13 400	52 331	0	39 831	12 500
Finland	56 069	52 822	1 480	1 767	49 515	45 027	2 704	1 784
Netherlands	44 028	39 529	4 499	0	49 176	43 541	5 635	0
Belgium	34 638	31 906	2 732	0	33 099	27 542	5 557	0
Denmark	19 666	16 743	2 822	101	26 674	23 442	3 163	69
United Kingdom	16 360	0	16 360	0	17 013	0	17 013	0
Estonia	14 340	13 300	1 000	40	15 010	13 700	1 280	30
Austria	10 064	0	10 004	60	11 603	0	11 554	49
Poland	6 537	4 230	2 301	6	8 416	4 500	3 819	97
Czech Republic	6 247	0	6 247	0	7 193	0	7 193	0
Ireland	1 816	0	1 804	12	3 489	0	3 465	24
Hungary	611	362	247	2	815	432	381	2
Slovakia	585	0	585	0	721	0	721	0
Lithuania	260	0	15	245	605	0	605	0
Luxembourg	156	0	156	0	100	0	100	0
Bulgaria	20 727	19 173	1 036	518	n.a.	n.a.	n.a.	n.a.
Slovenia	5 226	2 118	3 108	0	n.a.	n.a.	n.a.	n.a.
European Union	2 130 154	1 911 791	191 354	27 009	2 572 838	2 325 625	219 090	28 123

** Estimate. Note: Datas from italian, french and portuguese aerothermal heat pump market are not directly comparable to others, because they include the heat pumps whose principal function is cooling.*

Source: EurObserv'ER 2016.

market, the general fall in investment in the renovation sector compounded by falling oil prices. It also points out that about half the 6 000 family homes built in 2015 were equipped with GSHPs. The remaining GSHPs were either installed to replace oil-fired boilers or used to supply district heating networks.

The German market gradually picks up

Data published by the German Ministry of the Economy and Energy's working group on renewable energy statistics (AGEE-Stat) shows that 69 331 HPs were sold in 2015 compared to 71 403 in 2014, which represents a drop of 2.9%. For the first time this data includes exhaust air HP statistics, which is the reason for the disparity with the previous years' figures that only included air-to-water and GSHPs. However air-to-air HPs are still excluded from the AGEE Stat figures.

Of the various technologies, only the air-to-water segment managed to stand its ground with 39 831 units sold in 2015 as opposed to 39 503 in 2014 (an increase of 0.8%). This is contrasted by GSHP sales, which slipped further (8.1%) from 18 500 units in 2014 to 17 000 in 2015. The exhaust air HP segment also slid (6.7%) with 12 500 units sold in 2015 compared to 13 400 in 2014.

Nonetheless 2016 should be a better year for water-borne system HPs. According to BDH (the Federal association of the German heating industry) statistics, the market showed a 14% increase over the first quarter of 2015. GSHP (glycol solution-to water) sales increased by 22% while air-to-water HPs increased by 12%.

The reason for the market's recovery is the government's commitment to give high-performance renewable heating systems a boost. The Market Incentive Programme, "Marktanreizprogramm" (MAP) was given a fillip in April 2015 (see the 2015 EurObserv'ER HP barometer). Furthermore, from 1 January 2016 onwards new incentives were introduced through a new energy efficiency stimulation programme, the "Anreizprogramm Energieeffizienz (APEE)". The new scheme aims to help finance the replacement or modernisation of existing heating systems with the proviso that their efficiency is improved. Optimization can only be achieved by replacing a gas- or oil-fired heating system (condensing boilers are excluded from the scheme) with a heating system that runs on biomass, or is driven by a heat pump or combined solar thermal system (DHW and heating). The additional APEE incentive is equal to 20% of the MAP inventive, while an additional 600-euro premium may be awarded for any investment that improves the energy efficiency of an existing heating system.

Summer temperatures boost French sales of reversible HPs

According to the Observ'ER ***2015 individual heat pump market and price monitoring report***, the ASHP market enjoyed good growth in 2015, with an 11.2% increase in the air-to-water segment, i.e., 73 570 units sold in 2015 and a 15.7% increase in the air-to-air segment (i.e. 332 110 units sold in 2015 including 267 080 mono-split units). The summer heat wave certainly drove up sales of reversible systems. The GSHP segment contracted further (by 5.8%) with 3 810 units sold, although the fall was not as sharp as in previous years (sales in this segment dropped by 35% in 2014), which could usher in market stabilisation. The growth prospects for HPs for water-borne systems are good for 2016, as they should take advantage of the slight upturn in the new build market. In August 2016, the French Housing Minister announced that new housing starts between May and July were up by 4.7% to 91 900 units on a year-for-year basis.

THE EUROPEAN HP BASE STOOD AT ALMOST 30 MILLION UNITS IN 2015

It is hard to estimate the HP base in service because of the variety of assumptions used and the availability of statistics

Tabl. n° 2

Market of geothermal heat pumps in 2014 et 2015 (number of units sold)*

Country	2014	2015**
Sweden	23 356	26 377
Germany	18 500	17 000
Finland	11 125	9 210
Austria	5 885	5 897
Poland	5 275	5 567
France	4 045	3 810
United Kingdom	2 190	2 388
Netherlands	2 510	2 086
Denmark	2 242	1 885
Estonia	1 520	1 750
Czech Republic	1 578	1 586
Belgium	988	1 404
Italy	780	952
Lithuania	815	785
Bulgaria	532	532
Slovenia	390	390
Ireland	508	337
Slovakia	312	234
Luxembourg	55	87
Hungary	80	85
Spain	0	72
Portugal	58	59
European Union	82 744	82 493

** Hydrothermal heat pumps included. ** Estimate.* ***Source: EurObserv'ER 2016.***

supplied by the Member States and HP industry associations. By way of example, EHPA only includes HPs that it considers are used for heating purposes for its European installed base calculations in the same was as it does for the market. This effectively excludes a high proportion of the reversible air-to-air HP base. In its publication European Heat Pump Market and Statistics Report 2016, it reckons that roughly 8.4 million HPs have been installed since 1995, which according to the association amounts to 73.6GW of combined thermal capacity at the end of 2015. It puts the resulting output of useful energy at 148TWh (12.7Mtoe), including 94.7TWh (8.14Mtoe) of renewable energy. The reason for this difference is that HPs use electricity to extract the renewable energy from the air, ground or water and transfer it to the dwelling.

The EurObserv'ER estimate of the European HP base is broader because it is founded on the questionnaires filled in by the official bodies and published industry association data. According to our reckoning, the EU installed HP base approaches 29.5 million units to date (29.6 million at the end of 2015), the difference being that we have included a higher proportion of reversible air-to-air HPs.

As for the installed thermal capacity and renewable energy output figures, EurObserv'ER draws on the statistics provided by each Member State for the purposes of the Eurostat SHARES (SHort Assessment of Renewable Energy Sources) project. The most recent data covers 2014 and indicates 194.3 GW of capacity to date (including 178.4 GW of ASHP capacity) bearing in mind that a number of EU countries, with small populations have not provided data on the capacity of their HP bases. The capacity of the HP for water-borne systems segment comes to 37.7GW (21.8GW air-to water: 15.9GW geothermal or hydrothermal). It is worth noting that the Italian HP base alone accounts for 119.2GW (including 111.6GW of reversible air-to-air HPs), or 61.3% of the capacity of European Union's installed base.

EurObserv'ER puts the capacity of the European HP base at around 206.7GW at the end of 2015 (196.5 GW at the end of 2014) including 188.2 GW of ASHPs. As for renewable energy output, the SHARES tool puts input by HPs at the end of 2014 at 8.2Mtoe (8 175.5ktoe), that EurObserv'ER rounds up to 8.8Mtoe for 2015. This estimate is surprisingly close to the EHPA estimate of 8.14Mtoe in 2015 despite the fact that the bases are very different, which may indicate differences in computing methods. The latter may stem from country breakdowns of the HP base governed by climate zones or the findings of national surveys funded by the Member States.

SIGHTS SET ON THE RENOVATION MARKET

Heat pump technology is popular in the new build market because it is particularly suitable for well-insulated properties, especially those whose only exchanges with the outdoors are permitted by ventilation. Heating systems for these types of buildings are optimized at low temperature and are thus highly economical in terms of energy. Thus the technology is particularly in phase with the demands of low energy-consumption or positive energy buildings.

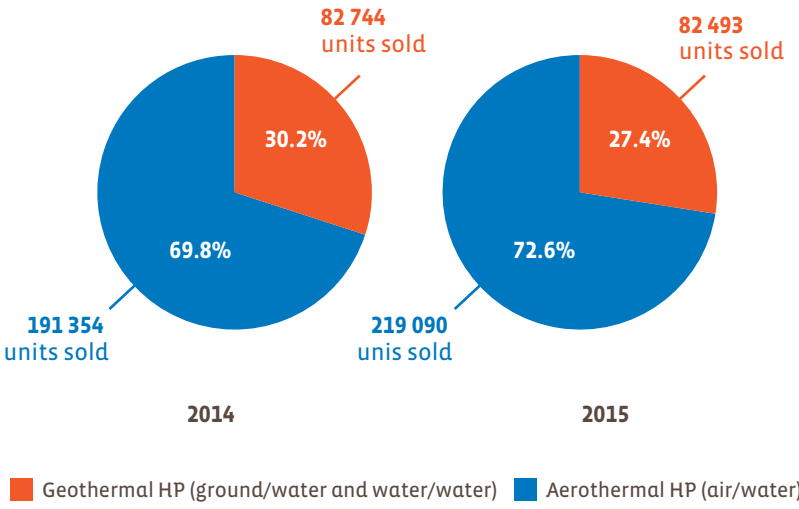
Now today's challenge for the HP industry is to make inroads into the renovation market (primarily by replacing gas-fired boilers) which dominates heating system sales (see further on). This trend is already emerging in mature markets like France and Scandinavia. It means that these new products can meet the needs of renovation operations and also pave the way to gaining market shares in countries where HP-powered heating is less widespread.

Another reason for this positive trend in the renovation market stems from consumers' new expectations for comfort, such as being able to cool their homes. These recent needs are linked to the general perception that summer heat waves are harder to bear and increasingly blamed on climate warming.

Accordingly new products have been launched on the HP market that are especially dedicated to the renovation market. These include hybrid gas HPs that couple a condensing boiler and a heat pump within the same appliance. The systems offer the advantage of enabling old housing stock to harness renewable energy technologies without having to replace their original "high-temperature" radiators. The auxiliary

Graph n° 1

Market share between geothermal and air-water heat pumps ***with hydronic system in 2014 and 2015***[1]



1. An hydronic heat pump system uses water or another liquid as a heat transfer fluid in heating and cooling systems (with radiators or a heating floor). ***Source: EurObserv'ER 2016.***

energy means that the HP does not need to be oversized and that the system's energy efficiency is increased when external temperatures are very low. The system's electronics calculate the most efficient heating mode (gas only, hybrid or HP only). We can quote as an example how the Viessmann Vitocaldens 222 hybrid HP works. The system comprises an ASHP, a gas-fired boiler and a hot water tank. According to Viessmann, the heat pump covers 80% of annual heating needs. This product offers three operating modes depending on the user's preferences – Economy, Green or Comfort. After entering the parameters (the gas price, the electricity price or the primary energy factor), the energy manager automatically determines which of the two generators, gas boiler or HP, gets priority or whether parallel operation is preferable. Factors such as the current outdoor temperature, capacity required and necessary initial temperature will then be factored in.

Smart management of these various systems – HP hybrid gas or otherwise – is also provided by the implementation of connected technologies. Applications such as "Bosch Pro Control" enable the heat pump to be controlled directly using a smartphone or connected tablet. Users can set the temperature, switch from one heating mode to the other or change the current programme remotely and extremely simply via an intuitive interface. The application can also enable solar power's input for the current day or month to be visualized, when the HP is coupled to a solar-powered system. Stiebel Eltron of the UK goes even further than remote control by proposing a system that can be installer-controlled to improve installation maintenance and repairs.

It is worth noting that hybrid HP solutions were originally pioneered by heating market generalists (Viessmann, Bosch Thermotechnologie, Vaillant, etc.) that are not only condensing boiler but HP experts. This market is also targeted by the major air-conditioning players.

Tabl. n° 3

*Total number of heat pumps in operation in 2014 and 2015**

Country	2014			2015		
	Aerothermal HP	Geothermal HP	Total heat pumps	Aerothermal HP	Geothermal HP	Total heat pumps
Italy**	18 218 000	13 200	18 231 200	18 430 000	14 100	18 444 100
France**	4 233 228	144 865	4 378 093	4 638 908	148 675	4 787 583
Spain**	754 345	1 144	755 489	1 497 344	1 216	1 498 560
Sweden	920 813	474 057	1 394 870	988 191	497 658	1 485 849
Germany	527 422	314 503	841 925	567 327	330 244	897 571
Finland	528 293	85 294	613 587	577 808	94 504	672 312
Denmark	225 209	51 638	276 847	245 291	56 023	301 314
Netherlands	199 148	45 986	245 134	248 051	47 407	295 458
Portugal**	177 353	773	178 126	254 944	832	255 776
Bulgaria	214 971	4 272	219 243	214 971	4 272	219 243
Austria	55 584	91 157	146 741	66 907	95 860	162 767
United Kingdom	97 781	24 875	122 656	114 794	27 263	142 057
Estonia	86 697	8 875	95 572	101 707	10 625	112 332
Belgium	51 400	6 370	57 770	84 499	7 774	92 273
Czech Republic	36 819	19 908	56 727	44 012	21 494	65 506
Poland	13 566	24 688	38 254	21 982	30 255	52 237
Slovenia	22 231	5 500	27 731	22 231	5 500	27 731
Ireland	5 538	3 116	8 654	9 027	3 453	12 480
Slovakia	5 886	2 839	8 725	6 607	3 073	9 680
Hungary	4 400	463	4 863	5 200	510	5 710
Lithuania	1 265	2 908	4 173	1 870	3 693	5 563
Luxembourg	1 095	333	1 428	1 195	420	1 615
European Union	26 381 044	1 326 764	27 707 808	28 142 866	1 404 851	29 547 717

** Estimate. **Note: Datas from Italy, France, Spain and Portugal are not directly comparable to others, beacause they include the heat pumps whose principal function is cooling.*

Source: EurObserv'ER 2016.

THERMIA/DANFOSS

Heat pump Danfoss assembly plant in Arvika (Sweden)

For instance, the Daikin catalogue lists the "Daikin Altherma hybrid" solution that couples an air-to-water HP with a gas boiler.

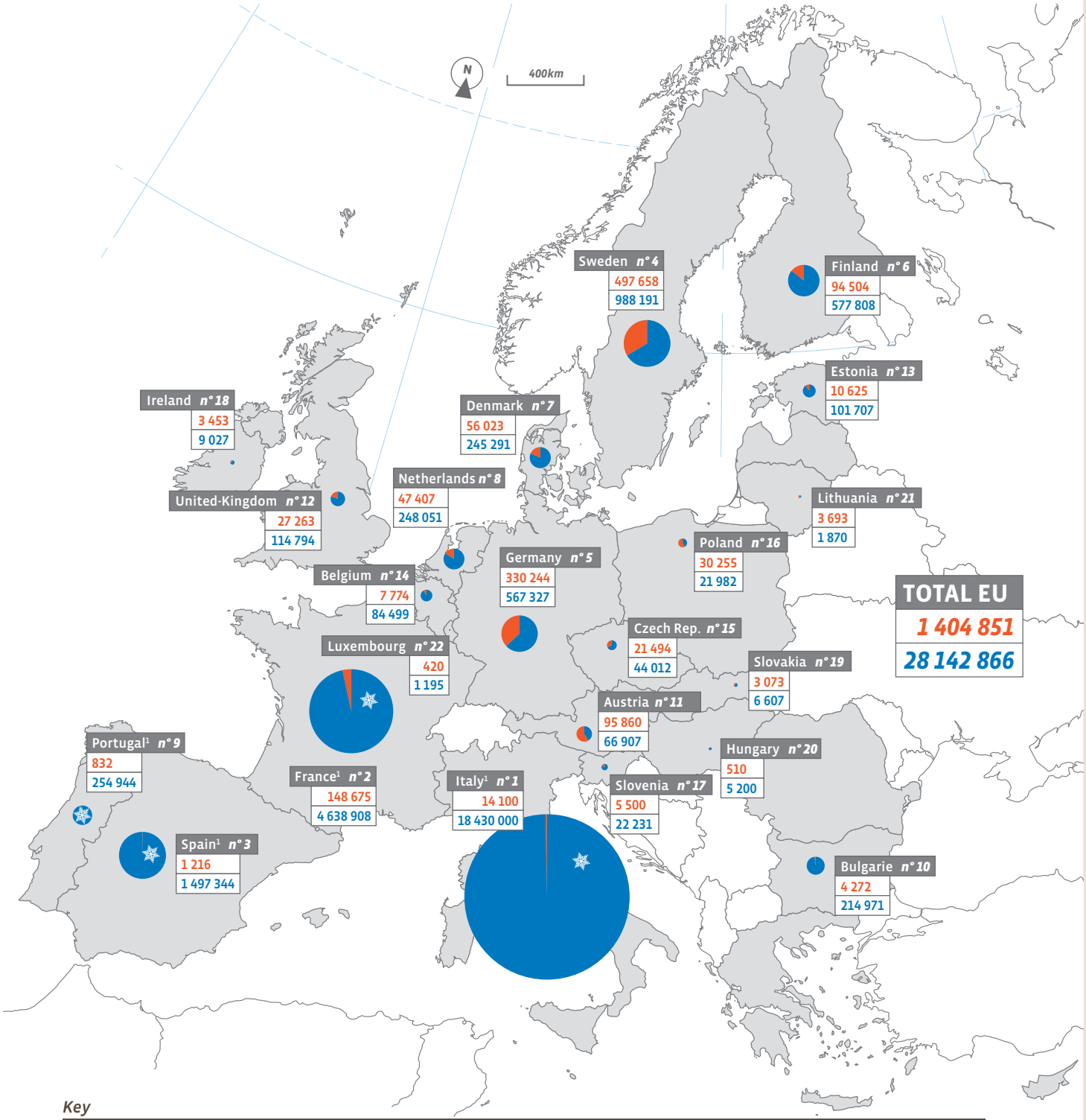
The search for energy independence and the growth of the self-consumption market are driving another market trend that heat pumps can turn to their advantage. Some heat pump systems can be networked with PV panels. Bosch has presented a smart energy management system (called e.Control) that identifies when the heat pump needs electricity, and covers this need with solar energy if the sunlight level is high enough to provide it. This energy system can also incorporate a hybrid storage solution (Bosch Power Tec's BPT-S 5) which enables the system to use even more solar power stored in its lithium-ion batteries.

In another new product trend power modulation heat pumps have been launched, which use an inverter to continuously modulate the compressor power to match the requested temperature. Electricity consumption can be optimized and noise minimized by managing the compressor's power and make for maximum efficiency. While conventional heat pump compressors run at full power until the set temperature is reached and then cut out, invertor driven compressors operate continuously to provide better temperature control. We draw a parallel with car driving habits... fuel consumption is higher when you constantly alternate hitting the accelerator with hitting the brake, whereas, regular, smooth driving makes for lower fuel consumption. The invertor driven compressor operates on the basis of this principle. Nowadays most brands offer this type of HP in their catalogues such as Stiebel Eltron's WPL series. Hybrid systems such as the Rotex HPU hybrid heat pump and the Atlantic Alféa Hybrid Duo Gas system also benefit from this technology. These variable speed compressor systems have been successfully used for many years in air-conditioning technology and were initially developed by the sector's major Asian players.

New products are also appearing on the market, like adsorption gas heat pumps (also called gas adsorption heating appliances) and absorption gas heat pumps aimed at both the new build and renovation markets. These heat pumps combine a gas-fired condensing boiler with an adsorption heat pump in a compact appliance. This type of boiler reduces gas consumption by 25–28% compared to a conventional condensing boiler. The heating system uses zeolite, a mineral from the clay family that is also known as "boiling stone. It absorbs and adsorbs water vapour (the water molecules are bonded to the solid surface of the zeolite) to produce heat. The water vapour can be produced from the geothermal or solar thermal collectors' heat. Desorption starts once the zeolite is saturated with water vapour. The heat from the condensing gas boiler releases the zeolite's water vapour. Sorption heat and condensation heat are produced alternately and transmitted to the heating system. Examples of available products using this technology are the Viessmann Vitosorp 200 F and the Vaillant Zeotherm.

Gas absorption heat pumps recover heat from the absorption reaction. The system has to heat an ammonia solution (NH_4OH) with a gas burner to release high-temperature gaseous ammonia (NH_3). Heat production is provided by condensing the refrigerant fluid (liquid ammonia), by the absorption reaction between the fluid and an absorbent (water). The absorption of gaseous

Aerothermal and geothermal heat pump park in operation in European in 2015* (installed units)



Key

Geothermal heat pumps

Aerothermal heat pumps

6 996 *Total number of aerothermal heat pumps in function in the country*

27 545 *Total number of geothermal heat pumps in function in the country*

Datas from Italy, Spain, France and Portugal are not directly comparable to others, because thery include the heat pumps whose principal function is refresh.

** Estimate. Note : The pie charts are proportioned to the total number of units installed and not to the total capacity installed.* ***Source: EurObserv'ER 2016.***

ammonia (NH3) in the presence of water (H20) gives a concentrated ammonia solution (NH40H) accompanied by the release of a large quantity of high-temperature heat. Gas absorption HPs are generally dedicated to the high-power market, but a number of manufacturers sell systems suitable for the residential market such as the Italian manufacturer Robur with its GAHP (Gas Absorption heat pump), aerothermal (GAHP-A), reversible aerothermal (GAHP-AR), geothermal (GAHP-GS) and hydrothermal (GHAP-WS) series.

The technological impetus and proliferation of solutions offered are indications of the HP market's growth potential. The industry's financial clout should continue to increase in the next few years spurred on by the various Member States' energy efficiency and renewable energy targets. EHPA, which is only interested in the part of the HP market whose primary vocation is heating (as opposed to air-conditioning), reckons that the turnover generated by HP sales was 5.7 billion euros in 2015 including VAT (5.2 billion euros in 2014). Air-to-water HPs account for 37.1% of this total (30.6% non-reversible and 6.4% reversible air-to-water HPs), while reversible air-to-air HPs primarily intended for heating account for 30.6%. Geothermal and hydrothermal systems dedicated solely to producing heat account for 24.8% of this turnover. After examining the variety of national rates of VAT, EHPA concludes that the market has directly contributed almost 1 billion euros in taxes to the European states (0.97 billion euros according to its survey). The association also reckons that the European HP industry directly employs 48 073 individuals in Europe, 36% in HP manufacturing, 18% in component manufacturing, 16% in service and maintenance activities and 30% in installation.

ENCOURAGING POLITICAL SIGNS

In 2015, after several years of relative stagnation, the HP market, and particularly the air-source segment, posted very good performance levels. This performance goes right across the board, for apart from the Finnish market; all the countries where this technology has been developed posted strong growth rates.

The lights are set to green for the next few years, with firstly the confirmation of a recovery in the construction market, albeit modest as yet, and the sector's capacity to take market shares in the renovation sector through suitable products.

Another encouraging sign is that political and regulatory constraints should finally intensify in the renovation market. On 16 February 2015, the European Commission presented its ***Strategy for heating and cooling,*** in the form of a communication (COM 2016, 51 final), that aims to optimize heating and cooling production systems in two sectors, residential/tertiary and industry. This strategy is one of the flagship policies of the strategy framework for an Energy Union. It should contribute to improving the EU's energy security and the implementation of the post COP21 Climate Action programme. The Paris COP

NIBE

Tabl. n° 4

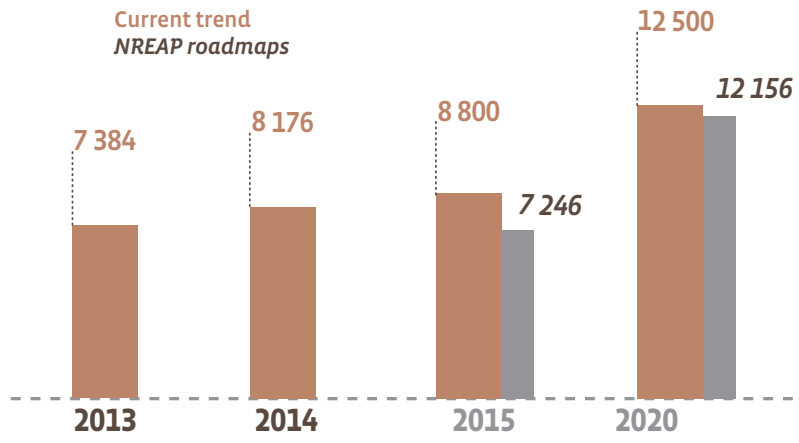
*Companies *representative Heat Pump Companies in the European Union in 2016.*

Company	Brand	Country	Type and capacity range in kW (in 2015)
BDR Thermea	De Dietrich	France	Sole/Water; Air/Water; Water/Water: 3,7 - 27,9 kW
	Sofath	France	Sole/Sole: 2,8 - 14,2 kW Sole/Water: 6,0 - 29,5 kW Water/Water: 5,7 - 32,2 kW Air/Water: 3,7 - 24 kW
	Brötje	Germany	Air/Water: 7,4 - 11,5 kW Air/Water (Split): 6 - 15,7 kW Sole/Water: 5,9 - 21,2 kW
Bosch Thermotechnology	IVT Industrier (Bosch Thermotechnik)	Sweden	GSHP: 4,7 - 17,4 kW Air/water: 8,6 - 17,4 kW Air/Air: 0,6 - 6,5 kW Exhaust Air HP: 1,5 kW
Daikin Europe	Rotex	Germany	Air/Water + Sole/Water: 3,5 - 15 kW
Danfoss	Thermia Värme AB (Danfoss)	Sweden	Air/water: 6 - 36 kW Air/Air: 1,4 - 6 kW GSHP: 3 - 17 kW
	KH Nordtherm (Klimadan)	Denmark	GSHP: 20 - 336 kW (Cascade)
Nibe	Alpha Innotec	Germany	Air/Water: 5 - 31 kW Sole/Water: 3 - 160 kW Water/Water: 11 - 430 kW
	Nibe Energy Systems Division	Sweden	GSHP: 1,5 - 17 kW Air/Water: 5 - 22 kW Air/Air heat pumps: n.a.
	Tecchnibel	France	Air/Water: 5 - 250 KW Sole/Water: 5 - 58 kW
	KNV	Austria	SSole/Water: 1,5 - 16 kW Air/Water: 5 - 15 kW Water/Water: 1,5 - 16 kW
Vaillant Group	Saunier Duval	France	Air/Water: 5 - 15 kW
	Vaillant	Germany	Sole/Water: 22 - 46 kW Water/Water: 3 - 19 kW Air/Water: 5 - 15 kW
	Bulex	Belgium	Air/Water: 5 - 15 kW
Viessmann Group (KWT, SATAG)		Germany	Sole/Water: 5,6 – 42,8 kW Water/ Water: 7,5 - 58,8 kW Air/Water: 7 - 50 kW (250 kW in cascade) Air/Water (Split): 3 - 50 kW
Buderus		Germany	Sole/Water: 6 - 17 kW, 40,2 KW Air/Water: 6 - 41 kW (82 KW cascade)
Ochsner Wärmepumpen		Austria	HP from 2 - 1600 kW (all types) Air: 5 - 80 kW GSHP: 5 - 18 kW Water: 7 - 104 kW Sole: 5 - 72 kW
Stiebel Eltron		Germany	Air/Water: 4,2 - 30 kW Sole/Water: 4 - 56 kW Water/Water: 6 - 21 kW
Waterkotte		Germany	Air/Air: 4 -14 kW (Cascade 22 - 56 kW) GSHP: 15 - 26 kW Water/Water: 5 - 26 kW
Wolf Heiztechnik		Germany	Air/Water: 8 - 14 kW Sole/Water: 6 - 16 kW Water/Water: 7 - 21 kW

** Non exhaustive list.* ***Source: EurObserv'ER 2016 .***

Graph n° 2

Actual trend of renewable energy from heat pumps ***compared with the National renewable energy action plans NREAP (in ktoe)***



Source: EurObserv'ER 2016.

21 agreement finally got the go-ahead from the Council of Ministers for the Environment on 30 September 2016 and was approved by the European Parliament's Euro MPs on 4 October.

In its Strategy paper, the Commission recalls that 50% of the European Union's annual energy consumption can be ascribed to heating and cooling. This represents 13% of the EU's oil and 59% of its total gas consumption, or 68% of all its gas imports. Moreover, gas is the main primary energy source used for heating and cooling (46%), followed by coal (15%), biomass (11%) heating oil (10%), nuclear energy (7%) and specific renewable electricity sources (wind power, photovoltaic and hydropower, about 5%). Solar thermal, ambient heat and geothermal energy recovered by HPs only cover 1.5% of this consumption and renewable energies taken together struggle to make 18%.

The Commission recalls that almost half of the boilers installed in the EU's buildings have been in service since prior to 1993. Their output is less than 60%, while 22% of gas-fired boilers, 34% of direct electric heating systems, 47% of oil-fired boilers and 58% of coal-fired boilers have outlived their technical lifetime. It puts the renovation rate of existing buildings at below 1%.

To put an end to energy losses in buildings, maximize efficiency and increase the renewable energy share, the EU's strategy for heating and cooling primarily intends to implement a range of measures destined to simplify multi-occupancy building renovations, such as the installation of modern heating and cooling systems, with special emphasis on HPs. It also plans more even sharing of gains to enable tenants and owners alike to take advantage of the investments granted for renovating old buildings and apartments or for replacing their old heating installations by modern, high-performance systems that use renewable energy sources.

The strategy also banks on increasing the share of renewable energies dedicated to heating and cooling in the context of forthcoming revisions of building energy performance directives, the directive on energy efficiency (scheduled for 2016) and the sources of renewable energies. It also plans to

Heat Pump Keymark

Already in place for solar thermal products, or thermal insulation products, now also the heat pump sector has developed a quality assurance standard – the so-called heat pump Keymark. On recommendation of the European Council, the European Standards Organizations CEN and CENELEC have launched a European and registered mark of conformity to standards, the KEYMARK. It provides proof of product conformity to European Standards and involves regular product testing and inspection of the factory production control. According to EHPA, the European Heat Pump Keymark is an ISO type 5 compliant certification system assessing product safety and performance according to European standards. All certificates are based on independent third party tests. The KEYMARK Certification scheme is owned by CEN. Tests can be performed in 9 empowered test institutes from across Europe and 43 certificates have been granted in Q 3 2016. The Heat Pump Keymark is based on a single set of requirements, third party testing, annual factory inspections and a quality assurance system.

Co-ordinated by the European Heat Pump Association (EHPA), in December 2015, leading European heat pump industrialists agreed on the Keymark as independently audited standard. The ultimate aim and intention of the Keymark certificate is to have a uniform quality assurance label valid throughout the European Union. It is not intended to replace existing national quality labels but amend these with an independently tested standard. The participants of the certification scheme included leading manufacturers such as Atlantic, Daikin, Emerson, Dimplex, Nibe, Stiebel Eltron, Vaillant, and Viessmann and three certification bodies (DIN CERTCO, BRE Global and SP Cert). The scheme has been open for certification bodies and test institutes to voice their interest in participation since January 2016. After these bodies were empowered, manufacturers could apply for the certificate.

As of September 2016, Stiebel-Eltron for an air-water heat pump (Germany) and Atlantic (France) were the first companies to certify their products under the HP KEYMARK according to information from EHPA. For manufacturers the advantage of the certification is that, once certified, they can market their products all over Europe and apply for funding under the different national support schemes. The Keymark might have positive impacts on the industry in that the mutual acceptance of the quality across Member States may avoid the administrative and financial burdens of multiple testing and certification procedures. A single certificate should be sufficient to be eligible for support schemes across borders. Before, the firms needed to provide various national certifications for one heat pump. In turn, the quality requirements are harder to meet than single national certificates. The benefit for the end user is that they can trust in the declared efficiency values, because they have been verified by an independent party.

allocate financial aid to encourage the deployment of technologies founded on renewable energies, available through European structural and investment funds, the "Horizon 2020" research and innovation programme and the strategic plan for energy technologies.
Thus the European Commission's policy vision is very much in favour of major deployment of HPs as part of its new energy strategy. The challenge is to ensure that this vision is properly relayed to each Member State and that the consumers (owners, tenants, building managers, public authorities) and the industry espouse these solutions and the possibilities of saving energy by using the digital revolution's new tools. □

Sources T1 and T2 : Italy (Ministry of Economic Development), France (Observ'ER), Sweden (SKVP), Finland (Sulpu), Germany (AGEE Stat), Netherlands (Statistics Netherlands), Denmark (Danish Energy Agency), Austria (Austrian Ministry for Transport, Innovation and Technology), Czech Republic (Ministry of Industry and trade), Luxembourg (STATEC), Hungary (University of Miskolc), Observ'ER, EHPA.

The topic of next barometer will be solid biomass

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