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Ufficio Italiano Brevetti e Marchi
Divisione VII-Brevetti**

**DATA ON THE NUMBER OF GREEN PATENTS IN ITALY
A UIBM analysis of patents filed in the field of eco-sustainable technologies**

"Innovate for a green future" is the theme chosen by WIPO in 2020 to celebrate the *World Intellectual Property Day*. Working for a more sustainable future from an environmental point of view is, in fact, an inescapable imperative for both technological innovation and the intellectual property that sustains it.

The development and spread of new technologies, whether they are revolutionary or able to de-carbonising the existing ones and providing solutions for the more sustainable management of resources, is in fact of fundamental importance to address climate change while responding to the growing demand for energy and natural resources on a global scale.

A solid and widespread industrial property system, in particular a patent system, stimulates innovation and the development of technologies that allow us to effectively tackle climate change and support the emergence of the green economy, increasingly at the center of world political debates. For this reason, especially in the last decade, many international organizations such as the EPO (*European Patent Office*), the WIPO (*World Intellectual Property Organization*), the OECD (*Organization for Economic Cooperation and Development*), just to name a few, have concentrated many of their studies on the role of patents in the development and dissemination of sustainable technologies.

Patent databases - Research criteria for green patents

A valid and powerful tool for the analysis of technological progress is constituted by patent databases that allow to examine and measure the diffusion of new technologies and to evaluate, therefore specifically, the current trends of "sustainable" innovation also with the goal of obtaining a clear and more transparent outlook of the more general economic scenario.

Taking into account that the trend registered in the last century for all invention activities is growing without distinction between technological areas (sustainable or not), to obtain a more realistic indication of the growth rate of patents in sustainable technologies, it is necessary to identify the patent trends concerning conventional energy supply areas (Fossil-Fuel and Nuclear) and the patent trends concerning **CCMTs (Climate Change Mitigation Technologies)**, as well as filings concerning **ESTs (Environmentally Sound Technologies)** in general.

The identification of inventions regarding sustainable technologies is, however, extremely complex. Invention classification systems, in all countries, have been designed to categorize them according to technical features and not according to the purpose of the inventions, nor to the achievable benefits. The ways in which patents are catalogued and identified are mostly based on the following criteria:

- ✓ classification (e.g. *IPC - International Patent Classification* and *CPC - Cooperative Patent Classification*)
- ✓ keywords
- ✓ combination of previous search techniques (classification and keywords)
- ✓ manual selection

Patents in sustainable technologies are searched and studied mainly according to IPC and / or CPC classification systems. The identification of IPC / CPC classes that refer to green technologies can be performed using two alternative and complementary methods: examining the description of the classes; test searches on each class to verify if they produce satisfactory results.

Climate Change Mitigation Technologies (CCMTs)

www.epo.org; www.unep.org

Climate Change Mitigation Technologies (CCMTs) are all those technologies and applications that contribute to the reduction of climate change, or adaptation to it, through the control, reduction or prevention of anthropogenic greenhouse gas (GHG) emissions, especially of CO₂.

This category includes all those measures whose goal is to radically restructuring the production process, not integrating it but transforming it at the level of technology used.

Environmentally Sound Technologies (ESTs)

<https://stats.oecd.org/glossary/index.htm>

Environmentally sound Technologies (ESTs), catalogued by the United Nations Framework Convention on Climate Change (UNFCCC) are a set of techniques and technologies able to reduce environment damages through processes and materials that generate fewer potentially harmful substances, recover such substances from emissions prior to discharge, or utilize and recycle production residues.

EPO (European Patent Office) Methodology

Since 2009, the European Patent Office has been carrying out an overall monitoring of inventions in sustainable technologies through the collection, processing and analyses of statistical data relating to patents in CCMTs . Since 1st January 2013 EPO introduced a dedicated coding scheme for patent documents relating to climate change mitigation technologies, called **Y02 tagging scheme**, which is based on the CPC classification. Section Y, which has thus been added to the 8 standard sections A-H of the international classification, is divided into the following classes: **Y02**, which identifies technologies or applications for the mitigation of climate change; **Y04**, which concerns information or communication technologies that have an impact on other technological areas.

Currently, EPO databases contain approximately 2.8 million documents related to green technologies, the largest single repository of low-carbon technologies in the world.

The EPO's scheme for climate change mitigation technologies ("Y02/Y04S") covers:

- Y02B CCMTs relating to buildings;
- Y02C Greenhouse gas capture and storage;
- Y02E Energy generation, storage and distribution;
- Y02P CCMTs in production;
- Y02T CCMTs relating to transport;
- Y02W CCMTs in waste treatment;
- Y04S Smart grids.

WIPO (World Intellectual Property Organization) Methodology

The "**IPC Green Inventory**" methodology, developed by WIPO for the search and retrieval of patent documents, aims at facilitating the identification of patents relating to *Environmentally Sound Technologies* (ESTs), based on the IPC classification.

Also ESTs are distributed in a high number of IPC classes, i.e. in a wide range of technical fields: for this reason the Green Inventory tries to collect all them in a single catalogue. The IPC Green Inventory contains approximately 200 items directly relevant to eco-friendly technologies with more than 1180 IPC related codes.

The Green Inventory collects technologies by grouping them into 7 main fields:

- 1. Alternative Energy Production;**
- 2. Transportation;**
- 3. Energy Conservation;**
- 4. Waste Management.**
- 5. Agriculture and Forestry;**
- 6. Administrative, Regulatory or Design aspects;**
- 7. Nuclear Power Generation**

IPC Green Inventory and WIPO Green

IPC Green Inventory

(https://www.wipo.int/classifications/ipc/en/green_inventory/), developed by the IPC Committee of Experts, facilitates searches of patent information relating to Environmentally Sound Technologies (ESTs), as listed by the United Nations Framework Convention on Climate Change (UNFCCC).

WIPO GREEN (<https://www3.wipo.int/wipogreen/en/>) is an online platform that facilitates connections between people looking for green environmental solutions and technologically advanced service providers.

The platform favours the exchange of technologies that contribute to the accelerated use of innovative green solutions.

Since 2013, more than 600 connections have been made between patents' owners registered on the platform and companies interested in innovation. The Green Technologies framework is very complex as there is no international standardized agreement to categorize green inventions; for this reason WIPO GREEN fills this gap trying to accelerate the change towards a sustainable and green global economy also considering the growth forecasts of the sector.

According to WIPO analysis (<https://www.wipo.int/publications/en/details.jsp?id=4351&plang=EN>), the number of green patents doubled between 2003 and 2013 but afterwards there was a slowdown in filings probably due to the decrease in investments in R&D and the entry of more mature technologies. Based on these data and forecasts, WIPO set the following goals in the **WIPO Green Strategic Plan 2019-2023**:

- Objective 1: Link green technology providers with people seeking solutions in a targeted manner, catalyzing and maximizing the potential of green technology transfer and diffusion.
- Objective 2: Accelerate access to green technology innovation opportunities for countries at all levels of development.
- Objective 3: Support member states in leveraging IP and innovation in global efforts to address major policy issues related to climate change, food security, and the environment.

OECD (Organisation for Economic Co-operation and Development) Methodology

The green patent search strategy adopted by the OECD, originated from the cooperation between universities, research centers and EPO, identifies about 80 technological fields, to which both the IPC and CPC codes are associated, divided into 9 macro areas:

- ENVIRONMENTAL MANAGEMENT
- WATER-RELATED ADAPTATION TECHNOLOGIES
- BIODIVERSITY PROTECTION AND ECOSYSTEM HEALTH
- CLIMATE CHANGE MITIGATION technologies related to ENERGY generation,
- CAPTURE, STORAGE, SEQUESTRATION OR DISPOSAL OF GREENHOUSE GASES
- CLIMATE CHANGE MITIGATION technologies related to TRANSPORTATION
- CLIMATE CHANGE MITIGATION technologies related to BUILDINGS
- CLIMATE CHANGE MITIGATION technologies related to WASTEWATER TREATMENT OR WASTE MANAGEMENT
- CLIMATE CHANGE MITIGATION technologies in the PRODUCTION OR PROCESSING OF GOODS

The identified sustainable technologies represent about 5-10% of all patented inventions.

UIBM (Ufficio Italiano Brevetti e Marchi) Methodology

To identify Italian patent applications regarding green technologies, UIBM adopted the WIPO methodology, which is based on the IPC Green Inventory, retrieving patents classified as eco-innovations through at least one IPC code belonging to the Green Inventory. The choice is due to the exclusive use of the IPC system to classify Italian patent applications.

Although the definition of eco-innovation is very broad and not exhaustive, UIBM decided to use all the fields identified by the WIPO Inventory in order to reduce the risk of excluding patents relating to potentially sustainable technologies.

The eco-sustainable inventions in Italy (UIBM data)

The UIBM dataset allows users to carry out analyses on Italian patent applications filed from 2009 to 2018. Eco-sustainable inventions are on average 9.6% of the total patents filed in Italy in the last decade, confirming a relevant activity of Italian companies in the research for technological innovations careful of environmental sustainability, in line, but in the higher range, with the percentages - between 5-10% of the total filings - that, on a global level, are attributed to eco-inventions.

As in the rest of Europe, also in Italy companies have carried out investments and strategic initiatives for the development of technologies that improve environmental sustainability.

Figure 1 illustrates the trend of patent applications over the years, represented as a percentage of total patent filings. Against a decline of 1% in the 2013-2014 two-year period, probably due to the decrease in investments in R&D caused by the economic crisis and the entry of more mature green technologies, there is a positive tendency in the medium-term with a rise of patent filings since 2014 until reaching 10.6% in 2018.

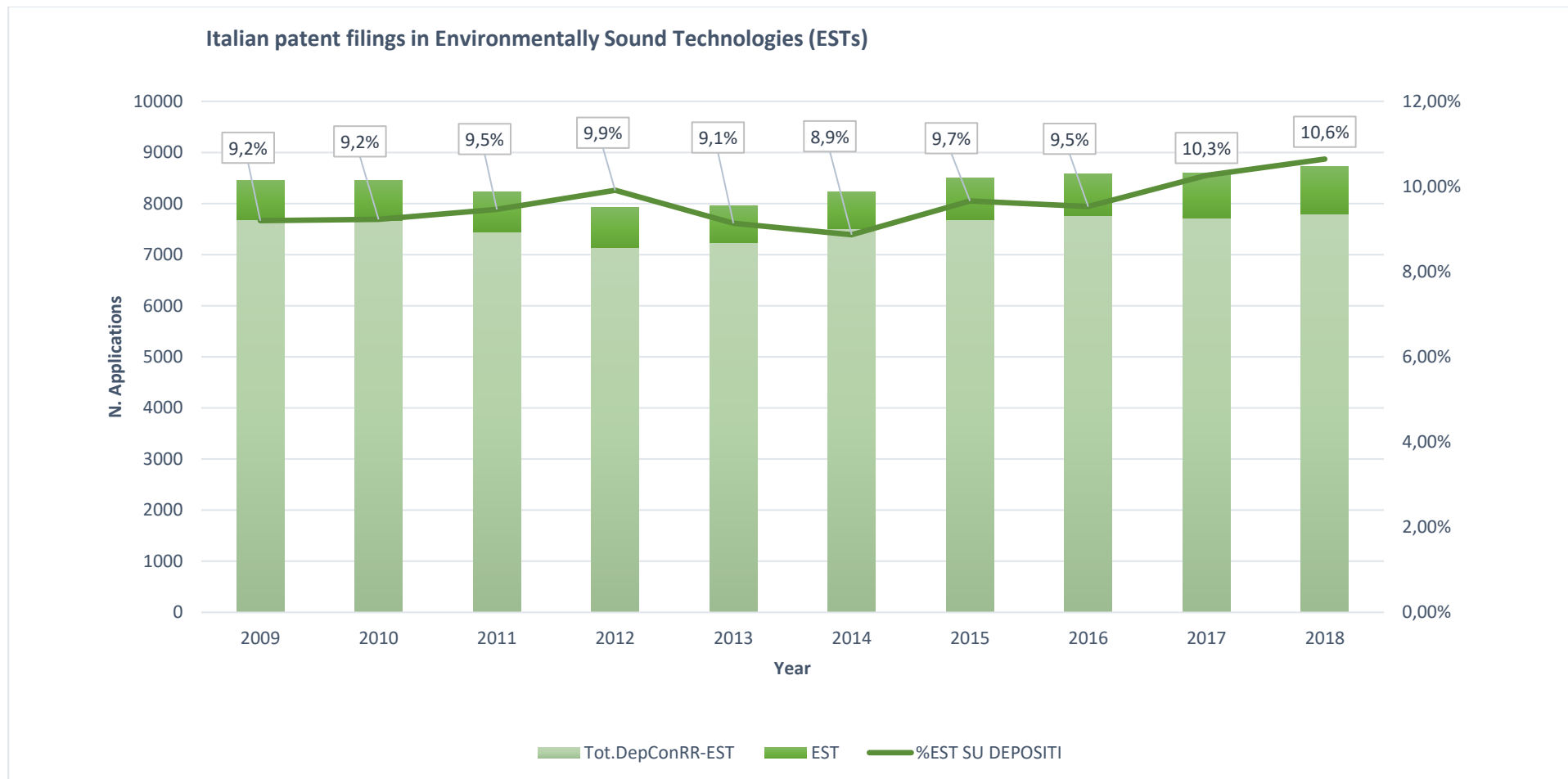


FIGURE 1: TREND OF PATENT FILINGS IN ENVIRONMENTALLY SOUND TECHNOLOGIES

This growing trend is also represented below in absolute numbers:

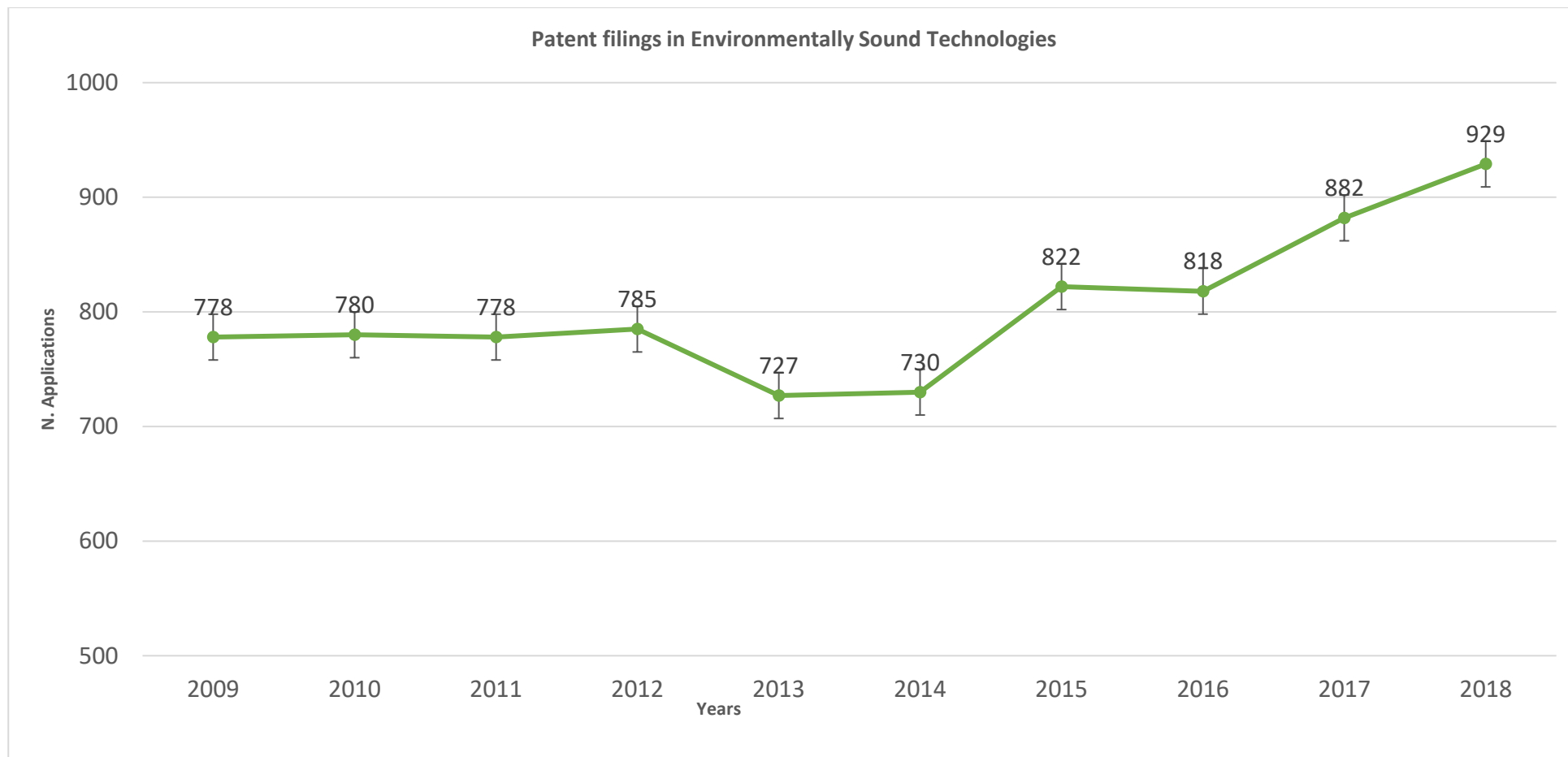


FIGURE 2: TREND OF FILINGS IN ESTs IN ABSOLUTE NUMBERS

If one carries out a detailed analysis of the Italian patents by inserting them in the 7 technological fields as classified in the IPC Green Inventory, it appears that the Italian patent applications are mainly concentrated in 3 areas:

- ***Alternative Energy Production;***
- ***Waste Management;***
- ***Energy Conservation.***

These sectors cover more than 60% of the whole dataset.

The following are the percentages of Italian patent applications relating to the 7 technological areas of the Green Inventory

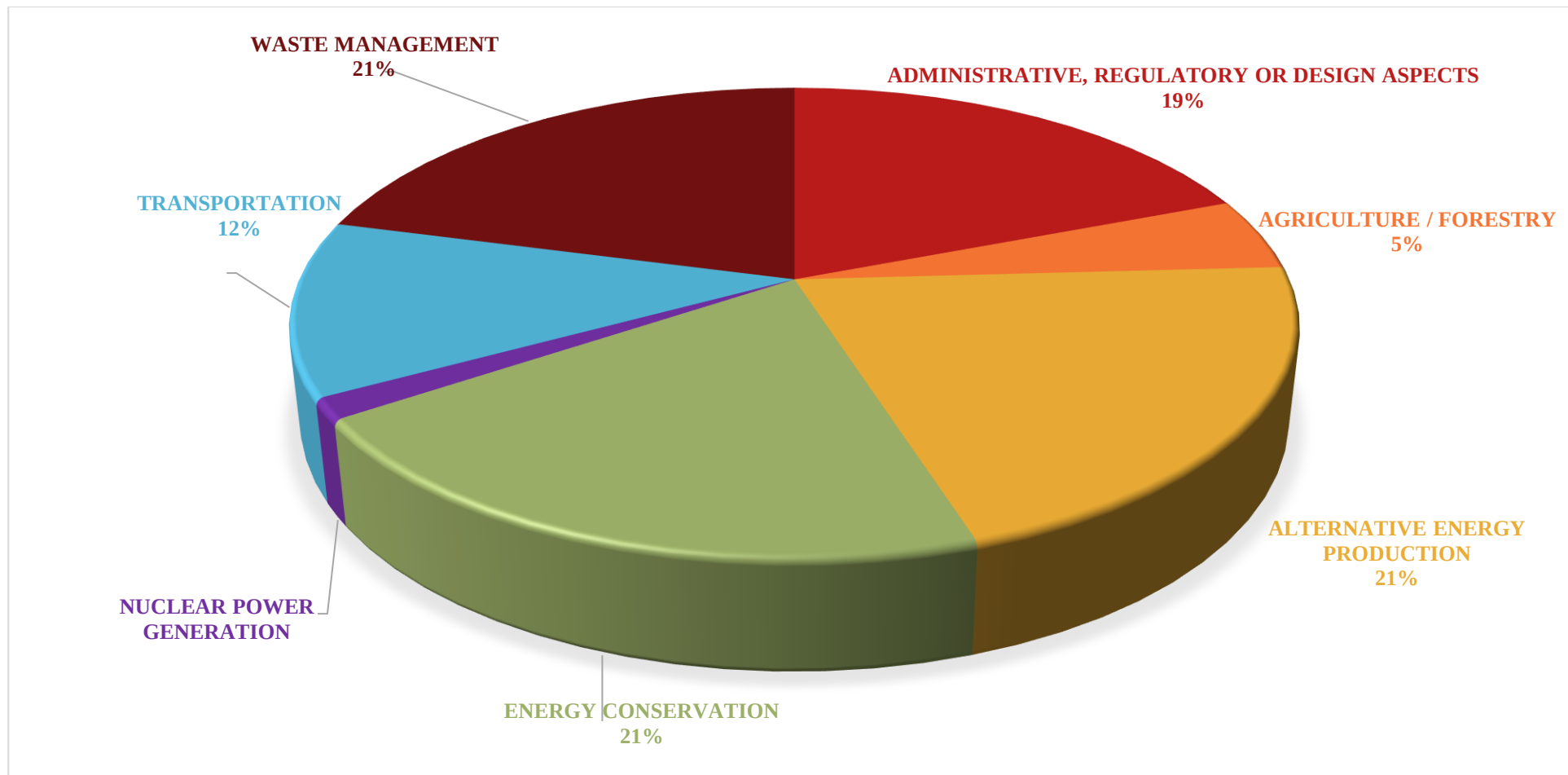


FIGURE 3: ITALIAN PATENTS IN THE 7 AREAS OF THE IPC GREEN INVENTORY

The analysis of Italian patent data in the last decade clearly shows the growing trend of the Administrative, Regulatory and Design Aspects sectors, due to the evolution of international, European and national policies on technological innovations aimed at environmental sustainability.

In the years from 2014 to 2018, the growing trend of Italian patent applications affects the Transport sector first and then the Agriculture sector. While there have been no significant increases in technologies relating to Nuclear Energy Production since 2016.

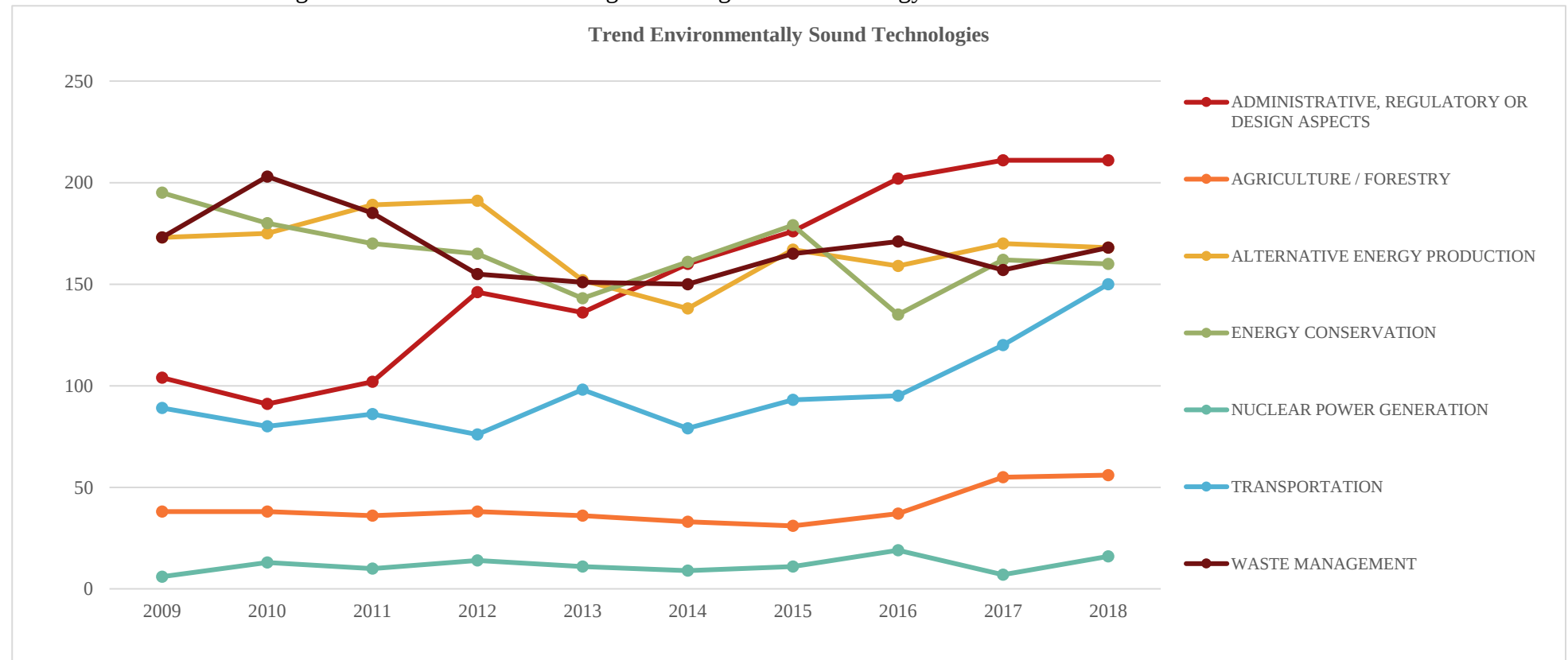


FIGURE 4: TRENDS 7 AREAS OF THE IPC INVENTORY

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Average %
ALTERNATIVE ENERGY PRODUCTION	22,2%	22,4%	24,3%	24,3%	20,9%	18,9%	20,3%	19,4%	19,3%	18,1%	20,9%
WASTE MANAGEMENT	22,2%	26,0%	23,8%	19,7%	20,8%	20,5%	20,1%	20,9%	17,8%	18,1%	20,9%
ENERGY CONSERVATION	25,1%	23,1%	21,9%	21,0%	19,7%	22,1%	21,8%	16,5%	18,4%	17,2%	20,6%
ADMINISTRATIVE, REGULATORY OR DESIGN ASPECTS	13,4%	11,7%	13,1%	18,6%	18,7%	21,9%	21,4%	24,7%	23,9%	22,7%	19,2%
TRANSPORTATION	11,4%	10,3%	11,1%	9,7%	13,5%	10,8%	11,3%	11,6%	13,6%	16,1%	12,0%
AGRICULTURE / FORESTRY	4,9%	4,9%	4,6%	4,8%	5,0%	4,5%	3,8%	4,5%	6,2%	6,0%	5,0%
NUCLEAR POWER GENERATION	0,8%	1,7%	1,3%	1,8%	1,5%	1,2%	1,3%	2,3%	0,8%	1,7%	1,4%

TABLE 1: TREND % PATENT FILINGS ESTS

Definitely, the most active sectors in Italy are: **Waste Management, Energy Saving and Alternative Energy Production** which cover more than half Italian green patents.

The patent activity therefore confirms that our country is actively taking part in the development of the green economy with relevant performances in technologies that provide a reduction of pollutants and the reuse of secondary materials, as well as in technologies aimed at improving energy efficiency and the use of renewable sources, with significant investments in logistics and transport.

Analysing the macro areas with higher percentages, we can highlight how some technologies present greater dynamism. The table below shows the detailed data relating to the technological sectors that fall within the areas of Alternative Energy Production, Waste Management and Energy Saving.

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Average %
ALTERNATIVE ENERGY PRODUCTION	22,2%	22,4%	24,3%	24,3%	20,9%	18,9%	20,3%	19,4%	19,3%	18,1%	20,9%
<u>Solar energy</u>	<u>7,8%</u>	<u>7,8%</u>	<u>8,9%</u>	<u>7,8%</u>	<u>7,0%</u>	<u>5,3%</u>	<u>5,7%</u>	<u>6,0%</u>	<u>7,7%</u>	<u>6,9%</u>	<u>7,1%</u>
Harnessing energy from manmade waste	3,7%	2,6%	3,9%	5,7%	3,6%	4,2%	4,0%	4,0%	4,1%	3,3%	3,9%
Geothermal energy	3,5%	4,4%	4,0%	3,2%	3,0%	2,5%	3,2%	2,8%	2,8%	3,3%	3,3%
Bio-fuels	4,2%	4,0%	3,5%	3,6%	3,7%	3,4%	3,5%	2,6%	1,9%	2,2%	3,2%
Others	3,0%	3,7%	4,1%	4,1%	3,6%	3,4%	3,9%	4,0%	2,7%	2,4%	3,5%
WASTE MANAGEMENT	22,2%	26,0%	23,8%	19,7%	20,8%	20,5%	20,1%	20,9%	17,8%	18,1%	20,9%
<u>Pollution control</u>	<u>13,5%</u>	<u>17,2%</u>	<u>15,0%</u>	<u>13,5%</u>	<u>13,6%</u>	<u>13,7%</u>	<u>12,3%</u>	<u>13,8%</u>	<u>11,3%</u>	<u>13,7%</u>	<u>13,7%</u>
Waste disposal	5,5%	5,1%	4,2%	3,3%	3,3%	3,0%	3,6%	3,2%	2,9%	1,8%	3,6%
Others	3,2%	3,7%	4,5%	2,9%	3,9%	3,8%	4,1%	3,9%	3,5%	2,6%	3,6%
ENERGY CONSERVATION	25,1%	23,1%	21,9%	21,0%	19,7%	22,1%	21,8%	16,5%	18,4%	17,2%	20,6%
<u>Thermal building insulation, in general</u>	<u>11,3%</u>	<u>7,2%</u>	<u>7,1%</u>	<u>6,9%</u>	<u>6,6%</u>	<u>6,6%</u>	<u>6,3%</u>	<u>6,1%</u>	<u>6,2%</u>	<u>5,3%</u>	<u>6,9%</u>
<u>Measurement of electricity consumption</u>	<u>5,5%</u>	<u>6,9%</u>	<u>6,8%</u>	<u>4,7%</u>	<u>5,4%</u>	<u>5,1%</u>	<u>4,7%</u>	<u>4,3%</u>	<u>6,2%</u>	<u>5,3%</u>	<u>5,5%</u>
Power supply circuitry	3,9%	4,9%	3,5%	5,4%	5,0%	6,6%	6,1%	4,8%	4,1%	5,3%	4,9%
Others	4,4%	4,1%	4,5%	4,1%	2,8%	3,8%	4,6%	1,3%	1,8%	1,4%	3,2%

TABLE 2: FOCUS ON 3 TECHNOLOGICAL FIELDS

As shown in table 2, within Alternative Energy Production, innovation in *solar energy* (7.1%) played a dominant role compared to other technologies; within Waste Management area, *pollution control* (13.7%) shows a prevalence compared to other sub-fields. In the area of Energy Conservation, the innovations relating to *Thermal building insulation*, shows a general stability, during the analysed decade.

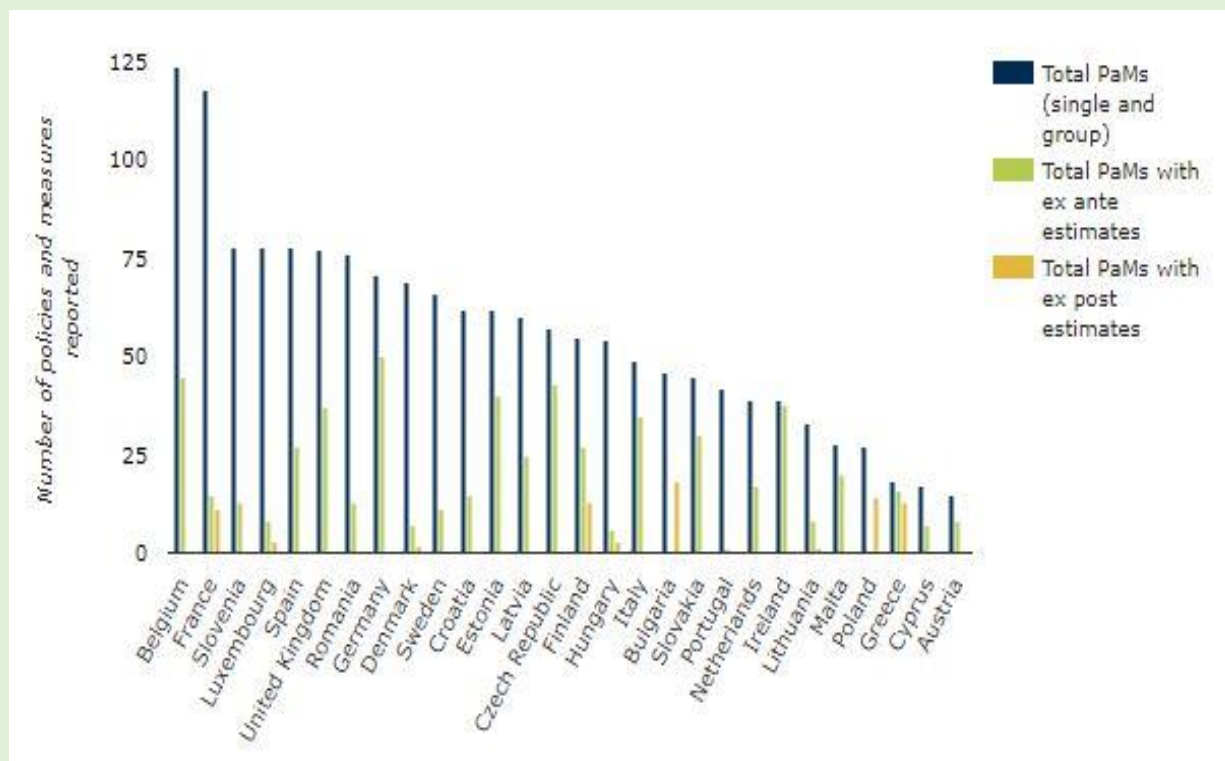
The table 3, below, illustrates in detail the first 10 sectors that present the highest percentages of patent applications.

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Avarage%
Carbon/emissions trading, e.g. pollution credits	9,8%	8,6%	11,2%	15,5%	16,1%	18,9%	17,4%	21,0%	21,2%	20,1%	16,1%
Pollution control	13,5%	17,2%	15,0%	13,5%	13,6%	13,7%	12,3%	13,8%	11,3%	13,7%	13,7%
Solar energy	7,8%	7,8%	8,9%	7,8%	7,0%	5,3%	5,7%	6,0%	7,7%	6,9%	7,1%
Thermal building insulation, in general	11,3%	7,2%	7,1%	6,9%	6,6%	6,6%	6,3%	6,1%	6,2%	5,3%	6,9%
Vehicles other than rail vehicles	5,7%	6,3%	5,1%	5,7%	6,6%	5,2%	6,6%	5,9%	8,5%	7,4%	6,4%
Measurement of electricity consumption	5,5%	6,9%	6,8%	4,7%	5,4%	5,1%	4,7%	4,3%	6,2%	5,3%	5,5%
Power supply circuitry	3,9%	4,9%	3,5%	5,4%	5,0%	6,6%	6,1%	4,8%	4,1%	5,3%	4,9%
Harnessing energy from manmade waste	3,7%	2,6%	3,9%	5,7%	3,6%	4,2%	4,0%	4,0%	4,1%	3,3%	3,9%
Rail vehicles	3,9%	2,7%	4,0%	2,5%	3,9%	4,4%	3,0%	4,4%	3,7%	4,3%	3,7%
Waste disposal	5,5%	5,1%	4,2%	3,3%	3,3%	3,0%	3,6%	3,2%	2,9%	1,8%	3,6%

TABLE 3: TOP 10 SECTORS

FOCUS – Reduction of greenhouse gas impact Italy / Europe

In the European panorama, the great effort put in place to achieve the goals set by the green economy, as shown in the following graph, is highlighted by the number of policies and measures (PaM) implemented, adopted or planned by each member State in order to reduce greenhouse gas (GHG) emissions.



The graph shows the number of policies for which the achievement of this goals is estimated ex ante (expected) or ex post (achieved).

Attention to these issues, combined with the adoption of targeted policy measures, stimulated R&D in green technologies which has increased patent applications filed.

The effort made to achieve these results has been relevant, and each Member State over the last decade adopted a large number of policies and measures aimed at reducing the impact of greenhouse gas (GHG) emissions.

The sectors involved in these actions are precisely the energy, both from the point of view of consumption and supply, and the transport, i.e. those sectors that have shown greater dynamism also from the patent point of view:

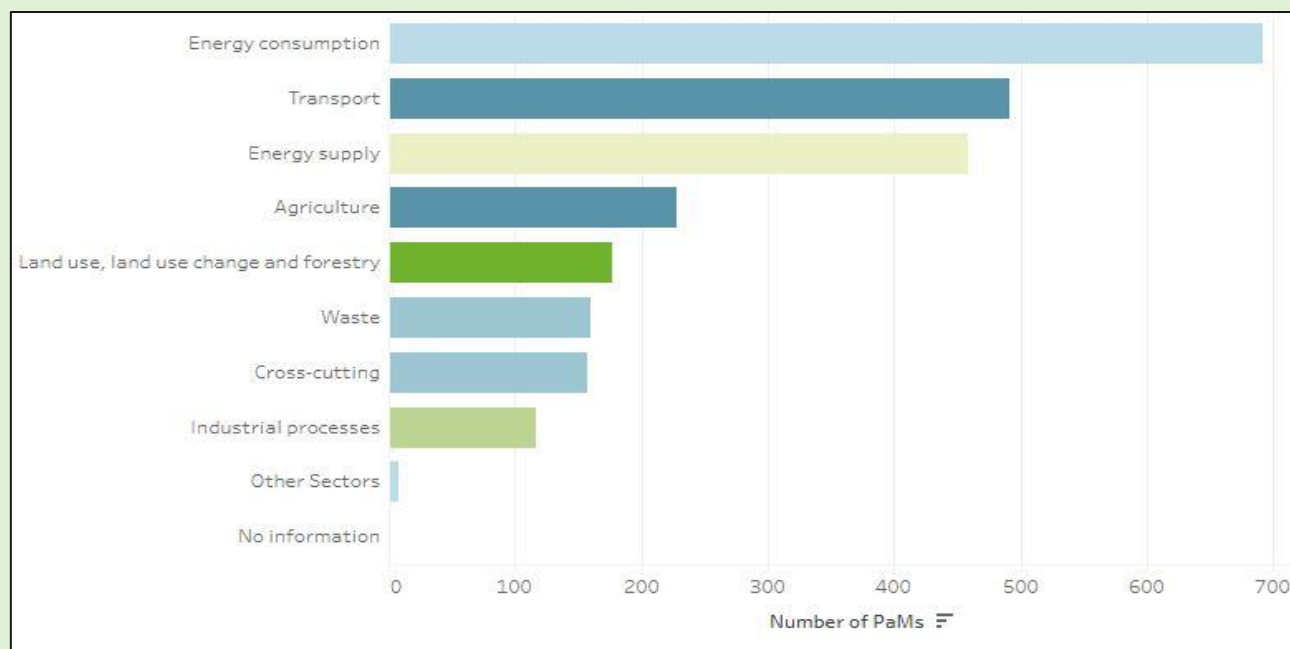


FIGURE 5: NUMBER OF POLICY MEASURES TO REDUCE THE IMPACT OF GREENHOUSE GASES AT EUROPEAN LEVEL AND SECTORS INVOLVED

In Italy, as shown in Figure 6, this trend is fully confirmed, as a consequence of the adoption of political measures aimed at sustainable mobility and better exploitation of energy resources.

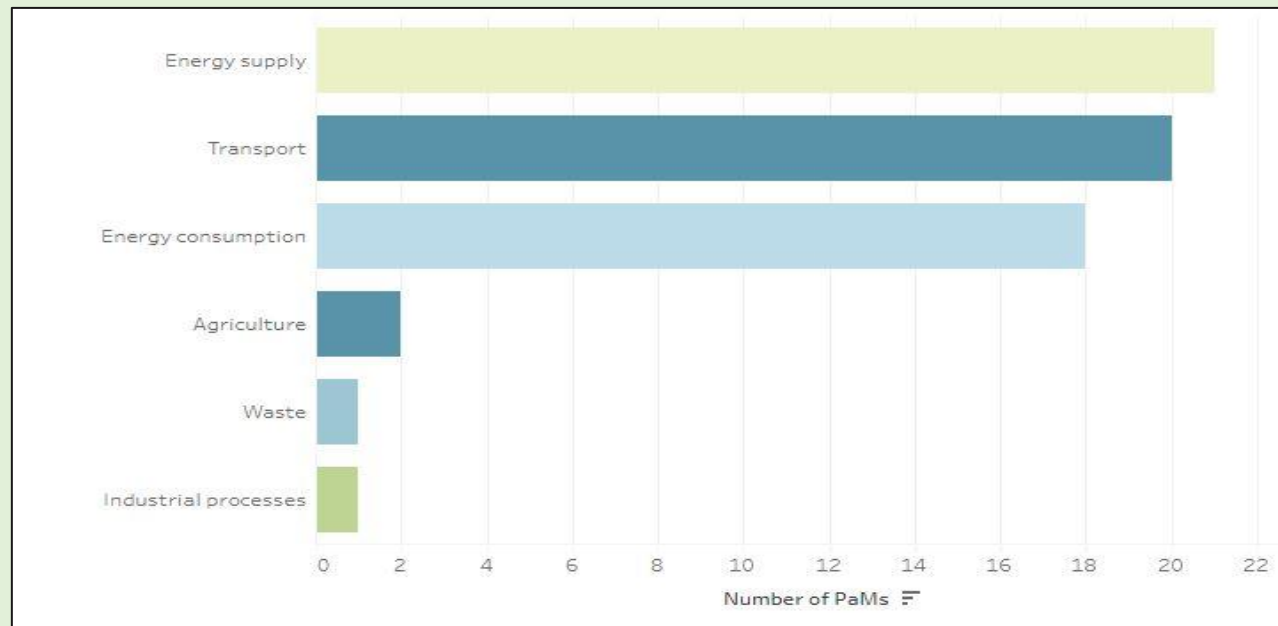


FIGURE 6: NUMBER OF POLICY MEASURES AIMED AT REDUCING THE IMPACT OF GREENHOUSE GASES AT ITALIAN LEVEL AND INVOLVED SECTORS

[European Green Deal](https://www.eea.europa.eu/it) (<https://www.eea.europa.eu/it> *European Environment Agency*)

For the future, the European Union has set very ambitious medium and long-term goals.

As part of the [European Green Deal](https://www.eea.europa.eu/it), the Commission proposed in September 2020 to raise the target of reducing greenhouse gas emissions within 2030, including emissions and removals, to at least 55% compared to 1990 levels. Considering all necessary actions in all sectors, including an increase in energy efficiency and energy from renewable sources; in June 2021 the process will begin to formulate detailed legislative proposals in order to implement this major ambitious goal.

The key objectives for 2030 include:

- a reduction of at least 40% **of greenhouse gas emissions** (compared to 1990 levels)
- a share of at least 32% of **renewable energy**
- an improvement of at least 32.5% **in energy efficiency**.

Moreover, in November 2018, the European Parliament adopted a resolution calling on the EU to set climate neutrality by 2050 as a long-term goal under the Paris Agreement. This agreement, signed by 194 countries and the EU, aims at limiting global warming below 2 ° C and continuing efforts to limit it to 1.5 ° C in order to avoid the catastrophic consequences of climate change.