

Italy needs a 10-year plan to reduce emissions from the domestic burning of wood biomass by 70%

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Executive summary

Atmospheric pollution and air quality have always been at the centre of public and political debate. We prepared this document with the awareness that the domestic burning of wood biomass is an objective issue in relation to air quality, which as a trade association we do not want to deny, rather **tackle with a sense of responsibility**.

Domestic heating, across Italy as in other European countries, is a significant source of particulate which, nationally, represents 54% of PM₁₀ emissions (Ispra 2020), thereby ranking as the primary source. These emissions are mainly generated by biomass burning which ranks third as the source in generating atmospheric particulate and represents 50% of the primary PM₁₀ emission (Arpae 2019).

Most of these emissions nevertheless come from the stoves of dated fireplaces characterised by outdated combustion technologies. **More than 70% of wood and pellet appliances installed in Italy are more than 10 years old, approximately 6.3 million, and contribute to 86% of the PM₁₀ emissions** generated through domestic biomass burning (Aiel 2020). Therefore old and inefficient domestic stoves represent the main source of particulate deriving from domestic heating, therefore use must be limited and **replacement with modern and efficient wood and pellet heating systems must be encouraged**. Modern biomass appliances are in fact characterised by PM₁₀ emissions that are 4 to 8 times lower than obsolete technologies. Generally a wood stove installed more than 10 years ago presents emission factors of more than 480 mg/Nm³ while a modern insert or a modern stove has emissions between 20 and 30 mg/Nm³. Open fireplaces, which are still the most common wood appliance in Italy today, have emission factors exceeding 860 mg/Nm³.

The **technological turnover**, i.e. the replacement of appliances characterised by obsolete burning processes with modern technologies, represents **a realistic solution that the sector can uphold to meaningfully contribute to reducing the impact of domestic wood and pellet burning on air quality**. Nevertheless, solely replacing technologically outdated generators is not enough to guarantee appreciable results and a significant leap in improving air quality. In fact it will be crucial to start a broad “awareness creating” action on end users, especially those who burn wood which, if the appliance is not used correctly, can cause an increase in PM₁₀ emissions and organic carbon, which is responsible for the formation of organic and secondary particulate in the atmosphere, as much as 10 times more in comparison to optimal use.

The intention of the biomass heating sector, as the first party to take action, is to actively work towards improving air quality. In order for this to be possible it is necessary to implement, in partnership with the competent ministers and local reference bodies, an organic framework of planned actions, i.e. an action plan that makes it possible to turn the strategic objective into tangible results. The sector is therefore asking to be **supported in this virtuous journey and demands the need for a national plan** that may only be actuated through the support of the political world and the competent institutions if they take it on as their own, with a strategic and political view.

A national action plan to reduce the PM10 emissions of domestic biomass burning by 70% in 10 years

Domestic heating, across Italy as in other European countries, is a significant source of particulate with a particularly critical concentration in some zones of the country, such as the Po Plain (Figure 1), and in our country contributes to 54% of primary PM10 emissions (Ispra 2020), thereby ranking as the main source. These emissions, in the winter season, are mainly generated by the domestic burning of biomass, wood and prevalently pellets. If we consider the particulate measured in the atmosphere (primary and secondary¹), we discover that domestic heating, with 17%, represents the third source of emissions, just after road transport and farming (Arpae 2019) producing 50% of primary particulate (Figure 2).

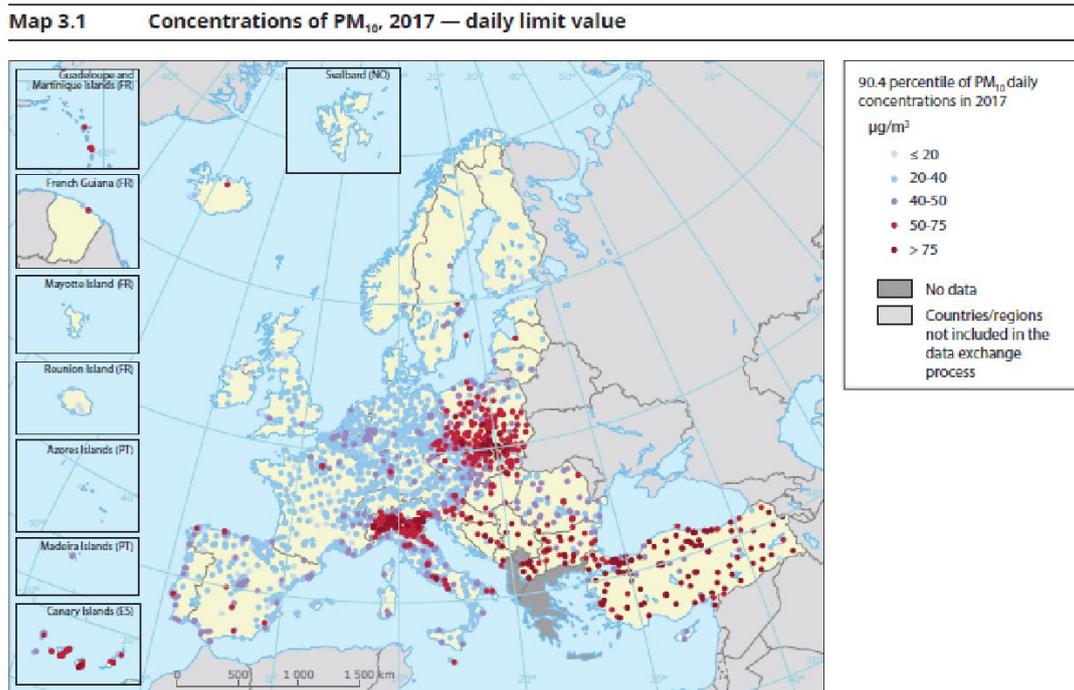


Figure 1 PM₁₀ concentration in Europe (daily limit value). Year 2017 (EEA 2019)

¹ Atmospheric particulate is distinguished into primary and secondary. Primary particulate is found in the atmosphere in the form of dust directly released by the various polluting sources. Secondary particulate originates in the atmosphere following chemical-physical reactions that occur between primary pollutants and other compounds.

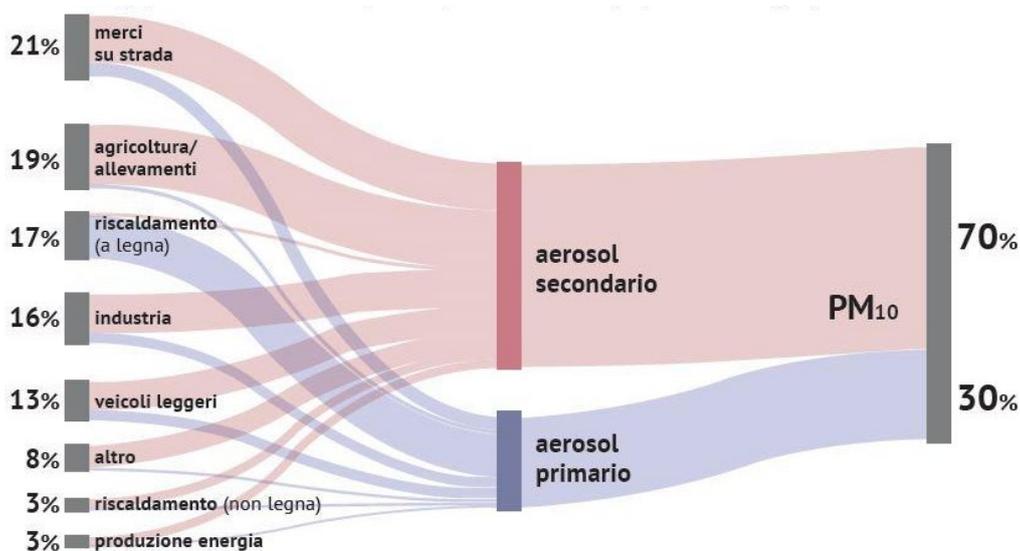


Figure 2 “PM₁₀-equivalent” emissions in Emilia-Romagna. The band width is proportional to “PM₁₀-equivalent” (Arpae 2019)

This leads to the need to propose a **ten-year strategy of scrapping obsolete systems and educating users** with the aim of **tangibly improving air quality**, offering heating to the country’s families with a renewable, sustainable and *carbon neutral* source. All of this without overlooking the subsequent social-economic benefits that translate into increased and/or maintained turnover of the manufacturing industry, guaranteeing employment and contributing to the national GDP, while strengthening the concept of *Made in Italy*.

Implementing this objective will, nevertheless, only be possible thanks to the support of the institutions who will support it through a strategic and political vision. For this reason, the wood biomass heating sector, taking the first steps of action alongside the Aiel trade association, asks to be **supported in this virtuous journey that will accelerate the technological turnover**, i.e. the scrapping process of old stoves with modern technologies and creating awareness on reducing the impact of domestic burning on air quality, further strengthened by the correct management of heating systems by the end users.

This will be possible without having to make additional investments but simply by guaranteeing and specialising the existing incentives systems, particularly Conto Termico (*Italian government aid which funds efficient renewable heating sources*) and Ecobonus/Superbonus.

Why can’t the energy industry by-pass biomass?

Renewable energy sources sustain Italian consumption for a total of 21.6 millions of tonnes of oil equivalent (Mtoe), an amount that made Italy rank third in Europe for the use of alternative energies in 2018 (Figure 3).

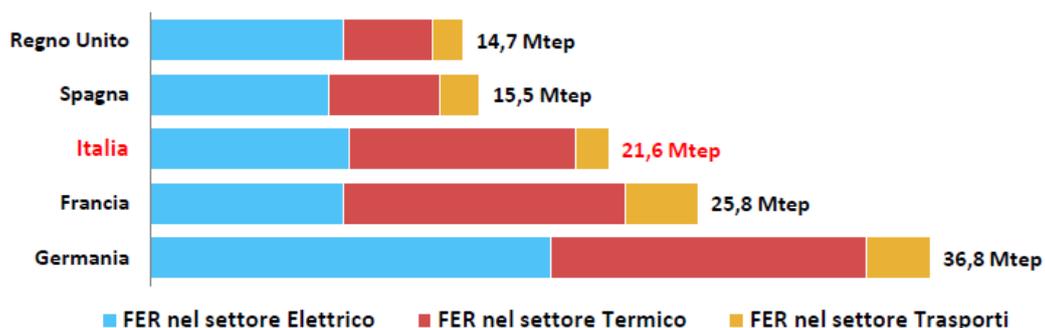


Figure 3 The main European countries for the use of renewable sources in 2018 (Gse 2020a)

Italy is also one of the 12 Member States of the European Union (EU) to have reached its 17% objective in terms of renewables for 2020, and among the five main EU countries in terms of overall energy consumption (Germany, France, Spain, United Kingdom) it has the highest value for quota covered by renewable energy sources (Res), of 17.8%.

Bioenergy used in heat production, **especially in the residential sector in the form of wood and pellets, with 7.7 Mtoe², they are the main renewable energy source used in our country** (Figure 4). This is the reason why they are often referred to as the “unknown giant” of renewables.

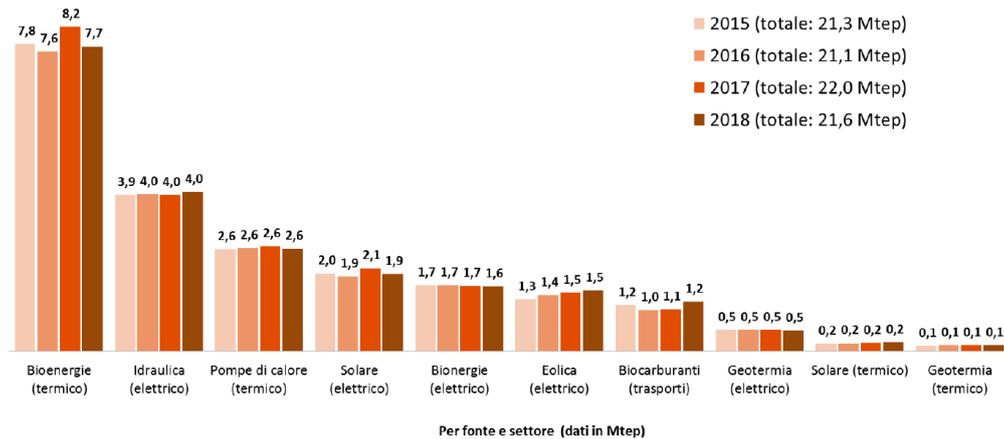


Figure 4 Contribution of the various sources to gross final consumption of energy from Res (Gse 2019)

The very **use of wood and pellets** in the residential heating sector **allowed Italy to reach, two years in advance, the 2020 renewable energy objectives set by Europe**. Also, in the Integrated national plan for energy and climate (Pniec), that sets the energy and climate objectives for 2030, wood biomasses play a decisive role in the renewable production of heat: **more than half of the thermal energy (53%) must be produced by solid biomasses** (Figure 5) guaranteeing an annual production of approximately 7 Mtoe over the coming 10 years (Figure 6).

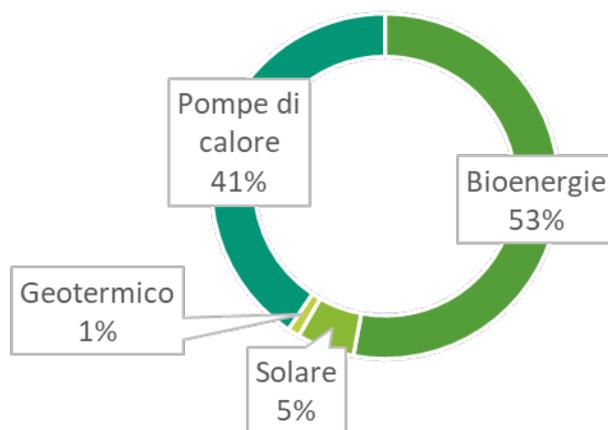


Figure 5 Final consumption of Res by 2030 for the heating sector, set forth by Pniec (Econ. Dev. Min. 2020)

² Without considering the biodegradable fraction of waste

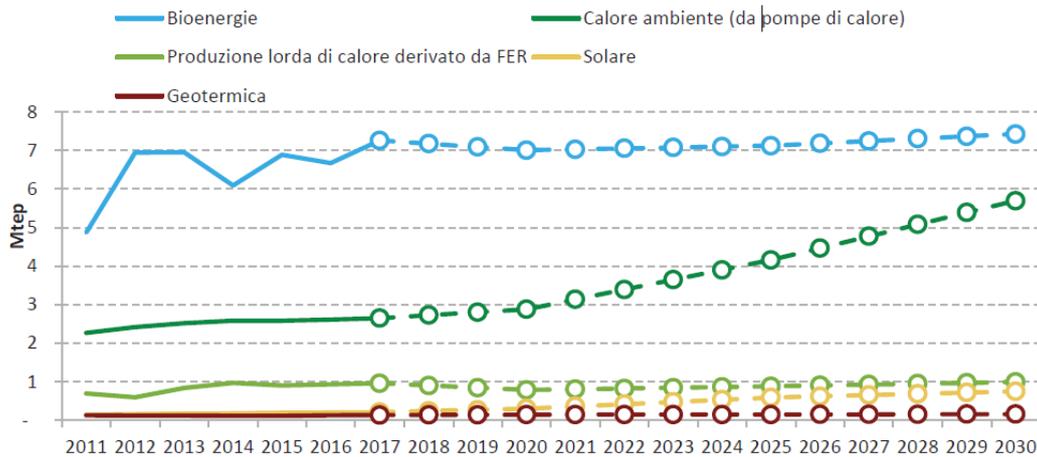


Figure 6 Growth trajectories of energy from renewable sources for 2030 in the heating sector set forth by Pniec (Econ. Dev. Min. 2020)

In addition to this, an element that cannot be overlooked, is the current climate change affecting the entire planet, caused by greenhouse gases, especially CO₂. **Wood biomass is a renewable source, considered carbon-neutral³**. It is therefore a closed circuit where, thanks to plant growth, over a few years, the carbon emissions produced during energy use are guaranteed to be reabsorbed. **With fossil fuels, on the other hand, carbon dioxide that has been bound over the course of geological eras is massively released into the atmosphere and cannot be reabsorbed.**

In actual fact we need to nevertheless consider **that cutting, transporting and processing timber are operations that consume energy, not to mention the construction of energy conversion systems.** For this reason, the only way to correctly assess the impact in terms of climate-altering emissions is to consider the entire life cycle (LCA). Comparing various fuels used for heating, whether fossil or wood, starting with obtaining the raw materials all the way to management at the end of the useful life, including the stages of fabrication, distribution, transport and use, it is observed that the emissions expressed in CO_{2eq} for fossil fuels, for the same amount of produced energy (MWh) are considerably higher than those for wood. In particular fuel oil releases 326 kg of CO_{2eq} into the atmosphere, LPG 270 kg of CO_{2eq}, methane 250 kg of CO_{2eq}, pellets 29 kg of CO_{2eq} and wood for burning 25 kg of CO_{2eq} (Figure 7). It is therefore possible to conclude that **the use of wood biomass for the production of heat makes it possible to reduce CO_{2eq} emissions by between 89% and 94% in comparison to traditional fossil fuels.**

³ The principle of neutrality of biomasses is covered by Community Legislation with Directive EC/87/2003 on the Emission Trading Scheme, which attributes a CO₂ emission factor of zero to biomass used for energy purposes in sectors subject to the Emission Trading Scheme (ETS) (Annex IV of the Directive)

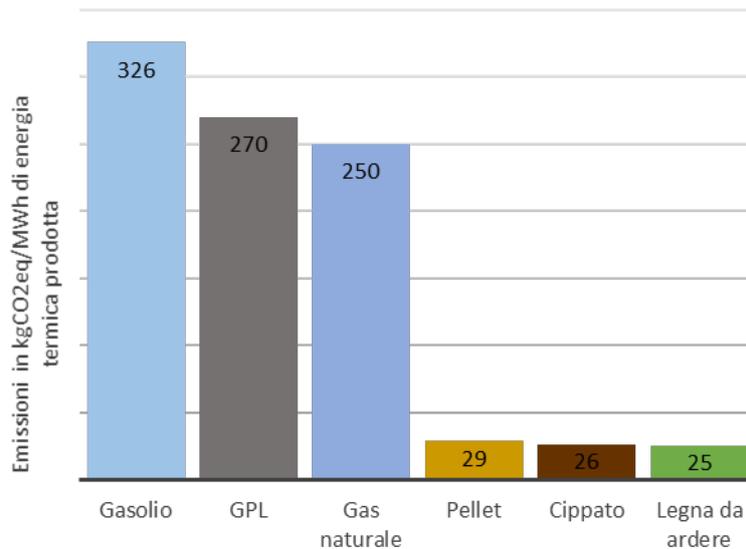


Figure 7 Greenhouse gas emissions for various fuels for heating⁴ (Eltrop 2018)

But are the emissions coming from our sector truly on the rise?

Not only is air quality improving (EEA 2019) but **in Italy, the emissions of wood burning have dropped by 23% from 2010 to 2018**, going from 123,000 to 95,000 tonnes (Ispra 2020). This decrease is highlighted by the 12% drop in the weighted average emission factor (EF) of PM₁₀ on the consumption percentage of each category of appliances considered in the inventory which **went from 406 g/GJ in 2010 to 356 g/GJ in 2018** (Francescato 2020).

In Lombardy, where over 10% of the wood biomass used in the residential sector is consumed (Gse 2019), the official data highlights that over the course of 8 years the particulate emissions attributed to the domestic heating sector with biomass dropped by approximately 30% (Lanzani 2020), in consideration of an almost unchanged number of installed domestic appliances, i.e. 600,000 units. In Veneto, based on the results of a statistical study conducted in 2018 by the Regional Governments of the Po Plain within the framework of the prepAIR project, the emissions dropped by 35% between 2006 and 2018, i.e. approximately 5,000 tonnes of PM₁₀ (Aiel 2020).

Over the course of the years there has also been a drop in the overall number of installations. **The total number of domestic heat generators fuelled with burning biomass is approximately 9 million** (year 2019), of which 76% is wood and 24% is pellets, **for a consumption of just under 15 million tonnes**, of which 11.7 million wood, 3.1 million (Figure 8). In the last 10 years the consumption of wood fuels **dropped overall by 17% with a main decrease in wood (-30%) and double the consumption of pellets** (Aiel 2020). We can therefore observe that over the years the level of performance and technology of the heating systems changed: obsolete burning technologies were gradually replaced by modern appliances, characterised by high efficiency and reduced emissions.

⁴ The mentioned LCA emission factors take into account the consumption of all the resources along the entire life cycle of the respective energy source. The factors are expressed in kg CO₂eq per MWh of final energy. The factors are calculated by the University of Stuttgart (Institut für Energiewirtschaft und Rationelle Energieanwendung, IER), using the GEMIS (Global Emissions Model for integrated Systems) database Version 4.95.

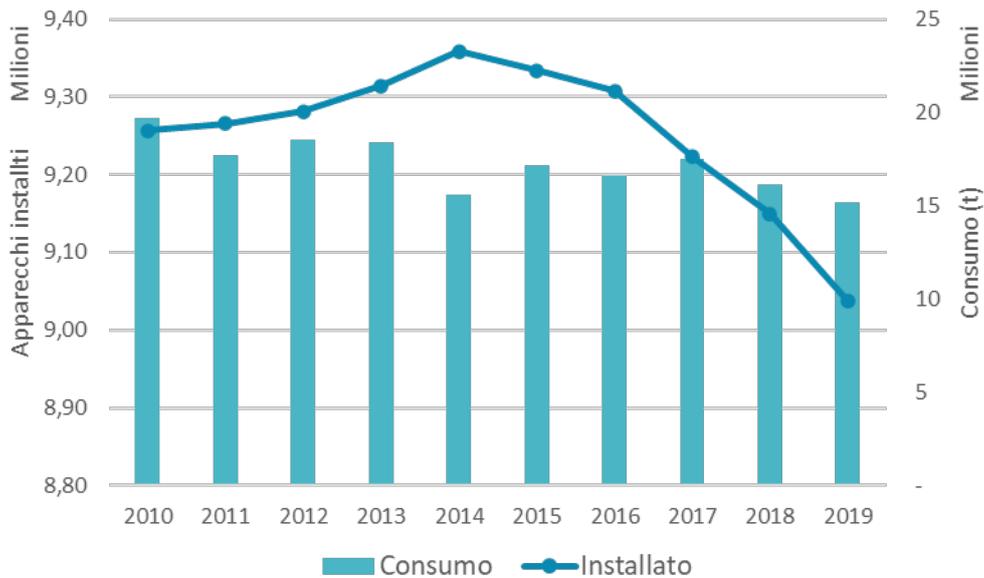


Figure 8 Comparison between the trend in installations and consumption of wood fuels (Aiel 2020)

Certainly, the Conto Termico considerably accelerated the technological *turnover*, as it was a tool made available to private clients and the public administration to encourage **upgrades to increase energy efficiency and for the thermal energy production from renewable sources**. For heating systems running on biomass, the Conto Termico was **especially aimed at re-qualifying existing appliances, exclusively allowing the replacement of obsolete appliances with new technologies that guarantee excellent performance, higher efficiency and lower emissions**. Yet not many people know about or have availed of the Conto Termico: the annual costs in 2019 for the promotion **of upgrades carried out by private clients (77.6% of the total) amounted to 213.6 million euros**, when there was an annual spending limit of 700 million euros⁵. Upgrades on biomass heating systems, just under 68,000, cost 146.5 million euros (Gse 2020b), i.e. **68% of the incentives paid out to private clients**. Regardless, the environmental effects generated by the technological turnover are considerable. **In 2017, when just over 23,400 upgrades were carried out with replacements, it was possible to guarantee 1,100 tonnes less emissions of particulate (PM) into the atmosphere per annum and approximately 80,000 tonnes of CO_{2eq} per annum** (Gse 2018). For 2019, with triple the replacement upgrades (67,000) it is reasonable to also expect triple the relative benefits for the environment.

Why does domestic burning from biomass still generate 50% of primary particulate emissions?

The logical question one should be asking is why, regardless of the high performance of modern appliances, **domestic burning of biomass still generates 50% of primary particulate emissions, representing the third highest source of emissions**. The answer lies in the age of the currently installed appliances: **70% of them, approximately 6.3 million, are older than 10 years and contribute to 86% of particulate emissions** (Figure 9) stemming from domestic biomass burning (Aiel 2020). Therefore, to significantly reduce the impact of atmospheric emissions it is necessary to replace the heating systems that are causing the majority of the emissions.

⁵ The Conto Termico places an overall amount of 900 mln€ per year of which 700 mln€ reserved for private applicants and 200 mln€ for public administration at the disposal of thermal energy efficiency upgrades from renewable sources

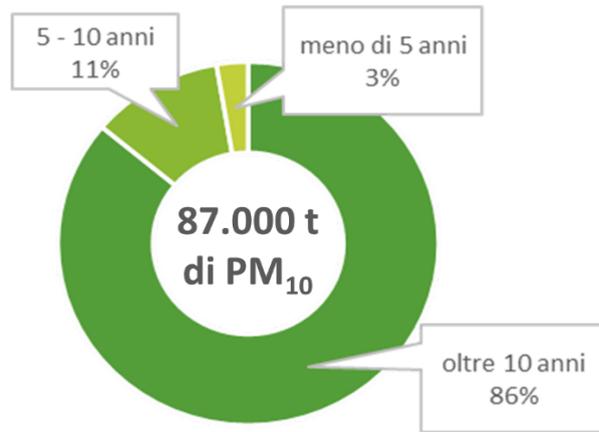


Figure 9 Incidence of age of the currently installed appliances on PM₁₀ emissions deriving from domestic biomass burning (Aiel 2020)