THE ROLE OF HEAT PUMPS IN ITALY:

STATE OF THE ART AND DEVELOPMENT OPPORTUNITIES

Executive Summary of the Study

January 2025

Initiative realised in collaboration with:

ASSOCLIMA
COSTRUTTORI SISTEMI DI CLIMATIZZAZIONE

Position Paper realised by TEHA Group S.p.A. in collaboration with Assoclima.

The contents of this Report refer exclusively to the analysis and research work, represent the opinion of TEHA Group and may not coincide with the opinions and views of the people involved in the study.

This Strategic Study was carried out by TEHA Group on behalf of Assoclima. The mission of the Study is to qualify the relevance of the Italian and European heat pump industrial supply chain for the energy transition and the competitiveness of the country-system, promoting the strategic role of electric heat pumps as a key lever to accelerate the country's decarbonisation and efficiency process, with a particular focus on the buildings sector. The Study was designed to address three objectives:

— to qualify, through factual evidence and a robust narrative, the role of the electric heat pump industry in promoting the energy transition and decarbonisation in Europe and Italy;

— to define, within the developed scenario framework, the evolutionary directions and policy actions necessary to support the development of the sector, integrating Assoclima's views with intelligence and scenario elements that are functional to optimise the directions and guidelines of the topics under analysis;

— provide decision makers with authoritative and *super partes* knowledge elements functional to better guide actions in line with the identified development priorities, creating positive advocacy action and widespread awareness.

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KEY MESSAGES OF THE STUDY

1. Growing concerns over climate change place decarbonization at the center of the European strategic agenda, aiming for a net-zero economy by 2050. However, both Europe and Italy must accelerate the decarbonization process. At the current pace, climate neutrality targets would only be achieved by 2102 and 2097, respectively.

In recent years, increasing concerns related to climate change have positioned decarbonization as a core priority in the European strategic agenda. With the rise of extreme weather events and the undeniable environmental impact of greenhouse gas emissions, the European Union has established ambitious goals to achieve a net-zero economy by 2050. As outlined in the EU Climate Law, the EU and its Member States have committed to transforming the European Union into the **first emission-neutral continent by 2050**, setting an intermediate target of at least a 55% reduction in net emissions by 2030.

To address these challenges, the EU introduced the **REPowerEU** plan in 2022, a strategy designed to significantly reduce dependence on fossil fuels and promote renewable energy sources to **mitigate European energy dependency** and the repercussions of the energy crisis following the outbreak of the Russia-Ukraine conflict. Within this framework, the European Commission has proposed increasingly ambitious objectives for EU countries, aiming for a 90% reduction in emissions by 2040 compared to 1990 levels. However, the current pace of emission reductions is insufficient, highlighting the **need to accelerate and foster decarbonization strategies capable of leveraging all available technologies**. Based on an inertial scenario, the European Union and Italy would not achieve net-zero emissions before **2102** and **2097**, respectively.

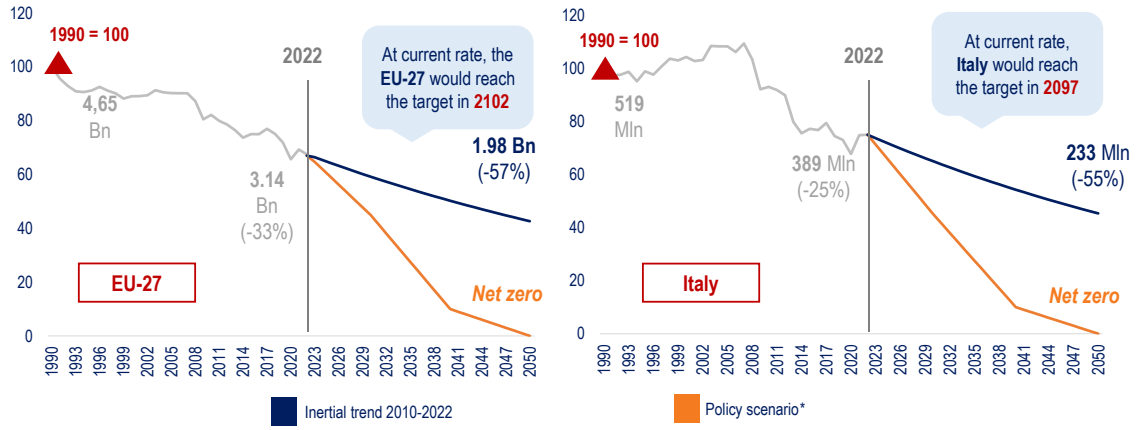

Figure I. Net GHG emissions in the EU-27 (left graph) and Italy (right graph) in tons of CO2 equivalent (index value 1990=100), 1990-2050e. (*) The policy scenario considers the decarbonization targets set by the EU and the PNIEC under the "Fit for 55" and RePowerEU plans. *Source: TEHA Group analysis based on Eurostat and EEA data, 2024.*

2. The European strategy for energy transition identifies three primary levers for decarbonization: energy efficiency, widespread use of renewable energy for generation, and electrification of final energy consumption. In this context, the civil (residential and tertiary) and industrial sectors are pivotal to steering the economy and society toward decarbonization.

In line with a principle of **technological neutrality**, achieving European decarbonization targets will depend on the ability to synergistically leverage all available tools and technologies to accelerate the energy transition while safeguarding the competitiveness of the European economy. In this framework, the European strategy highlights three key decarbonization levers: **energy efficiency**, **electrification of final energy consumption**, and the **use of renewable energy for power generation**. The "**Energy Efficiency First**" principle has been identified by the EU as a guiding framework for supporting the energy transition of European countries by promoting a more sustainable and efficient use of resources to limit energy production to the actual needs of European nations. Within this scenario, in October 2023, the new European Energy Efficiency Directive was approved, establishing a target of a **15.4% reduction in energy consumption by 2030** (compared to 2022 levels). The directive sets a maximum cap for final energy consumption in the EU at 763 Mtoe and introduces annual energy-saving obligations, which will increase from 1.3% in 2024 to 1.9% between 2028 and 2030.

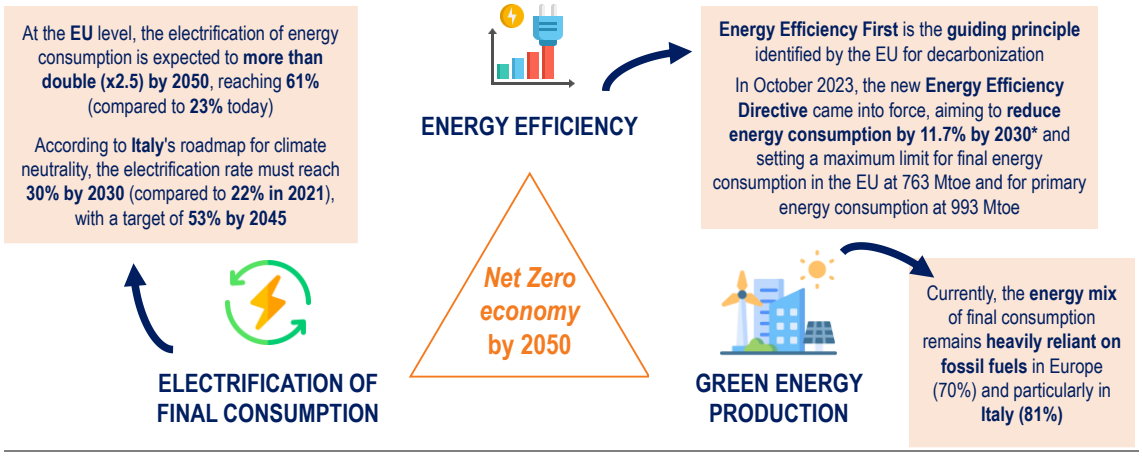

Figure II. Main decarbonization levers identified by the European Union (illustrative). *Source: TEHA Group analysis based on data from Eurostat, European Commission, Eurelectric, and various sources, 2024.*

The second lever identified by the EU focuses on the **electrification of final energy consumption** to promote the energy transition of sectors most reliant on fossil fuels, such as the civil sector, industry, and transportation. At the European level, the electrification of final consumption is projected to grow more **than two-fold by 2050**, reaching **61%** of total energy consumption. However, from 1990 to today, the rate of electrification has only marginally increased, from 18% to 23%, highlighting significant technological challenges and criticalities in sustaining the electrification of certain sectors, particularly high-temperature industrial processes. Currently, the energy mix of final consumption in Italy and Europe remains heavily

dependent on fossil fuels, which account for 81% and 70% of final energy consumption, respectively. Notably, Italy ranks among the most energy-dependent countries, importing approximately **79%** of its gross available energy (16.6 percentage points above the EU-27 average).

In this context, it becomes increasingly important to support the adoption of technologies capable of **decarbonizing thermal energy consumption**, which is primarily tied to fossil fuels. Technologies such as heat pumps are essential for decarbonizing thermal energy consumption in buildings or low-temperature industrial processes. However, to unlock the benefits of electrification, the promotion of **renewable energy sources for electricity generation** remains critical. Electricity generation in both Europe and Italy continues to depend significantly on fossil fuels. This third and final lever is central to Italian and European strategies for energy transition, which aim to increase the share of renewables in electricity generation by **24.3** and **19.7** percentage points, respectively, by 2030.

Achieving decarbonization goals by 2050 will strongly depend on the synergistic optimization of all these levers and available technologies to decarbonize sectors most reliant on fossil fuels. The **civil** (residential and tertiary) **and industrial sectors** are responsible for **nearly two-thirds of final energy consumption** in Italy (42% for the civil sector and 22% for industry) and **more than one-third of generated GHG emissions**. Moreover, **since 1990, the civil sector is the only sector in Italy that has increased greenhouse gas emissions** (+6.6%). At current trends, meeting European 2050 targets would be nearly impossible, underscoring the urgent need to support and accelerate the decarbonization process.

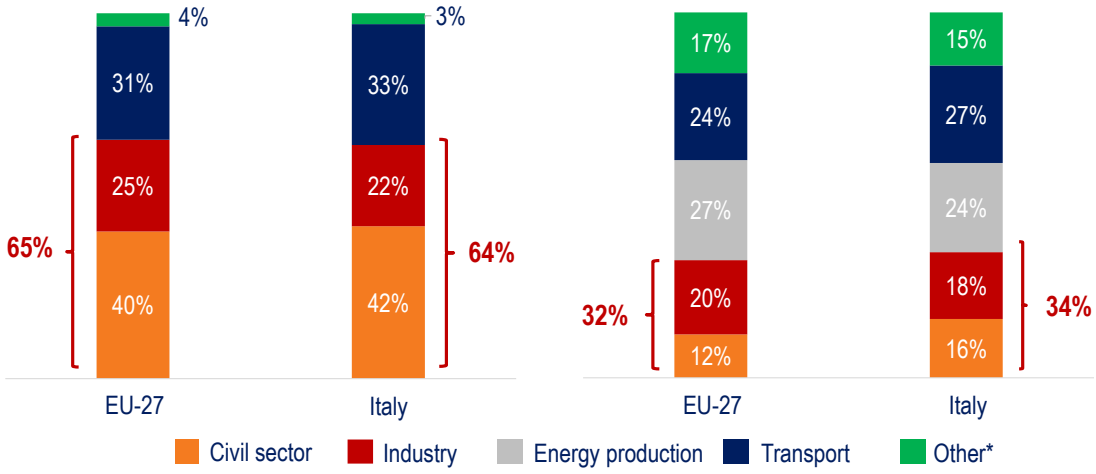

Figure III. Final energy consumption by sector (left graph, %) and greenhouse gas emissions by sector in the EU-27 and Italy (right graph, %), 2022. Note: The civil sector includes the residential and tertiary sectors. (*) "Other" includes other industrial processes, agriculture, and waste. Source: TEHA Group analysis based on Eurostat and EEA data, 2024.

3. In this context, electric heat pumps represent a key technology for decarbonization, particularly in the civil sector, thanks to their efficiency, use of renewable energy sources (thermal and electrical), significant emission reductions, and wide application flexibility across different contexts and climatic conditions.

The average annual energy consumption of a household consists of nearly **80%** thermal energy, used for space heating and domestic hot water production. Given the substantial contribution of the civil sector to final energy consumption in both Italy and the EU, electric heat pumps clearly emerge as a key technology for replacing fossil fuels in building heating. By transferring heat from air or water to buildings, **heat pumps can extract renewable energy from the external environment, reducing primary energy needs by approximately 58.5%** for heating residential buildings. Considering the challenges in decarbonizing thermal energy consumption, electric heat pumps are therefore a **mature and pivotal technology**, providing high levels of efficiency that ensure their benefits even in colder climatic zones. Moreover, emission reductions achieved by heat pumps are already significant with the current energy mix: for the **same thermal kWh** produced, an **electric heat pump reduces CO2 emissions by 65% compared to a condensing boiler**. These benefits are further amplified when compared to non-condensing boilers, achieving a 75% reduction in CO2 emissions. Looking ahead to 2030, the expansion of renewables in electricity generation will further enhance the emission-reduction potential of heat pumps, highlighting the increasing energy and environmental advantages of this technology.

In the residential sector, heat pumps stand out as one of the most cost-effective energy efficiency solutions per kWh of energy saved. Examining data from projects implemented under the so called “Superbonus” (Article 119 of the Decree Rilancio No. 34/2020), electric heat pumps deliver a **cost per thermal kWh saved that is 35% lower than condensing boilers**. While the installation of an electric heat pump requires a **higher initial investment** compared to traditional heating systems, significant long-term energy cost savings are achieved due to their higher efficiency and use of renewable energy. Furthermore, integrating a heat pump with photovoltaic systems can increase **bill savings to more than 80%**. Data from “Superbonus” investments also show that electric heat pumps accounted for **11.1% of thermal energy savings** between 2020 and 2022, despite representing only 6.8% of total investments. Additionally, unlike traditional boilers, electric heat pumps can be used for both heating and cooling buildings, making them a versatile solution suitable for a wide range of residential, commercial, and industrial applications across various contexts and climatic conditions.

Building on these considerations, the Italian NECP (National Energy and Climate Plan) highlights electric heat pumps as a key instrument for the energy transition, emphasizing their versatility in application and the necessity of introducing incentives and supporting mechanisms to promote their widespread adoption within Italy’s building stock. The latest

version of the NECP, published in July 2024, sets a goal for 2030 to cover approximately **36%** of thermal sector consumption in Italy with renewable sources, forecasting a growing role for heat pumps in the thermal energy mix, with an expected contribution of **5.2 Mtoe**.

Distinctive Features of Electric Heat Pumps

- **Emission Reduction:** For the same amount of thermal kWh produced, an electric heat pump **reduces CO2 emissions by 65% (75%)** compared to a condensing boiler (non-condensing boiler)
- **Energy Efficiency:** a heat pump can achieve a **primary energy savings of 58.5%** for heating a residential building compared to a traditional system
- **Renewable Energy Integration:** integrating a **heat pump with photovoltaic systems** can increase **energy bill savings to over 80%** (vs. 27% with the heat pump alone)
- **Flexibility/Versatility:** heat pumps are a mature technology and can be used for both **heating and cooling** buildings across **different contexts and climatic conditions**. This makes them suitable for a wide range of residential, commercial, and industrial applications
- **Cost Effectiveness:** heat pumps rank among the **most cost-effective energy efficiency solutions in the residential sector**. Although installing a heat pump requires a **higher initial investment** compared to traditional heating systems, **significant medium- to long-term energy cost savings** can be achieved due to their higher efficiency and use of renewable energy.

Figure IV. Distinctive features of electric heat pumps for the decarbonization of the civil sector. *Source: TEHA Group analysis based on data from ENEA, Assoclima, EHPA, and various sources, 2024.*

4. As a result of these benefits, the EU and Italy anticipate significant growth in the stock of installed heat pumps by 2030, with an increase of 40 million units in the EU and 8.6 million units in Italy. However, in 2023, uncertainty surrounding incentives caused a sharp decline in sales in Italy (-33% compared to 2022).

In the coming years, the heat pump market is expected to grow significantly across Europe, **nearly tripling the number of installed units** compared to 2023, reaching a total of **63 million heat pumps by 2030**. To accelerate the decarbonization of the building sector, many EU countries have also set ambitious growth targets for the heat pump market. **Germany** and the **United Kingdom**, for instance, plan to install over **500,000 units** annually. In Poland and Spain, final energy consumption from heat pumps is projected to grow threefold and sixfold, respectively, over the next decade. Within this framework, Italy is also strongly focusing on this technology, with a **target of 8.6 million heat pumps installed by 2030**, potentially reaching 11.6 million units (**+287%** compared to 2023).

However, the past two years (**2023-2024**) have seen a **significant slowdown in the heat pump market**. After a decade of steady growth in Europe, with annual installations rising from 750,000 units in 2014 to 2.8 million in 2022, the first signs of a market downturn emerged in 2023. The number of installed units contracted by **3.6%** compared to 2022. Current data for the **first half of 2024** indicate even more concerning trends in European demand for heat pumps, with a **47% decline compared to the same period in 2023**. In particular, **Italy** experienced a sharp drop in sales during the first half of 2024, with a **46% decrease** compared to the first half of 2023. Indeed, the decline in European sales is largely attributed to the Italian market, where the number of installed units had already **decreased by 33% in 2023**, compared to a 4% reduction at the European level. This decline in the Italian market has been primarily driven by **instability and uncertainty in incentives** that supported the sector until

2022, now posing a serious threat to achieving the decarbonization targets for 2030. It is therefore clear that this sector requires support not only through incentive mechanisms but also through the establishment of a **stable regulatory framework in the short to medium term**. Such a framework is crucial to ensure optimal conditions for **industrial planning and investments in the Italian heat pump supply chain**, which are essential to safeguarding the competitiveness and energy security of this key sector for decarbonization.

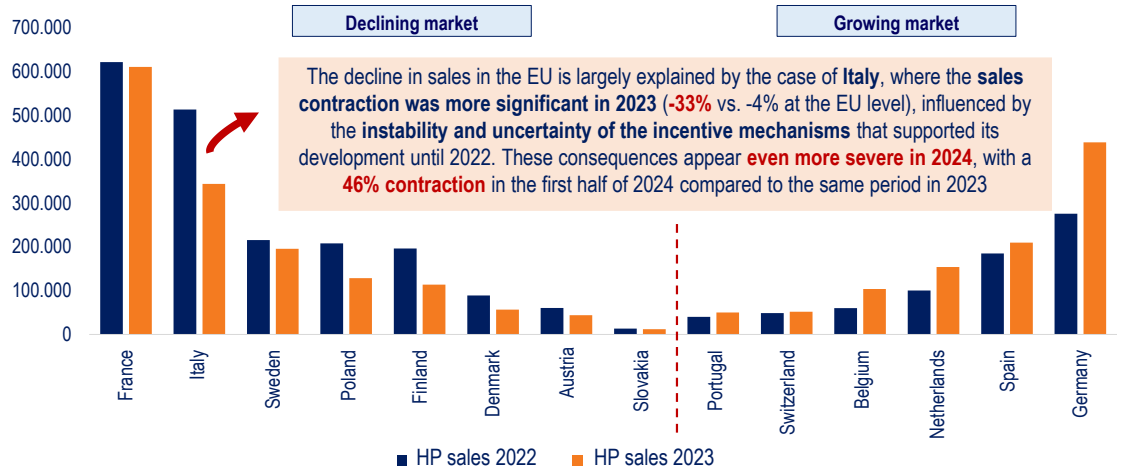

Figure V. Number of heat pump sales in major European countries (units), 2022-2023. *Source: TEHA Group analysis based on EHPA data, 2024.*

5. In the energy transition process, it will be crucial to avoid shifting from energy dependence to technological dependence, supporting and consolidating the competitiveness of strategic industrial supply chains. Unlike other green technologies, Europe's and Italy's technological dependence is limited in the production of heat pumps: as of today, the incidence of Italian production for the main components of the technology in Italy is 60%, rising to approximately 90% within the European perimeter. However, attention must be paid to the segment of heat pumps with power <18 kW, which is strategic for the decarbonisation of the residential sector. In this segment, the incidence of Italian production in sales is, on average, less than 30%.

The need to **enhance the value chains of green technologies** is perceived by all **major global economies** which, in recent years, have adopted several measures to support their industrial development. Examples of these initiatives can be found in China's 14th Five-Year Plan, the US Infrastructure Investments and Jobs Act and Inflation Reduction Act, and the European Green Deal Industrial Plan, which allocate respectively €177 billion, €46 billion and €99 billion per year, over their respective funding period.

In order to fully realise on the **potential of the energy transition and its technologies**, it is crucial to **create, develop, and strengthen green industrial supply chains** to sustain the growth expected in the coming years and gradually reduce dependence on third countries. Currently, **China dominates all green technology markets except for heat pumps**, where it

holds **39%** of global manufacturing capacity (29% in North America, 16% in Europe, and 16% in the rest of the world). This technology is identified as **strategic** for achieving a net-zero economy by 2050 in the **Net Zero Industry Act (NZIA)**. Beyond the expected development of heat pumps at the European and Italian levels, it is increasingly necessary to **support and strengthen the competitiveness and solidity of the manufacturing sector**, as also emphasized by Mario Draghi in his Report *"The Future of European Competitiveness".*

In this context, the **Italian and European** heat pump **supply chain** proves to be **robust**: the **incidence of Italian production for the main components**[1] of electric heat pumps produced in **Italy** is **59%**, a figure that rises to **87%** when considering a broader perimeter: the **European** one.

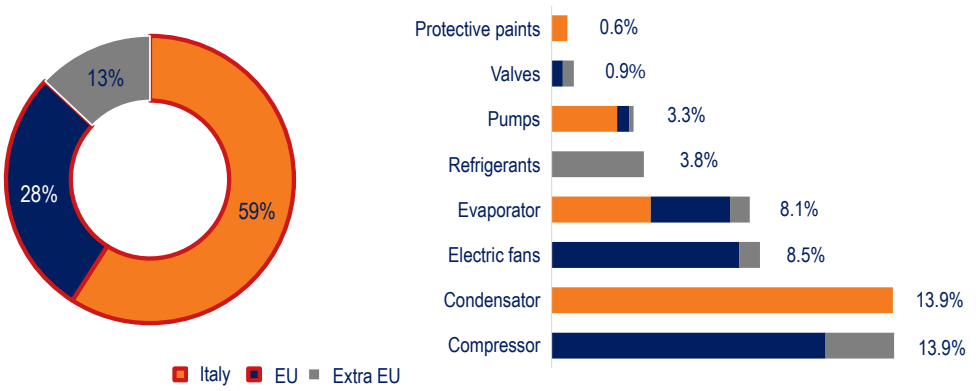

Figure VI. Left graph: Incidence of production of heat pump components sold in Italy (%), 2023 or latest year available and Right graph: Incidence of heat pump components by production area (%), 2023 or latest year available. *Source: TEHA Group elaboration on Assoclima data, 2024.*

However, there are also some **critical issues**: the **dependence of Italian manufacturing** is particularly high on **compressors**, which are mostly imported from foreign countries. A further point of attention concerns the market for heat pumps with a **power of less than 18 kW**. This segment is highly **relevant**, as a **substantial increase** in the use of **heat pumps in the residential sector** is expected in the near future, replacing more polluting boilers. Indeed, breaking down the **incidence of Italian production on the total heat pump sales** according to their power, it emerges that for devices with a **power of less than 18 kW**, this value is, **on average, below 30%.**

[1] The main components considered in the Study are exclusively those identified as strategic by the NZIA: protective paint, valves, pumps, refrigerants, evaporator, condenser, electric fans, compressor.

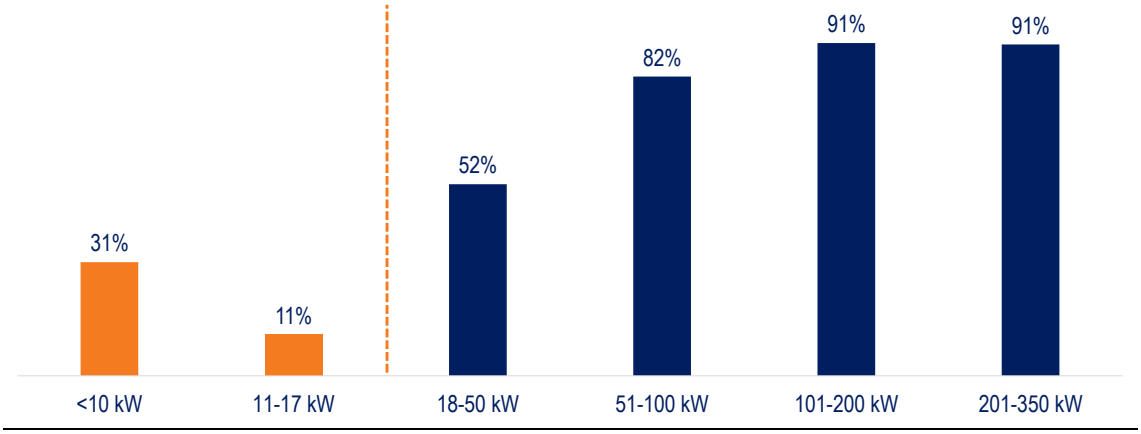

Figure VII. Incidence of Italian production on total sales by power (%), 2023. *Source: TEHA Group elaboration on Assoclima data, 2024.*

6. The demand for electric heat pumps is expected to grow significantly in the coming years: in Italy, there are approximately 6 million non-condensing boilers that should ideally be replaced with electric heat pumps in the short to medium term. To expand the production capacity of Italian companies, investments and government support are required. Without efficient and effective investments, there is a risk of losing market share and competitiveness to EU countries that have already announced their support programs (e.g., France) or non-EU countries (e.g., China), as has already occurred in other European energy sectors.

After assessing the **current strength** of the Italian and European electric heat pump **supply chain** (Key Message 5), TEHA evaluated whether the **companies and the industrial sector related to the production of electric heat pumps would be able to meet the anticipated growing demand** in the near future and **avoid losing competitiveness and market share**.

In this regard, TEHA developed a **methodology** to calculate the **potential use of electric heat pumps**. The calculation consists of 3 steps:

— **screening procedure** to select buildings suitable for heat pump installation;

— **calculation of the potential** installed, assuming the replacement of 60% of non-condensing boilers with electric heat pumps (small power, suitable for residential use);

— calculation of the annual **heat pump sales rate** required to complete the replacement of the oldest boilers by **2035**, and comparison with the **average annual sales rate** of the past **2 years**.

What emerges from the application of the TEHA methodology is that the potential for installation in the short to medium term in **Italy** is approximately **6.5 million units to be installed by 2035** (**60%** of the non-condensing boilers currently present in buildings), and that with the current sales rates, the replacement of non-condensing boilers with heat pumps would only be completed by **2040**.

The model has been applied in the 40 European countries with the largest number of companies producing heat pumps: Italy (50), France (42), Germany (33), and Spain (27). All of these countries still have **heat pump sales rates that are too low** to complete the replacement by 2035. Without a change in pace, in fact, **France** would reach the target in **2036**, **Spain** in **2041**, and **Germany** in **2060**.

The expansion of production capacity, which will need to involve the major players in the European market, requires **investments** from companies and necessary **support from government policies to deploy them**. If this is not implemented, the **market shares and competitiveness of European companies could be at risk** in favour of non-European companies (e.g., Chinese), which can rely on more competitive prices due to economies of scale, as has happened, for example, in other energy manufacturing sectors such as **photovoltaics**, which, despite being the RES with the greatest prospects, has seen much of its **competitiveness lost in just under 15 years**.

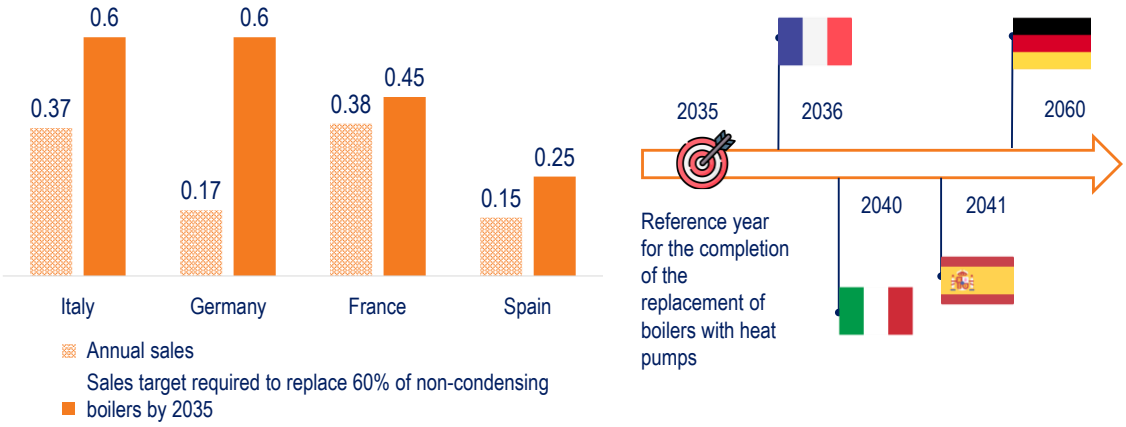

Figure VIII. Left graph: Annual sales of heat pumps and the required annual sales rate to achieve the replacement of 60% of non-condensing boilers by 2035 (millions of units), 2023 and Right graph: Forecast of completion year of the replacement (illustrative). (*) Calculated as the average of the 2021-2022 sales reported by EHPA. *Source: TEHA Group elaboration on Assoclima, EHI and EHPA data, 2024.*

7. In light of the need for capacity expansion, TEHA has analysed how solid and ready the extended supply chain is to face this expansion. In particular, with an industrial production value of 5 billion euros and about 110,000 jobs supported, Italy is the 2nd country in Europe for the production of components (accounting for 22% of total European production) and for the number of workers in the extended heat pump supply chain. Furthermore, 2/3 of Italy's extended supply chain components imports take place within the EU (compared to 49% for the EU as a whole), once again demonstrating the strength of the domestic industry.

TEHA carried out a **holistic mapping of the electric heat pump supply chain** in **Italy** and **European countries** to substantiate its economic-strategic relevance, quantifying the role of the electric heat pump industrial sector and estimating the strategic importance of the industry. **13** industrial **technologies** have been identified within the electric heat pump supply

chain, related to the components identified as strategic within the NZIA (National Zero-Emission Industry Strategy).

The analysis[2] conducted by TEHA on the supply chain clearly highlights its **solidity**: at European level, the value of **potentially activatable production in the extended** heat pump component **supply chain** is estimated at **€27 billion**, while the number of **employees** reaches **963,000**. In this context, **Italy** also stands out for its **strategic role**, ranking as the **2nd country** in Europe for industrial production value, €5.3 billion, and number of employees, 107,000, in the extended electric heat pump supply chain, second only to Germany, which accounts for €7.8 billion in industrial production value and 198,000 employees in the extended supply chain.

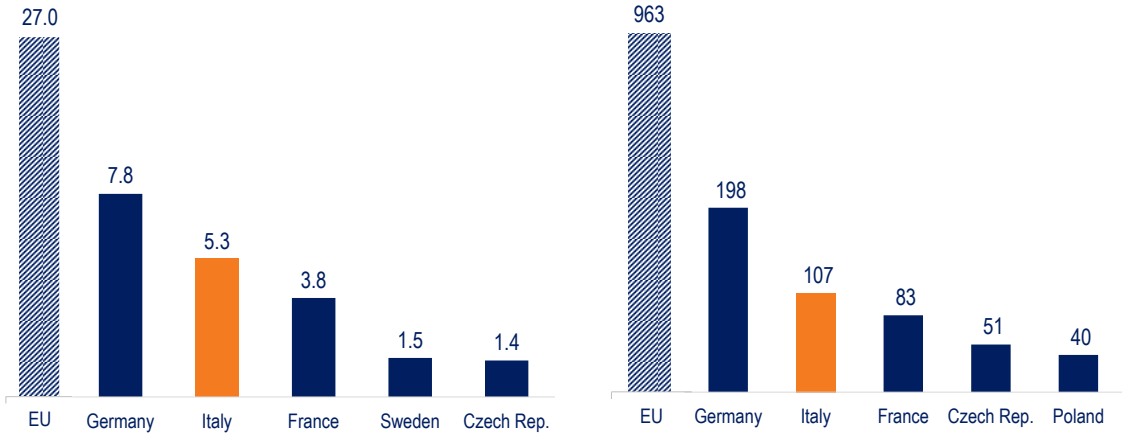

Figure IX. Left graph: Value of production potentially activated in the extended supply chain of heat pump components in the EU and top-5 countries (billion euros), 2022 and Right graph: Number of employees* in the extended heat pump supply chain in the EU and top-5 countries (thousands of employees), 2022. N.B.: Data for France are not available for the years 2021-2022, the values shown in the graphs have been estimated from the latest available year. (*): The employment values were calculated from the ratio of production value to the number of employees in the identified sectors falling within the perimeter of the extended electric heat pump supply chain. *Source: TEHA Group elaboration on ProdCom and Eurostat data, 2024.*

A more detailed analysis of the supply chain mapping reveals that the production value of components varies in its contribution to the total value of European production (€27 billion). Specifically, the **condenser and evaporator** are the components that **contribute the most** to the production value (**39%**), followed by **protective paint** (**22%**), **microprocessors** (**11%**), **compressors** (**10%**), and the remaining components[3] (which cumulatively account for 18%).

It is also important to highlight that **Italy**, at the European level, is particularly distinguished in the production of **protective paint, copper pipes, valves, resistors, condensers and**

[2] TEHA methodology used to calculate the value of the extended supply chain considers the production value of all economic activities involving the components of a heat pump. In this way, it is possible to obtain the economic value in terms of industrial output of the entire extended industry involved in heat pump production. Consequently, the value of the extended supply chain represents a broader scope, and thus a higher economic value, than the heat pump industry alone (intended as the finished product).

[3] Copper pipes (4%), electric resistors (4%), electric fans (4%), pumps (3%), valves (3%).

evaporators, components for which it contributes respectively **25%, 53%, 37%, 24%, and 22% of the European production value**.

The last analysis conducted by TEHA on the extended electric heat pump supply chain focuses on the breakdown of imports and exports of components. Once again, this shows the **strength** of the Italian heat pump supply chain, capable of **importing and exporting about 2/3 of the components within the European perimeter**. These values are higher than those recorded at the European level, where 49% of imports and 57% of exports remain within the borders of the Union.

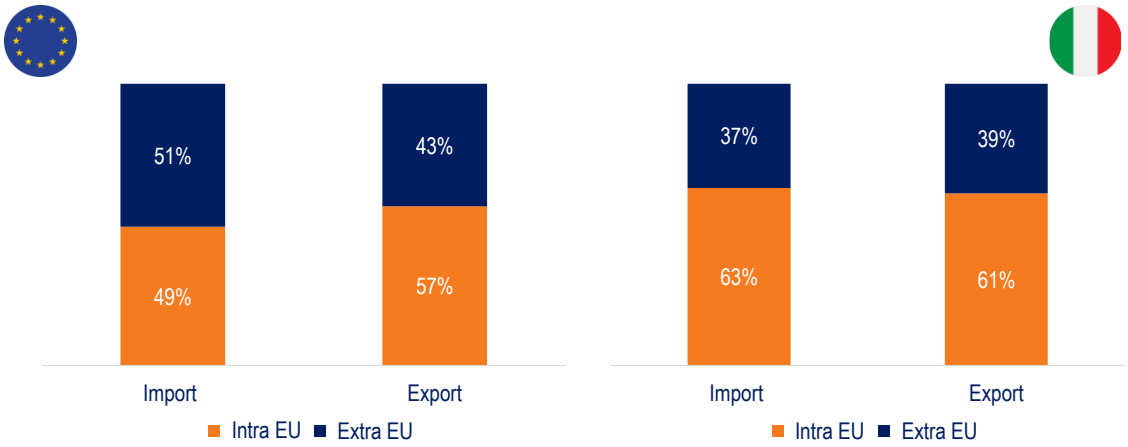

Figure X. Left graph: Breakdown of imports and exports of heat pump components in Europe (%), 2022 and Right graph: Breakdown of imports and exports of heat pump components in Italy (%), 2022. *Source: TEHA Group elaboration on Comext data, 2024.*

8. The need to expand the production capacity of heat pumps in Italy is also reflected in the perceptions and expectations of supply chain operators. A survey conducted by TEHA with the support of Assoclima highlights the importance of fostering the development of a highly strategic Italian heat pump industry for the energy transition, incentivizing investments in new production capacity and research and development (R&D) to meet anticipated growth in the coming years.

To better frame policy proposals aimed at supporting and strengthening the competitiveness of the Italian electric heat pump industrial supply chain, TEHA conducted a **survey among companies** associated with Assoclima. This was designed to complement the sector's quantitative analysis with the **expectations and perceptions** of supply chain operators.

The survey was carried out in July 2024 among 30 Assoclima member companies, with the objective of investigating:

— **market growth expectations** for heat pumps in Italy;

— **investment growth forecasts to increase production capacity** and adapt to market evolution;

— **investment growth forecasts in Research and Development (R&D)** and/or **training and specialization programs**;

— **key challenges** perceived by the Italian industrial supply chain **hindering the development of the heat pump sector** in Italy;

— **main policy proposals and operational recommendations** to support the growth of the heat pump sector in Italy.

The survey results reveal that, despite **negative growth expectations for 2024** (**8 out of 10** companies anticipate lower sales compared to 2023), supply chain operators predict a market recovery in the coming years. Specifically, the proportion of companies forecasting sales growth of **over 10% in 2024** compared to the previous year was only **13%** of the sample, rising to **57%** for the **2025-2027** period and **69%** for the **2028-2030** period.

In response to anticipated sales growth, the survey highlights an increasing willingness among companies to **expand their production capacity**. Over the next three years (**2025-2027**), about **42%** of heat pump manufacturing companies (compared to 8% in 2024) plan to increase their production capacity by **over 20%**. This capacity expansion will be accompanied by a significant increase in related investments: **4 out of 10 companies** expect to **increase investments** in production capacity by **more than 30%** during the next three years (2025-2027).

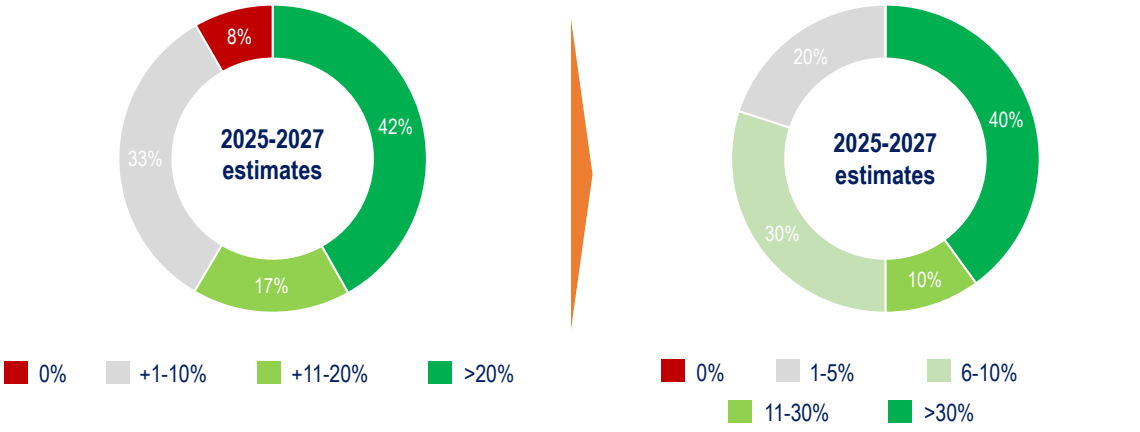

Figure XI. Left graph: Responses to the question, "*Given market growth expectations, do you plan to increase your company's heat pump production capacity during the period 2025-2027?*" (values in % relative to 2023 production capacity), 2024 and Right graph: Responses to the question, "*How much does your company plan to increase investments aimed at expanding heat pump production capacity over the next three years (2025-2027) compared to 2023?*" (values in % relative to 2023 investments), 2024. *Source: TEHA Group survey to Assoclima member companies, July 2024.*

The survey also reveals a **growing** trend in **investments in Research and Development (R&D) and in training and specialization programs**. The percentage of companies allocating more than 10% of their total investments to R&D (relative to the reference period) is expected to increase from 8% in 2019 to approximately **54% by 2030**. Similarly, the proportion of companies dedicating more than 5% of their total investments to training and specialization is projected to rise from 8% in 2023 to around **38% by 2030**.

9. The development of the supply chain, the industrial competitiveness of the sector, and the diffusion of heat pump technology are constrained by several market, supply chain, and systemic critical issues.

Given the importance of the European industrial heat pump supply chain for the energy transition, various **critical issues** at the market, supply chain, and system levels must be addressed, as they risk undermining the industrial competitiveness of the sector and the adoption of this key decarbonization technology. According to the survey conducted among industry operators, more than 90% of Italian companies identify **dependence on incentives** as the **primary obstacle** to sector growth in the coming years. This issue is exacerbated by the high installation costs and the comparative affordability of gas over electricity, which prolong the return on investment for private individuals. In fact, the demand for heat pumps in Italy risks stagnating in the coming years after the boom driven by the "Superbonus" initiative and in absence of targeted incentives, highlighting the **significant immaturity of the domestic market**.

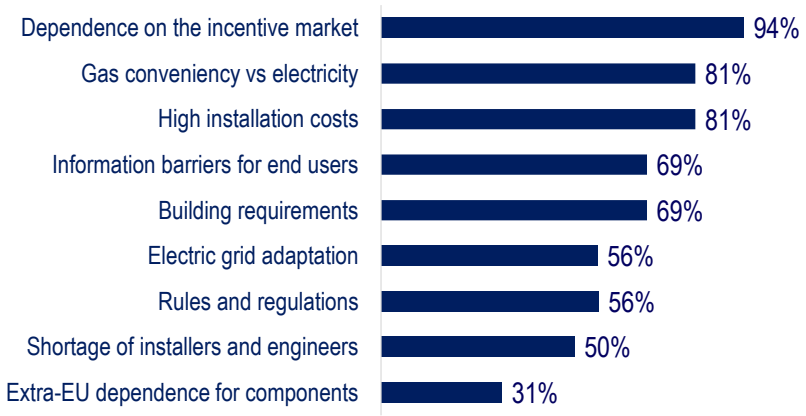

Figure XII. Main critical issues reported with medium-to-high severity* for the development of the heat pump sector according to industry operators (% of companies out of total), 2024. (*) Each company rated each challenge on a scale from 1 to 5 based on their perception, where 1 corresponds to very low severity and 5 to very high severity. Challenges with medium-to-high severity include all responses rated from level 3 to level 5, identifying the issues deemed most critical by industry operators. *Source: TEHA Group survey to Assoclima member companies, July 2024.*

Another key issue to address is the **ratio between electricity and gas prices**, which **81%** of industry companies consider a significant obstacle to the adoption and affordability of heat pumps. To achieve a quick return on the initial investment and stimulate demand, the price of electricity **should not exceed double the price** of gas. However, **in Italy**, this ratio reaches **3.5 due to excise duties and higher system charges**. Examining the individual components of electricity and natural gas tariffs for industrial users, excise duties are **1,684%** higher for electricity compared to natural gas for the same energy delivered, with costs rising to **2,534%** higher when system charges are included, contributing to an overall electricity price 3.5 times higher than gas.

Another challenge for supply chain operators lies in the **high installation costs**, particularly affecting market demand in the residential sector. Heat pumps have higher equipment and installation costs compared to traditional boilers, with costs being 80% higher for air-to-air heat pumps and 110% higher for air-to-water systems. However, when **comparing total costs over the system's lifespan**, the significant advantages of heat pumps become evident due to lower operating costs, which offset the initial investment. As shown also by the analysis of "Superbonus" interventions, heat pumps are among the most cost-effective energy efficiency solutions in terms of cost per thermal kWh saved.

Finally, another critical issue in the Italian market concerns **information barriers for end users**. Nearly 7 out of 10 companies report that citizens' limited awareness of the benefits and savings enabled by heat pumps represents a major obstacle to their adoption across the country. Many of the common **false myths about heat pumps** are often unfounded, highlighting the need for transparency and public education initiatives to highlight the advantages of this technology. Among the main information barriers for end users, examples include incompatibility with low outdoor temperatures or with radiator heating systems. Actually, modern heat pumps are designed to operate efficiently even at temperatures below 0°C, down to -15/20°C. Even with radiator systems, heat pumps can maintain thermal comfort in the house by reaching higher flow temperatures. Specifically, the main false myths mapped by the Study are:

— heat pumps only work in **new buildings**: modern heat pump technologies can work effectively even in less energy-efficient buildings. Improved insulation or the use of high-temperature heat pumps can further enhance efficiency in older structures;

— heat pumps only work in **highly insulated buildings**: in less insulated buildings, heat pump efficiency is ensured with proper system sizing and can be further improved with partial renovation measures, such as wall insulation or replacing windows;

— heat pumps do not work in **apartments**: heat pumps can be installed in apartments, especially air-to-air and air-to-water models. Compact units are designed to fit the limited space of apartments;

— heat pumps **do not work in cold climates**: modern heat pumps are designed to operate efficiently even at low external temperatures, with many air-to-air and air-to-water models performing effectively down to -15/-20°C;

— heat pumps **do not provide sufficient heating**: heat pumps can maintain thermal comfort even in colder climates, reaching thermal flow temperatures high enough for space heating, including in systems with radiators;

— heat pumps are **noisy**: most outdoor units operate at noise levels of around 40-50 dB, comparable to a refrigerator. Indoor units are generally very quiet, making heat pumps suitable for residential use;

— heat pumps are expensive and **increase energy bills**: heat pumps are among the most cost-effective energy efficiency solutions in the residential sector. While installation requires a higher initial investment, significant medium- to long-term savings are achieved due to their high thermal efficiency;

— heat pumps are **less efficient than gas boilers**: heat pumps are far more efficient at converting energy into heat compared to direct gas combustion. While gas boilers have an efficiency of around 90-95%, heat pumps can achieve seasonal efficiencies exceeding 300-400%, delivering a primary energy savings of 58.5%, even compensating electricity generation from fossil fuels;

— heat pumps **reduce property value**: properties with efficient heating systems are more attractive to potential buyers due to energy class certifications. Integrating heat pumps with photovoltaic systems or BACS systems further increases property value;

— heat pumps have a **short operational lifespan**: modern heat pumps have an average operational lifespan of about 15-20 years, comparable to traditional boilers. Proper maintenance can extend their lifespan even further for residential heating applications.

10. In order to maximize the contribution of heat pumps to decarbonization and strengthen the competitiveness of the Italian supply chain, it is crucial to introduce adequate policies to support the growth of demand in the coming years, ensuring subsidised investments, effective building renovation policies, and a regulatory framework in line with sector development.

Italian heat pump manufacturers identify the **regulatory framework** as a significant **barrier** to the development of the sector. According to the survey conducted by TEHA, **none** of the companies interviewed **believe that the current market support policies are adequate to foster the growth of the heat pump sector in Italy**.

However, industry operators have a clear understanding of the policies that could better support the sector's growth. The main recommendations include:

— **subsidised green financing** to stimulate demand;

— promotion of **building renovation policies** with heat pumps;

— a **regulatory framework adequate** to the development needs of the sector.

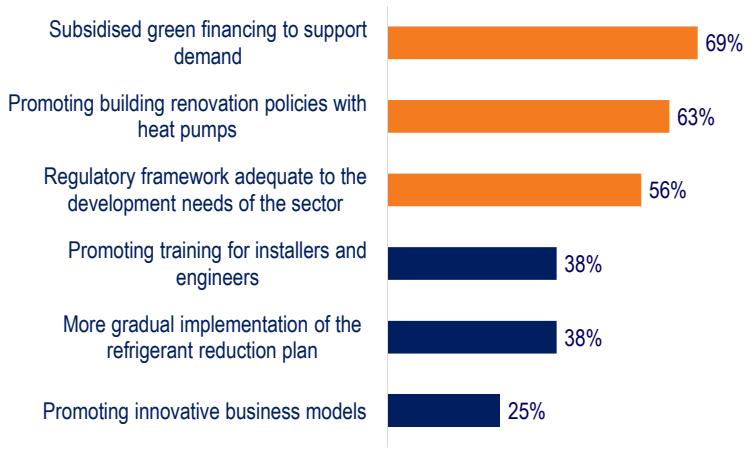

Figure XIII. Main policy proposals with medium-to-high relevance for supporting the growth of the electric heat pump sector according to industry operators (% of companies out of total), 2024. *Source: TEHA Group survey to Assoclima member companies, July 2024.*

In the light of the energy transition targets set for 2030 and the contraction of demand in Italy, it is necessary to introduce **medium- to long-term policies** adequate to **support the growth of heat pump demand in Italy** in order to allow for adequate industrial planning to **strengthen the industrial competitiveness of the supply chain**.

Regarding **green financing** to support demand, the specific policy proposals include:

— promoting **green loans at favourable rates for the installation of heat pumps** as the primary heating system in homes, partially funded through revenues from European Emissions Trading System (ETS) auctions and the European Social Climate Fund;

— supporting investments by **low-income households** for the purchase of heat pumps by reducing installation costs for end users through subsidies, ensuring **equitable access to green technologies**;

— **incentivizing the disposal of old systems** (combined with green loans) to reduce the overall costs borne by families and businesses.

In terms of more effective **building renovation policies**, specific measures include:

— ensuring stability in incentive schemes over a **medium- to long-term horizon** (at least until 2030) for heat pump installation in the building sector, with **clear and stable criteria** over time and **reward mechanisms** for who also carry out insulation work or install renewable energy systems to complement the heat pumps;

— promote the reorganisation of incentives into a **Consolidated Act on building bonuses**, aligned with European objectives, ensuring **greater selectivity** of technologies with **incentives proportional** to the **potential primary energy savings** achieved through building renovation projects.

Finally, among the policies that are most frequently indicated by sector operators there is the need to develop an **adequate regulatory framework for the sector development**, specifically:

— **subsidised electricity tariffs** for users who use heat pumps as the primary heating system in their homes, to increase the convenience of electricity over gas in Italy;

— the alignment of Italian legislation with **European eco-design** standards, replacing the current minimum requirements for access to incentives, based on nominal values at full load, with **seasonal minimum requirements based on primary energy savings**;

— the reduction of the annual rates of recognition of existing incentives, ensuring that the **initial rate** is at least **equal to the VAT on the investment** for a heat pump, to help users manage the high initial installation costs;

— the promotion of **information and awareness campaigns** aimed at educating end users on the benefits of heat pumps in the residential sector.