

First Biennial Transparency Report
of **Italy** to the United Nations
Framework Convention
on Climate Change



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EXECUTIVE SUMMARY

This is the First Biennial Transparency Report (BTR) of Italy, under the United Nations Framework Convention on Climate Change (UNFCCC), where for the first time, in the Paris Agreement era, Parties have the opportunity to showcase their efforts in adopting and implementing effective climate policies.

The BTR serves as a primary tool for Parties to demonstrate their progress in fulfilling the objectives of the Paris Agreement. As part of the Enhanced Transparency Framework established under Article 13, the report ensures transparency, accountability, and fosters trust among Parties by requiring consistent and detailed reporting on climate actions. This includes tracking of progress toward achieving Nationally Determined Contributions (NDCs), support provided and received, and adaptation actions undertaken.

As member state of the European Union, Italy forms part of the EU commitment to reduce greenhouse gas emissions by at least 55% by 2030, compared to 1990 levels. Italy is playing its part in fulfilling the European contribution to climate objectives implementing national policies and measures to tackle climate change and promote sustainable economic growth towards an inclusive, climate resilient and net-zero emissions future.

In this context, Italy adopted new policies and measures and took new actions to mitigate climate change. One of the most important tools is represented by the *Recovery and Resilience Plan* (NRRP), adopted on July 2021, which not only addresses the economic and social impacts of the COVID-19 pandemic but also directs Italy toward an ecological and just transition. The NRRP includes several measures to repair the economic and social damage caused by the pandemic crisis, contributing to addressing the structural weaknesses of the Italian economy, strengthening the circular economy, and advancing a more sustainable and inclusive growth model.

In addition, Italy submitted its first *National Energy and Climate Plan* (NECP) to the European Commission in 2020, and a fully updated version was provided in July 2024, in line with the Regulation (EU) 2018/1999. The plan seeks to drive a broad economic transformation focused on decarbonization, the circular economy, efficiency, and the fair use of natural resources. These goals aim to create a more people and environmental-friendly economy. It also emphasizes integrating national energy markets into a unified market, ensuring affordable prices and reliable energy supply.

The BTR also underscores Italy's ongoing efforts in international climate finance and capacity-building. Italy continues to play a pivotal role in global climate action by scaling up its public climate specific finance, with significant increases in funding for developing countries. In the period 2021-2022, Italy made substantial contributions, enhancing both the quantity and transparency of its climate finance reporting. Total public climate specific support, for the biennium 2021-2022, reached 1.91 billion USD, an increase of 69% over the previous 2019-2020 biennium, when it reached 1.13 billion USD.

As a member of the OECD Development Assistance Committee (DAC), Italy integrates climate considerations into its development cooperation, including through support for the NDCs and National Adaptation Plans (NAPs) of developing countries. Italy is committed to tripling its climate finance contribution to \$1.4 billion annually by 2026.

As a key milestone, in 2022 the Italian Climate Fund has been created, and from 2023 it is fully operational, constituting a key vehicle to support developing countries in implementing adaptation and mitigation actions in line with their national climate plans.

A key milestone in this area is the establishment of the Italian Climate Fund in 2022, which became fully operational in 2023.

The ICF contributes to the achievement of the objectives established by the international agreements on climate and environmental protection of which Italy is part. With a total endowment of 4 billion euros, including an additional 400 million euros allocated through the 2024 budgetary law, the ICF stands as Italy's primary public financial instrument dedicated to fulfilling the country's international climate finance commitments.

In terms of domestic climate risk assessment, Italy has also made notable strides. In October 2022, the Ministry of Environment and Energy Security, in collaboration with ISPRA, launched the National Adaptation Platform. This platform fosters data exchange on climate impacts, vulnerabilities, and adaptation strategies among central government agencies, local authorities, and relevant stakeholders.

Italy's BTR provides verified data and insights that are crucial for shaping effective climate policies and actions, ensuring that Italy's commitments under the Paris Agreement remain on track. Italy remains steadfast in its commitment to the long-term temperature goals of the Paris Agreement and will continue to work collaboratively with national and international partners to advance a decarbonized, resilient, and inclusive future.

1 NATIONAL CIRCUMSTANCES AND INSTITUTIONAL ARRANGEMENTS

1.1 National circumstances

This paragraph contains relevant information concerning Italy, which helps understanding the national data on emissions trend, policies and measures and projections. The main drivers are discussed specifically: population dynamics; rate of urbanization; mobility; employment rate; national economy indicators and a short analysis of the most significant macro sectors.

1.1.1 Government structure

Italy is a bicameral parliamentary Republic. The Republic is constituted by the State, the Regions, the Provinces, the Metropolitan Cities and the Municipalities. There are 20 Regions, which are part of the constitutional structure of the State. Five Regions (Friuli-Venezia Giulia, Sardinia, Sicily, Trentino-Alto Adige and Valle d'Aosta) have special statutes and thus have greater autonomy. Provinces, Municipalities and Metropolitan areas are lower-level territorial entities.

Constitutional law n.3 of 2001 has deeply modified the attributions of powers between the central and the local entities with the aim of establishing a system of administrative federalism. The Regions have legislative powers for matters not expressly reserved to the exclusive competence of the State and have the responsibility to administer matters on which they legislate. The Constitutional Law also rearranged the distribution of administrative functions, foreseeing an enhanced administrative role for municipalities.

The protection of the environment, of the ecosystem and cultural resources are under the exclusive competences of the State. In particular, the Italian Ministry for the Environment was established in 1986 as the Italian Ministry for the Environment and Territory and renamed as IMELS in 2006. In 2021, with Law Decree 22/2021, converted with amendments into Law 55/2021 the competences and structures of certain ministries were reorganized. In particular, the IMELS has been renamed “Ministry of Ecological transition” (MITE). With the subsequent Legislative Decree 173/2022, converted, with amendments, by Law 204/2022, containing «Urgent provisions regarding the reorganization of the powers of the Ministries» the “Ministry of Ecological Transition” is renamed “Ministry of the Environment and Energy Security” (MASE).

MASE inherits the competences of the former Ministry and is enriched with new competences that are closely linked to energy security. Its functions concern the sustainable development, energy security, the protection of the environment, the territory, the water resources and the terrestrial and marine ecosystems, animal and plant species at risk, the reclamation of areas and waterways, policies to combat climate change and global warming, by reduction of pollution and emissions sources

The Ministry guarantees the safety of energy and geo-mining infrastructures and systems, supply, efficiency and competitiveness, and the promotion of renewable energy. It also deals

with the waste management, reuse and recycling and circular economy, protection of water resources and their management, coordination of measures to combat and contain environmental damage, as well as the remediation and safe restoration of contaminated sites, prevention and protection from atmospheric, acoustic and electromagnetic pollution and from industrial risks. The MASE also supervises the national natural heritage in the terrestrial and marine areas (national parks, marine protected areas, basin authorities, environmental consortia and those regulating the large lakes).

In February 2022, with the Constitutional Law n. 1/2022, which modifies articles 9 and 41 of the Constitution, environmental protection is introduced into the Italian Constitution. The new Constitutional Charter introduces among its fundamental principles the protection of the environment, biodiversity and ecosystems, including in the interest of future generations.

Article 4 of Decree-Law 22/2021 establishes, within the Presidency of the Council of Ministers, the Inter-Ministerial Committee for Ecological Transition (CITE), tasked with ensuring the coordination of national policies related to ecological transition and their associated programming. The Committee is chaired by the President of the Council of Ministers, or, in their absence, by the Minister for the Environment and Energy Security. It is composed of the Ministers for the South and Territorial Cohesion, Environment and Energy Security, Economy and Finance, Economic Development, Infrastructure and Sustainable Mobility, Labour and Social Policy, and Agriculture, Food and Forestry.

The CITE is tasked with approving the Ecological Transition Plan (PTE), which coordinates policies aimed at reducing greenhouse gas emissions, promoting sustainable mobility, addressing hydrogeological instability and soil consumption, managing water resources and related infrastructure, improving air quality, and advancing the circular economy. The PTE was approved through CITE Resolution No. 1 on March 8, 2022.

Since 2011, MASE, in consultation with other relevant ministries, has been responsible for preparing an annual report on the progress of greenhouse gas (GHG) emission reduction commitments, along with emission trends and projections. This report is annexed to the Economic and Financial Document (DEF), which is approved annually by the Government.

MASE also plays a key role in promoting and supporting international partnerships and cooperation in the pursuit of global sustainable development. In sectors such as energy production, transportation, and distribution, both the central Government and the Regions have concurrent legislative powers.

1.1.2 Population profile, urban structure and building stock

Demographic and social trends are generally considered among the main driving forces for the emissions trends. Although changes in the national population have occurred (Figure 1.1) over the last 30 years they have not directly affected the national trend of emissions significantly. The national population was 56.744 million in 1991 (13th national survey) and 56.960 million in

2001 (14th national survey) while it was 59.948 million in 2011 (15th national survey) (ISTAT)¹. Since 2018 the National survey on Population and Housing has been taking place yearly and no longer every ten years.

The resident population has been steadily decreasing since 2014 as a consequence of a strong negative natural dynamic with more deaths than births, no more mitigated by the migration balances. On the first of January 2022, it was 59,030.133 million, -2.2% compared to 2014. As of December 31, 2022, Italy's resident population amounted to 58,850,717 with -179,416 compared to the beginning of the same year. As reported by ISTAT, the widening gap between births and deaths – started about thirty years ago together with the most recent contraction in the migration balance are the main causes of the demographic trend. The SARS-CoV-2 pandemic in 2020 and 2021 has contributed to this demographic dynamic already in a recession since 2014. Between 1 January 2020 and 1 January 2021, the Italian population decreased by 405 thousand units (corresponding to -0.7% of its population) and in absolute terms, it was the highest decrease observed in the European Union that registered a drop of 278 thousand people.

Between 1 January 2021 and 1 January 2022, a drop of 0.35% (corresponding to -206 thousand units) was registered with the pandemic still present, albeit with less pronounced impacts than in 2020. In the two pandemic years, the population decline was mainly due to the strongly negative natural balance: deaths were dramatically high during the pandemic period and remained at high levels compared to the pre-covid. In the following Figure 1.1 the resident population (per 1,000 inhabitants) from 1991 to 2022 is reported.

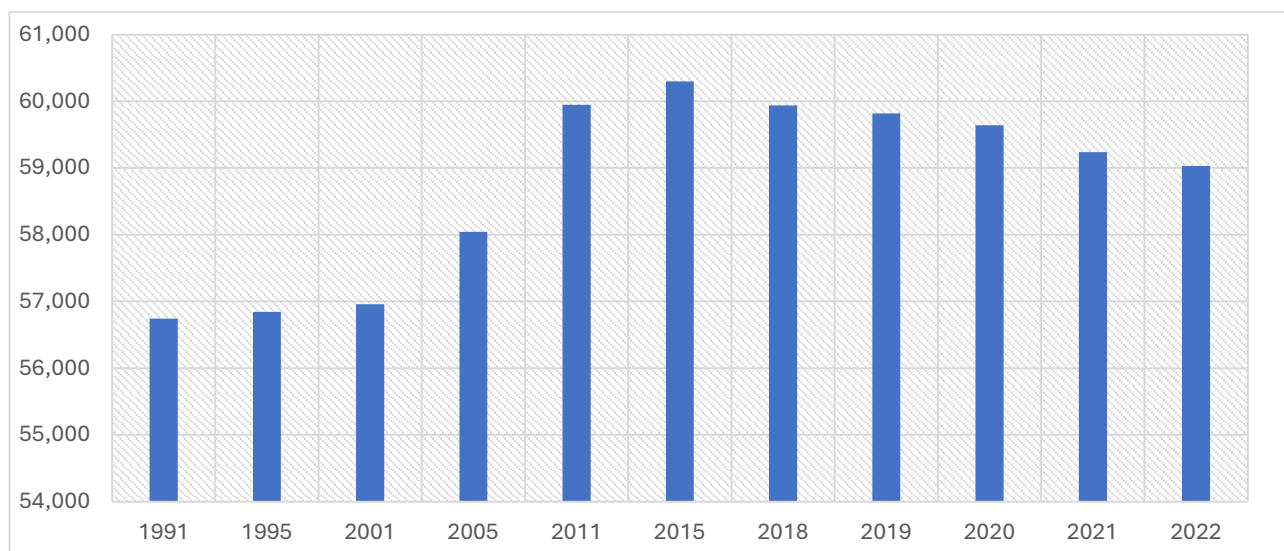


Figure 1.1 - Resident population (1000 inhabitants) of Italy along the last two decades

Source: ISTAT

¹ <http://demo.istat.it/>

Figure 1.2 shows the number of births and deaths and the natural balance in Italy from 2003 to 2022. The year 2022 with 393,333 record the record low of births; for the first time since the Unification of Italy the births were under 400 thousand. Over the period 2003-2022 the highest number of births occurred in 2008 (576,659) then births started to decrease again and in 2022 they were -31,8% compared to 2008. The number of deaths steadily increased over time with a peak in 2020 due to the pandemic SARS-COVID 19. In 2022 it was equal to 713,499 higher by 0.63% compared to the previous year. Because of the low births and the high number of deaths the natural balance of the population steadily decreased from 2006 and remained negative with the record in 2020 (-341,254). In the last 3 years there has been a reduction of about 970,000 individuals.

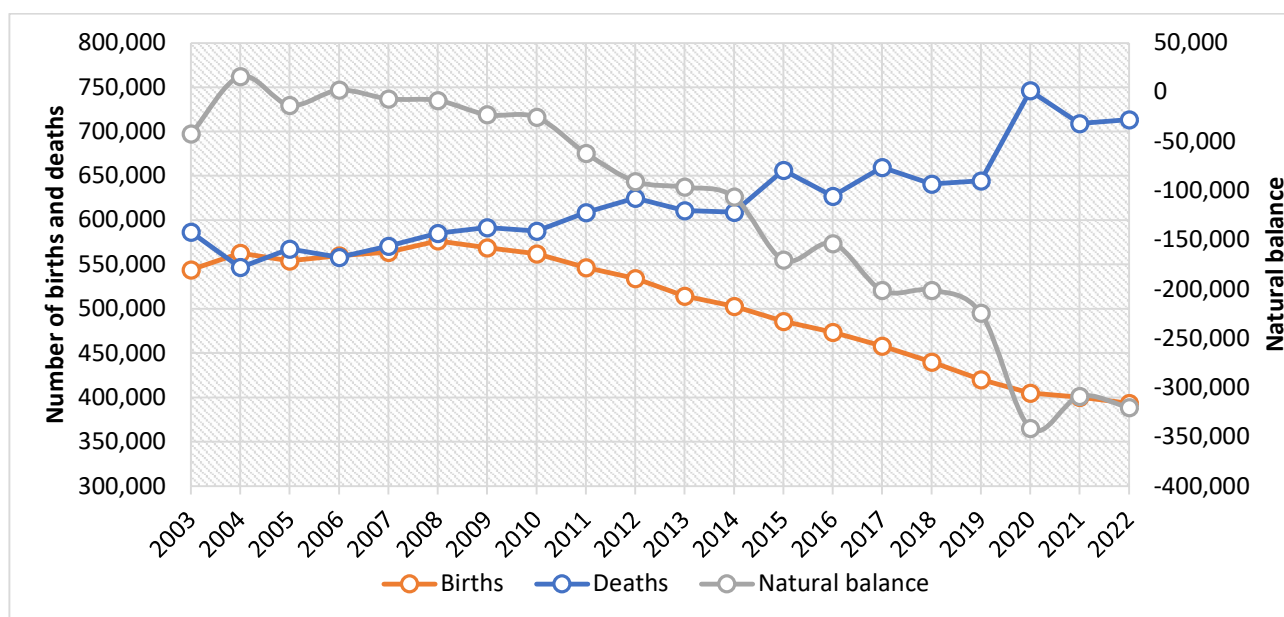


Figure 1.2 -Births, deaths (on the left) and natural balance (on the right) in Italy from 2003 to 2022
Source: ISTAT

As reported in the ISTAT Annual Report 2023, this is called “demographic winter” because from year to year the population's ability to renew itself is reduced. This is due to several factors: the choice than in the past to have fewer or no children, the reduction of the female population at reproductive ages (15 to 49), and its gradual aging (in 2022 there will be 126 women aged 35-49 for every 100 women aged 20-34). The change of the structure of the population, with the reduction of the number of potential parents by past denatality which have effects birthrates of the coming years is responsible for 80 % of the overall decline of about 27,000 births between 2019 and 2022; while the remaining 20% is due to lower fertility (ISTAT Annual Report 2023).

The aging trend of population has been increasing due to a low birth rate with a continuous growth of the elders: on 1st January 2022, the median age of the Italian population was 46.2 years compared to 41.9 in 2002. Figure 1.3 shows the distribution of the Italian in age classes (per 1,000 inhabitants) from 1982 to 2022. The extremely elderly people, people aged 80 and older, are 7.6% (4,505,526 units) of the population in 2022 and they were 5.9% in 2011, 4.4% in 2002 and 2.2% in 1982; they represent a considerable and growing portion of the Italian population. In 1982 the youngest people (aged 19 and lower) represented the 29.6% of the

Italian population while in 2022 they represent the 17.5%. Younger individuals and those of an active age, however, are constantly decreasing over the years. According to ISTAT projections, in Italy between 2022 and 2050, the resident population is estimated to decrease by almost 5 million (from 59 to just over 54 in the median scenario), despite the assumption of positive migration balances. However, it should be noted that the magnitude of the reduction depends on the high variability of the forecast scenarios².

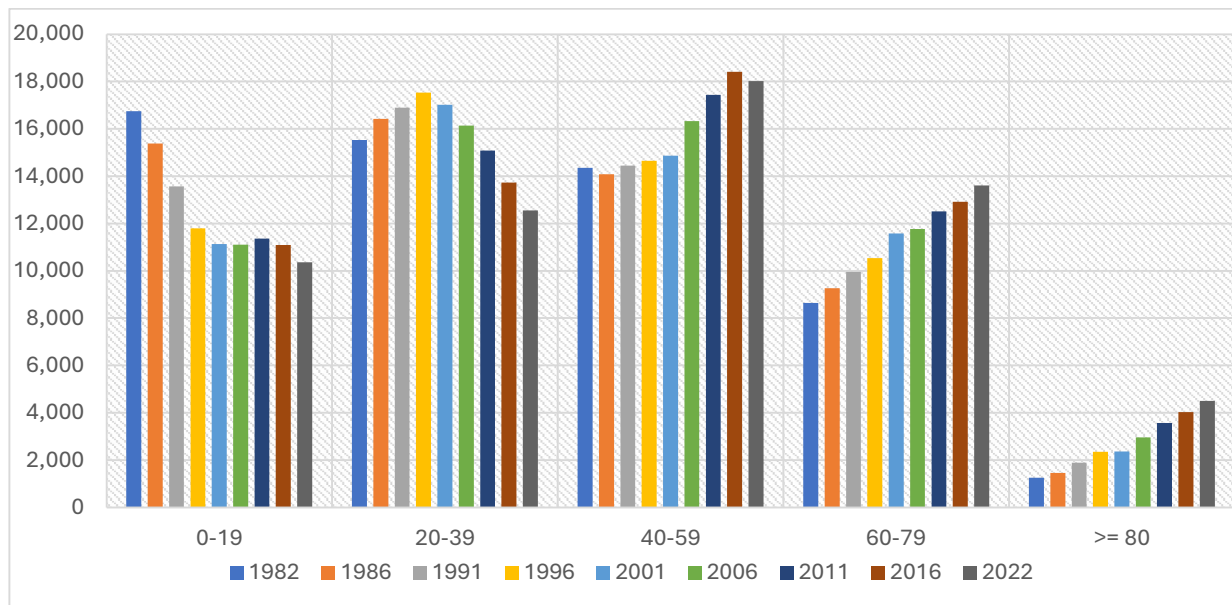


Figure 1.3- Distribution of Italian population (1000-inhabitants) in age classes through the last three decades
Source: ISTAT

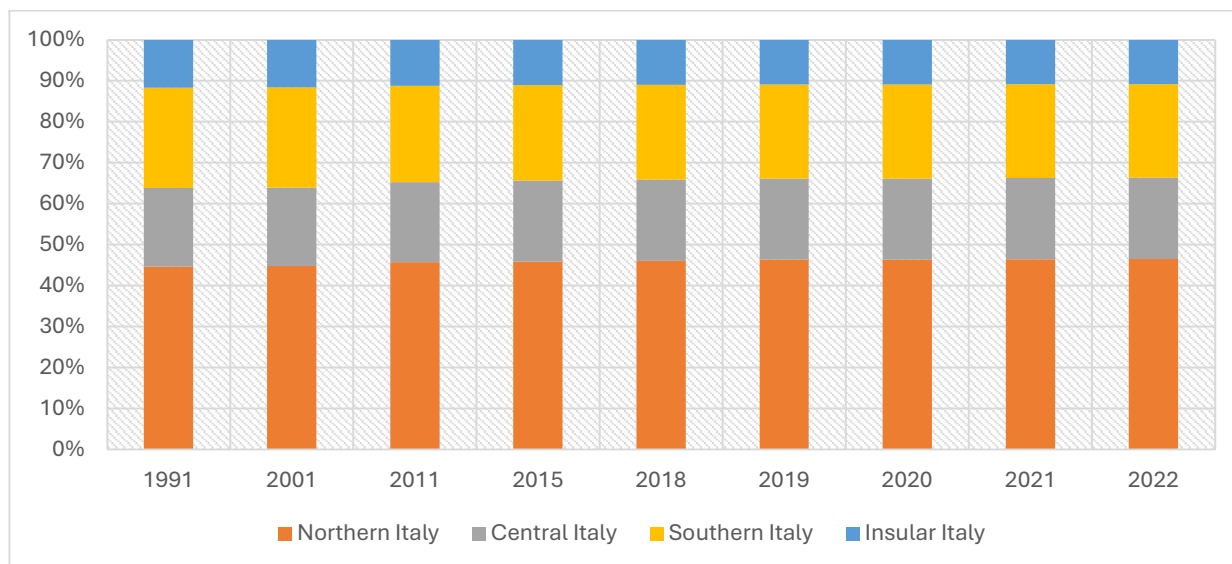


Figure 1.4 - Distribution of the Italian population among four statistical regions
Source: ISTAT

² ISTAT, Rapporto Annuale 2023. La situazione del Paese.

At first January 2022, about 46% of the resident population lives in northern Italy, about 20% of the population lives in central Italy, about 23% of the population lives in southern Italy and the remaining 11% lives in the islands (Figure 1.4). Increases in the resident population from 1991 to 2022 have occurred in northern and central Italy with +8.07% and +7.45% respectively, while a decrease has occurred in resident population of southern (-2.55%) and insular Italy (-2.92%). The distribution of the population may have implications for transport demand and for the development of energy supply infrastructure.

Another characteristic which may affect efficiency consumption patterns and emissions is the average family size (Figure 1.5). In general, small average family size implies greater consumptions, because of a larger acquisition and use of durable goods such as household appliances, cars, etc., previously shared among a greater number of people. In Italy, according to the National Institute of Statistics, there are 25 million families in 2022 with an average size of 2.3 people per family. Over the last forty years, the percentage of single-person families has increased and the percentage of large families has decreased (Figure 1.5).

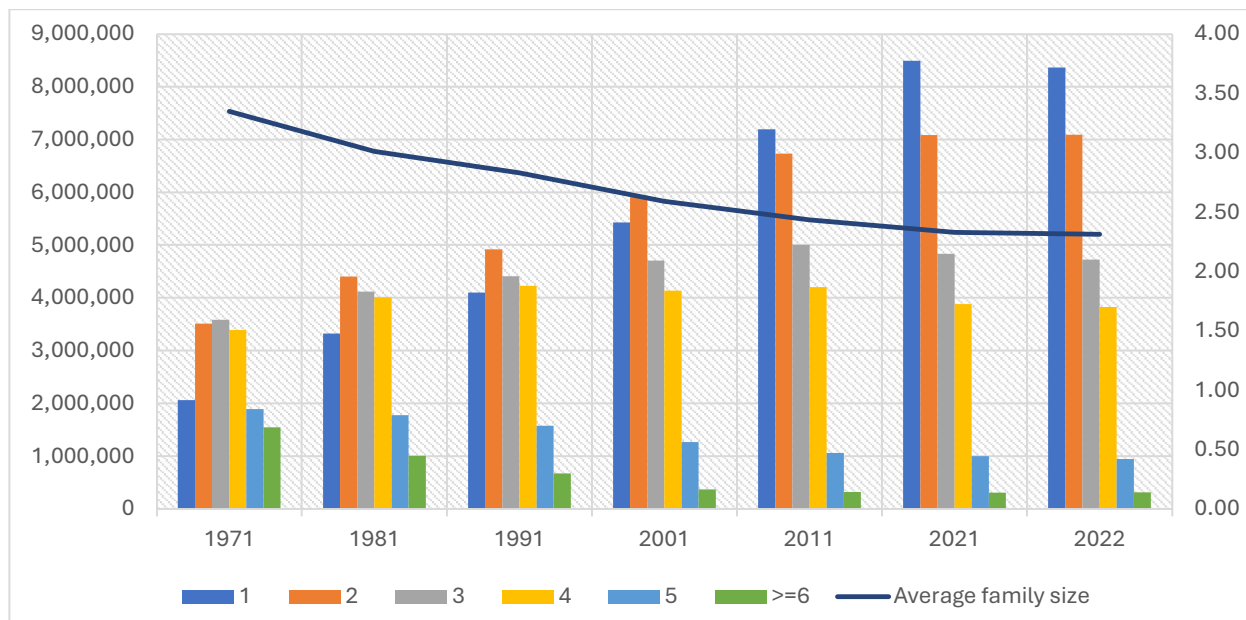


Figure 1.5 - Average family size and number of families by number of components in Italy
Source: ISTAT

According to the results of annual surveys concerning Italian families, the number of households living in dwellings equipped with air-conditioning systems increased considerably in the last 2 decades, from 10.7% in 2001 to 50.7% in 2022 (it was 33% in 2011 and 48.6 in 2021). In addition to changes in population habits, climate change and increasingly frequent heat waves have also contributed to the increase in the number of air conditioners. Air conditioning systems, equipped with highly climate-altering refrigerant gases (hydrofluorocarbons), contribute to the emissions of these gases into the atmosphere. The share of families living in dwellings with a washing machine and a dishwasher also increased. The families with washing machine accounted the 96.5% of the total in 2001 and 98% in 2022 while the share of households living in homes equipped with dishwashers increased from 33.1% to 56.0%. Households with a car were 79% in 2001 and 81% in 2022 and the family share

with more than 1 car slightly increased from 33.4% to 34.4%. As regards the building stock, according to ISTAT, in Italy there were about 19.7 million occupied dwellings in 1991, and this number has been steadily increasing over the years. Although new buildings are more energy efficient, the increase in the number of families and dwellings has resulted in an increase in residential energy demand through the last two decades.

A factor that affects Italian atmospheric emissions is the vehicular traffic, public and private. In 2022, the vehicle fleet is reported to consist of 45,704,699 vehicles, of which 88% passenger cars, 11% trucks and 0.2% buses. The largest vehicle fleet in terms of passenger cars is in Lombardy with 15.6%; followed by Latium and Campania, with 9.6% and 9.0%, respectively (ISTAT ASI 2023)³. Measures to be taken with positive effects on air pollutants include those aimed at reducing traffic congestion and travel time. Choosing public mobility systems instead of private transportation is a sustainable behavior that could contribute positively to this regard. In contrast, data for our country show a high reliance on private motorization, driven by the difficulty of households with respect to public transportation connections in the area where they reside⁴. Regarding motorization rates (cars per thousand inhabitants), in 2022 Italy led the ranking of the 27 European countries, with 682 cars per thousand inhabitants (Figure 1.6).

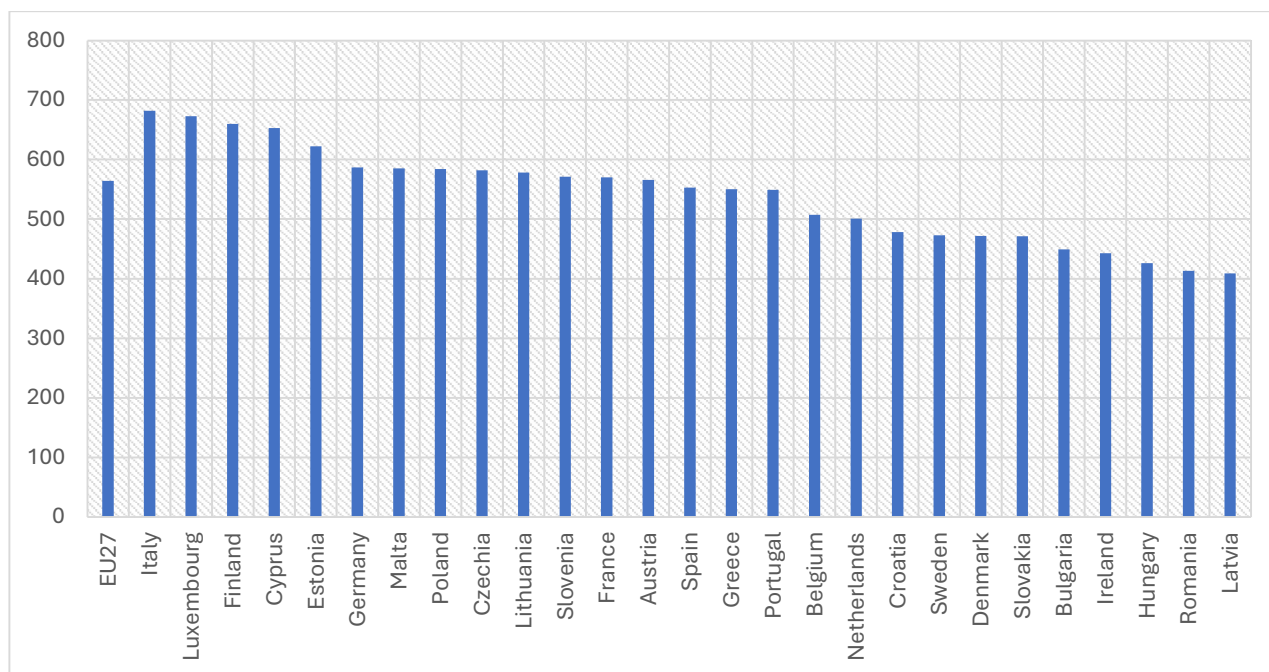


Figure 1.6 - Motorization rates (cars per thousand inhabitants) in 2022 in the 27 European countries.
Source: EUROSTAT

Italy's average motorization rate from 1995 to 2022 was 610, compared to 410 for the EU-27 and over the 1998-2021 period, Italy has always had very high motorization rates. Figure 1.7 shows the time series from 2005 to 2022 of the number of cars per thousand inhabitants in Italy. Since 2013 the motorization rate has grown steadily. In the period 2013-2022 it increased by 12.2%, in line with the EU-27 average (12.6%) and slowed (but not stopped) by the economic

³ Annuario Statistico Italiano 2023 <https://www.istat.it/produzione-editoriale/annuario-statistico-italiano-2023/>

⁴ ISTAT, Rapporto annuale 2023. La situazione del paese.

impact of the pandemic (ISTAT, 2023). Over the same period, growth in the motorization rate in the other stronger EU economies was much less pronounced: in Germany there was an increase of 8.1%, in France 4.4%; only Spain experienced a greater increase than Italy at +16.6%.

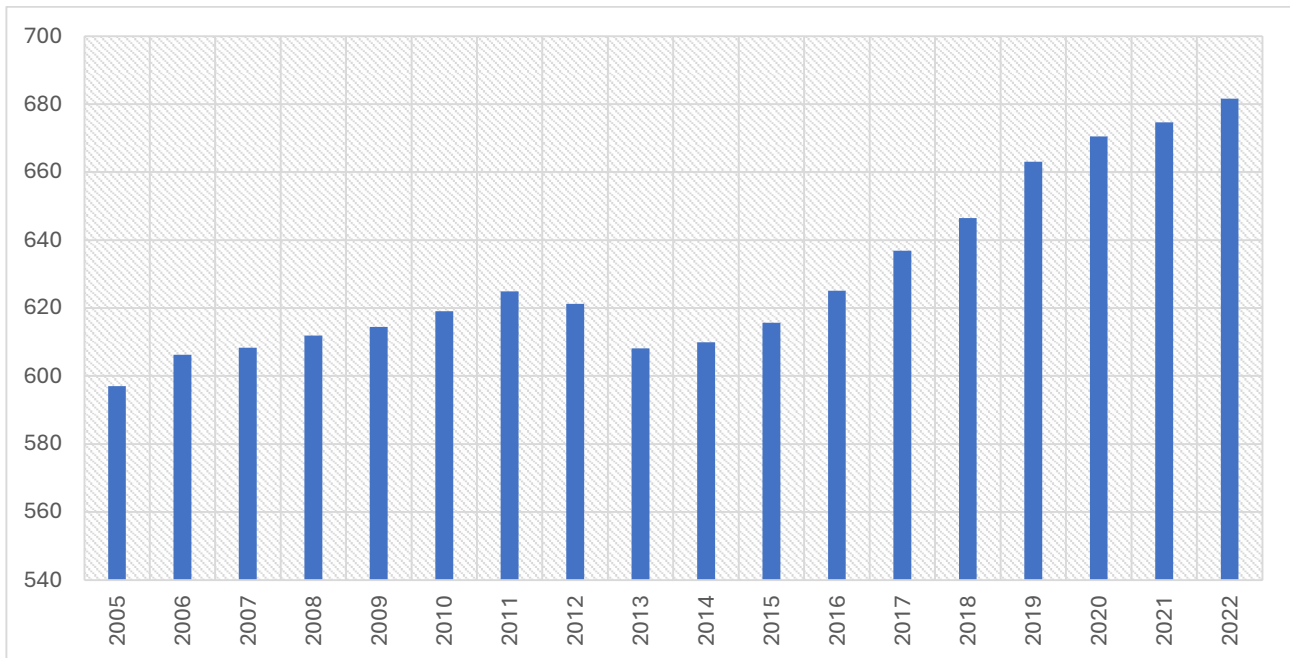


Figure 1.7– N. of passenger cars per 1000 inhabitants. 2005-2022 -Italy
Source: ISTAT

Motorization rates tend to be lower in urban areas, where there is a concentration of the supply of local public transport and shared mobility services, modes that are increasingly common in the historic centers of large cities, partly as a result of restrictions on the circulation of motor vehicles (ISTAT, 2023). The composition of the fleet in terms of emission standards also plays an important role in air emissions.

In Italy, 53.6% of road freight services originate in four regions: Piedmont, Lombardy, Veneto, and Emilia-Romagna; in 2022, at the level of geographical breakdown, in comparison with the previous year, there is growth in the regions of the Center (+7.2%), followed by the South (+5.1%)⁵.

Another factor affecting Italian GHG emissions per capita is the mobility demand for work and study, which is due to the mismatch between the residential areas and the areas where the economic activities are concentrated, the so-called local labor market areas.

Based on the official statistics, as of 31 December 2019, 50.7% of the resident population (30,214,401 people) made daily journeys to their place of study or work; it was 48.6% in 2011. The highest percentage were registered in the regions of the North while all the regions of the south of Italy registered percentages below the national average value (50.7%).

⁵ <https://noi-italia.istat.it/home.php>

The pandemic caused a drastic drop in all types of travel for the adopted containment measures including travel restrictions and incentives for the use of smart working. In January 2020, about 3.7% of the staff of enterprises with at least three employees were working remotely. In the two months March-April 2020, with the restrictions of Covid pandemic in force, the overall incidence among the analyzed companies suddenly rose to 19.8%; thereafter, in 2021 when pandemic came back under control, smart working continued to be widely used, and it remained at more than double its level in the early 2020. Therefore, it is plausible to think that this is a structural change destined to last⁶.

1.1.3 Geographical and climate profile

Italy is in the Southern part of Europe and includes the Italian peninsula, stretching from the Alps into the Mediterranean Sea, and several islands including Sicily (the largest in the Mediterranean Sea) and Sardinia. The Alps Mountain range is the Italian natural northern border which separates Italy from the rest of Europe. The total national area is 301,340 km², about 40% of the total national area is mountainous. In Italy there are the following protected areas⁶:

- 25 National Parks,
- 33 Marine Protected Areas,
- 147 State Natural Reserves,
- 148 Regional Natural Parks,
- 1 Interregional Park
- 422 Regional Natural Reserves,
- 695 Other Protected Areas

The Italian peninsula lies between latitudes 47° and 35° N and longitudes 6° and 18° E, it is nearly in the middle of the temperate area of the boreal hemisphere. Being surrounded by sea, Italy's climate is temperate Mediterranean. From the Alps to Sicily there are 11 degrees latitude. The peninsula is divided into two versants from the Apennines, and the continental part of the country is surrounded by Alps. Italy's climate is formally divided in four types, characterized by specific features:

1. Alpine climate, dominant on Alps and northern and central Apennines, characterized by night and winter low temperatures and moist summer;
2. Mediterranean climate, in the island and in the southern Italy, characterized by mild temperatures and moist winter;
3. Peninsular climate, peculiar of the central part of the peninsula, characterized by mild temperatures along the coast and in the prompt hinterland (in the middle where the altitude is high there is an alpine climate), moist in spring and autumn;

⁶www.parks.it

4. Po valley climate, with low temperatures in winter, high temperature in summer, moist in spring and autumn.

With these features, domestic heating is required through winter months, and the use of air conditioning systems during summer months has been increasing in the last decade.

Regarding the climate state and variations over Italy, temperature and precipitation trends are updated every year based on climate data, indices and indicators gathered through the National System of climate data (SCIA)⁷ and reported on the annual bulletin published by the Italian Institute for Environmental Protection and Research (ISPRA).⁸ According to the report “Il clima in Italia nel 2022”⁹ the year 2022 was characterized by intense heat and drought. Regarding the temperature, 2022 was the warmest year since 1961 with an average anomaly compared to the thirty-year period 1991-2020 of +1.23°C (+0.58 °C more than the previous record in 2018) (Figure 1.8). 2022 was the ninth consecutive year with a positive anomaly compared to the norm and, excluding four years (2004, 2005, 2010 and 2013), since 2000 anomalies have almost always been positive confirming an increasing trend in temperature.

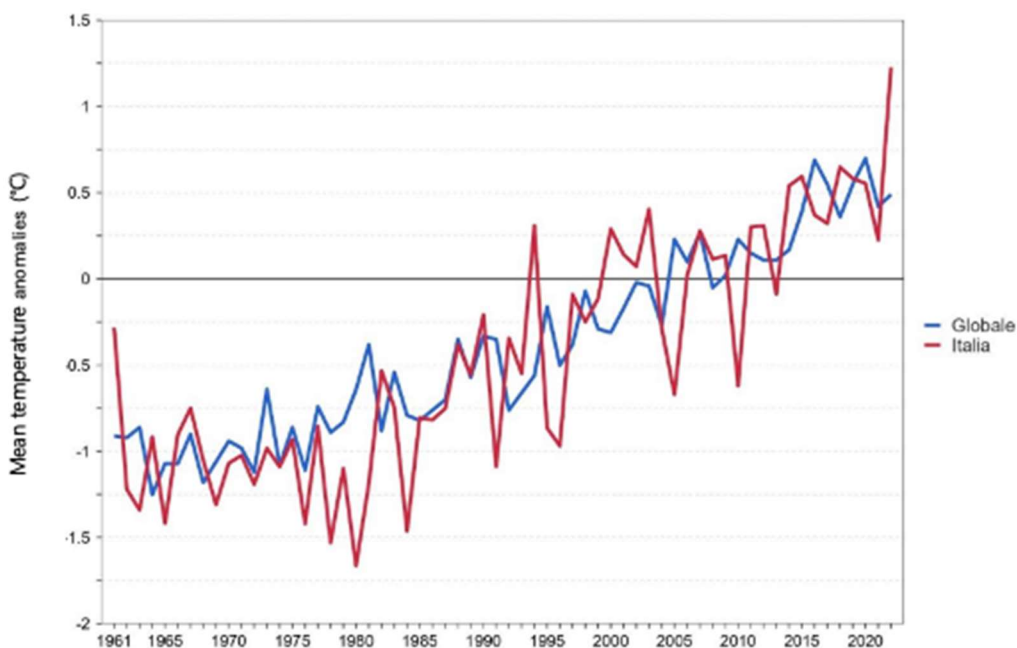


Figure 1.8- Time series of the mean temperature anomalies (land-only) at global scale and in Italy, compared with normal climatic values

Sources: “Il clima in Italia nel 2022”, Report SNPA 36/2023”

The year 2022 also leads the series in terms of the maximum temperature anomaly (+1.42°C) and the minimum temperature anomaly (+1.03°C). Average temperatures higher than the 1991-2020 normal values were recorded in all months of the year, except March and April.

⁷ www.scia.isprambiente.it

⁸ Gli indicatori del clima in Italia nel 2021, XVII Ed., ISPRA – Stato dell’Ambiente N. 98/2022

⁹ “Il clima in Italia nel 2022”, Report SNPA 36/2022

The positive anomaly of the annual average temperature in 2022 was mainly due to the summer, which with an anomaly of +2.18°C was the second hottest since 1961 (following 2003). Positive anomalies were also registered for winter (+0.58 °C) and autumn (+1.38°C, by ranking first in the series since 1961). Compared to all the other seasons, spring instead recorded an anomaly similar to the 1991-2020 climatological average. The average annual temperature was higher than the 1991-2020 average in all Italian macro-regions: North(+1.39°C), Center (+1.23°C), South and Islands(+1.06°C).

The year 2022 was also characterized by record values as regards extreme temperature indices, ranking first among the highest in the series since 1961 for the average number of tropical nights (with minimum temperature greater than 20°C) and average number of summer days (maximum temperature above 25°C) and ranking second (behind 2003) for the for the average number of hot days (maximum temperature above 35°C).

2022 was also ranked first among the highest in the series since 1961 for the duration of warm periods expressed by the index WSDI (Warm Spell Duration Index). Cold days and nights show a decreasing trend, while warm days and nights show an increasing trend over the last 10 years and 2022 was characterized by a record regarding this. As regards heat waves (number of days with maximum temperatures above 30°C), the summer of 2022 in Sicily was the hottest since the beginning of observations: the heat wave index in fact marked a new record of 10 days higher than the 2003 value.

The surface temperature of the Italian seas in 2022 recorded a positive anomaly of +1.0°C compared to the 1991-2020 climatological average, placing it in first place in the series since 1982. The year 2022 was the twelfth consecutive year with a positive anomaly compared to the norm. Besides, the monthly mean sea temperature anomaly was characterized by positive anomalies throughout the year (except for April), with a pick in June and July (+2.11°C).

In the Figure 1.9 precipitation trends in Italy in recent decades is shown. In detail, the figure reports the series of anomalies of annual cumulative precipitation in the period 1961-2022, compared to the climatological value 1991-2020. Mean cumulated precipitations in 2022 have been about 22% lower than the average, making 2022 the least rainy year in the entire series since 1961. All four seasons were less rainy than usual. Spring was drier than the norm with -35% followed by winter with -32% and autumn with -12%. Summer registered a small anomaly (-2%). Negative precipitation anomalies were recorded from January to July (with -39% in this period).

October and January were the driest months with negative anomalies of -62% and -54% respectively, while the relatively rainiest month was August, with a positive anomaly of +69%. From January to July and October, precipitation was below normal everywhere, except for the month of May in the South and in the Islands. In August, however, the anomalies were positive everywhere.

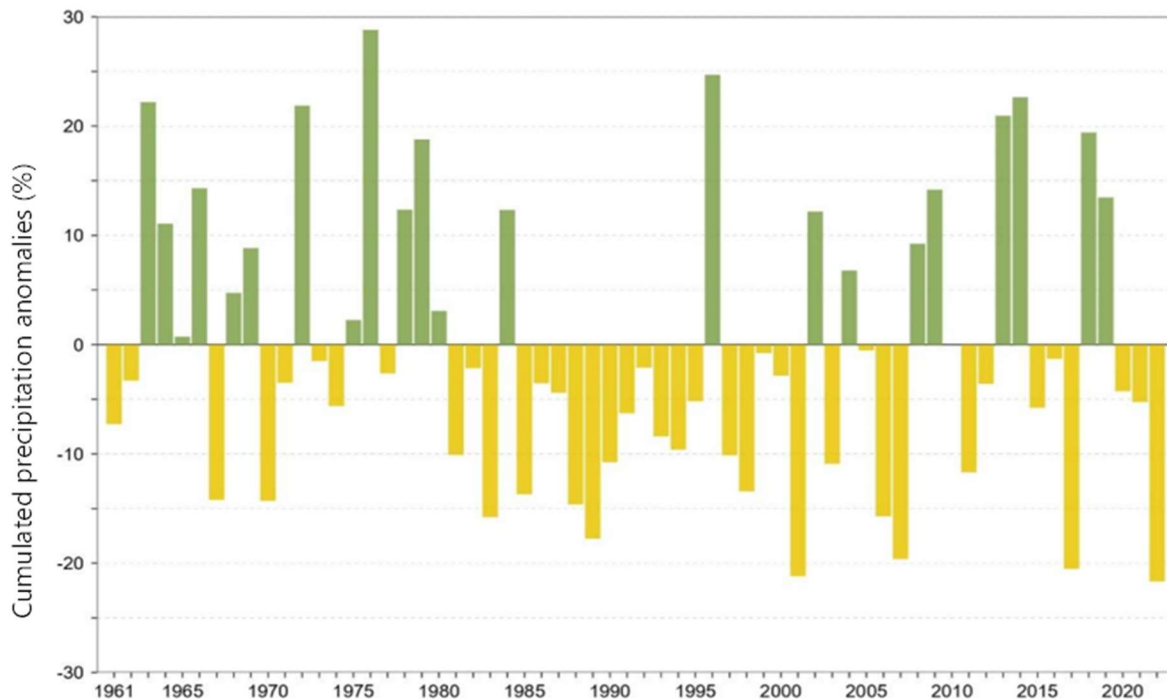


Figure 1.9- Time series of mean annual cumulated precipitation anomalies over Italy, compared to the normal value 1991-2020.

Sources: “Il clima in Italia nel 2022”, Report SNPA 36/2023

Drought conditions have particularly affected central-northern Italy and the north-western areas. In Piedmont, a negative precipitation anomaly of 41% was recorded at a regional scale, compared to the reference data for the 30-year climatological period 1991–2020. Precipitation anomalies for the period September 2021-May 2022, compared to the 1991–2020 climate, record very high and extensive negative monthly values in the north (from -40% to -50%, with peaks of up to -60%), followed by the areas of the Apennine and Tyrrhenian sector of central Italy (-20% /-30%,); precipitation on average or slightly above average was recorded in the southern regions and the major islands.

In 2022, the number of dry days (with precipitation less than or equal to 1 mm) was generally very high. The highest values are recorded in Piedmont and Western Liguria, Sicily and Sardinia, where peaks of 330 dry days locally and maximum of 347 days. The lowest values (up to about 230 dry days) were recorded in the central-eastern Alps and Prealps and on the Apennine ridge.

The 'Consecutive Dry Days' (CDD) drought index¹⁰ recorded high values, especially in Sicily (up to 160 consecutive dry days) and Sardinia (up to 130 days) followed by the central Tyrrhenian coast (up to 100 days). The data analysis does not reveal clear signs of changes in the frequency and intensity of precipitation in the medium-long term. Prolonged drought conditions, associated with high temperatures, have led to a strong reduction in the natural availability of water resources. Anyway in 2022 also extreme precipitation events occurred, the peak value of daily precipitation was registered in the Marche region with 419 mm.

¹⁰ Drought index: the maximum number of dry days consecutive in the year.

1.1.4 Economic profile

Italy was the fifth largest economy by nominal GDP in the world in 1990 and its rank has been decreasing since then. According to the World Bank¹¹, in 2022 Italy is the tenth largest economy at world level, and the third largest economy among the EU countries, behind Germany and France.

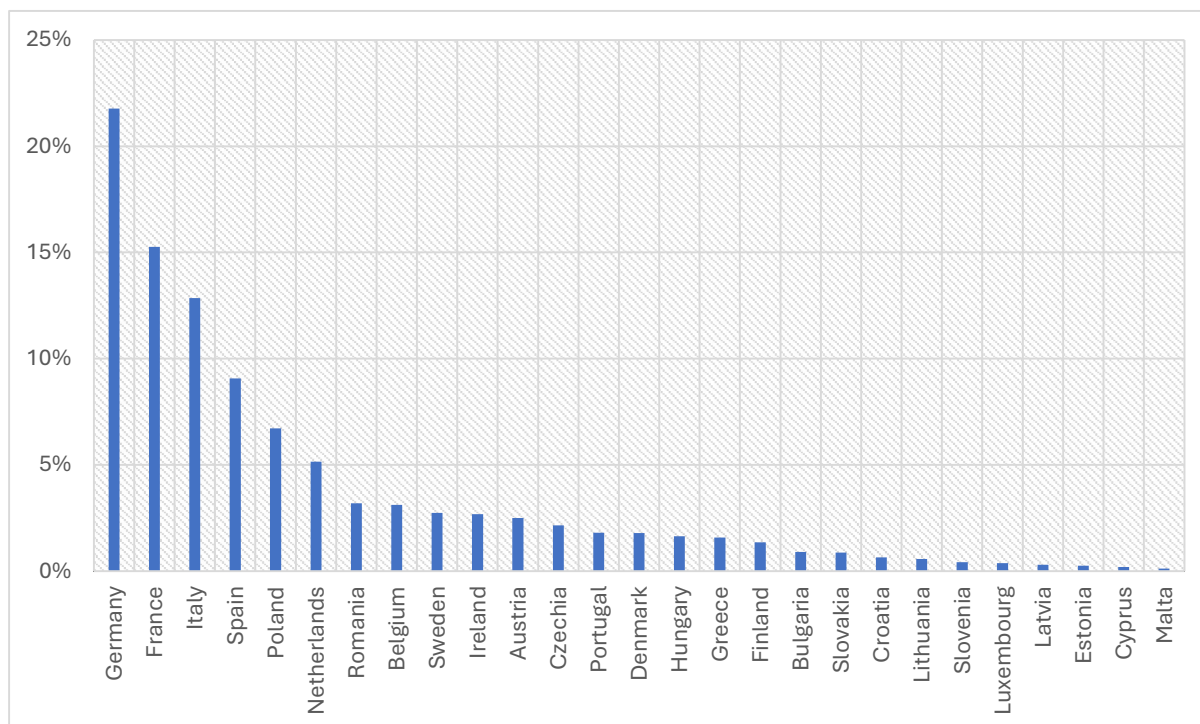


Figure 1.10 - GDP real expenditure (in PPS_EU27_2020) in 2022
Source: EUROSTAT

Figure 1.10 shows the percentage distribution of EU-27 GDP at current prices expressed in purchasing power standards (PPS), which are values adjusted to take into account differences in price levels between countries. In 2022, the sum of the 4 largest EU economies (Germany, France, Italy and Spain) accounted for 59.0% of EU GDP (in PPS terms). Germany alone accounted for 21.8% of EU GDP, followed by France with 15.3% and Italy with 12.9% (equivalent to 2,044,942 million PPS). In 1995 Italy accounted for 16.8%, placing itself just behind Germany.

Figure 1.11 show the GDP grow rate for the period 2006-2022 in Italy and European Union (27 countries). Around the mid-2000s, a global financial and economic crisis hit the advanced economies thus resulting into severe recession in the EU, Japan and the United States. In 2009 Italy's GDP fell by 5.5% compare the previous year and by the end of that year, a general recovery in the economies appeared and the GDP raised by 1.7% in 2010.

Between 2010 and 2012 Italy, like many advanced economies, has moved into recession again then the national economy has been showing a moderate recovery until 2017 (+1.6%). In the year 2020 due to the Covid pandemic, with the implementation of severe measures of social

¹¹ https://databankfiles.worldbank.org/public/ddpext_download/GDP.pdf

containment and restriction of production activities, Italian GDP contracted by 8.9% from the previous year, compared to a fall in EU-27 GDP of 5.6%. The fall in GDP was mainly driven by the collapse in domestic demand, particularly consumption. In 2021 the GDP grew by +8.9% over 2020 while the EU GDP increased by 6.3%. In 2022, GDP growth of 4.7% from the previous year compared with European-wide growth of 3.5%. In the recovery phase from the 2020 shock, Italy is the economy that, among the four largest European Union (France, Italy, Germany and Spain) has grown at a higher rate (ISTAT, 2024)¹².

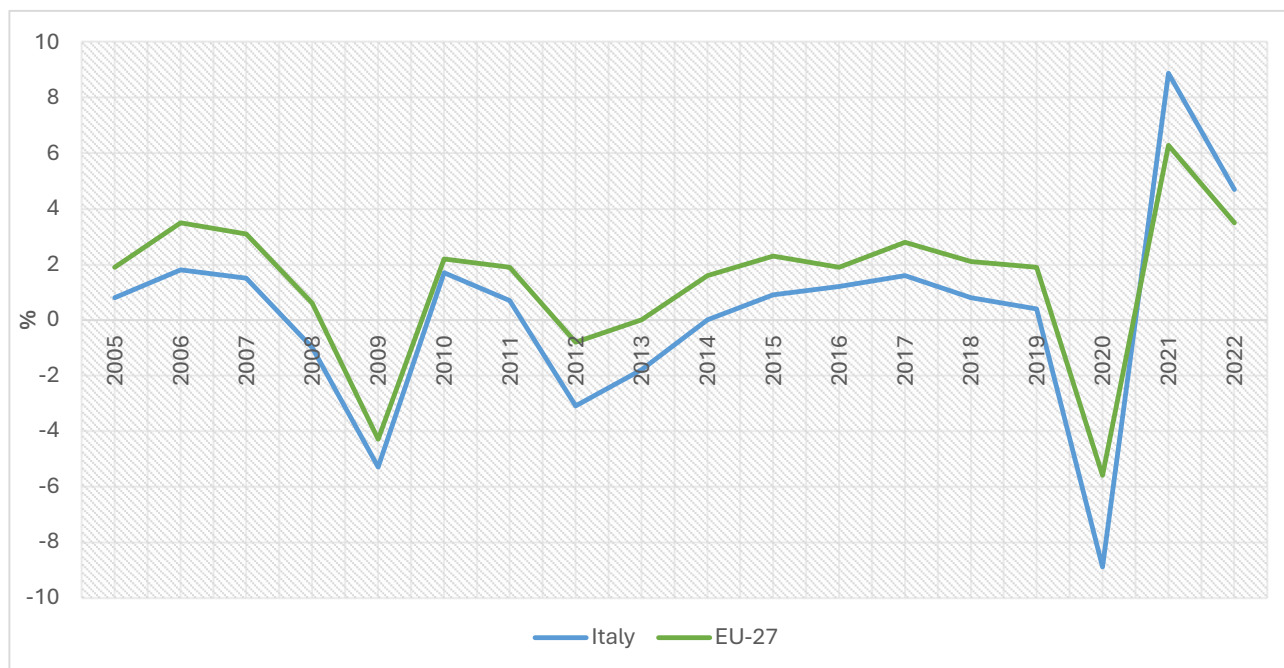


Figure 1.11- GDP growth rate (chain linked volumes, % changes on previous year) of EU27 and Italy
Source: EUROSTAT

At territorial level, the economic recovery of 2022 was more pronounced in the North-East area where the GDP registered +4.2% compared to the previous year and in the Center (+4.1%); it was more moderate in the South (+3.5%) and Northwest (+3.1%), (ISTAT, 2023)¹³.

Figure 1.12 shows GDP per capita (2010 chained volumes) for Italy and the EU-27 countries from 2000 to 2022. Italy's GDP per capita data show a general upward trend during 2000-2007, when GDP reached € 28,940 per capita. It then decreased to 26,760 € per capita in 2009. From 2009 to 2013 there was first a slight recovery, then a new decline trend until 2013 (25,690 € per capita) when the GDP started to increase again until 2019. In 2020 because of the Covid pandemic the GDP fell to 24.960 € per capita, down 8.4% from the previous year. In the last 2 years a recovery in GDP per capita was registered and in 2022 it was 28,670 € per capita, almost reaching the level of 2007. Italian GDP per capita has always been higher than the GDP of the EU-27 during the period from 2000 to 2014; in subsequent years the situation has reversed.

¹² ISTAT - Rapporto Annuale 2024. La situazione del Paese.

¹³ ISTAT - Rapporto Annuale 2023. La situazione del Paese.

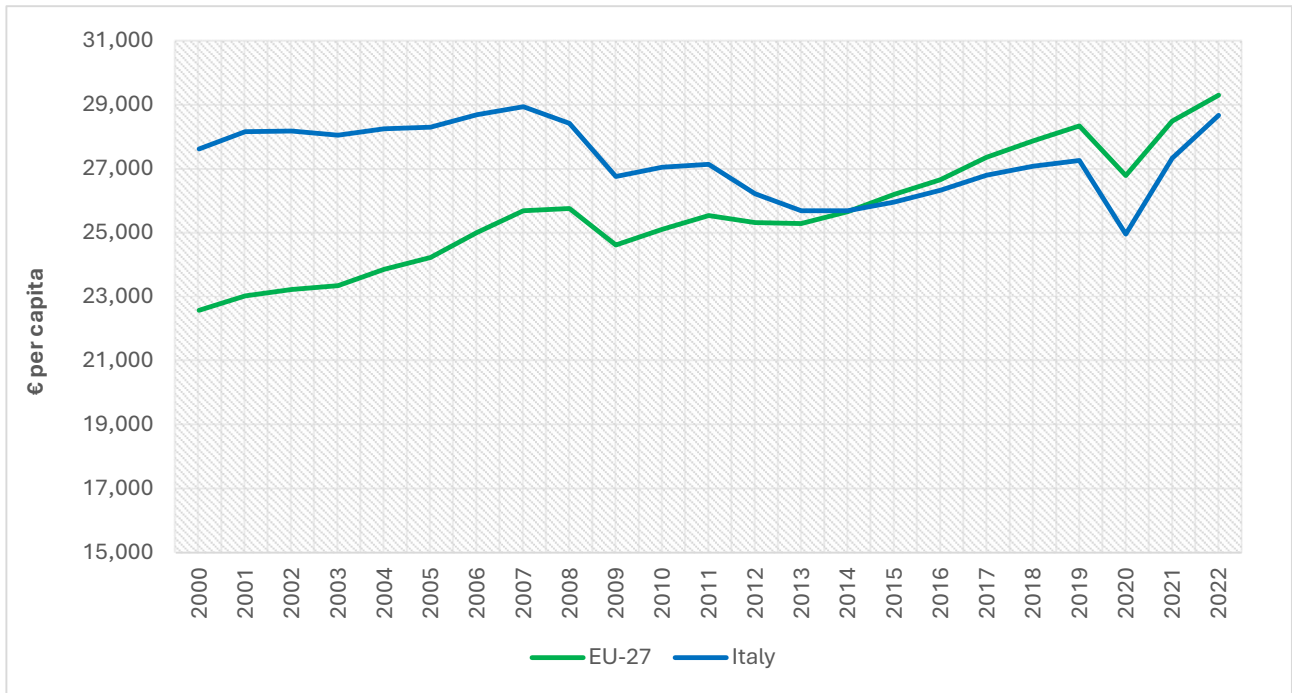


Figure 1.12 - GDP per capita (Italy and EU27) time series (chain lined volumes, 2010)
Source: EUROSTAT

In the following figure (Figure 1.13) the time series of GDP and GVA (Gross value added) from 1995 to 2022 are reported. Italy's Gross value-added increased between 1995 (1,395,344.6 M€) and 2007 (1,674,696 M€), then it started to decrease and in 2009 it was about by 6.3% lower than in 2007. A slight recovery was registered in the following two years, then value added started to decrease again until 2014.

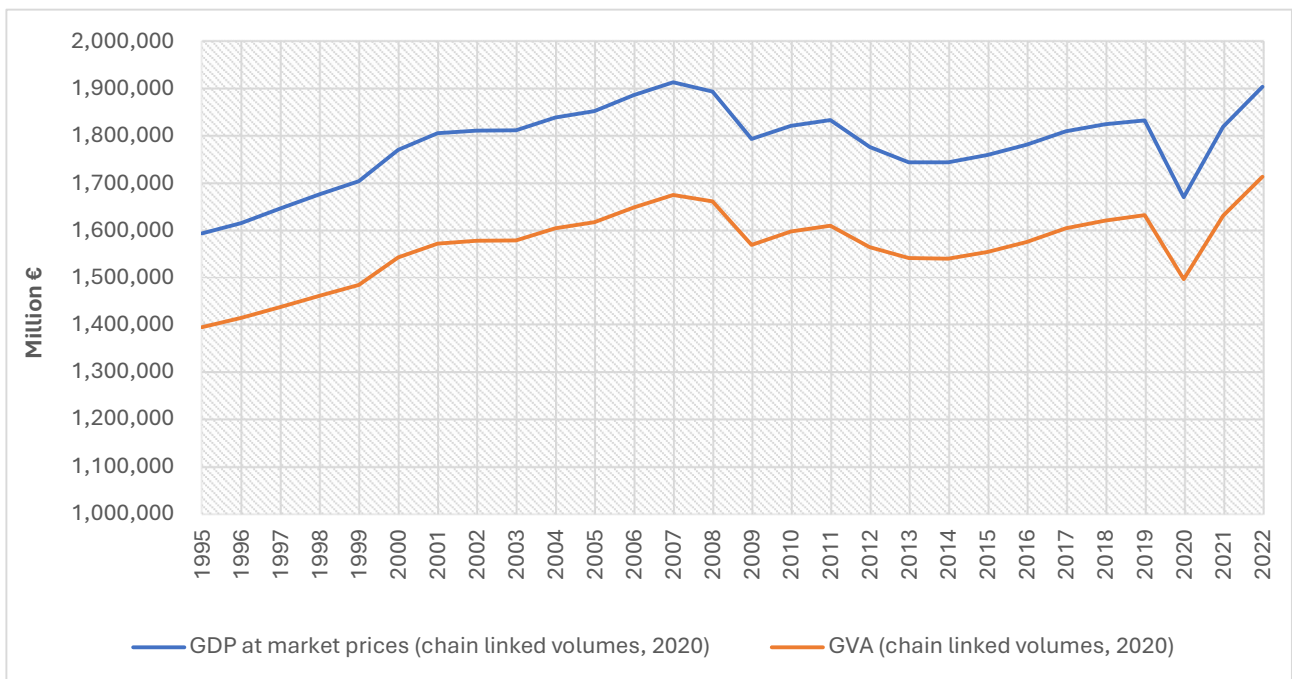


Figure 1.13 - Italy's GDP and GVA along the last decades (chain linked volumes, 2020)
Source: ISTAT

From 2014 to 2019 the GVA steadily increased and in 2019 it was 1,631,728.4 M€. The pandemic led to a drastic decline in 2020 (-8,4 % compared to the previous year) with a recovery in 2021 when it was 1,630,469.8 M€. In 2022 the GVA was equal to 1,713,637.2.

The driving sector of the national economy is the service sector, which accounted for 68.2% of GVA in 1995, then it increased to 70.2% in 2003 and remained below 71% (with a minimum of 70.47% in 2007) with slight fluctuations until 2009, when it increased to 73.4%. and to 74.2% in 2014 and 2015. Since 2015 the share of the service sector started to decrease and in 2018 it was 73.8% of GVA. In 2020, it increased up to 74.5% (the highest value since 1995) then in 2022 it fell to 73.6 % (+0.63% compared to 2021)

Industry-related activities¹⁴ accounted for 23.3% of GVA in 1995, then decreased up to 18.3% in 2009 (-12.2% compared to 2008). In the following years, from 2010 to 2022, the industry share remained in the range of 18.99% (in 2020) and 19.97% (in 2021). In 2022 industry-related activities accounted for 19.01% of GVA. Agriculture accounted for 2.3 of GVA in 1995 while in 2022 it accounted for 1.9%. The average weight of agriculture on added value, in the period 1995-2022, is equal to 2.2%. The construction sector accounted for 6.4% of GVA in 1995, decreased to around 6.0% in 1998, 1999, 2000, later increased up to 6.6% of GVA in 2005 and 2006. From 2007 it started to decrease again up to 4.3% in the years from 2016-2018. In the last four years an increase was registered and in 2022 the share of construction was 5.5% of GVA.

In the following figure the trend of GVA (at base prices, chain linked volumes, 2020) for activities sectors in millions of Euros is reported. The GVA of the industrial sector recorded a significant decrease in 2009 with -17.1% compared to 2008, a year in which it had already fallen by 2.8% compared to the previous year. In 2010 the sector recovered, recording +7.7% respect 2009. The Covid pandemic caused a drastic fall of the industry sector GVA with -12.1% in 2020 compared to 2019 and a recovery in 2021 (+14.6%). In 2022 the industry sector GVA with 325,713.8 million Euros remains approximately at the level of 2021 (+0.02%).

The Services sector recorded an increasing trend from 1995 to 2007, then in 2008 it decreased by 0.20% compared to 2007, with a greater decrease in 2009 (-2.24%). This sector was also negatively affected by the Covid pandemic, recording -7.6% in 2020 and a subsequent sharp recovery in 2021 (+7.0%). In 2022 the Services sector GVA was equal to 1,261,073.8 million euros (+5.8 % compared to 2021).

The agriculture sector registered an increasing trend of GVA from 1995 to 2000 then it started to strongly decrease and in 2003 it recorded -11.0% compared to 2000 with a strong recovery in 2004 (+11.7% compared to 2003). A fluctuating trend continued in the following years and also this sector was affected by the pandemic in 2020.

For the Constructions sector an increasing trend was registered from 1999 to 2006 then the GVA started to decrease and in 2015 it was -38.7% compared 2006. Then it increased again

¹⁴ The following activities are meant mining, manufacturing, electricity, gas, steam and air conditioning supply, water supply, sewerage networks, waste treatment and remediation activities

with a drop in 2020. A strong recovery was registered in 2021 (+21.9% compared to 2020) and in 2022 (+16.4% compared to 2021).

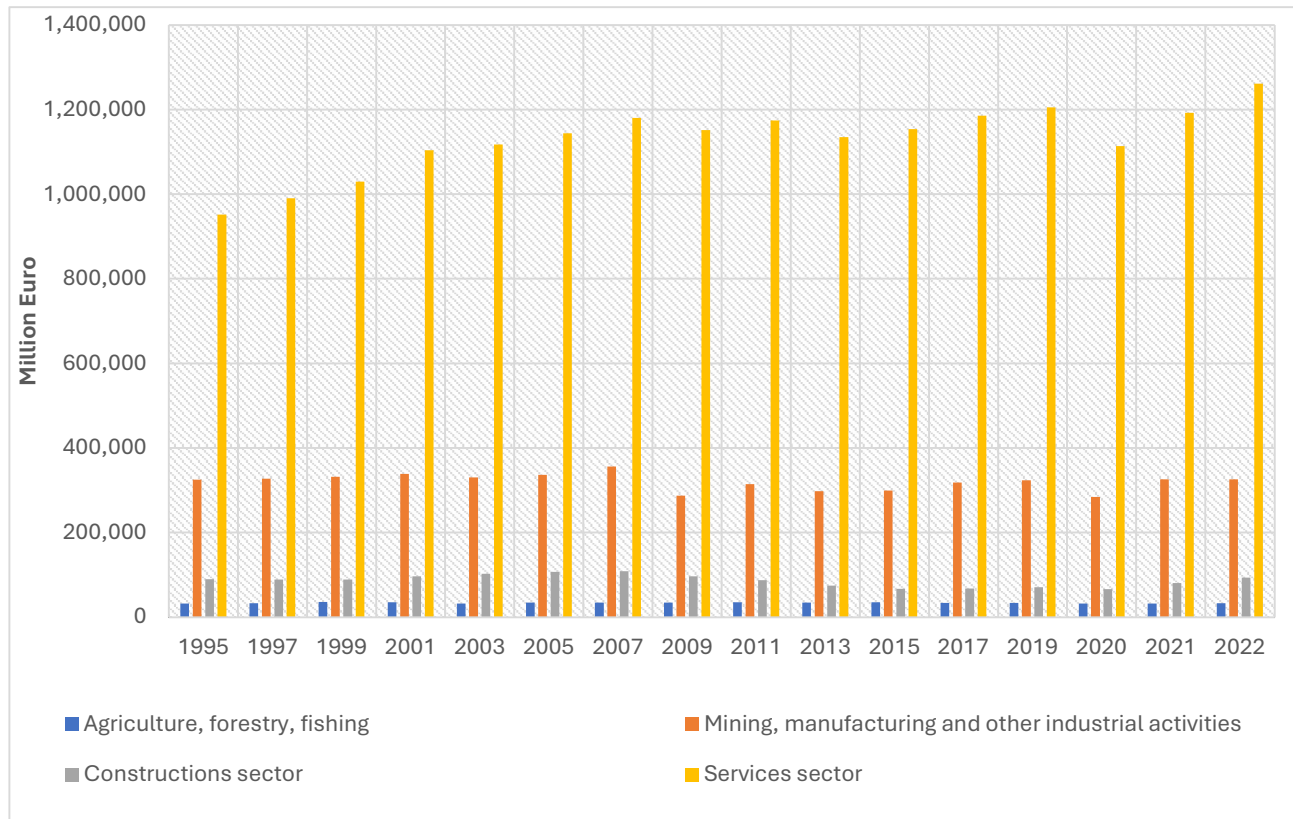


Figure 1.14 - GVA per activities sectors (M€ - chain linked volumes, 2020)

Source: ISTAT

The imports of goods and services showed an increasing trend from 1996 to 2007, then a fluctuating trend due to the fluctuation of domestic demand (Figure 1.15). Since 2013, imports of goods and services had been increasing until 2018 when they amounted to 486,592.6 M€, down to 421,070.6 million Euro in 2020 due to the economic crisis and SARS-CoV-2 pandemic (-12.48 % compared to 2019). In 2021, there is a recovery in the volume of imports of goods and services confirmed in 2022 as well with 552,605.1 M€.

From 1995 to 2007 the exports of goods and services increased by 50.3% reaching the value of 492,488.1 M€; in 2009 there was a significant fall in exports (-17.8%) compared to the previous year when they were 476,337.7 M€. From 2009 exports trend was crescent but in 2020, during the SARS-CoV-2 pandemic exports decreased by 13.7% compared to 2019. In 2021, with pandemic under control a recovery in exports (+14.1% compared to 2020) occurred and in 2022 exports continued to increase reaching 600,865.2 M€. (Figure 1.17). The balance exports - imports was always positive over the years 1995-2022 except with the minimum value registered in 2010 with 763.9 M€.

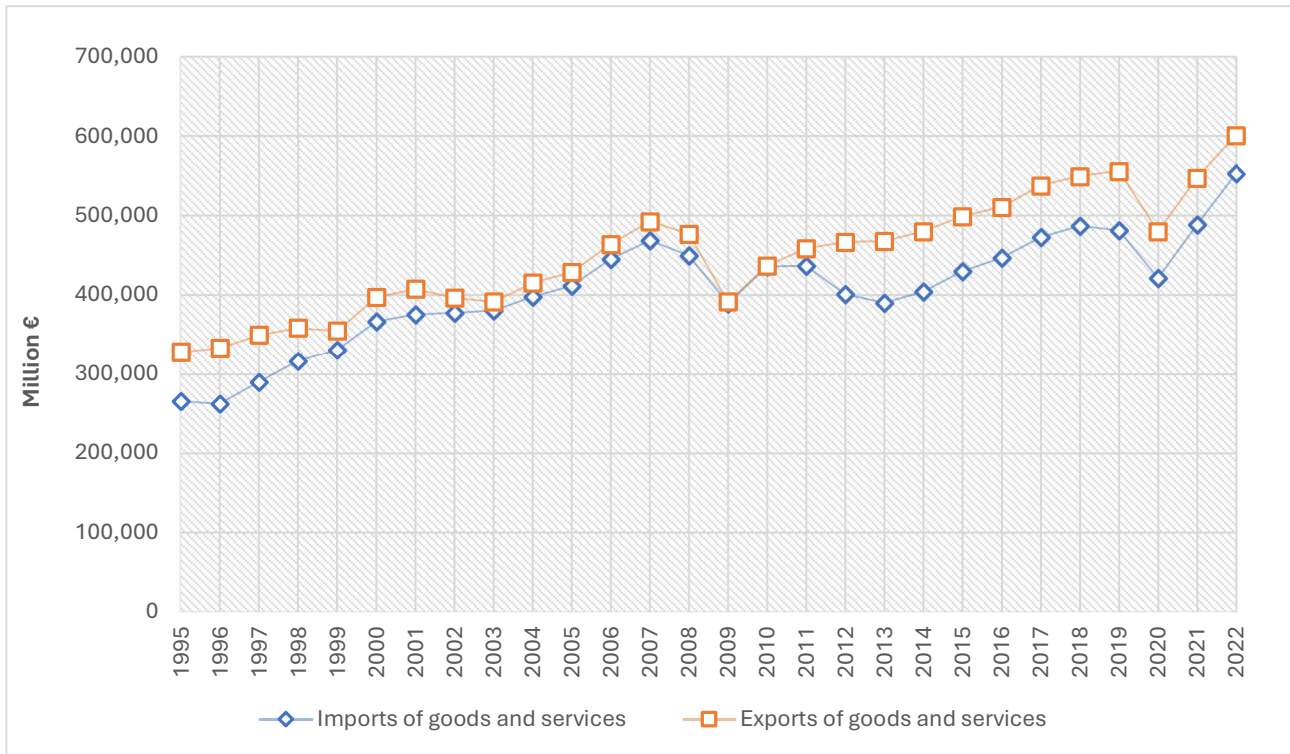


Figure 1.15 - Italy's Imports and exports of goods and services (M€ - chain linked volumes, 2020)

Source: ISTAT

In 2022, Italian imports and exports were mainly from/to the European Union (51.29% for imports and 52.77% for export). The percentage of imports from the EU in 2022 registered the lowest value since 2014 when it was equal to 54.24%. The highest value was registered in 2020 (+58.35%). As regards imports, the second area of the world from which Italy imports the most is Asia with 22.63% while for export America is the second area with 14.46% and then Asia with 12.46%. Compared to 2021, in 2022 imports from the EU decreased by 9.5% while imports from Asia increased by 15.0%, in the same period exports to America increased by 8.9% (+9.7% to Northern America and +6.1 to Central and South America). Since 2016 export to UE was always higher than 50% with the peak in 2021 with +52.73%. In terms of value, the main imported goods in 2022 were: natural gas (9.6%), chemical products and crude oil (both 6.5%), pharmaceuticals (4.8%), auto vehicles and precious base metals and other non-ferrous metals and nuclear fuel (4.6%), In the same year the main exported goods were pharmaceutical products (7.1%), “other general purpose machines”¹⁵ (4.7%), general purpose machines (4.4%) auto vehicles (3.8%)¹⁶.

¹⁵ Furnaces, burners and heating systems, Lifting and handling machinery and equipment Office machines and equipment (excluding computers and peripheral units), non-domestic equipment for refrigeration and ventilation ventilation.

¹⁶ <https://www.infomercatiesteri.it/osservatorio-economico-intercambio-commerciale-italiano-mondo.php#>

1.1.5 Energy

Italian energy asset is essentially dependent by import. The energy dependence of Italy from abroad is high compared with the EU27 average (79.2% in Italy vs 62.5% in EU in the 2022) as shown in the following table, although the dependence for Italy has been decreasing since 2000, except for the surge of 2022.

Table 1.1 - Total energy dependence (Italy and EU27)

Energy dependence	1990	1995	2000	2005	2010	2015	2020	2021	2022
Italy	84.4	82.0	86.5	83.3	82.6	77.0	73.5	73.3	79.2
EU27	50.0	52.2	56.3	57.8	55.7	55.8	57.5	55.5	62.5

Source: EUROSTAT

National gross inland energy consumption shows an increasing trend from 1990 until 2005 when it peaked at 189.4 Mtoe, then there was a reduction accelerated by the effects of the economic crisis with the minimum value of 149.8 Mtoe reached in 2014 and a recovery in the following years. After the fall occurred in 2020 due to SARS-CoV-2 pandemic in 2021 a rebound of consumption has been recorded (+8.8% higher than 2020), with 154 ktcoe, followed by further setback in 2022 (-3.9% lower than 2021).

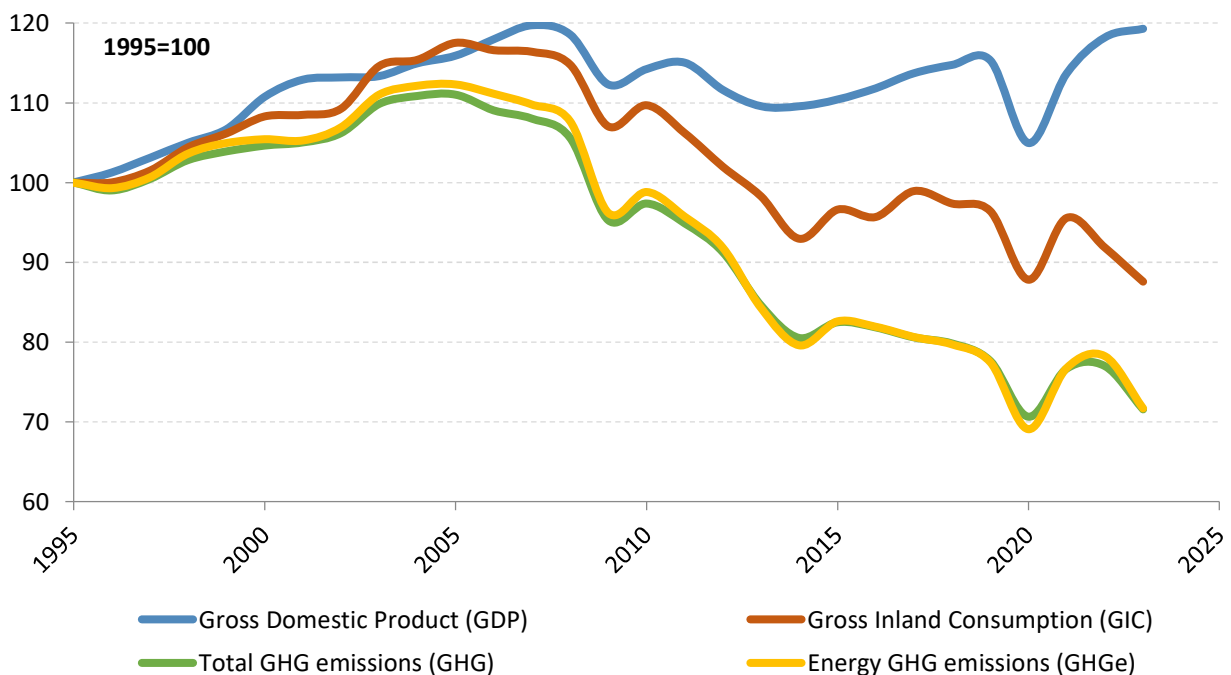


Figure 1.16 - Indexed trends (1995 = 100) of gross domestic product, gross inland energy consumption, total and energy GHG emissions (GDP; chained link values 2015).

Source: ISTAT, MSE, ISPRA, 2024.

To assess the relationship between energy consumption, economy and GHG emissions the trends of gross inland energy consumption (GIC), gross domestic product and GHG emissions are analyzed. GDP and GIC have parallel trends up to 2005. Then the two parameters begin to diverge showing an increasingly decoupling. GHGs growth was slower than that of GDP until 2005, highlighting a relative decoupling. After 2005, the divergence between the two parameters becomes increasingly marked by showing absolute decoupling up to 2019.

The gross inland consumption of energy per fuel types (Figure 1.16) is characterized by:

1. a reduction of the oil share, which was the most important energy source in the '90s;
2. the corresponding increase in the use of natural gas;
3. and the gradually increasing share of energy from renewable sources.

Compared with other European countries, Italy's energy consumption is characterized by a higher share of natural gas, a lower coal share, a structural electricity imports, and the absence of nuclear power. The share of renewable energy (which increased from 4.4% in 1990 to 19% in 2022) in Italy's gross inland consumption is higher than the EU27 average (18.4% in 2022)¹⁷. The Russia-Ukraine war at the beginning of 2022 determined a contingent contraction of natural gas consumption and slight increase of solid fuels and petroleum products.

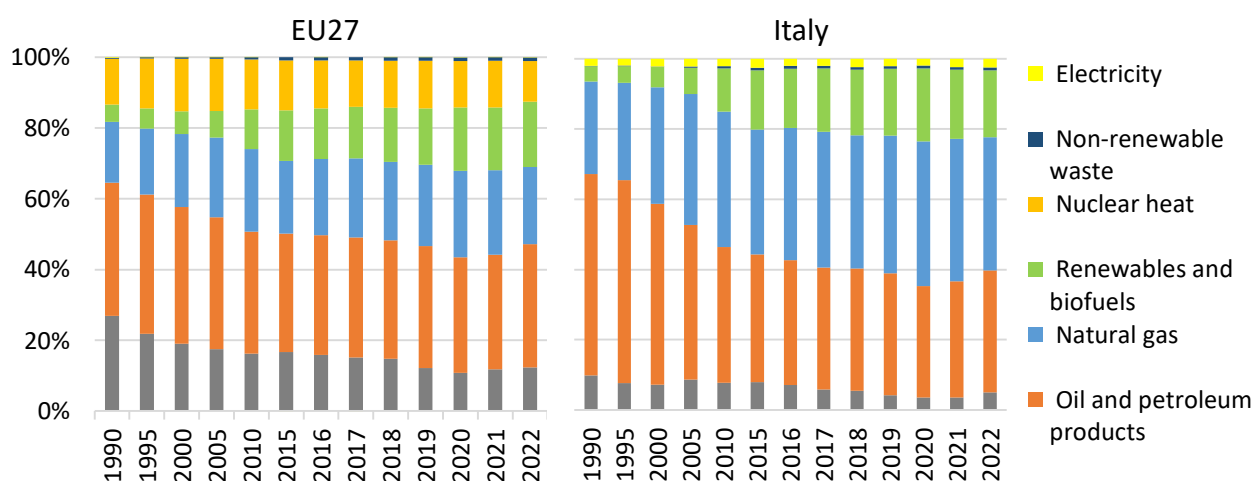


Figure 1.17 - Share in gross inland energy consumption by sources in EU27 and Italy (%).

Source: Eurostat, Ministry of Economic Development

In 2022 the final energy consumption in the end users was about 110.8 Mtoe, showing a significant increase compared to 2020 level (103.1 Mtoe), when the lowest value since 1990 was reached due to the measures, such as economy lockdown, implemented to stop the diffusion of SARS-CoV-2 pandemic. The previous lowest value was reached in 2014 (108.8 Mtoe), when the impacts of economy crisis started in 2008 was at the highest level. The 2022 level is 6% higher than the 1990 level.

The long-term trends of energy consumption in end-uses sectors can be pictured as:

1. energy consumption in the industry sector has been decreasing since 2004 (-34.3% in 2022 wrt 2004). The fall in energy consumption recorded in 2009 (-17.3% wrt 2008) was related to the national economy crisis and to the fall of industrial production. The sector's energy consumption in 2020 decreased by 4.3% compared to the previous year, also because of pandemic. In general, the long term decrease is mainly due to the heavy drop in consumption in the petrochemical and iron & steel sectors. Since 2015 the industry consumption show a quite stable trend;

¹⁷ ISPRA 2024, Efficiency and decarbonization indicators for total energy consumption and power sector. Comparison among Italy and the biggest European countries. <https://www.isprambiente.gov.it/it/pubblicazioni/rapporti/efficiency-and-decarbonization-indicators-in-italy-and-in-the-biggest-european-countries-edition-2024>

2. a stabilization of consumptions in the transport sector, although with wide oscillations, (about 36 Mtoe from 2013 to 2019) after the decreasing trend registered between 2007 and 2013 (-15.6%);
3. an overall increase in the consumption trend in the civil sector (households and services) up to 2010 and next fluctuations around 49 Mtoe. The energy consumptions in the services have increased from 1990 up to 2022 (+97.4%), while consumptions in the households, after the increase from 1990 to 2010, have been fluctuating around 32 Mtoe.

Energy end-uses total consumption in 2022 was of 110.8 Mtoe, of which 41.7% related to the civil sector (households, commercial and public services) and 33.1% to the transports. Industry accounts for 22.2% of total end-uses energy consumption, as shown in the following Figure 1.18.

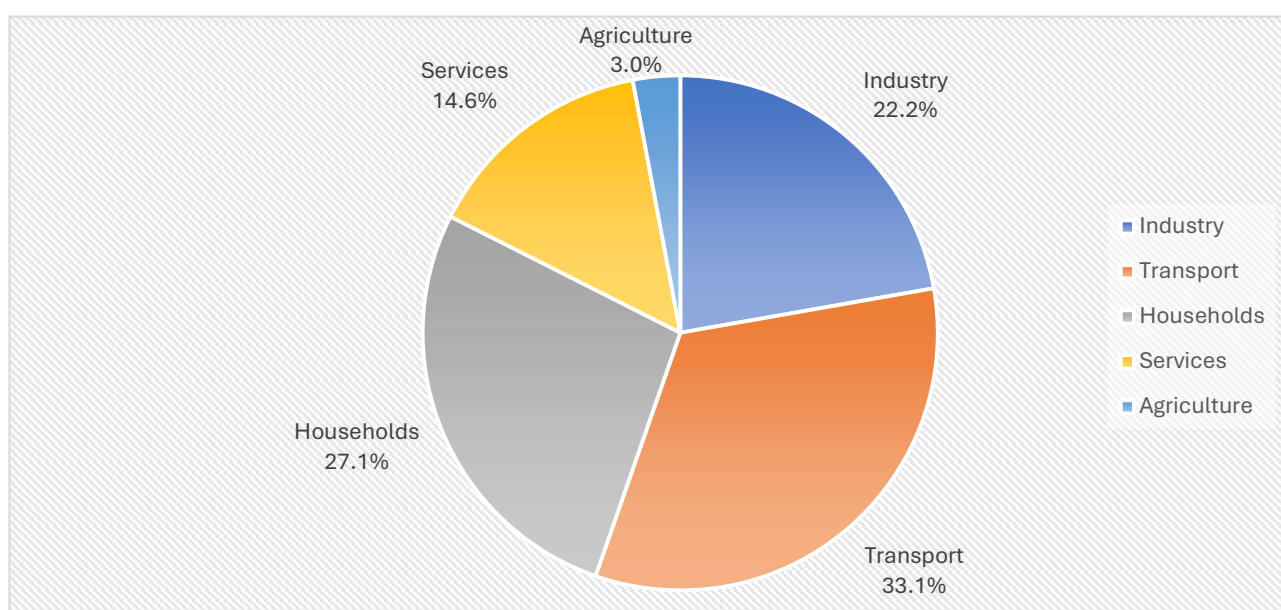


Figure 1.18 - Share of energy end-use consumptions per sector in 2022
Source: Processing of data from the National Energy Balance.

Concerning the power sector, the average electricity production provided by thermoelectric power plants was around 80.5% from 1990 to 2007. After such year the share has been decreasing up to the lowest value of 63% in 2014 in correspondence with the highest level of renewable share reached by the country (43.4% of electricity production without pumping). The weight of renewable sources, after a fall to 35.3% up to 2017, has kept growing up to 2020 and 2021, with 42% and 40.5%, respectively. The massive fall of hydroelectric production in 2022 slow down the share of renewable electricity to 35.6%. The capacity of renewable power plants has been constantly increasing with an average rate of 6.5% per year from 2005 to 2022. The unpredictability of precipitation and related hydroelectric production make sense for the variability of renewable electricity production.

The renewable target according to the European Directive 2009/28/EC concerns the share of energy from renewable sources in the gross final energy consumption. Gross final energy consumption is defined in the mentioned Directive on renewable energy sources as energy commodities delivered for energy purposes to final consumers (industry, transport,

households, services, agriculture, forestry and fisheries), including the consumption of electricity and heat by the energy branch for electricity and heat production, and including losses of electricity and heat in distribution and transmission. The accounting rules in the Directive prescribe that electricity generated by hydropower and wind must be normalized for annual variations (hydro 15 years and wind 5 years). The overall share of renewable energy consumption in 2020 for Italy is 20.4%, over the target of 17% to be achieved in 2020.

In 2023, the EU adopted the Commission proposals to reduce net greenhouse gas emissions by at least 55% by 2030, compared to 1990 levels. On the energy efficiency side, the EU has agreed on the binding target of reducing final energy consumption by at least 11.7% compared to projections of the expected energy use for 2030, according to the projections to the 2020 reference scenario. Moreover, the revised Renewable Energy Directive, adopted in 2023, raises the EU’s binding renewable energy target for 2030 to a minimum of 42.5%, but aiming for 45% (Figure 1.19).



Figure 1.19 - Evolution of renewable energy targets in Europe.
Source: European Commission.

To achieve the 2030 targets, the European Union has adopted the Regulation (EU) 2018/1999 establishing the Governance of the Energy Union with the main objective of planning the policies and measures implemented by the Member States. Within this framework, in June 2024 Italy transmitted to the European Commission its National Energy and Climate Plan with a horizon to 2030, whose aim is to implement an energy policy that ensures full environmental, social and economic sustainability for the transition.

1.1.6 Transport

As for transport facilities, the Italian railroad network was in 2022 about 20,139.9 km (67.7% of which electrified), while the Italian road network was at the end of 2022 about 169,837 km, 13.7% more compared to the road extension in 1990.

The extension of the Italian oil pipeline network was 3,948 km in 2022 and 3,983 km in 2023, with a coefficient of use equal to 47.0% and 46.1% in 2022 and in 2023 respectively. The extension of the Italian gas pipeline network in 2023 was 35,381 km.

Passengers' transportation in Italy, in 2023, was about 881,430 million of passengers-km (+10.6% compared to 2022 and -2.2% compared to 2015).

Road transport is the prevailing mean of passengers' transportation: in 2023 it was 90.5% and in 2022 it was 91.4% (considering private transport, collective urban and extra-urban transport) of the total passengers-km, while railroad transport accounted for 6.5% and 5.9% respectively in 2023 and 2022, water transportation accounted for about 0.4% both in 2023 and 2022, air transportation was 2.5% and 2.3% of the total passengers-km in 2023 and 2022 respectively¹⁸.

Since 2005, the picture of passenger transportation has not changed significantly. Among the European countries, Italy has the second highest motorization rate (694 cars per 1,000 inhabitants in 2023)¹⁹. There were about 40.9 million private cars circulating in 2023²⁰.

The goods transported were about 198.8 billion tons-km in 2023 (-1.6% compared 2022); in 2022 (about 201.9 billion tons-km) a decrease was observed of about -3.0% since 2021.

The analysis of the related data points out that:

1. road freight transport is the predominant transport mode over the years (about 62.4% and 61.0% of the total goods transported, in road haulage >50 km, in 2023 and 2022);
2. goods transported by water are about 21.2% and 21.9% respect to the total respectively in 2023 and 2022;
3. goods transported by railroad are about 11.3% and 12.0% respect to the total respectively in 2023 and 2022.

Italian families' average expenditure for the transport sector was about 15.5% in 2000, while it is about 11.7% and 12.3% in 2022 and 2023 respectively.

Mobility demand has increased since 1990 and the road is still the main mode of transport. Road mileage increased from 1990 to 2022, as shown in the following Table 2.5 and Table 2.6.

The reduction of passenger car sales over the years has affected negatively the replacement rate of passenger cars, so the average car life has been increasing and the circulating passenger car fleet has been gradually aging. In 2010, the share of passenger cars in use aged between 10 and 15 years was about 20.7%; since then, this figure has increased up to 23.3% in 2020 and then decreased to 18.0 in 2023. The share of passenger cars in use aged between 15 and 20

¹⁸ Conto Nazionale delle Infrastrutture e dei Trasporti Anni 2022-2023, Ministry of Infrastructure and Transport 2024.

¹⁹ Eurostat database, <https://ec.europa.eu/eurostat/data/database>

²⁰ ACI, Autoritratto 2023, <https://www.aci.it/laci/studi-e-ricerche/dati-e-statistiche/autoritratto/autoritratto-2023.html>

years was 8.2% in 2010, 16.1% in 2020 and it has increased up to 18.1% in 2023; the share of cars older than 20 years was 10.5% in 2010, 19.1% in 2020 and 23.0 in 2023²¹.

Table 1.2 - Road transportation in Italy: trends in mileage ²²

Vehicle category	1990	1995	2000	2005	2010	2015	2020	2021	2022	D* (%)
	Vehicles mileage (billion veh*km)									
Passenger Cars	315.6	368.3	409.0	407.9	408.7	406.2	314.7	392.7	408.2	29.4%
Light-duty trucks	34.5	40.0	44.6	64.9	56.0	45.8	38.2	43.7	49.1	42.3%
Heavy-duty vehicles including buses	38.5	39.2	39.7	42.8	33.2	28.6	27.7	32.9	34.9	-9.4%
Mopeds and Motorcycles	29.8	40.8	41.5	41.6	33.9	32.0	23.5	24.7	25.9	-13.2%
Total	418.3	488.4	534.7	557.3	531.8	512.5	404.2	494.1	518.0	23.8%

* The variation from the first available year in the time series is reported.

Source: ISPRA estimates, 2024.

In 2022, the total road mileage of vehicles was estimated to be 23.8% higher than it was in 1990: passenger cars have increased by 29.4%, light-duty trucks have increased by 42.3%; heavy vehicles including buses have decreased of about -9.4% from 1990 to 2022, while mopeds and motorcycles have decreased by -13.2%.

Table 1.3 - Road transportation in Italy: distribution of mileage by vehicle power supply

Vehicle power supply	1990	1995	2000	2005	2010	2015	2020	2021	2022	D* (%)
	vehicles mileage (billion veh*km)									
Petrol	246.5	328.2	326.6	263.4	190.4	150.9	109.0	127.4	138.1	-44.0%
Petrol Hybrid	-	-	-	-	0.2	0.8	4.6	9.8	16.4	6958.4%
Diesel	145.8	131.3	178.8	270.9	311.3	320.2	255.4	316.4	321.9	120.8%
Diesel Hybrid	-	-	-	-	0.0	0.1	0.9	2.1	3.1	98317.8%
Lpg	23.7	26.1	25.3	18.4	21.1	29.3	23.8	25.6	28.1	18.4%
Cng	2.4	2.8	4.1	4.6	8.7	11.3	10.0	11.8	9.1	282.5%
Electric	-	-	-	-	0.0	0.0	0.5	1.0	1.4	13882.5%
Total	418.3	488.4	534.7	557.3	531.8	512.5	404.2	494.1	518.0	23.8%

* The variation from the first available year in the time series is reported.

Source: ISPRA estimates, 2024.

²¹ ACI, Annuario statistico 2024, <https://www.aci.it/laci/studi-e-ricerche/dati-e-statistiche/annuario-statistico/annuario-statistico-2024.html>

²² Table 1.2 and table 1.3 report historical data series about the fleet mileage estimates, expressed in vehicles*km (fleet data source: ACI, ANCMA, Ministry of Infrastructure and Transport, several years), at the basis of the 2024 submission of the National emissions Inventory (ISPRA, <https://emissioni.sina.isprambiente.it/inventario-nazionale/>).

As for the vehicle power supply, the following Table 1.4 describes the distribution of the vehicles (petrol, petrol hybrid, diesel, diesel hybrid, liquefied petroleum gas, compressed natural gas, electric).

Over the period of more than three decades, considering the distribution by fuel types, petrol vehicles mileage decreased of about -44.0%, diesel vehicles mileage increased by 120.8%; LPG vehicles increased by 18.4% and CNG vehicles increased by 282.5%. Hybrid and electric vehicles mileage showed strong increases in recent years, although its weight on the total is still a minority.

Road transport sector energy consumption in Italy in the period 1990 - 2022 has increased by about 11.0%; after the minimum reached in 2020 due to the pandemic, increases were then observed both in 2021 and 2022. Relative growth over the years has been observed for alternative fuels, but the weight respect to the national total consumed is still not significant, as shown in the following Table 1.4.

Table 1.4 - Road Transport sector energy consumption in Italy per fuel (PJ)

	1990	1995	2000	2005	2010	2015	2020	2021	2022	D*
Fuel	PJ									%
Gasoline	568	754.9	731.2	589.6	428.9	334.4	250	303	339	-40.3%
Diesel	652.5	616.9	732.2	958.3	925.2	904	732.9	901.3	934.1	43.2%
LPG	62.6	68.9	65.6	47.5	56	76.3	60	64.5	70.4	12.5%
Natural Gas	8.7	10.2	13.7	15.9	29.1	37.7	28.9	32.5	21.7	149.2%
Biogas	-	-	-	-	-	-	3.4	5.7	7.7	125.3%
Biodiesel	-	1.7	2.4	7.5	54.9	48.3	52.7	58.8	57.3	3343.9%
Biogasoline	-	-	-	-	5.1	1.1	0.8	1.1	1.5	-71.4%
Electricity	-	-	-	-	0.2	0.3	0.7	1.6	2.2	882.4%
Total	1291.7	1452.6	1545	1618.8	1499.5	1402.1	1129.5	1368.5	1434	11.0%

* The variation from the first available year in the time series is reported.

Source: ISPRA elaboration on the basis of National Energy Balance consumption data, several years.

As shown in the previous table, energy consumption in the road transport sector increased by about 142.3 PJ in the period 1990-2022. The road transport sector keeps depending almost completely on oil products (gasoline and diesel account for about 88.8% of the total in 2022).

Energy prices and the economic recession had an effect in the transport sector. It is observed a strong increase starting from 1990 until 2007 on one side, due to the increase of vehicle fleet, total mileage and consequently fuel consumptions and, on the other side, in the following years a decrease in fuel consumption and CO₂ emissions basically due to the economic crisis and to a lesser extent to the penetration into the market of progressively more efficient vehicles; then, during last year, from 2019 to 2020, there has been a sharp reduction in consumptions, as a result of the pandemic crisis. Subsequent recovery results then in increases in 2021 and 2022.

As regards the targets for average type-approval emissions for new passenger cars, the Regulation (EU) 2019/631 set further reduction targets for 2025 and 2030, with respect to the previous Regulation (EC) 443/2009; finally, the Fit for 55 package set the proposal of more

ambitious CO₂ reduction targets for new passenger cars and vans (-100% in 2035 for cars and vans versus 2021). Emissions of CO₂ per km from new cars are targeted to decrease over time. On the other side, Table 1.5 reports the trend in CO₂ emissions from passenger cars in Italy since 1990 to 2022, showing an increase of about 15.9%.

Table 1.5 - Trend of CO₂ emissions from passenger cars in Italy in the period 1990-2022

Emissions from passenger cars	1990	1995	2000	2005	2010	2015	2020	2021	2022	D (%)
CO ₂ (Mt)	54.9	63.3	69.9	70.1	67.8	66.0	49.3	61.3	63.6	15.9%

Source: ISPRA, National Greenhouse Gas Emissions Inventory 2024.

1.1.7 Industry

As reported above, industry-related activities contribution to total GVA have been decreasing since 1995, with significant fluctuations linked to national and global economic situation. In this decreasing trend the contribution of the different components of this sector is slowly changing, with the so-called engineering sector increasing over time as well as the food, drink and tobacco sector, while more energy intensive industries, like non-metallic minerals, pulp, paper and printing, and basic metal, are decreasing. Textile manufacturing has seen a major decrease in terms of GVA contribution over the time considered.

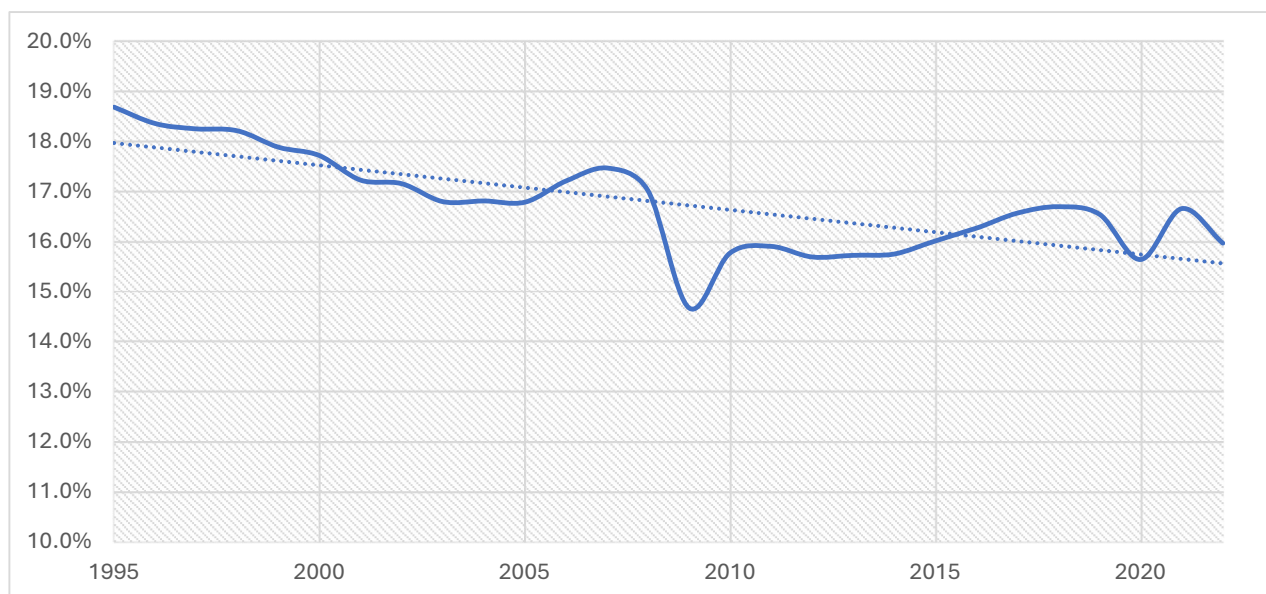


Figure 1.20- Contribution of manufacturing industries (%) to total national GVA

Source: EUROSTAT

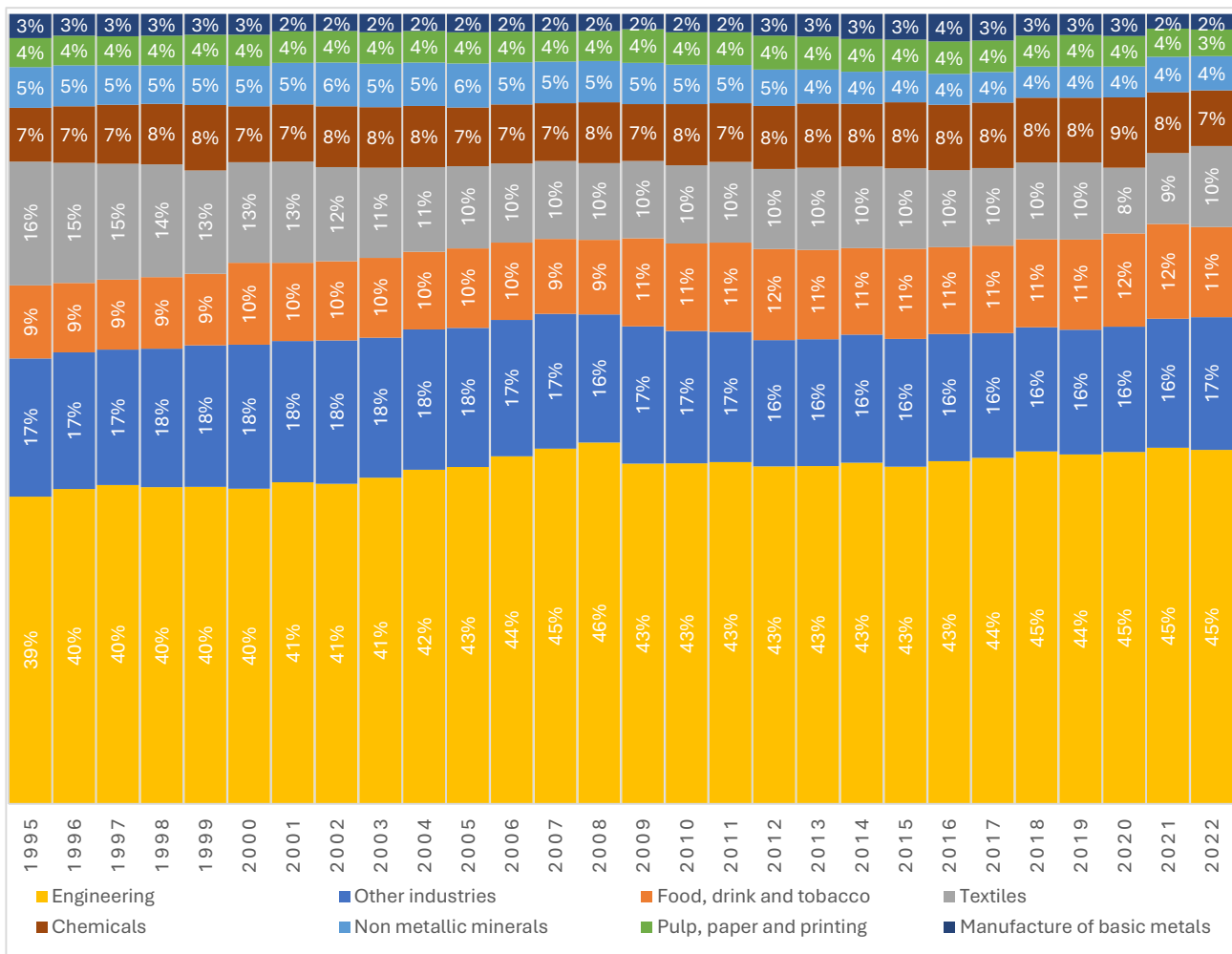


Figure 1.21- Contribution of industrial sectors (%) to manufacturing industries total national GVA
Source: EUROSTAT

1.1.8 Agriculture

Main drivers of GHG emission trends for Agriculture are the number of animals, the variation of cultivated surface/crop production and use of nitrogen fertilizers. Trends and changes of these parameters at national level have been affected by some EU policies and measures implemented at national level, which are described in 3.4.5 Policies in Agriculture sector.

In Italy, 21.7% of the total agricultural holdings in 2020²³ dealt with livestock farming. Changes in livestock farms have occurred since 1982: the number of livestock farms has decreased by 71.2%.

Based on the yearly sample survey of the Italian Institute of Statistics (ISTAT), changes in livestock populations have also occurred: specifically, in 2022 compared to 1982 cattle reduced by 34.8% while poultry increased by 19.4%; the number of pigs decreased slightly (-0.8%).

²³ Considering farms with cattle, pigs or poultry during the 2019-2020 crop year, according to the first results of the 7th General Census of Agriculture, conducted in 2021

The total agricultural area, the utilized agricultural area (UAA) and the number of agricultural holdings have been decreasing since 1982 (Table 2.9) according to the Agricultural Census conducted by ISTAT every 10 years; the data related to 2013 and 2016 are the results of the Farm Structure Survey 2013 and 2016, a three-year investigation in the form of sample surveys based on the same definitions of the Census. The reduction in the number of agricultural holdings (-63.8% in 2020 compared to 1982) is more significant than the reduction of UAA (-21.5%) thus resulting in the noticeable increase of the average size of Italian agricultural holdings along the same years (+117.1%). In about 40 years, small farms (with UAA less than 1 ha) and large-scale farms (with UAA more than 10 ha) declined by 75% and 35%, respectively. Furthermore, few farms hold the majority of UUA, as small and medium-sized companies have come to large companies over the years: the UAA of small and medium-sized companies (up to 10 ha) fell by 59% from 1982 to 2020, and large-scale farms have increased the average share of UAA from 66.9% to 80.6%. Official statistics concerning the distribution of agricultural holdings by type show that family-run business is still a peculiar feature of the Italian agricultural holdings.

Table 1.6 - Agricultural holdings characteristics in Italy between 1982 and 2020

Agricultural holdings characteristics	1982	1990	2000	2010	2013	2016	2020
Number of agricultural holdings	3,133,118	2,848,136	2,396,274	1,615,590	1,471,185	1,145,705	1,133,006
UAA (ha)	15,832,613	15,025,954	13,181,859	12,856,048	12,425,995	12,598,161	12,431,808
Total agricultural area (ha)	22,397,833	21,628,355	18,766,895	17,081,099	16,678,296	16,525,472	16,085,987
Average size of agricultural holdings (ha)	5.1	5.3	5.5	8.0	8.4	11.0	11.0

Source: ISTAT Agricultural Census for the years 1982 to 2010 and 2020; ISTAT Farm Structure Survey (FSS) 2013 and 2016

In the last decade, the decrease in the use of fertilizers is the result of both the Common Agricultural Policy (CAP) and trend of the fertilizers market prices. The decrease in the use of mineral products with a corresponding increase of organic formulated products is also in line with the CAP aiming at promoting the use of organic manures and fertilizers instead of the use of synthetic mineral products, to reduce the impact of agricultural production on environment and health (air and water quality, GHG emissions).

According to the 6th and 7th Agricultural Censuses, agricultural holdings producing renewable energy as a remunerative activity have more than tripled in 2020 compared to 2010, passing from about 3,400 to about 10,300.

1.1.9 LULUCF

From 1990, changes in the land use in Italy have resulted in an increase of the area included under the forest land category (26%), settlements (43%) and wetlands (15%), and a reduction of the cropland area (17%) and grassland area (10%).

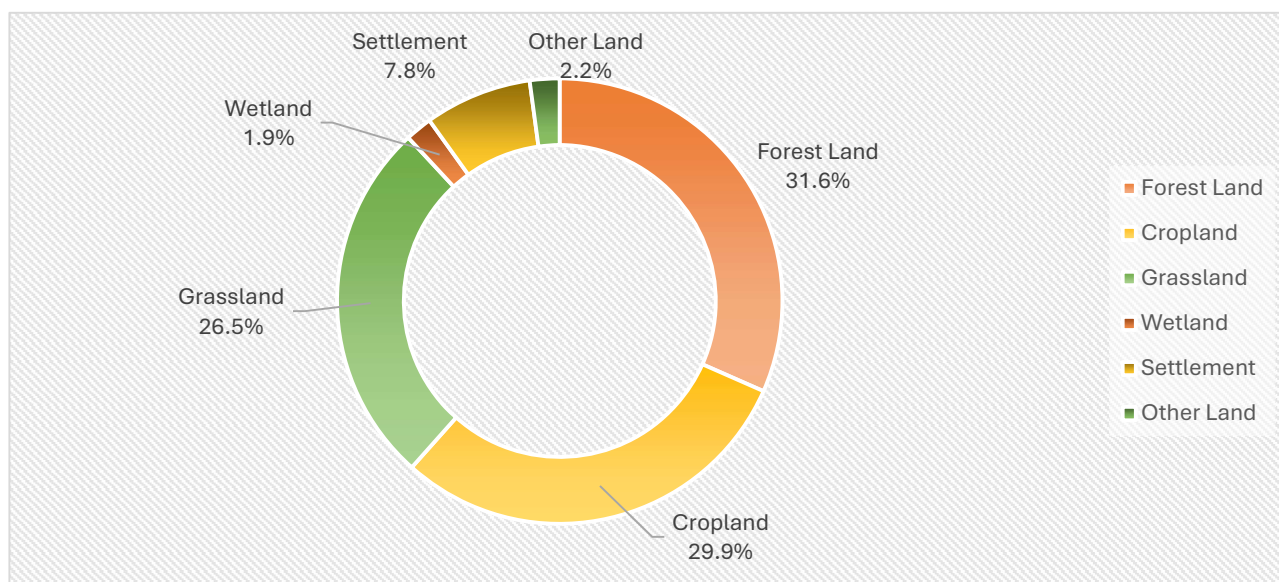


Figure 1.22 - Land use in Italy in 2022

Italy has a rich biological heritage of forest and several types of landscape, as our peninsula constitutes a bridge between the central European environmental settings, including those of the continental type, and the Mediterranean ones. The diversification can be observed, in terms of forestry resources, in the contrast between the Alpine woods of resinous trees, like those of central and northern Europe, and the mixed forests of leave bearing trees, with the range extending to Mediterranean brush and formations typical of cold, arid climates closely related to those of the North African countries.

Italian forest land area was about 7,590 kha in 1990; 8,369 kha in 2000; 8,986 kha in 2010; and 9,532 kha in 2022, equivalent to about 32% of our national land surface. The Italian forested area is spreading due to the dismissal of agriculture practices, mostly in mountain zones, and to the natural conversion of cultivated lands and grazing into forests. However, forest expansion rate has been decreasing throughout the last decade: it was about 78 kha y⁻¹ in 2000 (with respect to 1990) and it was about 45.5 kha y⁻¹ in from 2010 to 2022.

The natural protected areas (established on various administrative levels: national, regional and local) include 31.1% of the total forested areas²⁴. The Italian Forest areas certified under international forest management certification schemes was 925,609 ha in 2022 under the Programme for Endorsement of Forest Certification schemes (PEFC)²⁵.

²⁴ National Forest Inventory 2015

²⁵ <https://www.pefc.it/>

Table 1.7 - Italian land surface areas according to the GHG inventory, along the inventory period²⁶

Categories	Area [kha]							
	1990	1995	2000	2005	2010	2015	2020	2022
Forest land	7,590	7,980	8,369	8,759	8,986	9,214	9,441	9,532
Cropland	10,841	10,924	10,487	9,879	9,159	8,845	9,040	9,020
Grassland	8,891	8,278	8,186	8,265	8,630	8,605	8,095	7,995
Wetlands	510	512	515	517	534	571	586	586
Settlements	1,644	1,782	1,920	2,058	2,170	2,244	2,317	2,346
Other land	658	657	656	656	655	655	655	655
TOTAL	30,134	30,134	30,134	30,134	30,134	30,134	30,134	30,134

Source: ISPRA

The areas (forests, cropland and grassland) burnt by fires since 1990 are depicted in Figure 1.23: forested areas affected by fires in 2022 amount to approximately 39% of the total land surface burned by fire in the same year, while 53% is the area affected by fires classified under grassland category in 2022.

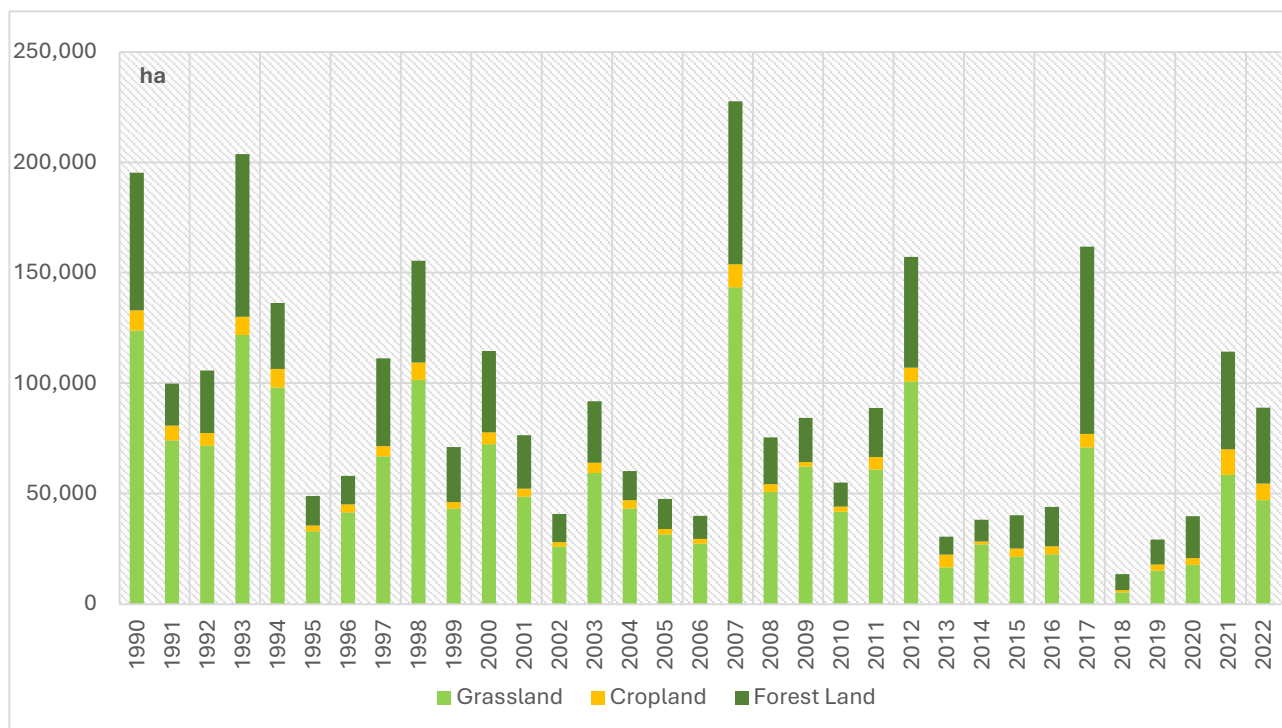


Figure 1.23 – Forest land, Cropland and Grassland (kha) affected by fires

1.1.10 Waste

From 1990 Italy has evolved a lot considering the management of waste. For what concern wastewater according to the National Institute of Statistics in 2012 about 93% of the Italian municipalities were served by a sewer system and about 79% of the population was connected

²⁶ ISPRA, NID 2024

to wastewater treatment plants, whilst in 2022 these percentages have increased to 99.6% and 91% respectively. In the following Table 2.11 estimates of the number of facilities for the treatment of waste in Italy are reported.

Table 1.8 – Waste and wastewater treatment in Italy: number of facilities

Type of waste facility	1990	1995	2000	2005	2010	2015	2020	2022
Landfills	480	650	657	340	211	149	131	117
Incinerators	122	135	132	111	148	124	115	112
WWTP	6,820	9,550	12,003	14,473	17,532	17,897	18,042	n.a.

Source: ISPRA

The production of municipal waste in Italy has increased from 22 Mt in 1990 to about 32 Mt in the years between 2005 and 2010, while it has remained approximately stable around 29-30 Mt since 2019. Changes in lifestyle and consumption patterns, rather than the enforcement of waste legislation, seem to be the main drivers for the gradual reduction in MSW production; the international crisis of the economy and Covid-19 pandemic has contributed too. In 2022, 29 Mt of municipal waste was produced, corresponding to 494 kg/year per person. The production of special waste by manufacturing industries has been increasing since 1990: it accounted for about 33 Mt in 2000; 36.7 Mt in 2005; 39.4 Mt in 2010; 26.7 in 2020 and 28.3 in 2022.

Separate collection has been increasing since 1996: in 2022, near 19 Mt of MSW (65.2%) were subjected to separate collection compared to 11.4 Mt (35.3%) in 2010 and to 1.8 Mt (7.2%) in 1996. Although separate collection rates vary across the country, an increasing overall trend during the last years can be observed. The municipal waste has been managed as shown in Table 2.12 for the last two decades.

Table 1.9 – Main management systems of Municipal Waste (%)

Treatment	1990	2000	2005	2010	2015	2020	2022
Landfilling	91.1	76	48.6	38.2	21.0	16.3	14.8
Incineration	4.6	8	10.2	13.3	15.0	15.0	15.2
Mechanical-biological treatment	2.4	10.8	22.5	22.6	28.3	26.1	25.1
Composting/anaerobic digestion	0.6	6.6	5.6	10.0	14.0	19.3	20.0
Other material recovery technologies			13.1	16.0	21.8	23.3	24.9

Source: ISPRA

In Italy, the number of landfills has been decreasing since 1999 (786 landfills): a reduction of 669 landfill installations was registered in 2022 due to the decommissioning of unmanaged and smaller size landfills. Since the early '90s, landfilling as a waste disposal practice has been decreasing also due to changes in national policies which now support other waste treatments (e.g. mechanical-biological treatment; composting; anaerobic digestion; incineration; etc.). The amount of methane derived from landfill gas and sent to energy recovery was 132 kt in 2000, 278 kt in 2010 and 203 kt in 2022. The number of operating incineration plants was 122 in 1990, it reached 138 in 2010, and it was 124 in 2015. In 2011, more than 95% of the total amount of incinerated waste was treated in installations with energy recovery systems and this

share has increased up to 99% in 2015. The production of special waste in Italy has increased since 1990: from 77.1 Mt in 1990, 137 Mt in 2010 and 161.4 Mt in 2022. The per capita production of special waste in 2022 at national level was 2.7 t/y, 2.6 t/y for non-hazardous special waste and 0.2 t/y for hazardous special waste, respectively. The correlation between special waste production trend and the Italian GDP trend is good: especially for the last years, the ups and downs in the special waste production trend are related to the trend of the Italian economy. For the last two decades, the amounts of special wastes produced in Italy have been reported in the following Table 2.13.

Table 1.10 - Special wastes produced in Italy between 1990 and 2022 (Mt)

	1990	2000	2005	2008	2009	2010	2015	2020	2022
Non-hazardous special waste	-	51.8	55.6	60.5	58.7	61.1	70.3	72.3	72.2
Hazardous special waste	-	3.9	7.9	11.3	10.3	9.6	9.1	9.8	10.0
Inert waste (Mt)	-	27.3	45.9	70.8	65.3	67	52.9	64.8	79.2
Total Special Waste	77.1	83.0	109.4	142.8	134.6	137.9	132.4	146.9	161.4

Source: ISPRA

The different systems of managing special wastes in Italy for the last decade are summarized in Table 2.14.

Table 1.11 - Management of Special Waste (%)

Treatment	2000	2005	2010	2015	2020	2022
Storage	15.1	13.7	13.6	10.8	11	11.20
Other disposal operation	14.5	14.6	17.2	13.7	10.3	9.90
Energy recovery	2.5	2.7	1.6	1.5	1.1	1.00
Incineration	1	1.1	0.7	0.7	0.8	0.60
Recovery of material	39.8	48.6	57.5	65.1	70.6	72.20
Landfilling	27.1	19.4	8.2	8.2	6.2	5.00

Source: ISPRA

It is worth noting that the amount of special waste destined to the recovery of material has been increasing for the last years and landfilling of special waste has been reducing for the same years. As for the wastewater treatment plants, the overall treatment capacity over the last 20 years has been increasing as reported in the following table.

Table 1.12 - Wastewater treatment capacity in Italy

	1990	1995	2000	2005	2010	2015	2020	2022
Number of WWTPs	6820	9550	12003	14473	17532	17897	18042	n.a.
Total treatment capacity (M p.e.)	46	60	65	73	76	75	91.00	94.00

Source: ISPRA

2 NATIONAL INVENTORY REPORT OF ANTHROPOGENIC EMISSIONS BY SOURCES AND REMOVALS BY SINKS OF GHGS

2.1 Introduction

Italy submitted the greenhouse gas (GHG) inventory in November 2024. The submission contains information on emissions and removals of GHGs, including precursors (nitrogen oxides [NO_x], carbon monoxide [CO], non-methane volatile organic compounds [NMVOC]), and sulfur oxides [SO_x] from 1990 to 2022 based on Articles 4 and 12 of the United Nations Framework Convention on Climate Change (UNFCCC) and Article 13 of the Paris Agreement. The national inventory document prescribed in the Modalities, procedures and guidelines for the transparency framework for action and support referred to in Article 13 of the Paris Agreement (Annex to Decision 18/CMA.1, hereinafter referred to as the “MPGs”) has been submitted as a stand-alone report, therefore, this chapter provides only a summary of the information in the report.

The National Inventory Document and the related Common Reporting Tables (CRTs) may be found on <https://unfccc.int/first-biennial-transparency-reports>.

2.2 Institutional arrangements for the Italian GHG inventory

A brief description of the institutional arrangements for the preparation of the national emission inventory is provided in this section. Further explanation is reported in the National Inventory Document.

The National System for the Italian Greenhouse Gas Inventory was established by the Legislative Decree 51 of March 7th 2008 and confirmed by the Legislative Decree 30 of March 13th 2013. The Institute for Environmental Protection and Research (ISPRA) is the single entity in charge of the preparation and compilation of the national greenhouse gas emission inventory. The Ministry of the Environment is responsible for the endorsement of the inventory.

The ‘National Registry for Carbon sinks’, instituted by a Ministerial Decree on 1st April 2008, is part of the Italian institutional arrangements. In agreement with the Ministerial decree art. 4, the Ministry of the Environment is responsible for the management of the National Registry for Carbon sinks. The Decree also provides that ISPRA and the former State Forestry Service, now Carabinieri Forestali, are involved as technical scientific support for specific activities as defined in the relevant protocol. ISPRA is responsible for the preparation of emission and removals estimates for the LULUCF sector.

In March 2006 Italy started operating a national registry under the European Emission Trading Scheme (EU ETS). In June 2012 all national registries of the EU Member States as well as the national registries of Norway, Liechtenstein and Iceland were grouped in a single central software system managed by the European Commission. According to Legislative Decree N. 47

of 9 June 2020, enforcing European Directive 2018/410/EC, ISPRA is responsible for the administration of the Italian part of the Union Registry; the Institute performs this task under the supervision of the National Competent Authority.

ISPRA is the national entity with overall responsibility for the national GHG inventory of Italy.

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The Institute prepares annually a document that describes the institutional arrangements including all updated information on institutional, legal and procedural arrangements for estimating emissions and removals of greenhouse gases and for reporting and archiving inventory information. The reports are publicly available at <http://emissioni.sina.isprambiente.it/inventario-nazionale/>.

The Italian National System, currently in place, is fully described in the document *National Greenhouse Gas Inventory System in Italy*²⁷.

2.3 Description and interpretation of emission trends for aggregate greenhouse gas emissions

Total greenhouse gas emissions, in CO₂ equivalent, excluding emissions and removals from LULUCF, have decreased by 19.9% between 1990 and 2022, varying from 522 to 413 CO₂ equivalent million tons (Mt). Table 1 shows the national greenhouse gases for 1990-2022, expressed in CO₂ equivalent terms and by substance; emissions are reported excluding and including emissions and removals from LULUCF and with indirect emissions which, for Italy, equals the total emissions.

²⁷ ISPRA, 2018. National Greenhouse Gas Inventory System in Italy. Year 2018. <http://www.sinanet.isprambiente.it/it/sia-ispra/serie-storiche-emissioni>

<http://www.isprambiente.gov.it/it/pubblicazioni/rapporti/national-greenhouse-gas-inventory-system-in-italy.-year-2013>

Table 2.1 Greenhouse gas emissions and removals from 1990 to 2022 by gas (kt CO₂ eq.)

GHG emissions	1990	1995	2000	2005	2010	2015	2019	2020	2021	2022
	<i>kt CO₂ equivalent</i>									
CO₂ excluding net CO₂ from LULUCF	438,208	448,596	469,598	501,366	435,701	361,246	339,641	302,614	335,920	340,904
CO₂ including net CO₂ from LULUCF	432,937	424,242	448,286	466,925	395,419	318,828	301,380	274,409	310,024	318,796
CH₄ excluding CH₄ from LULUCF	54,971	57,026	57,698	54,806	52,874	49,370	46,685	47,402	47,036	45,714
CH₄ including CH₄ from LULUCF	55,691	57,196	58,098	54,973	53,071	49,518	46,787	47,588	47,525	46,072
N₂O excluding N₂O from LULUCF	24,475	26,416	27,183	26,337	18,305	17,101	16,897	17,570	17,457	15,738
N₂O including N₂O from LULUCF	25,383	27,212	27,872	26,925	18,707	17,436	17,354	18,090	18,076	16,288
HFCs	372	1,100	3,747	9,666	12,805	12,082	11,089	9,971	9,411	9,085
PFCs	2,615	1,351	1,363	1,759	1,377	1,529	915	499	395	439
Unspecified mix of HFCs and PFCs	NO,NA	24	24	24	24	24	23	22	25	22
SF₆	421	700	621	565	405	483	438	252	282	390
NF₃	NA,NO	77	13	33	20	28	18	16	15	20
Indirect CO₂	1,311	1,211	1,073	1,041	860	692	786	705	740	728
Total (excluding LULUCF, with CO₂ indirect)	522,373	536,500	561,322	595,598	522,371	442,557	416,493	379,051	411,282	413,041
Total (including LULUCF, with CO₂ indirect)	518,730	513,112	541,099	561,913	482,687	400,621	378,791	351,552	386,495	391,842

Source: ISPRA

The most important greenhouse gas, CO₂, which accounts for 82.7% of total emissions in CO₂ equivalent, shows a decrease of 22.3% between 1990 and 2022. In the energy sector, in particular CO₂ emissions in 2022 are 20.0% lower than in 1990. In 2022, CH₄ and N₂O emissions are equal to 11.1% and 3.8% of the total CO₂ equivalent greenhouse gas emissions, respectively. CH₄ emissions decreased by 16.8% from 1990 to 2022, while N₂O emissions have decreased by 35.7%. As for other greenhouse gases, HFCs account for 2.2% of total emissions, PFCs and SF₆ are both equal to about 0.1% of total emissions; the weight of NF₃ is less than 0.01%. Figure 2.1 illustrates the national trend of greenhouse gases for 1990-2022, expressed in CO₂ equivalent terms and by substance; total emissions do not include emissions and removals from land use, land use change and forestry.

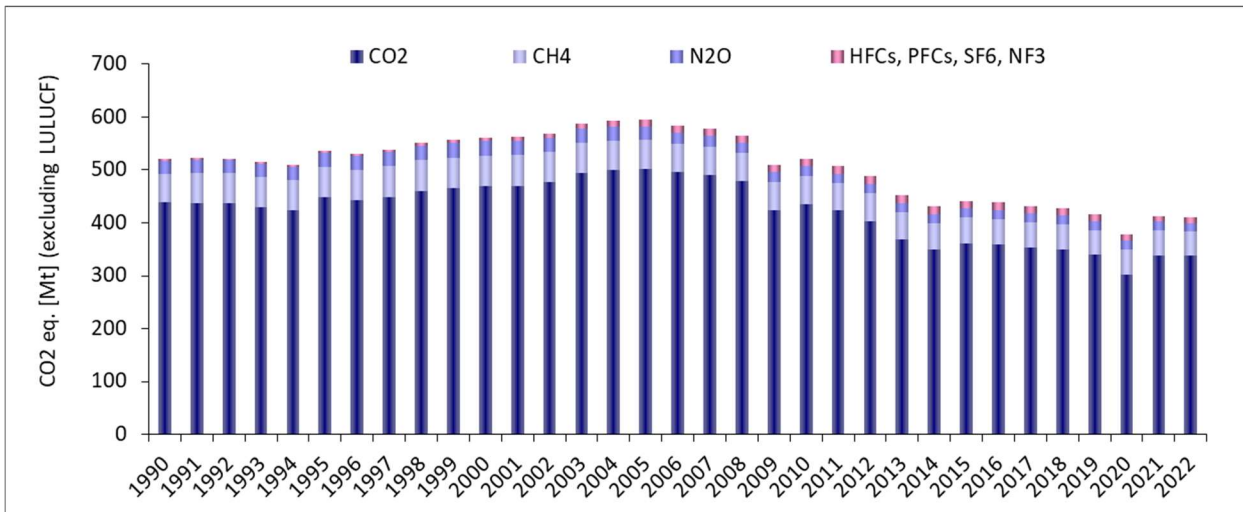


Figure 2.1 National greenhouse gas emissions from 1990 to 2022 (without LULUCF) (Mt CO₂ eq.)
Source: ISPRA

The share of the different sectors, in terms of total emissions, remains nearly unvaried over the period 1990-2022. Specifically, for the year 2022, the greatest part of the total greenhouse gas emissions is to be attributed to the energy sector, with a percentage of 81.8%, followed by agriculture and industrial processes and product use, accounting for 7.4% and 5.7%, respectively, and waste contributing with 4.9% to total emissions.

Total greenhouse gas emissions and removals, including LULUCF sector, are shown in Figure 2.2 subdivided by sector. In 2022, considering the total GHG emissions (including the absolute value of net LULUCF emissions/ removals), the percentage contribution of the sectors is: 77.9% for energy, 7.1% for agriculture, 5.4% for industrial processes and product use, 4.9% for LULUCF and 4.6% for waste.

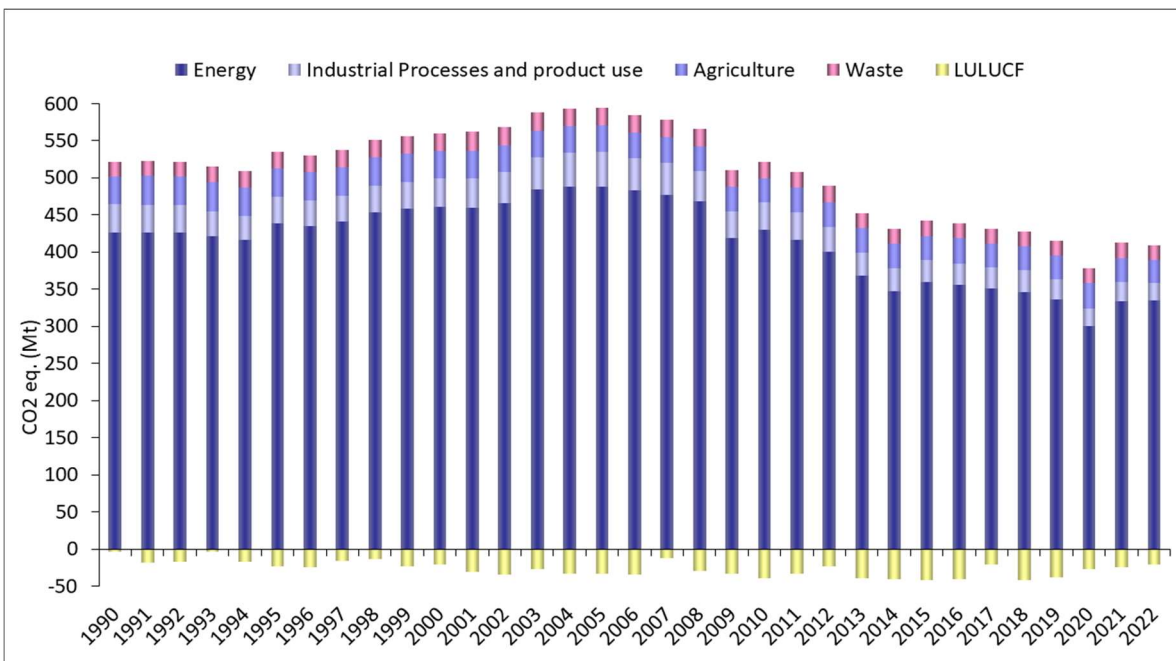


Figure 2.2 Greenhouse gas emissions and removals from 1990 to 2022 by sector (Mt CO₂ eq.)
Source: ISPRA

2.3.1 Description and interpretation of emission trends by gas

2.3.1.1 Carbon dioxide emissions

CO₂ emissions, without LULUCF, decreased by 22.3% from 1990 to 2022, ranging from 438 to 342 million tons. The most relevant emissions derive from transportation (31.9%) and energy industries (27.7%). Non-industrial combustion accounts for 20.0% and manufacturing and construction industries for 15.8%, while the remaining emissions derive from industrial processes (3.9%) and the other sectors (about 0.6%). The trend of CO₂ emissions by sector is shown in Figure 2.3. Indirect CO₂ emissions range from 1.3 Mt in 1990 to 0.7 Mt in 2022.

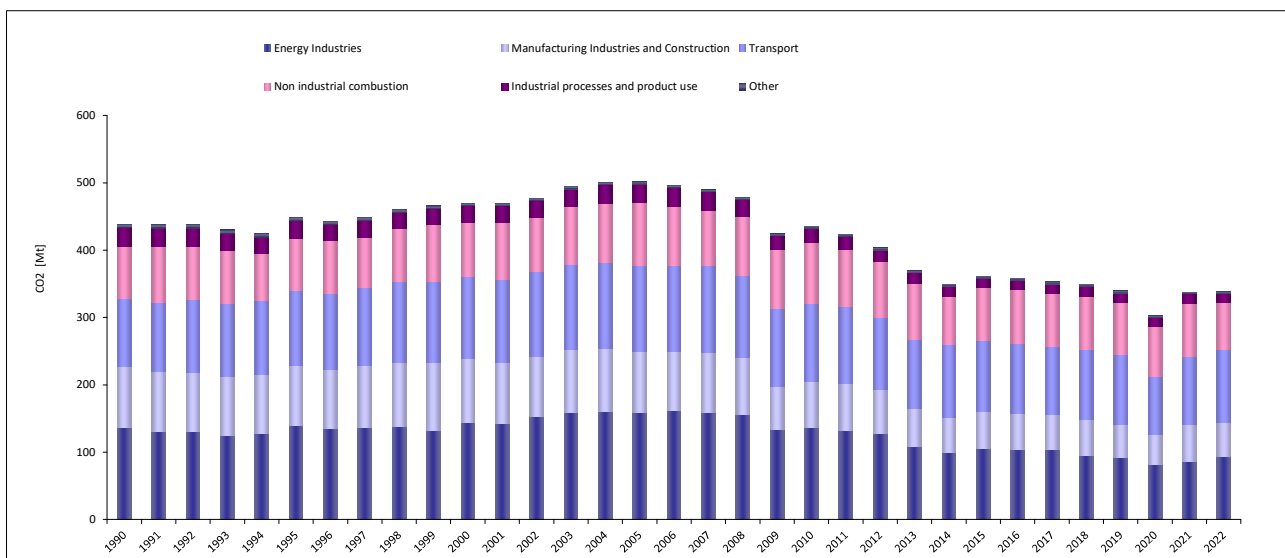


Figure 2.3 National CO₂ emissions by sector from 1990 to 2022 (Mt)

Source: ISPRA

The main driver for the reduction of CO₂ emissions is the reduction in emissions observed in energy industries and manufacturing industries and construction; in the period 1990-2022, emissions from energy industries decreased by 31.1% while those from manufacturing industries and construction show a decrease of 40.8%. The transport sector has shown an increase in emissions until 2007 and then a decrease both for the economic recession and the penetration of vehicles with low fuel consumption. Non industrial combustion emission trend is driven by the annual climatic variation while emissions from industrial processes decreased by 53.0% mainly for the decrease in cement production.

Figure 2.4 illustrates the performance of the following economic and energy indicators:

- Gross Domestic Product (GDP) at market prices as of 2010 (base year 1990=100);
- Total Energy Consumption;
- CO₂ emissions, excluding emissions and removals from land-use change and forests;
- CO₂ *intensity*, which represents CO₂ emissions per unit of total energy consumption.

CO₂ emissions in the 1990s essentially mirrored energy consumption. A decoupling between the curves is observed only in recent years, mainly because of the substitution of fuels with high carbon contents by methane gas in the production of electric energy and in industry; in the last years, the increase in the use of renewable sources has led to a notable reduction in CO₂

intensity. The pandemic situation due to Covid-19 has led to a sharp fall in emissions and a slowdown in economic growth in 2020. The expected countertrend has been observed in the last two years.

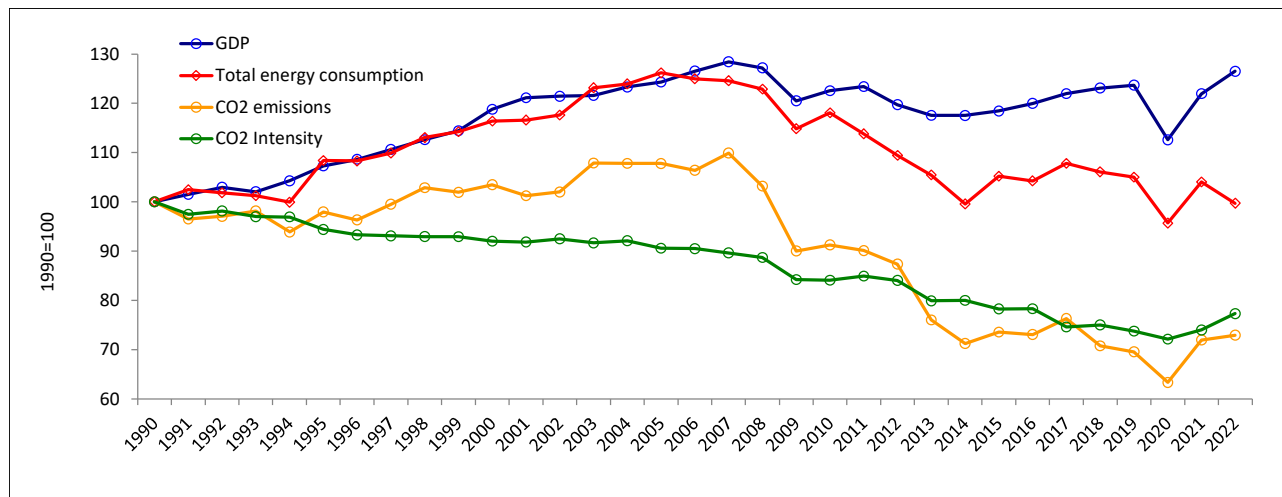


Figure 2.4 Energy-related and economic indicators and CO2 emissions
Source: ISPRA

2.3.1.2 Methane emissions

Methane emissions (excluding LULUCF) in 2022 represent 11.1% of total greenhouse gases, equal to 45.7 Mt in CO₂ equivalent, and show a decrease of 16.8% as compared to 1990 levels. In 2022 CH₄ emissions mainly originated from the agriculture sector which accounts for 45.6% of total methane emissions, as well as from the waste (40.3%) and energy (14.1%) sectors.

Emissions in the agriculture sector regard mainly the enteric fermentation (69.5%) and manure management (23.0%) categories. The sector shows a decrease in emissions equal to 16.8% as compared to 1990, attributable widely to a reduction in livestock and the recovery of biogas for energy purposes (for swine and poultry).

Activities typically leading to emissions in the waste-management sector are the operation of dumping sites and the treatment of industrial wastewater. The waste sector shows an increase in CH₄ emission levels, equal to 6.3% compared to 1990; the largest sectoral shares of emissions are attributed to solid waste disposal on land (84.6%) and waste-water handling (14.5%), which show an increase equal to 13.9% and a decrease by 25.6%, respectively.

In the energy sector, the reduction of CH₄ emissions (-50.0%) is the result of two contrasting factors: on the one hand there has been a considerable reduction in emissions deriving from energy industries, transport, fugitive emissions from fuels (caused by leakage from the extraction and distribution of fossil fuels, due to the gradual replacement of natural-gas distribution networks), on the other hand a strong increase in the civil sector can be observed, as a result of the increased use of methane and biomass in heating systems. Figure 2.5 shows the emission figures by sector.

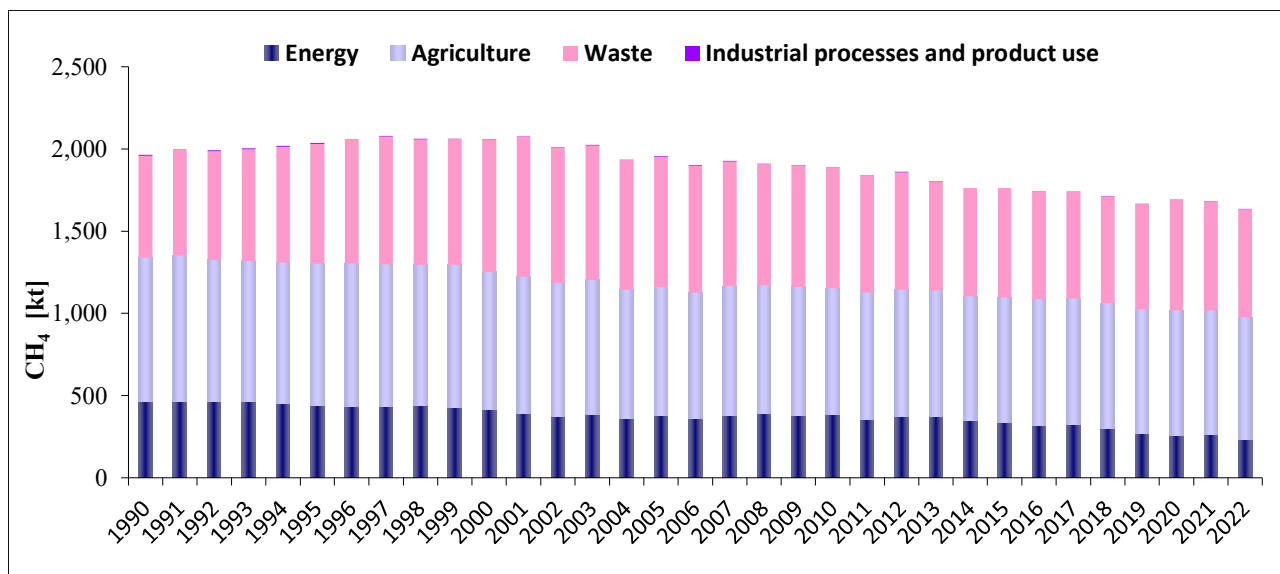


Figure 2.5 National CH₄ emissions by sector from 1990 to 2022 (kt)
Source: ISPRA

2.3.1.3 Nitrous oxide emissions

In 2022, nitrous oxide emissions (excluding LULUCF) represent 3.8% of total greenhouse gases, with a decrease of 35.7% between 1990 and 2022, from 24.5 to 15.7 Mt CO₂ equivalent. The major source of N₂O emissions is the agricultural sector (61.6%), in particular the use of both chemical and organic fertilizers in agriculture, as well as the management of waste from the raising of animals. Emissions from the agriculture sector show a decrease of 24.3% during the period 1990-2022, due to a reduction in livestock number.

Emissions in the energy sector (25.6% of the total) show a decrease by 1.6% from 1990 to 2022; this trend can be traced primarily to the reduction of 40.2% in the manufacturing and construction industries (which account for 4.5% of the total N₂O emissions) due mainly to the reduction in the last years of cement production; the downward trend was counterbalanced by the increase of emissions by 32.0% in the other sectors category, which accounts for 13.0% of the total N₂O emissions, as a result of the increased use of biomass in heating systems.

For the industrial sector, N₂O emissions show a decrease of 92.5% from 1990 to 2022. The decrease is almost totally due to the introduction of abatement systems in the nitric and adipic acid production plants which drastically reduced emissions from these processes. A further component which has contributed to the reduction is the decreasing use of N₂O for medical purposes.

Other emissions in the waste sector (9.7% of national N₂O emissions) primarily regard the processing of industrial and domestic waste-water treatment and the biological treatment of solid waste. Figure 2.6 shows national emission figures by sector.

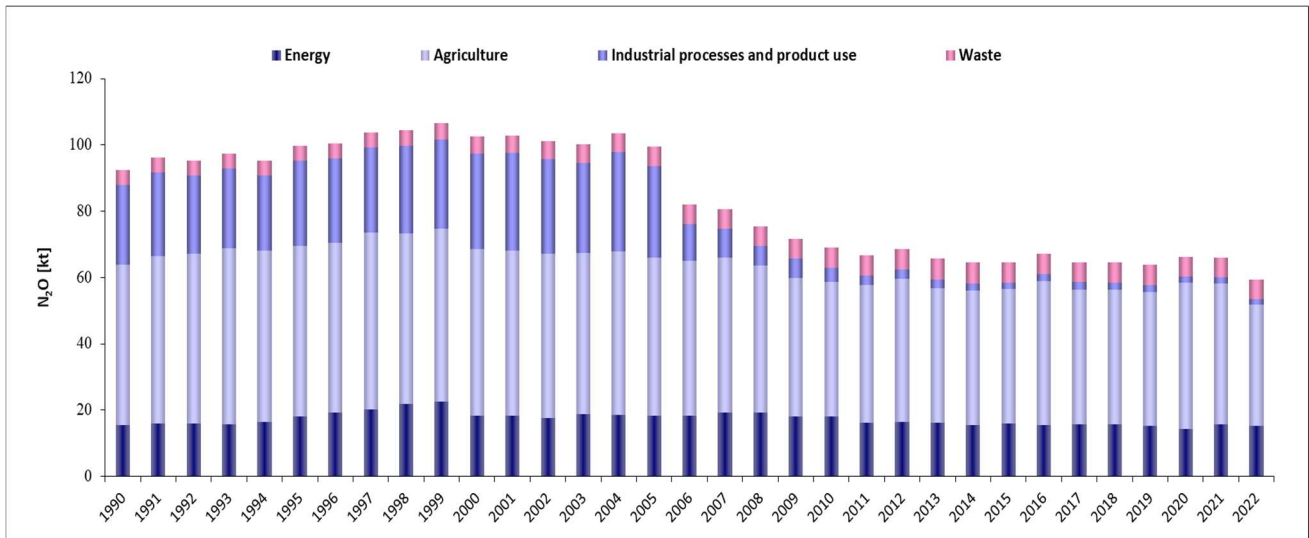


Figure 2.6 National N₂O emissions by sector from 1990 to 2022 (kt)
Source: ISPRA

2.3.1.4 Fluorinated gas emissions

Italy has set 1990 as the base year for emissions of fluorinated gases, HFCs, PFCs, SF₆ and 1995 for NF₃. Taken altogether, the emissions of fluorinated gases represent 2.4% of total greenhouse gases in CO₂ equivalent in 2022 and they show a significant increase between 1990 and 2022. This increase is the result of different features for the different gases. HFCs, for instance, have increased considerably from 1990 to 2022, from 0.4 to 9.1 Mt in CO₂ equivalent. The main sources of emissions are the consumption of HFC-134a, HFC-125, HFC-32 and HFC-143a in refrigeration and air-conditioning devices, together with the use of HFC-134a in pharmaceutical aerosols. Increases during this period are due both to the use of these substances as substitutes for gases that destroy the ozone layer and to the greater use of air conditioners in automobiles.

Emissions of PFCs show a decrease of 83.2% from 1990 to 2022. The level of PFC emissions in 2022 is equal to 0.4 Mt in CO₂ equivalent, and it is due to by product emissions in fluorochemical production (66.1%), and the use of the gases in the production of semiconductors (33.9%).

Emissions of SF₆ are equal to 0.4 Mt in CO₂ equivalent in 2022, with a decrease of 7.3% as compared to 1990 levels. In 2022, 76.4% of SF₆ emissions derive from the gas contained in electrical equipment, 7.6% from the use of this substance in accelerators and 15.8% from the gas used in semiconductors manufacture. NF₃ emissions account for 0.01 Mt in CO₂ equivalent in 2022 and derive from the semiconductors industry.

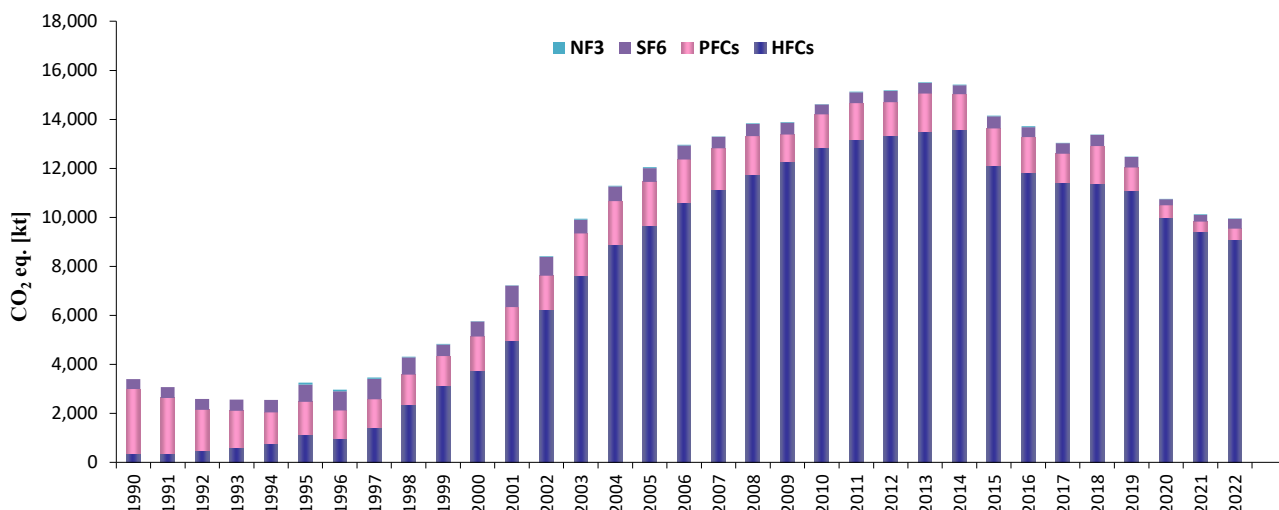


Figure 2.7 National emissions of fluorinated gases by sector from 1990 to 2022 (kt CO₂ eq.)
Source: ISPRA

2.3.2 Description and interpretation of emission trends by source

2.3.2.1 Energy

Emissions from the energy sector account for 81.8% of total national greenhouse gas emissions, excluding LULUCF, in 2022. Emissions in CO₂ equivalent from the energy sector are reported in Table 2.2 and Figure 2.8.

Table 2.2 Total emissions from the energy sector by source (1990-2022) (kt CO₂ eq.)

	1990	1995	2000	2005	2010	2015	2019	2020	2021	2022
	<i>kt CO₂ eq.</i>									
Total emissions	426,167	438,670	460,484	488,344	429,916	359,981	336,404	300,064	332,164	337,877
Fuel Combustion (Sectoral Approach)	411,964	425,294	448,394	477,728	420,239	351,304	329,440	293,871	326,508	332,826
Energy Industries	137,620	140,603	144,874	159,890	137,467	106,052	91,693	81,634	86,428	94,871
Manufacturing Industries and Construction	92,151	90,204	96,245	92,299	70,048	55,569	49,958	45,839	54,561	54,728
Transport	102,190	114,215	123,954	128,358	115,902	106,716	106,347	86,561	102,926	109,774
Other Sectors	78,868	78,713	82,444	95,867	96,134	82,490	80,977	79,196	82,270	72,929
Other	1,136	1,559	877	1,314	688	477	466	640	324	523
Fugitive Emissions from Fuels	14,203	13,376	12,090	10,616	9,676	8,677	6,964	6,193	5,656	5,051
Solid Fuels	148	83	109	101	97	59	36	29	28	30
Oil and Natural Gas	14,055	13,293	11,982	10,515	9,580	8,618	6,928	6,165	5,628	5,022

Source: ISPRA

From 2005, GHG emissions from the energy sector have been decreasing because of the policies adopted at European and national level to implement the production of energy from renewable sources. From the same year, a further shift from petrol products to natural gas in producing energy has been observed as a consequence of the starting of the EU greenhouse gas Emission Trading Scheme (EU ETS) on January 1st, 2005. From 2009, a further drop in the sectoral emissions is due to the economic recession; an increase is observed only from 2009 to 2010 (+2.7%); since then, except for the increase of 3.5% between 2014 and 2015, the annual variations are always negative until 2019.

Total greenhouse gas emissions, in CO₂ equivalent, show a decrease of about 20.7% from 1990 to 2022; in particular, an upward trend is noted from 1990 to 2004, with an increase by 14.4%, while between 2005 and 2022 emissions decreased by 30.8%.

The GHG with the highest impact, in the energy sector, is CO₂, accounting for 96.9% of the sectoral total, in 2022, whose levels have decreased by 20.0% from 1990 to 2022.

In 2022, CH₄ emissions account for 1.9% of the sectoral total. Their trend shows a decrease of 50.0% from 1990 to 2022, and it is driven by the combined effect of technological improvements that limit volatile organic compounds (VOCs) from tail pipe and evaporative emissions (for cars) and the expansion of two-wheelers fleet.

N₂O shows a decrease of 1.6% with a share out of the total equal to 1.2%, mainly driven by the technological development in road transport and to the switch from gasoline to diesel fuel consumption.

In general, for the sector, the decrease in emissions from 1990 to 2022 is driven by the reduction in the energy industries and manufacturing industries and construction, which, in 2022, account for 28.1% and 16.2% and reduced by 31.1% and 40.6%, respectively. Specifically, for the manufacturing industries and construction, the reason for the reduced emissions is the cut in production in some subsectors (e.g. chemical, construction and building materials, steel) due to the effects of the economic recession but also to an increase in efficiency, especially identified in the chemical sector. A decrease in emissions also occurs in other sectors subcategory (-7.5%), which account for 21.6% in 2022; the transport sector, accounting for 32.5%, in 2022, shows an increase of 7.4%.

Road transport is the most relevant source in the transport sector, accounting in 2022 for 24.3% of total national CO₂ equivalent emissions.

The increase in other sectors, which refer to emissions originated from energy use in the civil sector and from military mobile activities, is due, from 1990 to 2000, to the increase in numbers and size of building with heating, and to the trend in weather conditions, while from 2002, and especially in the last few years, to the increase in other greenhouse gas emissions than CO₂ for the growing use of woody biomass and biogas for heating.

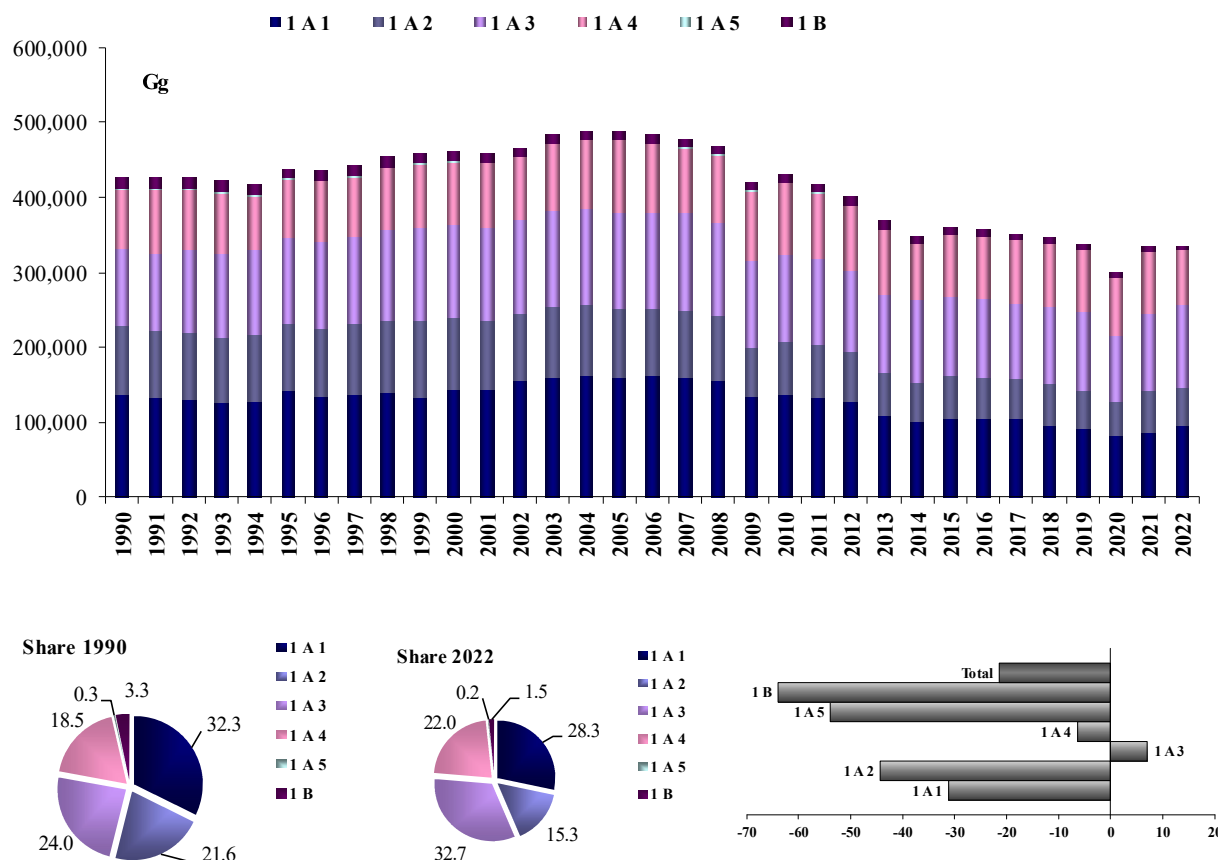


Figure 2.8 Trend of total emissions from the energy sector (1990-2022) (kt CO₂ eq.)
Source: ISPRA

2.3.2.2 Industrial processes and product use

Emissions from the industrial processes and product use sector account for 5.7% of total national greenhouse gas emissions, excluding LULUCF, in 2022. Emission trends from industrial processes are reported in Table 2.3 and Figure 2.9. Total emissions, in CO₂ equivalent, show a decrease of 37.8%, from 1990 to 2022. Considering emissions by substance, CO₂ and N₂O decreased by 53.0% and 92.5%, respectively; in terms of their weight out of the sectoral total emissions, CO₂ accounts for 55.7% and N₂O for 2.0%. CH₄ decreased by 73.2% but it accounts for only 0.2%. The decrease in emissions is mostly to be attributed to a decrease in the mineral and chemical industries. Emissions from mineral production decreased by 50.9%, mostly for the reduction of cement production. The decrease of GHG emissions in the chemical industry (-85.1%) is due to the decreasing trend of the emissions from nitric acid and adipic acid production (the last production process sharply reduced its emissions, due to a fully operational abatement technology). On the other hand, from 1990 to 2022, a considerable increase is observed in F-gas emissions (192.2%), whose share on total sectoral emissions is 66.4% in the last reporting year. The main drivers of the increase are the consumption of HFCs in refrigeration and air-conditioning devices, together with their use in pharmaceutical aerosols.

Table 2.3 Total emissions from the industrial processes sector by gas (1990-2022) (kt CO₂ eq.)

	1990	1995	2000	2005	2010	2015	2019	2020	2021	2022
kt CO ₂ eq.										
Total emissions	37,946	36,299	38,240	47,132	36,591	29,094	27,330	24,290	25,300	23,620
CO₂	27,992	26,049	24,743	27,663	20,804	14,355	14,230	12,932	14,621	13,145
CH₄	144	150	82	83	67	48	46	38	45	39
N₂O	6,402	6,848	7,646	7,338	1,088	545	570	559	505	480
F-gases	3,408	3,252	5,769	12,049	14,631	14,147	12,484	10,760	10,129	9,957
HFCs	372	1,100	3,747	9,666	12,805	12,082	11,089	9,971	9,411	9,085
PFCs	2,615	1,351	1,363	1,759	1,377	1,529	915	499	395	439
Unspecified mix of HFCs and PFCs	-	24	24	24	24	24	23	22	25	22
SF₆	421	700	621	565	405	483	438	252	282	390
NF₃	-	77	13	33	20	28	18	16	15	20

Source: ISPRA

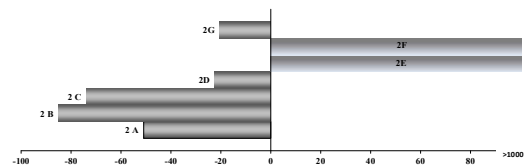
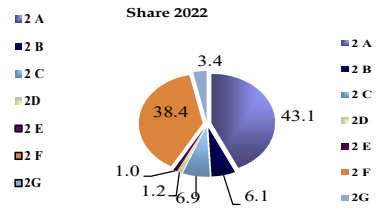
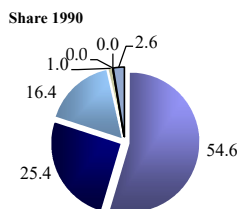
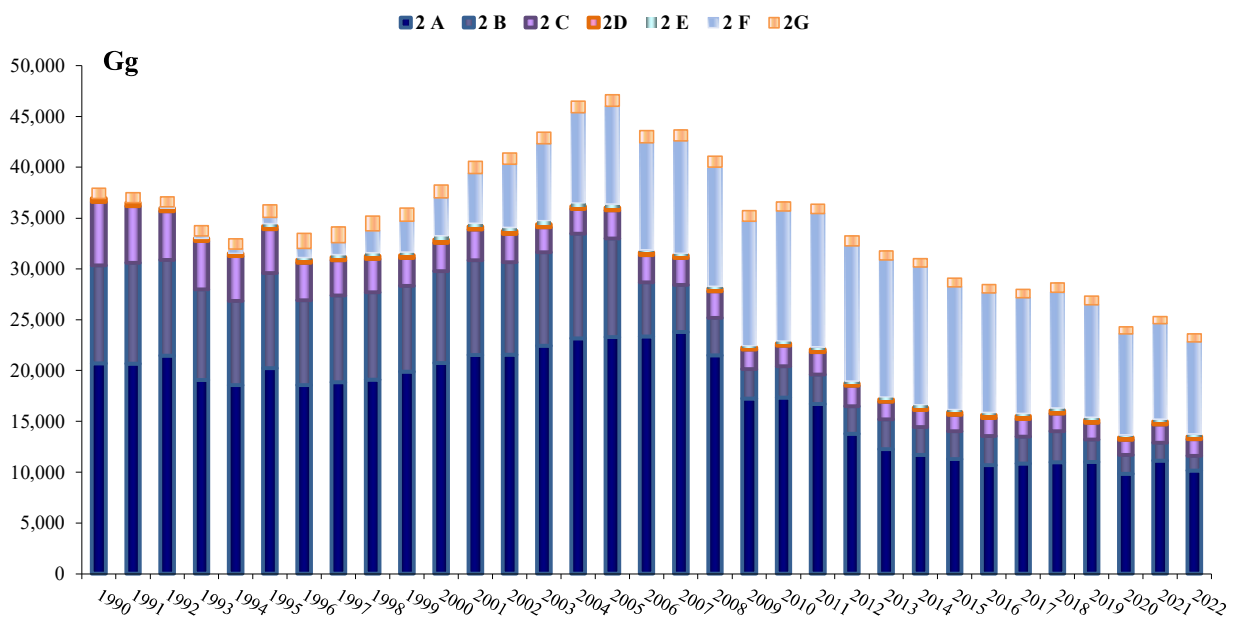


Figure 2.9 Trend of total emissions from the industrial processes sector (1990-2022) (kt CO₂ eq.)

Source: ISPRA

2.3.2.3 Agriculture

Emissions from the agriculture sector account for 7.4% of total national greenhouse gas emissions, in 2022, excluding LULUCF. Emissions from the agriculture sector are reported in Table 2.4 and Figure 2.10. Emissions mostly refer to CH₄ and N₂O, which, in 2022, account for 67.7% and 31.5% of the total emissions of the sector, respectively. CO₂ accounts for the remaining 0.8% of total emissions.

The decrease observed in total emissions (-18.9%) is mostly due to the decrease of CH₄ emissions from enteric fermentation (-15.2%) and to the decrease of N₂O (-22.5%) from agricultural soils; in 2022 these categories account for 47.1% and 25.9% of the total sectoral emissions, respectively.

Table 2.4 Total emissions from the agriculture sector by source (1990-2022) (kt CO₂ eq.)

	1990	1995	2000	2005	2010	2015	2019	2020	2021	2022
<i>kt CO₂ eq.</i>										
Total emissions	37,953	38,312	37,430	35,028	32,634	32,455	32,314	33,534	32,862	30,764
Enteric Fermentation	17,093	16,697	16,509	14,484	14,100	14,272	14,584	14,771	14,695	14,487
Manure Management	7,942	7,569	7,452	7,396	7,167	6,885	6,682	6,685	6,554	6,513
Rice Cultivation	2,102	2,228	1,855	2,078	2,255	1,943	1,721	1,696	1,677	1,547
Agricultural Soils	10,288	11,233	11,024	10,490	8,720	8,886	8,888	9,868	9,463	7,972
Field Burning of Agricultural Residues	19	18	18	17	12	11	10	10	11	10
Liming	1	1	2	14	18	14	16	10	26	4
Urea application	465	512	525	507	335	425	396	472	414	218
Other carbon-containing fertilizers	44	54	44	42	28	20	17	21	22	12

Source: ISPRA

Main drivers behind these downward trends are the reduction in the number of animals, especially cattle, in the whole period and the reduction of the use of nitrogen fertilizers. In addition, an increase in the recovery of the biogas produced from animal manure and used in the energy sector has occurred in the last years.

This biogas has been used for electricity production and combined electricity and heat production, thus contributing to the reduction of total emissions.

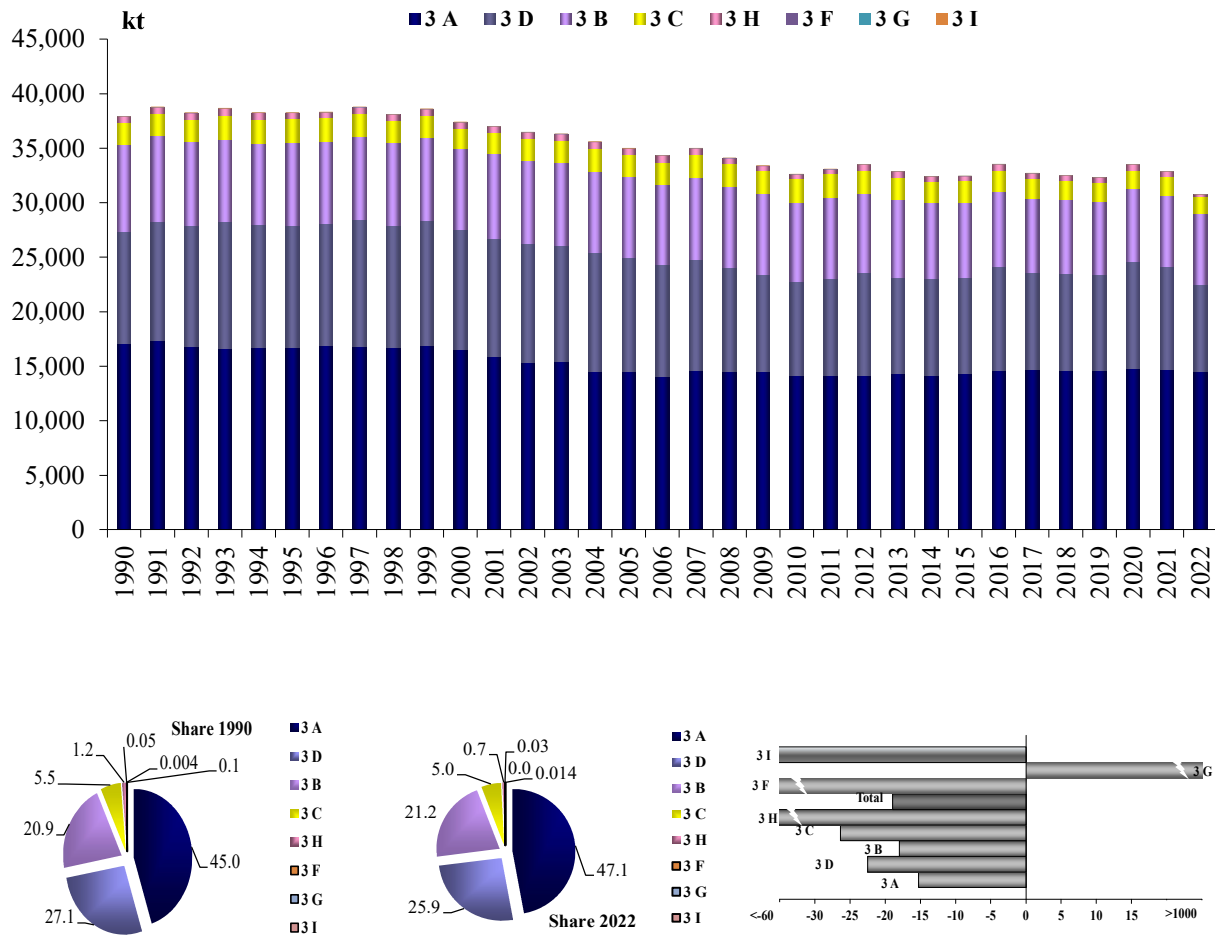


Figure 2.10 Trend of total emissions from the agriculture sector (1990-2022) (kt CO₂ eq.)
Source: ISPRA

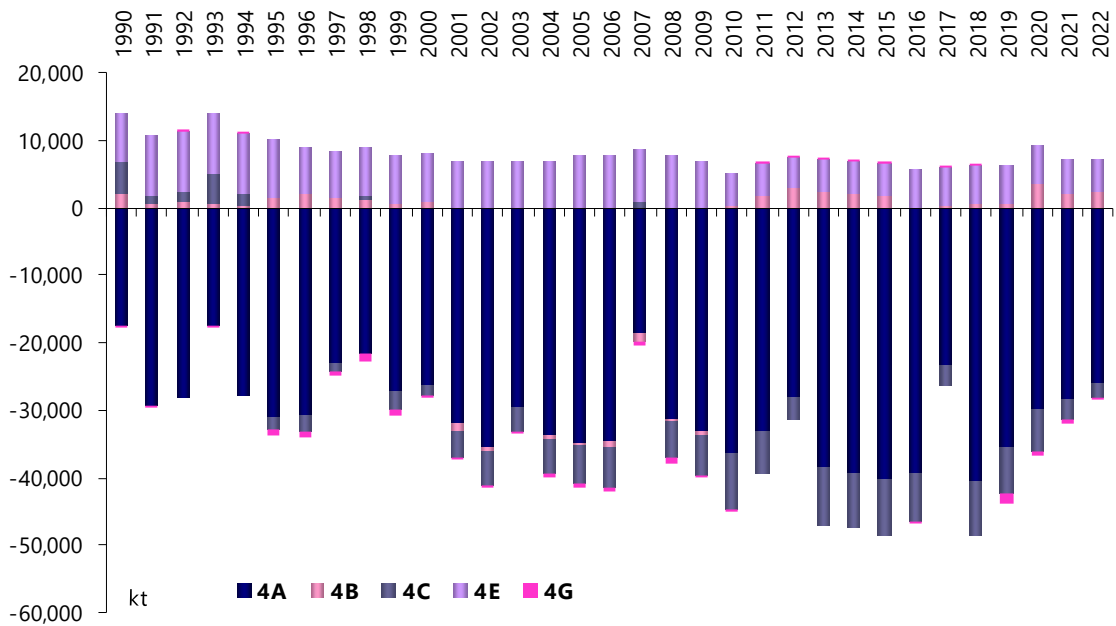
2.3.2.4 LULUCF

Emissions and removals from the LULUCF sector are reported in Table 2.5 and Figure 2.11. LULUCF total removals, in CO₂ equivalent, show a high variability in the period, remarkably influenced by the annual fires' occurrence and the related GHG emissions. CO₂ accounts for 96.1% of total emissions and removals of the sector, as absolute weight. The key driver for the rise in removals is the increase of carbon stock in forest land. Further details for LULUCF emissions and removals can be found in the specific chapter.

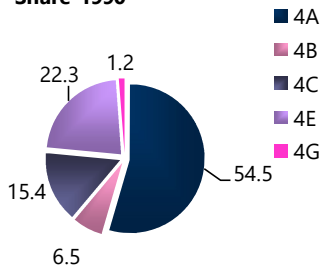
Table 2.5 Total emissions from the LULUCF sector by source (1990-2022) (kt CO₂ eq.)

	1990	1995	2000	2005	2010	2015	2019	2020	2021	2022
	<i>kt CO₂ eq.</i>									
Total emissions /removals	-3,586	-23,390	-20,190	-33,676	-39,669	-41,924	-20,384	-37,710	-27,509	-24,797
Forest land	-17,344	-31,019	-26,285	-34,943	-36,413	-40,278	-23,289	-35,391	-29,843	-28,440
Cropland	2,082	1,386	989	-410	375	1,742	336	674	3,707	2,220
Grassland	4,905	-1,941	-1,417	-5,594	-8,300	-8,326	-3,088	-7,095	-6,294	-3,038
Wetlands	NE,NO	5	8	8	130	130	32	32	32	NO,NE
Settlements	7,089	8,867	6,928	7,749	4,659	4,709	5,516	5,533	5,538	4,813
Other land	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Harvested wood products	-388	-706	-454	-503	-142	89	59	-1,469	-657	-361
Other (indirect N₂O soils)	70	18	40	17	23	11	50	8	9	9

Source: ISPRA



Share 1990



Share 2022

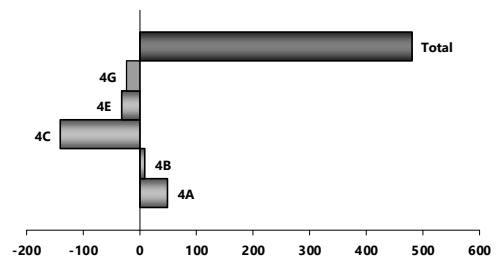
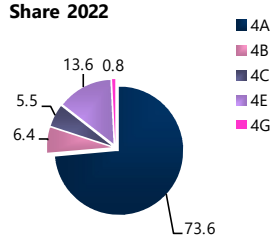


Figure 2.11 Trend of total emissions and removals from the LULUCF sector (1990-2022) (kt CO₂ eq.)

Source: ISPRA

2.3.2.5 Waste

In 2022, emissions from the waste sector account for 4.9% of total national GHG emissions, excluding LULUCF. Emissions from the waste sector are shown in Table 2.6 and Figure 2.12.

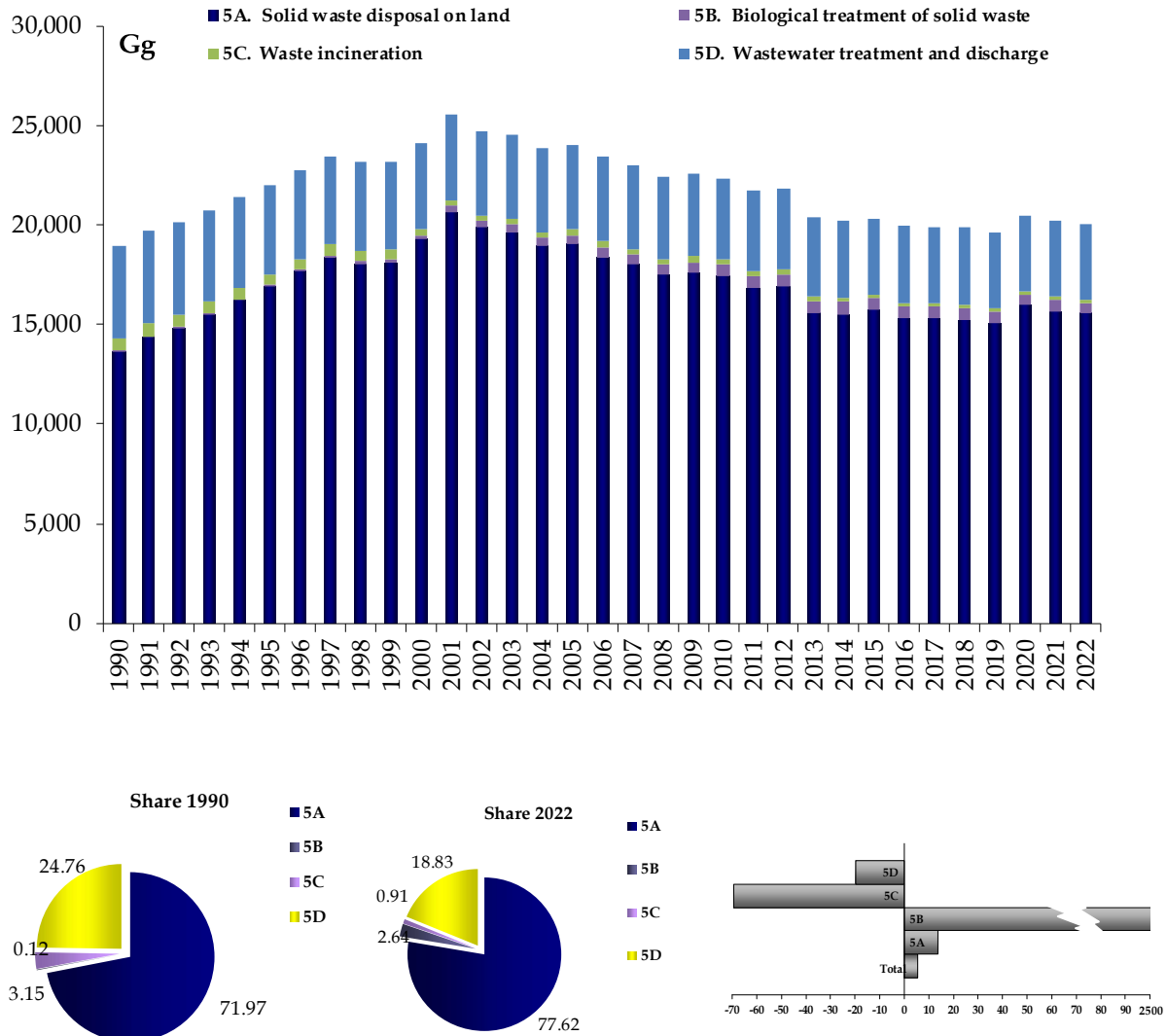


Figure 2.12 Trend of total emissions from the waste sector (1990-2022) (kt CO₂ eq.)

Source: ISPRA

Table 2.6 Total emissions from the waste sector by source (1990-2022) (kt CO₂ eq.)

	1990	1995	2000	2005	2010	2015	2019	2020	2021	2022
<i>kt CO₂ eq.</i>										
Total emissions	18,996	22,008	24,094	24,052	22,371	20,334	19,659	20,459	20,216	20,055
Solid waste disposal	13,671	16,938	19,264	19,043	17,429	15,718	15,060	15,967	15,683	15,565
Biological treatment of solid waste	23	54	232	456	577	599	582	560	558	530
Incineration and open burning of waste	598	547	287	314	255	175	168	162	188	182
Waste-water treatment and discharge	4,703	4,469	4,311	4,240	4,110	3,843	3,849	3,770	3,787	3,778

Source: ISPRA

Total sectoral emissions, in CO₂ equivalent, increased by 5.6% from 1990 to 2022. The trend is mainly driven by the increase in emissions from solid waste disposal (13.9%), accounting for 77.6% of the sectoral total in 2022, counterbalanced by the decrease of emissions from waste-water treatment (-19.7%), accounting for 18.8%. Considering emissions by gas, the most important greenhouse gas is CH₄ which accounts for 91.9% of the sectoral total and shows an increase of 6.3% from 1990 to 2022. N₂O levels have increased by 31.0% while CO₂ decreased by 77.8%; in 2022, these gases account for 7.6% and 0.6%, respectively.

2.3.2.6 Indirect CO₂ emissions

The contribution of indirect CO₂ emissions from atmospheric oxidation of NMVOCs to the greenhouse gas emissions is small, about 0.2% of the total greenhouse gas emissions.

3 INFORMATION NECESSARY TO TRACK PROGRESS

3.1 Institutional arrangements for tracking progress

As an EU Member State, Italy, contributes to the implementation of the European Union's NDC (see paragraph 3.2). To track progress of implementation and achievement of the European target for 2030, institutional arrangements are in place both on the EU-level as on national level, as outlined below. Those sections may contain common text for the BTRs of the EU and its Member States.

3.1.1 Institutional arrangements in the European Union

The EU's Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action ("Governance Regulation")²⁸ establishes a governance mechanism and specific arrangements to track the progress of the Union and its Member States towards the implementation and achievement of the EU's climate and energy targets and commitments under the UNFCCC and the Paris Agreement. These arrangements include the monitoring of GHG emissions and removals, the reporting of policies and measures, projections of GHG emissions and removals and progress on adaptation to climate change.

Under the Governance Regulation, the EU has established a Union Inventory System to ensure timeliness, transparency, accuracy, consistency, comparability and completeness of the data reported by the EU and its Member States. This inventory system includes a quality assurance and quality control programme, procedures for setting emission estimates, and comprehensive reviews of national inventory data to enable the assessment of compliance towards climate goals.

Each EU Member State compiles its GHG inventory in accordance with the requirements of the Paris Agreement²⁹ and the relevant Intergovernmental Panel on Climate Change (IPCC) guidelines³⁰. Inventory data on GHG emissions and removals, including information on methods, are submitted electronically using a reporting system managed by the European Environment Agency (EEA). The submitted data are subject to quality control procedures and fed into the compilation of the GHG inventory of the EU. Net GHG emissions, calculated from emissions and removals reported in the GHG inventory of the EU, are the key information used for tracking progress towards the EU NDC target of a least -55% net emission reduction by 2030 compared to 1990.

²⁸ Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action, <http://data.europa.eu/eli/reg/2018/1999/oj>.

²⁹ Chapter II of the annex to decision 18/CMA.1, <https://unfccc.int/documents/193408>; and decision 5/CMA.3, <https://unfccc.int/documents/460951>.

³⁰ 2006 IPCC Guidelines for National Greenhouse Gas Inventories, <https://www.ipcc-nggip.iges.or.jp/public/2006gl/>; and on a voluntary basis: 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, <https://www.ipcc.ch/report/2019-refinement-to-the-2006-ipcc-guidelines-for-national-greenhouse-gas-inventories/>.

Given the scope of the EU NDC related to international aviation and navigation, a specific share of international aviation and navigation emissions as reported in the GHG inventory data is calculated based on the Joint Research Centre's Integrated Database of the European Energy System (JRC-IDEES)³¹. Details on the methodology applied to identify GHG emissions from international aviation and navigation in the scope of the EU NDC, which are added to the national totals from the EU GHG inventory, are given in Annex 2 to this BTR.

Under the Governance Regulation each Member State must report to the Commission biennially on the status of implementation of its integrated national energy and climate plans (NECPs). This process allows the Commission to ensure that the EU and the Member States remain on track to achieve the climate-neutrality objective and progress on adaptation. Under the Governance Regulation, Member States further operate national systems for policies and measures and projections and submit and report standardized information, which is subject to quality and completeness checks. Based on the submitted data, the EEA compiles projections of GHG emissions and removals for the EU. The EU-wide information is summarized annually in the Climate Action Progress Report³² by the European Commission and in the 'Trends and projections' report by the EEA.³³ Both the Union and the national systems are subject to continuous improvements.

The national energy and climate plans (NECPs) were introduced by the Governance Regulation.

For Member States, the NECP for 2021-2030 plays a key role in enabling the tracking of progress towards the 2030 climate and energy targets. The update of the NECPs provides an opportunity for Member States to assess their progress, identify gaps and revise existing measures or plan new ones where needed.

Member States were due to submit their final updated NECPs, taking account of the Commission's assessment and recommendations, by 30 June 2024.

3.1.2 Institutional arrangements in Italy

The Enhanced Transparency Framework (ETF) system is an essential tool for ensuring transparency and accuracy in reporting greenhouse gas (GHG) emissions and removals, as well

³¹ European Commission, Joint Research Centre, Rózsai, M., Jaxa-Rozen, M., Salvucci, R., Sikora, P., Tattini, J. and Neuwahl, F., JRC-IDEES-2021: the Integrated Database of the European Energy System – Data update and technical documentation, Publications Office of the European Union, Luxembourg, 2024, <https://publications.jrc.ec.europa.eu/repository/handle/JRC137809>.

³² Climate Action Progress Report 2024, https://climate.ec.europa.eu/document/download/d0671350-37f2-4bc4-88e8-088d0508fb03_en?filename=COM_2024_498_F1_REPORT_FROM_COMMISSION_EN_V4_P1_3729454.PDF

³³ Trends and Projections in Europe 2024, <https://www.eea.europa.eu/en/analysis/publications/trends-and-projections-in-europe-2024><https://www.eea.europa.eu/en/newsroom/news/eea-trends-and-projections>

as for tracking progress toward the climate goals outlined in the Paris Agreement. Under the Paris Agreement, Italy, like other countries, has enhanced the previously established Monitoring, Reporting, and Verification (MRV) system for greenhouse gas (GHG) emissions to meet its commitments towards climate change mitigation.

With the Decree 9/12/2016 implementing law N. 79/2016, a national system for policies, measures and emissions has been set; the overall responsibility of the national system is assigned to ISPRA which, in cooperation with the Ministry of the Environment and Energy Security (MASE), collects all the information and data from the competent Ministries.

Article 1 of the abovementioned Decree reports the list of information and data that are to be sent by the competent ministries to MASE and ISPRA, as well as the timing for providing such information. With the establishment of this system, there has been a strengthening of roles and obligations for statistical data flow, useful for national GHG emission inventory and projections by gas and sources.

To be noted that ISPRA has established a wider network with other entities, universities and research institutes through temporary agreements and collaborations that can be activated when needed to collect data and information needed for the evaluation of policies and for the calculations of emission scenarios regarding all sectors.

A synthesis of the National system is shown in Figure 3.1.

The MASE is part of the National System and it is also supervising the dataflow pursuant to Decree 9/12/2016. Moreover, projections and PaMs evaluation is part of a specific Annex to the Economy and Financial Document (DEF), updated annually by the Ministry of environment and energy security and adopted by the Government. The DEF outlines the objectives that the multiannual state budget intends to pursue and defines the scope within which to build the annual budget. The aim of the DEF is to enable Parliament to know in advance the Government's economic and financial policy lines; the latter is politically committed to drawing up the next annual budget in accordance with the criteria arising from the parliamentary debate. DEF is usually adopted each year in March or April.

Emission scenarios, as well as the monitoring and evaluation of progress on policies and measures to cut greenhouse emissions, are also reported, every two years, by Member States to the European Commission under the Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action. Emission scenarios are also included in National energy and climate plans (NECPs) that must be prepared under the above-mentioned Regulation (EU) 2018/1999. Under this Regulation, in 2020, Italy submitted the first integrated national energy and climate plan (NECP) to the European Commission, and in July 2024 submitted a fully update version with new underlying assumptions.

Furthermore, as reported in BR 4 and NC VIII, Italy adopted in July 2021 the “National Recovery and Resilience Plan” (NRRP) to face the effects of COVID-19 pandemic. The NRRP includes several policies and measures to tackle climate change, which are also recalled in the updated NECP.

In July 2024, pursuant article 17 of the Regulation (EU) 2018/1999, ISPRA calculated new GHG emission projection and submitted them to the European Commission using updated historic data and macroeconomic and demographic drivers. The present BTR is based on the updated NECP and emission projections.

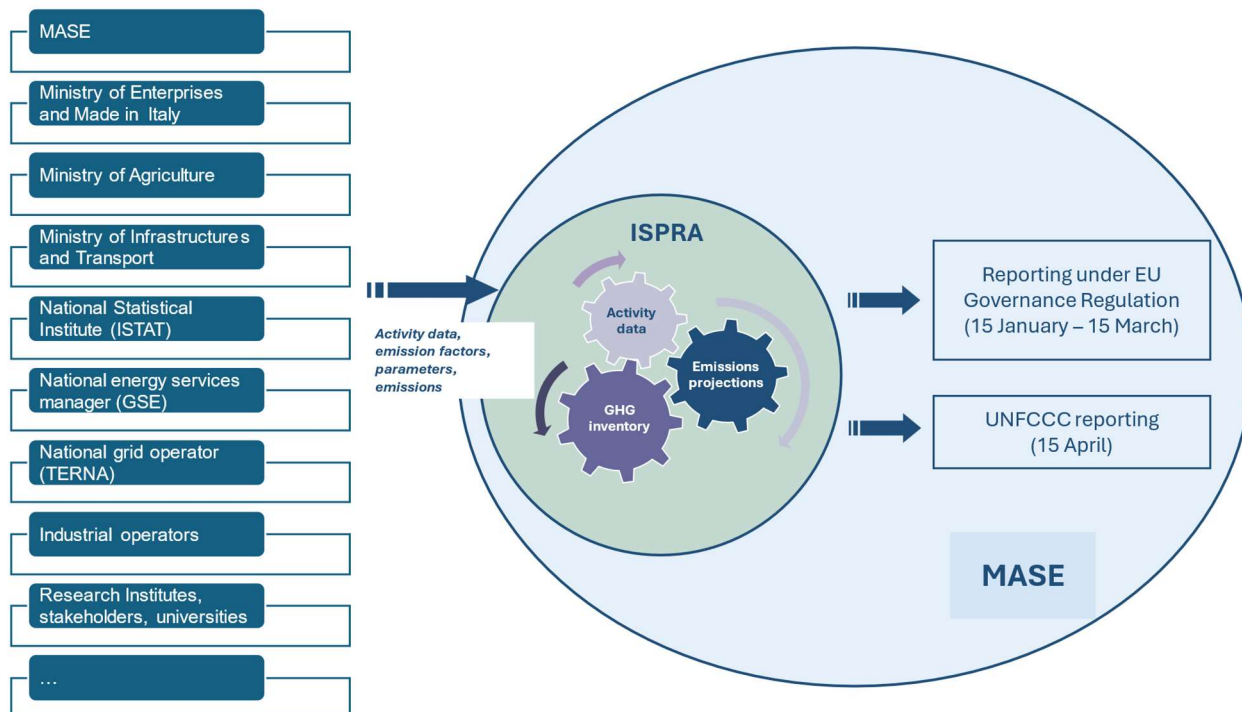


Figure 3.1: Institutional arrangements for tracking progress

3.1.3 Institutional arrangements for implementation of the NDC

The EU and its Member States have set up a comprehensive system for the implementation of the EU climate change mitigation targets. The European Climate Law⁴⁶ sets the goal of climate neutrality by 2050 and the intermediate target of reducing net greenhouse gas emissions by at least 55% by 2030 compared to 1990 levels. These targets cover emissions and removals that are regulated in the Union law.

To ensure that the EU and its Member States achieve their target, the 2030 Climate and Energy Framework was put in place. The main policies of this framework are the EU Emissions Trading System (EU ETS)³⁴, which caps GHG emissions in energy, industry, aviation and maritime transport; the LULUCF Regulation which includes national net removal targets for the LULUCF sector; and the Effort Sharing Regulation (ESR) which establishes national reduction targets for GHG emissions not covered by the EU ETS or the LULUCF Regulation i.e. domestic transport (excluding aviation), buildings, agriculture, small industry and waste. The implementation of

³⁴ This refers to the ETS1, i.e. the Emission Trading System for stationary sources (Chapter III of the ETS Directive) and for aviation and maritime transport (chapter II of the ETS Directive). Note that the ‘Emissions trading system for buildings, road transport and additional sectors’ (ETS2), added in 2023 as Chapter IVa of the ETS Directive, forms an instrument under the Effort Sharing Regulation (ESR).

the ESR is supported by additional sectoral policies and measures (details can be found in this BTR in the chapter on mitigation policies and measures). The legislative acts under the 2030 Climate and Energy Framework require the European Commission and the EU Member States to set up the institutional arrangements for implementing specific policies and measures.

Key European policies to reduce greenhouse gas emissions

The revised EU ETS Directive increases the level of ambition in the existing system from 43% to 62% emissions reductions by 2030, compared to 2005 levels and extend the system to also apply to international maritime transport. A separate carbon pricing system will apply to fuel combustion in road transport and buildings and small-emitting sectors (ETS2) with a 42% emission reduction target compared to 2005 across the sectors covered. The amended Effort Sharing Regulation (ESR) increased, for the sectors that it covers, the EU-level GHG emission reduction target from 29% to 40% by 2030, compared to 2005, which translates in updated 2030 targets for each Member State. The new LULUCF Regulation sets an overall EU-level objective of 310 Mt CO₂ equivalent of net removals in the LULUCF sector in 2030.

The ESR sets national targets for the reduction of GHG emissions in the Member States by 2030. Member States are also subject to gradually decreasing annual emission limits for each year from 2021 to 2030. The annual progress towards the national targets under the Effort Sharing Legislation is assessed by comparing GHG emission levels from the sectors covered by the ESR with the relevant annual emission allocations under the legislation (AEAs). To achieve compliance under the ESR, Member States are permitted to use flexibility options to a certain extent.

Progress in the implementation of these policies and measures is monitored under the Governance Regulation. Relevant information which is reported regularly and archived at the EEA include GHG inventories, approximated GHG inventories for the previous year, information on policies and measures, projections, and progress towards the implementation of integrated National Energy and Climate Plans (NECP). This information helps the EU and its Member States to correct their course if progress towards the targets of the 2030 Climate and Energy Framework is behind schedule. As an example, the European Commission assesses the drafts of new or updated NECPs and provides recommendations for improved planning and implementation. In addition, the reported information is subject to quality checks, and the GHG inventories reported by EU Member States are subject to comprehensive reviews in 2025, 2027 and 2032.³⁵

All EU legislation, including the legislation under the 2030 Climate and Energy Framework, is subject to a stakeholder engagement process. So-called ‘better regulation tools’ ensure that policy is based on evidence and the best available practice³⁶. During the preparation of legislative proposals, the European Commission invites citizens, businesses and stakeholder

³⁵ Consolidated text (2023) of Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action, <https://eur-lex.europa.eu/eli/reg/2018/1999/2023-11-20>.

³⁶ Decision-making process, https://ec.europa.eu/info/strategy/decision-making-process/how-decisions-are-made_en.

organizations to provide their views on the subject of the new legislation. These comments are documented in a dedicated portal³⁷, and the European Commission reports on how it takes these comments into account in the development of the legislative proposals. Furthermore, the Governance Regulation sets requirements for Member States to ensure that the public is given early and effective opportunities to participate in the preparation of the NECPs.

For Italy, the target set by the ESR is -43.7% by 2030 compared to 2005 levels.

3.2 Description of the Nationally Determined Contribution

Under their updated NDC³⁸ the EU and its Member States, acting jointly, are committed to a legally binding target of a domestic reduction of net greenhouse gas emissions by at least 55% compared to 1990 by 2030. The term ‘domestic’ means without the use of international credits.

The NDC consists of a single-year target, and the target type is ‘economy-wide absolute emission reduction’. The scope of the NDC covers the 27 Member States of the EU.

The 17 October 2023 updated NDC scope is supplemented by additional information to clarify the precise amount of international aviation and maritime emissions which are covered under the EU NDC. Details on the EU NDC can be found in table 3.1. **Errore. L'autoriferimento non è valido per un segnalibro.**

³⁷ Have your say – Public consultation and feedback, https://ec.europa.eu/info/law/better-regulation/have-your-say_en.

³⁸ The update of the nationally determined contribution of the European Union and its Member States, <https://unfccc.int/sites/default/files/NDC/2023-10/ES-2023-10-17%20EU%20submission%20NDC%20update.pdf>.

Table 3.1: Description of the NDC of the EU

Information	Description
Target and description	Economy-wide net domestic reduction of at least 55% in greenhouse gas emissions by 2030 compared to 1990. The term 'domestic' means without the use of international credits.
Target type	Economy-wide absolute emission reduction.
Target year	2030 (single-year target)
Base year	1990
Base year value	Net greenhouse gas emissions level in 1990: 4 699 405 kt CO ₂ eq.
Implementation period	2021-2030
Geographical scope	EU Member States (Belgium, Bulgaria, Czechia, Denmark, Germany, Estonia, Ireland, Greece, Spain, France, Croatia, Italy, Cyprus, Latvia, Lithuania, Luxembourg, Hungary, Malta, the Netherlands, Austria, Poland, Portugal, Romania, Slovenia, Slovakia, Finland, Sweden) including EU outermost regions (Guadeloupe, French Guiana, Martinique, Mayotte, Reunion, Saint Martin (France), Canary Islands (Spain), Azores and Madeira (Portugal)).
Sectors	Sectors as contained in Annex I to decision 5/CMA.3: Energy, Industrial processes and product use, Agriculture, Land Use, Land Use Change and Forestry (LULUCF), Waste. International Aviation: Emissions from civil aviation activities as set out for 2030 in Annex I to the EU ETS Directive are included only in respect of CO ₂ emissions from flights subject to effective carbon pricing through the EU ETS. With respect to the geographical scope of the NDC these comprise emissions in 2024-26 from flights between the EU Member States and departing flights to Norway, Iceland, Switzerland and the United Kingdom. International Navigation: Waterborne navigation is included in respect of CO ₂ , methane (CH ₄) and nitrous oxide (N ₂ O) emissions from maritime transport voyages between the EU Member States.
Gases	Carbon dioxide (CO ₂), methane (CH ₄), nitrous oxide (N ₂ O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF ₆), nitrogen trifluoride (NF ₃)
LULUCF categories and pools	The included LULUCF categories and pools are as defined in decision 5/CMA.3.
Intention to use cooperative approaches	The EU's at least 55% net reduction target by 2030 is to be achieved through domestic measures only, without contribution from international credits. Norway, Iceland and Liechtenstein have been participating in the EU ETS since 2008, and an agreement linking the EU and Swiss emissions trading systems entered into force in 2020. The EU is continuing to explore the possibilities to link the EU ETS with other robust emissions trading systems. The EU will account for its cooperation through the EU ETS with these and any other Parties in a manner consistent with the guidance adopted by CMA1 and any further guidance agreed by the CMA. The EU will account and report for cooperation with other Parties in a manner consistent with the guidance adopted by CMA1 and any further guidance agreed by the CMA.
Any updates or clarifications of previously reported information, as applicable	The information on the NDC scope contains clarifications/further details compared to the information provided in the updated NDC of the EU.

Note: This table is identical to table 'Description of a Party's nationally determined contribution under Article 4 of the Paris Agreement, including updates,' which has been submitted electronically together with this BTR.

Source: Updated NDC of the EU³⁹

³⁹ The update of the nationally determined contribution of the European Union and its Member States, <https://unfccc.int/sites/default/files/NDC/2023-10/ES-2023-10-17%20EU%20submission%20NDC%20update.pdf>.

As specified in Under their updated NDC the EU and its Member States, acting jointly, are committed to a legally binding target of a domestic reduction of net greenhouse gas emissions by at least 55% compared to 1990 by 2030. The term ‘domestic’ means without the use of international credits.

The NDC consists of a single-year target, and the target type is ‘economy-wide absolute emission reduction’. The scope of the NDC covers the 27 Member States of the EU.

The 17 October 2023 updated NDC scope is supplemented by additional information to clarify the precise amount of international aviation and maritime emissions which are covered under the EU NDC. Details on the EU NDC can be found in table 3.1. **Errore. L'autoriferimento non è valido per un segnalibro.**

, the NDC covers the emissions and removals from all sectors of the EU GHG inventory. In addition, CO₂ emissions from specific international flights (covered by the EU ETS) and GHG emissions from maritime voyages between EU Member States are included in the scope of the NDC.

3.3 Indicator, methodologies and progress

3.3.1 Indicator

For the tracking of progress towards implementing and achieving the NDC of the EU, an indicator is used which has the same unit and metric as the NDC base year and target values. The chosen indicator is ‘annual total net GHG emissions consistent with the scope of the NDC in CO₂eq’. Table 3.2 provides more information on this indicator.

Table 3.2: Indicator for tracking progress

Information	Description
Selected indicator	Annual total net GHG emissions consistent with the scope of the NDC in CO ₂ eq.
Reference level and base year	The reference level is total net GHG emissions of the EU in the base year (1990). The reference level value for the EU is 4 699 405 kt CO ₂ eq.
Updates	This is the first time the reference level is reported, hence there are no updates. The value of the reference level may be updated in the future due to methodological improvements to the EU GHG inventory and to the determination of international aviation and navigation emissions in the NDC scope.
Relation to the NDC	The indicator is defined in the same unit and metric as the target of the NDC. Hence it can be used directly for tracking progress in implementing and achieving the NDC target.
Definitions	Definition of the indicator ‘annual total net GHG emissions in CO ₂ eq’: Total net GHG emissions correspond to the annual total of emissions and removals reported in CO ₂ equivalents in the latest GHG inventory of the EU. The totals comprise all sectors and gases listed in the table entitled ‘Reporting format for the description of a Party’s nationally determined contribution under Article 4 of the Paris Agreement, including updates.’

Note: The information in this table is identical to the information in Common Tabular Format (CTF) tables 1 (‘Description of selected indicators’) and 2 (‘Definitions needed to understand the NDC’), which were submitted electronically together with this BTR.

Source: The reference level is based on the Annual European Union GHG inventory 1990-2022.

3.3.2 Methodologies and accounting approach

The EU use the following accounting approach for tracking progress towards the joint EU NDC: annual GHG data from the national GHG inventory of the EU, complemented for international aviation and navigation with estimations from the Joint Research Centre’s Integrated Database

of the European Energy System⁴⁰. The total net GHG emissions are provided in the scope of the EU NDC and are compared to the economy-wide absolute emission reduction target as defined in the NDC. The EU will account for its cooperation with other Parties in a manner consistent with guidance adopted by the CMA. As far as emissions and removals from the LULUCF sector are concerned, net emissions are used for tracking progress towards the 2030 target of the NDC based on all reported emissions and removals.

Details on methodologies and accounting approaches consistent with the accounting guidance⁴¹ under the Paris Agreement can be found in CTF table 3 ('Methodologies and accounting approaches'), which was submitted electronically together with this BTR.

3.3.3 Structured summary – status of progress

An important purpose of the BTR is to demonstrate where the EU and its Member States stand in implementing their NDC, and which progress they have made towards achieving it. The most recent information on GHG emissions and removals in the scope of the NDC constitutes the key information for tracking this progress. Table 3.3 summarizes the current status of progress.

Table 3.3: Summary of progress towards implementing and achieving the NDC

	Unit	Base year value	Values in the implementation period			Target level	Target year	Progress made towards the NDC
			2021	2022	2030			
Indicator: Total net GHG emissions consistent with the scope of the EU NDC	kt CO ₂ eq	4 699 405	3 272 650	3 205 223	Not Applicable	At least 55% below base year level	2030	The most recent level of the indicator is 31.8 % below the base year level.

Note that an annual emissions balance consistent with chapter III.B (Application of corresponding adjustment) will be provided in a subsequent BTR upon finalization of relevant further guidance by the CMA, based on the annual information reported under Article 6.2.

Note: More detailed information can be found in CTF table 4 ('Structured summary: Tracking progress made in implementing and achieving the NDC under Article 4 of the Paris Agreement'), which has been submitted electronically together with this BTR. This table is also annexed to this BTR.

Source: The indicator values are based on the Annual European Union GHG inventory 1990-2022.

Based on the GHG inventory data and data on international aviation and navigation for 2022, the EU and its Member States reduced net GHG emissions by 31.8 % compared to 1990. The EU and its Member States made progress towards implementing and achieving their NDC. The legal and institutional framework is in place to make further progress in the years ahead and to achieve the NDC target by 2030.

⁴⁰ European Commission, Joint Research Centre, Rózsai, M., Jaxa-Rozen, M., Salvucci, R., Sikora, P., Tattini, J. and Neuwahl, F., JRC-IDEES-2021: the Integrated Database of the European Energy System – Data update and technical documentation, Publications Office of the European Union, Luxembourg, 2024, <https://publications.jrc.ec.europa.eu/repository/handle/JRC137809>.

⁴¹ Decision 4/CMA.1, Further guidance in relation to the mitigation section of decision 1/CP21, <https://unfccc.int/documents/193407>.

3.4 Mitigation policies and measures

This section provides information on policies and measures implemented and planned in Italy, focusing on those that have the most significant impact on GHG emissions or removals and those impacting key categories in the national GHG inventory according to para. 80 of the MPGs.

The policies and measures adopted at the national level fall within the context defined by the European Framework, with particular reference to regulations on ESR, energy efficiency, renewables, and similar areas, and are aimed at achieving the objectives outlined therein.

In the case of European-level measures that apply directly to the national legal system and are capable of producing significant effects in terms of emission reductions, a concise description of the relevant European regulation is provided.

For several implemented measures an update is planned in the near future, in these cases, even though in CTF table 5 they have been reported separately, in the following paragraphs they are described in the same subparagraph for better understanding.

The overall effect of implemented PaMs in 2022 is estimated to be 57.4 MtCO₂eq of avoided GHG emissions from Energy, Transport, Industrial processes, Agriculture and Waste and -6.2 MtCO₂eq increased sinks in LULUCF. For 2030 the expected effects are respectively equal to 45.1 MtCO₂eq and -3.2 MtCO₂eq

For planned PaMs the overall effect in 2030 is estimated to be 60.8 MtCO₂eq of avoided GHG emissions from Energy, Transport, and Agriculture. For more detailed information please refer to CTF table 5.

3.4.1 Policies in the Energy sector

Coal phase out (implemented)

The measure to ban coal for electricity production within the end of 2025 was adopted by Italy since 2019. The measure has been implemented considering an adequate capacity replacement, the development of the electricity grid (mainly through the so-called Tyrrhenian link⁴² and SACOI 3⁴³ projects as well as the full development of storages) and the high penetration of renewable sources. Such constraints led to revising the deadline of the measure with only one region, Sardinia, phasing out coal within 2028.

The Russia-Ukraine war at the beginning of 2022 determined a heavy gas emergency and exacerbated the increases of prices of raw materials and, consequently, electricity. To deal with these critical issues, it was essential to adopt emergency measures, including the use of coal to produce electricity. Such events stopped in 2022 the decreasing trend of electricity by

⁴² <https://www.terna.it/en/projects/tyrrhenian-link>

⁴³ <https://www.terna.it/en/projects/projects-common-interest/sardinia-corsica-mainland-italy-electrical-interconnection>

solid fuels, trend that according to preliminary data resumed in 2023 and even more markedly in 2024.

The decommissioning of about 1,750 MW of coal-fired power plants and the conversion of 730 MW have been already implemented. The achievement of the phase-out process will require the decommissioning of the other coal-fired plants, for a total of about 3,650 MW within 2025 and 1,000 MW in Sardinia within 2028.

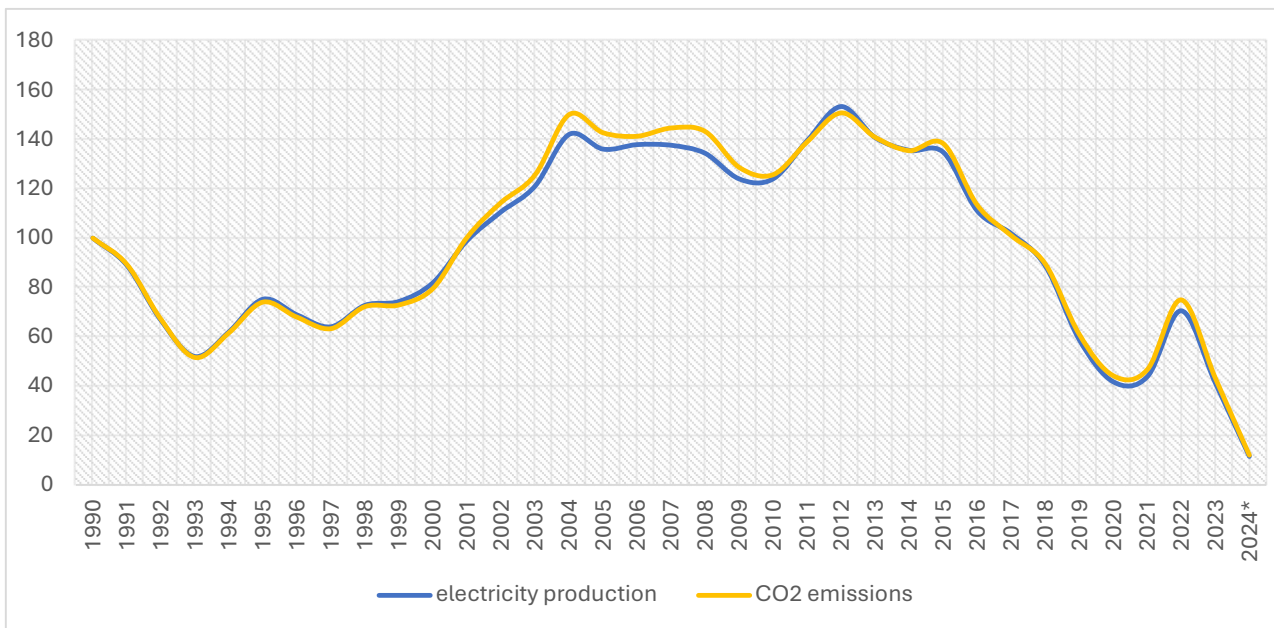


Figure 3.1: Electricity production and CO2 emissions from coal fired power plants (1990=100), provisional data for 2024
Source: TERNA for the electricity production and ISPRA for the emissions

In recent years, between 2019 and 2023, significant measures have been adopted to accelerate the authorization processes in the energy sector, aiming to stimulate the involvement of the relevant administrations. Decree Law 76/2020 introduced a simplified process for electrochemical storage plants and modifications to existing thermal power plants, focusing on improving efficiency and reducing environmental impact. Subsequently, Decree Law 77/2021 further simplified environmental assessments by excluding specific storage units from evaluation procedures.

Law 34/2022 specified the authorization methods for pure pumping plants, assigning state competencies and introducing a single authorization with a binding opinion from the Ministry of Infrastructure and Transport (MIT). With Law No. 41/2023, a new regulatory framework for electrochemical storage was defined, establishing a unique authorization process with a maximum duration of 60 days, without the need for regional agreements.

Additionally, the capacity market has incentivized new investments, particularly in gas generation, contributing to the modernization of the generation fleet toward more sustainable solutions. The capacity market auction in 2022 led to a significant increase in new capacity, which is crucial for ensuring a potential phase-out of more polluting sources, provided that the timelines for authorization and implementation are respected.

In 2019 the coal fired power plants generated 18.8 TWh with 17.1 Mt CO₂. According to the reference scenario the. Supposing in 2030 the same share of electricity generated by coal recorded in 2019 was produced by coal about 18.4 TWh would be produced and 16.7 Mt CO₂. With coal phase out in the reference scenario such electricity in 2030 will be produced by the average energy mix, with average emission factor around 218.8 g CO₂/kWh corresponding to 4 Mt CO₂. The difference between 16.7 Mt CO₂ and 4 Mt CO₂ results in 12.7 Mt CO₂ being avoided. As for the impact in 2022, the before mentioned surge of coal consumption in 2022 made not relevant the impact of this measure.

Tenders for electricity generation from large renewable plants with mature technologies (planned)

The Legislative Decree 199/2021 introduces the use of competitive bidding mechanisms to support mature technologies that have already achieved widespread adoption and reliability, even on the economic side. Here's a breakdown of these technologies:

- Onshore wind: wind energy generated on land, one of the most established renewable sources.
- Traditional PV plants: solar panels that generate electricity, widely adopted due to decreasing production costs.
- Hydropower: energy generated from water, still one of the most reliable and well-established renewable sources.
- Gas from wastewater treatment and biomass and biogas: use organic and waste materials for energy production, though high raw material costs can impact the competitiveness of these solutions.

To give full implementation to these provisions, the new FER-X decree, which is currently being designed, focuses on mature renewable technologies nearing market competitiveness. It introduces a centralized, asset-based model in which the system defines the quantity, location, and types of renewables to achieve decarbonization goals with optimal cost-benefit efficiency. The future decree will develop the two-way Contracts for Difference (CfD). Such financial instruments address inefficiencies and investment risks and are aimed at stabilizing the price of energy produced from renewable sources, protecting both producers and consumers from market fluctuations. In this type of contract, a "reference price" or "strike price" is set for renewable energy. If the market price of energy is below the reference price, the compensatory system steps in to pay the producer the difference, ensuring a minimum income. If the market price is above the reference price, the producer refunds the difference, lowering costs for consumers. This mechanism encourages investors and contributes to energy system stability. Moreover, the system will cover inflationary risks to ensure compensation aligns with evolving costs, further reducing operators' risk exposure.

The measure will be designed to target capacity planning, providing operators with five-year certainty for project development and renewals, supporting both new and repowered renewable installations.

For this measure, as well as, for all the measures regarding electricity generation from renewables the impact of each PaM has been estimated considering the new power capacity promoted and the average availability factor for each source in 2030 to calculate the electricity production. The impact arises from the combination of electricity usage and the CO₂ emission factor associated with electricity generated from natural gas, the energy source typically replaced by renewable energy in the power sector.

An additional capacity of further 24 GW, of which 18 GW PV, is expected by 2030 mainly thanks to this measure. The impact of such an increase in terms of emission reduction in 2030 is expected to be 11.5 Mt CO₂eq.

Power Purchase Agreements (PPAs) promotion for large renewable plants (implemented and planned update)

Italy aims to incentivize the use of PPAs to support investments in new renewable energy production plants, facilitating contracts that ensure an economic return over time. Legislative Decree 199/2021, which implements the EU RED II directive, provided that the GME (Electricity Market Operator) would create an online bulletin board to facilitate meetings between investors and buyers, with contract registration to ensure transparency and monitoring. Moreover, the mentioned Legislative Decree also provided for the development of an organized market platform, with voluntary participation, for the long-term trading of energy from renewable sources. Such PPA Platform will facilitate the meeting between sellers and buyers to supply consumers with green energy with standardized profiles. Contracts will need to be standardized and include penalties for non-compliance, as well as tools for managing counterparty risk. The Repower EU reform includes the establishment of a guaranteed system by 2024 to mitigate financial risks associated with renewable source PPAs. A progressive obligation for the Public Administration to purchase renewable energy through long-term PPAs is already implemented through tender tools, aiming for 100% coverage within five years. It is estimated that by 2030, around 18 GW of new capacity from renewable sources will be realized (about 47% implemented, 53% planned), primarily from photovoltaics and wind, without a direct resort to subsidies. The impact of implemented and planned PaMs in 2030 will be respectively 4.9 Mt CO₂eq and 5.1 Mt CO₂eq.

CO₂ capture, transport and storage for hard-to-abate sectors (planned)

In January 2021 Italy published The Italian long-term strategy on the reduction of greenhouse gas emissions. The document identifies possible paths to reach "climate neutrality" in Italy by 2050. To achieve this goal, CCS has been identified as one of the four fundamental levers to be integrated with energy efficiency. The final NECP, transmitted to the Commission in July 2024, sets more ambitious energy and climate target by 2030. The plan recognizes and confirm the key role of CCS to: decarbonise the HtA industrial sectors mitigating process and combustion emission, support the power mix providing a low carbon dispatchable energy resource able to maintain the adequacy and the reliability, foster the development of the hydrogen sector by

integrating renewable hydrogen with low-carbon hydrogen and enable the absorption of CO₂ (BECCS, DACCS).

The national CO₂ emission in 2022 of main industrial sectors that could be decarbonised through CCUS include: Hard to- Abate sectors with 67 Mt CO₂, Power sector with 71.4 Mt CO₂ and waste-to-energy with 7.5 Mt CO₂.

The NECP, considering the injection capacity profile of Ravenna storage site and the expected infrastructural developments, estimates, in 2030, 4 Mt of CO₂ captured by industrial emitters located in the Po Valley and some major industrial district located along the coast of the country. The plan also acknowledges the value of CALLISTO PCI, for the decarbonisation of Italian and Southern European industries, recognizing the delay compared to Northern Europe and the need to facilitate the development of CCS projects.

The CCS is regulated in Italy by Legislative Decree n.162/2011, which transposed Directive 2009/31/EC and outlined a regulatory framework aimed at allowing CO₂ storage in suitable geological formations. The Law Decree 181/2023 lastly amended Leg. Decree 162/2011, further intervening to complete the enabling regulatory framework for CO₂ storage permits. In particular, the D.L. 181/2023 has defined offshore depleted hydrocarbon reservoirs were identified as suitable for CO₂ geological storage, enabling the release of authorisations for large scale CO₂ storage programs. Furthermore, the Decree has outlined the path for defining the rules of CCUS business model through a study developed by Ministry of Environment and Energy Security in order to assess: (i) benchmark of CCUS national regulatory framework; (ii) technical and economic regulation for CO₂ transport and storage services; (iii) technical rules of CO₂ transport networks; (iv) CCUS supply chain cost; (v) CCUS demand and clustering; (vi) support schemes for carbon capture. The study under Law Decree 181/23 was launched in early 2024 and is about to be finalized.

Innovative plants, including agrivoltaics (implemented and planned update)

Some renewable technologies are recognized for their high innovative potential and are still facing significant economic challenges. Here's a breakdown of such technologies:

- Offshore wind: wind energy generated in open seas, where winds are stronger and more consistent than on land, offering significant scalability and growth potential.
- Concentrated solar power (CSP): uses mirrors to focus solar heat and generate energy, a promising option with high efficiency and energy storage capabilities.
- Low-impact geothermal: advanced geothermal technologies designed to minimize emissions and environmental disruption.
- Ocean energy: includes energy from waves, tides, and other forms of harnessing ocean movement, with a largely untapped potential.
- Advanced photovoltaic (floating and agrivoltaic): floating photovoltaics allows panels to be installed on water surfaces, while agrivoltaics combines solar panels with agricultural activities, promoting sustainable land use.

For technologies that are still far from economic competitiveness, or that have significant innovation potential, procedures will be implemented that are tailored to their specific characteristics. The use of tariff mechanisms will be assessed by considering the level of development, cost-reduction potential, exploitable capacity, possible contributions toward achieving national targets, compatibility with containing costs for consumers, environmental performance improvement, and the alignment with other objectives. In this regard, a support mechanism (called FER-2) will soon be enacted, with the European Commission having approved this aid measure on June 4, 2024, stating that it is compatible with the internal market under Article 107, Paragraph 3, Letter c) of the Treaty on the Functioning of the European Union.

The mechanism primarily targets technologies such as offshore wind, concentrated solar power (CSP), low-impact geothermal, ocean energy technologies, as well as certain photovoltaic applications, including floating installations on both inland and offshore waters. Limited quotas are also allocated for high-operating-cost technologies such as biogas and biomass plants that comply with the sustainability criteria set out in the RED II directive.

Regarding geothermal technologies, the establishment of a dedicated national guarantee fund is also proposed, like what has been implemented in France, to mitigate risk for operators while maintaining adequate incentives to operate efficiently and effectively.

Another innovative solution being prioritized is agrivoltaics-systems designed to maximize synergies between photovoltaic production and agricultural activities. In such direction also a national plan to convert greenhouses in agrivoltaic fields has been planned since 2024. The investment goal is to establish agrivoltaic facilities with a total capacity of 1.04 GW, generating around 1,300 GWh annually.

This measure establishes competitive bidding processes for the allocation of available quotas, totalling approximately 4.5 GW. The largest portion is earmarked for offshore wind, which is expected to make a significant contribution to decarbonization targets while minimizing environmental and landscape impacts, especially in the case of floating solutions.

The implementation of this measure is expected to achieve 1.2 GW of additional capacity by 2030. The planned update of the measure will increase the additional capacity of further 3.3 GW by 2030. The impacts of implemented and planned PaMs in 2030 are respectively 0.6MtCO₂ eq and 2.9 Mt CO₂ eq.

Promotion of renewables for energy communities and self-consumption (NRRP) and incentives for collective self-consumption groups and renewable energy communities (implemented and planned update)

Energy communities in Italy are an innovative approach to managing energy, where groups of citizens, businesses, or local authorities collaborate to produce, consume, and share renewable energy locally. The main goal is to promote the self-consumption of green energy, improving energy efficiency and reducing greenhouse gas emissions. Legislative Decree 199/2021 introduced and regulated energy communities in Italy. The decree provides incentives for the establishment of CERs, encouraging local energy production and sharing.

The GSE (Gestore dei Servizi Energetici) manages the incentives and facilitates the creation of energy communities.

Following the 2019 version of the National Integrated Energy and Climate Plan (NECP) and in line with the guidelines of the Directive (EU) 2018/2001, Italy initiated support for collective self-consumption configurations and energy communities. Specifically, through Decree-Law 162/2019 (Article 42-bis) and related implementing provisions (such as the ARERA Resolution 318/2020/R/eel and the Ministerial Decree of September 16, 2020) modalities and conditions for activating self-consumption from renewable sources and establishing renewable energy communities have been defined. The key features of this measure are:

- **Self-Consumption Mechanism:** the framework allows for the "sharing" of locally produced electricity from new small to medium-sized renewable energy installations (up to 200 kW) connected to the same secondary substation.
- **Incentive Structure:** participants in the configuration receive a premium tariff on the shared energy and some reimbursement for network service components due to local energy sharing.
- **Virtual Self-Consumption Model:** the model enables the valuation of real widespread self-consumption without needing new connections or additional electrical connections, except for the production facilities. It applies the current regulations for all end customers and producers involved in collective configurations.

The Legislative Decree 199/2021 has introduced updates to the transitional regulations concerning configurations for collective self-consumption and renewable energy communities. The decree from the MASE dated December 7, 2023, No. 414, incorporates the new provisions introduced by Legislative Decree 199/2021 and pertains to all configurations of self-consumption that utilize the electricity distribution grid for sharing produced energy. This regulation came into effect on January 24, 2024, and aims to promote the development of self-consumption setups. Key measures of the Decree are:

- **Non-repayable Grant:** up to 40% of eligible costs, funded by the National Recovery and Resilience Plan (NRRP) (Measure M2C2 – Investment 1.2, €2.2 billion), targeting collective self-consumption configurations and renewable energy communities in municipalities with fewer than 5,000 inhabitants.
- **Incentive Tariff:** an incentivizing tariff for renewable energy produced and shared, aimed at both collective and remote individual self-consumption configurations and renewable energy communities nationwide.

The implementation of this measure is expected to significantly boost self-consumption and renewable energy communities, potentially achieving 4.5 GW of additional capacity by 2030. The planned update of the measure will raise the additional capacity of further 2.8 GW by 2030. The impacts of implemented and planned measures from 2030 are respectively 1.9 MtCO₂eq and 1.2 MtCO₂eq.

Evolution of the net metering mechanism (implemented and planned update)

The net metering mechanism ("scambio sul posto") is an incentive system in Italy that allows producers of electricity from renewable sources (such as solar panels) to offset the energy they generate and feed into the grid with the energy they consume at different times. Essentially, it's a system that allows users to "exchange" the energy they produce and feed into the national grid with the energy they draw from the grid to meet their own consumption needs. A plant (for example, a photovoltaic system) produces electricity, and any unused energy is fed into the national grid. At other times (for example, at night or when the plant doesn't produce enough energy), the user can draw energy from the grid to meet their consumption needs. The system allows users to economically offset the energy fed into the grid with the energy consumed. It's not a direct exchange of kWh, but rather a financial compensation between the value of the energy fed into the grid and the energy consumed.

Legislative Decree 199/2021 introduced significant changes in the renewable energy sector and has outlined the gradual evolution of the net metering mechanism which will no longer be accessible for new plants. It will gradually be replaced by new tools and mechanisms that focus more on self-consumption, installation of storage systems and services for grid security.

The implemented measure starting from 2022 will promote in 2030 5.5 GW of PV plants, while the planned one will promote marginal effect with further 0.7 GW. The impacts of implemented and planned measures in 2030 are respectively 2.3 Mt CO₂ eq and 0.3 Mt CO₂ eq.

Incentives for renewable electricity (implemented)

The measures for the electricity sector are aimed at supporting the development of new plants and preserving and enhancing the existing plant fleet that remains potentially competitive and sustainable. Economic, regulatory, planning, informational, and administrative measures are tailored according to the type of intervention (new construction or reconstruction), the size of the plants, and the state of technology development.

In general, long-term incentive mechanisms are an effective tool to promote the establishment of new plants. In the absence of such term-based mechanisms, spot markets alone would not guarantee the capacity of renewables needed to meet decarbonization targets. The regulatory framework adopted in recent years has already made it clear that these mechanisms must be structural and integrated with spot markets. Specifically, Legislative Decree 199/2021 mandates that auctions be held to contract, on a term basis, additional renewable capacity.

The first operational tool for incentivizing (also) small plants is the Decree July 4, 2019. The measure should add about 4 GW, half photovoltaic and half wind plants, in 2030 with an impact of 2.5 Mt CO₂ eq.

Hydrogen Valleys (NRRP), Hydrogen Valleys (scale-up proposal), Operational account mechanisms for renewable hydrogen, Reform of the permitting system for hydrogen production (implemented and planned update)

The main policy for promoting renewable hydrogen and bio-hydrogen will be implemented through a tariff mechanism provided for in Article 11 of Legislative Decree 199/2021. This mechanism will ensure coverage of both operational and investment costs for hydrogen production plants. The main objectives of the decree, currently being finalized, include:

- A clear definition of renewable hydrogen.
- Establishment of incentives to stimulate the production of hydrogen from renewable sources, aimed at the transport sector and those difficult to decarbonize.
- Definition of procedures for accessing the provided incentives.
- Clarification of the cumulative modalities between the incentivizing tariffs and NRRP contributions.

The measure also anticipates a competitive bidding process through a contract-for-difference mechanism. The produced hydrogen will primarily be aimed at the transport sector and hard-to-abate sectors, in line with decarbonization goals. The public consultation concluded on March 4, 2024, and the decree will be submitted to the European Commission for the necessary evaluations.

The NRRP has placed significant emphasis on hydrogen, activating investments for €3.64 billion and two reforms, aiming at establishing a robust hydrogen economy in Italy and enhancing decarbonization efforts across various sectors. Up to now the measure should add about 4 GW in terms of electrical capacity absorbed by electrolyzers, in 2030 with an impact of 2.5 Mt CO₂eq.

The hydrogen investment plan focuses on promoting hydrogen production, usage, and research across strategic sectors:

1. “Hydrogen Production in Decommissioned Industrial Areas (Investment 3.1)”: This initiative supports the development of at least 10 hydrogen production projects in decommissioned industrial sites, each with a capacity of 1–10 MW, with a total budget of €500 million. By October 2022, €450 million was allocated to these projects, and €50 million reserved for strategic "flagship" projects. As of 2023, 54 projects had been approved.
2. “Hydrogen Use in Hard-to-Abate Sectors (Investment 3.2)”: With a budget of €2 billion, this investment aims to replace at least 10% of fossil fuels in industrial sites with hydrogen, reserving funds for particularly virtuous projects exceeding a 90% substitution rate. One billion euros is allocated to the DRI SpA project, and an additional €1 billion is reserved for carbon-intensive sectors.
3. “Hydrogen Experimentation for Road Transport (Investment 3.3)”: This project promotes hydrogen use in transport by establishing a network of hydrogen refueling stations (HRS),

with an investment of €230 million aimed at building at least 40 HRS by 2026. By 2023, 36 projects received funding.

4. “Hydrogen Experimentation for Rail Transport (Investment 3.4)”: With €300 million, including €276 million for infrastructure and €24 million for hydrogen-powered trains, this investment supports the development of hydrogen-based rail transport in various regions.
5. “Hydrogen Research and Development (Investment 3.5)”: This investment promotes R&D across four key areas: green hydrogen production, innovative technologies, fuel cells, and integrated management systems. A 2021 decree allocated €110 million for a partnership with ENEA, while additional 2022 calls provided funding for academic and industrial research. Through REPowerEU, an extra €140 million was allocated to previously unfunded projects.
6. “Developing Hydrogen Production Capacity (Investment 5.2)”: With a €450 million budget, this measure supports the establishment of hydrogen production facilities with an annual capacity of at least 1 GW, enhancing the electrolyzer supply chain.

Overall, these investments aim to drive the transition to hydrogen as an energy carrier, reducing GHG emissions, particularly in carbon-intensive industries and transport.

Reforms focus on regulatory and fiscal measures to facilitate green hydrogen development:

1. “Administrative Simplification and Regulatory Barriers (Reform 3.1)”: This reform promotes green hydrogen as a new energy carrier through several actions:
 - a. Establishing safety standards for hydrogen production, transport, and storage.
 - b. Streamlining procedures for small-scale green hydrogen production.
 - c. Regulating the participation of hydrogen production facilities in network services.
 - d. Creating a guarantee-of-origin system for renewable hydrogen.
2. “Measures to Promote Hydrogen Competitiveness (Reform 3.2)”: This reform includes fiscal incentives to support green hydrogen production and encourage its use in transportation, in alignment with the EU RED II Directive. Article 23 of Decree-Law 36/2022 exempts electricity used for green hydrogen production from general grid charges, with Ministry Decree No. 347 of September 21, 2021, setting out the criteria for this incentive mechanism.

These reforms aim at reducing regulatory barriers, promote hydrogen safety and transparency, and enhance green hydrogen's market competitiveness.

Agrisolar park (implemented)

The NRRP measure, known as "Agrisolar park" aims to support investments in photovoltaic solar energy systems within the agricultural and agri-food sectors, ensuring no land is consumed. The measure funds the purchase and installation of photovoltaic panels on the roofs of buildings used by beneficiary businesses, along with optional improvements like

asbestos removal, roof insulation, and ventilation systems to enhance energy efficiency. Additional contributions are available for energy storage systems and electric charging stations for sustainable mobility. The goal of the measure is to install at least 375 MW of new photovoltaic capacity with an impact of 157 kt CO₂ eq in 2030.

Small islands and green islands (implemented and planned update)

Italy has initiated a plan to progressively meet the energy needs of its smaller, non-interconnected islands through renewable sources. The D.M. 14/07/2017 sets specific renewable energy coverage targets for each minor island, supported by incentives based on avoided fuel costs, as outlined in ARERA's Resolution 558/2018. The plan also promotes modernizing the islands' electrical grids to enable high renewable penetration and pilot projects that focus on energy storage, electric transport, and integrating the electrical system with local water resources and flexible demand.

The NRRP includes investment, called "Green Islands," to fund projects on energy (renewables, electric grids, energy efficiency), water (desalination), transport (bike paths, zero-emission buses and boats), and waste (e.g., recycling) in Italy's small, non-mainland islands. This €200 million initiative targets 13 municipalities across 19 islands. In September 2022, Ministerial Decree No. 219 approved a list of 142 projects, totaling approximately €200 million, for these islands, and implementation is now underway.

The decree-law of March 1, 2022, No. 17, as amended by the conversion law of April 27, 2022, mandates an update to the D.M. of February 14, 2017, to support the energy transition of Italy's smaller, non-interconnected islands. The goal is to fully meet these islands' energy needs with renewable sources by December 31, 2026. To achieve this, the updated measure requires energy companies to convert fossil-fuel-based power plants to renewable sources by 2026, including investment plans for upgrading distribution networks. This planned measure will reach about 150 MW of PV with an impact of 56 kt CO₂ eq.

The effect of the measure has been only estimated considering the planned update. The effect of the measure as it is now does not impact the national total in a significant way.

Incentive to low-income families (planned)

Among the measures for promoting renewable energy sources and energy efficiency is the Energy Income initiative. This public incentive targets low-income families, enabling them to install photovoltaic panels on their homes with financial support covering up to 100% of the installation costs. The goal is to lower electricity bills through self-generated energy. The National Energy Income Fund was established by resolution no. 7 on March 17, 2020, from the Interministerial Committee for Economic Planning and Sustainable Development, with a budget of €200 million allocated from 2022, transferred from the Development and Cohesion Fund to the National Energy Income Fund. The measure will get about 100 MW of PV roof plants with an impact of 37 kt CO₂ eq in 2030.

Guarantees of origin for electricity from renewable sources (implemented)

Guarantees of Origin (GO) are certificates that verify the source of energy generated from renewable sources. They serve to promote transparency in the renewable energy market and support the tracking of energy production's environmental impact. Legislative Decree 199/2021 established guidelines for updating the issuance and management of GOs in Italy, focusing on enhancing their economic valuation and recognizing them across the entire volume of energy produced.

It is planned to enhance the system of Guarantees of Origin (GO) by promoting their greater valuation, including for Power Purchase Agreements (PPAs), and considering their recognition for all produced energy. The implementing decree, DM July 14, 2023, No. 24, was published on the Ministry of the Environment and Energy Security's website on July 17, 2023.

This measure is a market regulation tool to boost the other renewable energy support measures, and its impact cannot be evaluated separately from the other renewable energy support measures.

Floating PV (planned)

Among innovative technologies, the implementation of "floating" photovoltaic systems will be supported, both on inland waters and offshore. Floating photovoltaic installations require the identification of specific technological solutions and safety standards to address the unique environmental stresses they face, particularly in open seas. The inland installations, which are currently being explored in Italy through various experimental and demonstration initiatives, will showcase the functionality of these solutions and help define the technical requirements and criteria for their proper integration from both environmental and safety perspectives. In the short term, floating photovoltaic technology can contribute through installations on water bodies with lower environmental significance and minimal hydraulic and structural risk, such as irrigation basins, flooded quarries, and industrial ponds. There is still a lack in available data which makes it not possible to calculate the impact of this measure separately from the other renewable energy support measures.

Revision of the regulations for the allocation of hydroelectric concessions (implemented)

The Law of February 11, 2019, No. 12, converts the decree-law of December 14, 2018, No. 135, granting regions authority over existing large water concessions. It allows regions to assign hydroelectric concessions to qualified operators unless a public interest requires a different use of water. Criteria for assignments include setting minimum improvements in energy efficiency, generation capacity, and environmental restoration, with a portion of revenue allocated to funding environmental measures.

The Law of August 5, 2022, No. 118, implements these provisions, establishing procedures for concession assignments within two years of regional law enactment, with a deadline of December 31, 2023. Regions must inform the Ministry of Infrastructure about the assignment process, and if regional laws are not adopted on time, the Minister may intervene, ensuring that 10% of concession fees are retained by the state.

At the national level, support will be provided for new projects on smaller water networks, and the decree-law 77/2021 simplifies procedures for small hydroelectric repowering. It also updates guidelines for renewable energy installations, allowing facilities with a capacity of up to 500 kW to follow simplified construction regulations. Italy aims for greater harmonization of hydroelectric concession regulations at the European level, defining substantial and non-substantial modifications to streamline authorization processes.

It is not possible to precisely quantify the effect of this measure, as its main objective is to maintain current capacity with a particular focus on storage. In this regard, it also serves to support the integration of intermittent renewables into the grid.

National and Regional regulation of Suitable Areas for new renewable plants and digital platform (implemented)

Achieving Italy's renewable energy targets requires active involvement from the Regions, particularly through the establishment of regional objectives.

The 2020 renewable target was realized through burden sharing for renewable energy consumption targets. For 2030, objectives may include identifying suitable areas for photovoltaic and wind installations. Legislative Decree 199/2021 mandates that the Minister of the Environment, in coordination with other relevant ministries, set uniform criteria for identifying suitable and unsuitable areas for renewable energy projects. An agreement reached in June 2024 aims to publish a decree within six months to outline criteria that minimize environmental impacts and prioritize areas like built environments and abandoned industrial sites.

The EU Directive 2023/2413 (RED III) further accelerates this process by requiring member states to identify areas suitable for renewable energy installations by February 2026, facilitating better land planning and reducing permitting times.

To assist Regions and Autonomous Provinces, Article 21 of Decree 199/2021 establishes a digital platform (Piattaforma Aree Idonee – PAI) at the GSE, providing tools and information for territorial data processing and potential estimation.

Additionally, for maritime areas designated for offshore wind installations, efforts are underway to organize tenders for pre-identified sites, streamlining the authorization process and lowering development costs.

The effect of this measure cannot be evaluated separately from that of other measures promoting renewable energy, for which it serves as a strengthening tool.

Simplification of the authorization process for renewable energy plants (implemented and planned update)

Italy has initiated a process to simplify authorization procedures for energy plants, adapting them to the type and size of the facilities. The promotion of investments in renewable energy is an ongoing process. Among the initiatives to improve the authorization procedures are:

- **Standardization:** Introduction of homogeneous models and procedures for the construction and management of plants, with a unique model that unifies authorizations, grid connections, and access to support mechanisms.
- **Increase in thresholds:** The threshold for the unique model has been raised from 20 kW to 50 kW with Legislative Decree 199/2021 and then to 200 kW with Ministry Decree 2/8/2022, also facilitating small storage systems.
- **Expansion of the Simplified Authorization Procedure (PAS):** The thresholds for using the PAS have been raised up to 10 MW for agrivoltaic and floating plants, among others.
- **Extension of simplifications:** Law No. 11 of 2024 has extended certain simplifications until June 30, 2025, increasing the thresholds for requiring an Environmental Impact Assessment (VIA) for plants in suitable areas which passed the Strategic Environmental Assessment (VAS).

Additionally, a unique digital platform for the Unique Authorization (SUER) has been established, managed by the GSE, to guide administrative procedures and ensure interoperability. Law No. 118 of 2022 has delegated the Government to further simplify procedures in line with the directives of the NRRP. The proposed reform also includes:

- Simplification of authorizations at the subnational level;
- Identification of areas to accelerate the adoption of renewable energy;
- Creation of a digital single window for authorizations, continuing with the SUER.

Further simplification and reorganization of authorization procedures has been planned according to the results of the mentioned procedures.

This measure is part of a broader commitment to improve the efficiency of the Italian energy system, promoting the adoption of renewable sources and optimizing bureaucratic processes, for this reason it cannot be evaluated separately from that of other measures promoting renewable energy, for which it serves as a strengthening tool.

National greenhouse plan (planned)

The national plan will be aimed at converting greenhouse facilities into agro-energy hubs to promote environmental sustainability and improve energy efficiency in agriculture. The plan will emphasize the use of renewable energy, including incentives for installing semi-transparent photovoltaic systems on greenhouse roofs, applicable to both new constructions and renovations. It also advocates for the development of low-enthalpy geothermal systems

and heating and cooling systems powered by biomass or biogas. A key objective is to enable greenhouses to produce the energy needed for their operations, reducing reliance on external sources.

Energy efficiency is a central focus, with measures such as replacing traditional glass coverings with innovative materials, including photovoltaic systems and thermally insulating covers, to lower energy consumption. The plan will also introduce photo-selective and durable materials to optimize light management and thermal performance. Additionally, the collection and reuse of rainwater, integrating this practice with energy-efficient operations, will also be encouraged. Smart infrastructure upgrades will be promoted, including the modernization of environmental control systems for cooling, heating, and lighting using interactive technologies to enhance energy optimization. In essence, the initiative seeks to transform greenhouses into models of energy sustainability by leveraging innovative technologies to improve the production, conservation, and efficient use of renewable energy.

Currently, there is insufficient data to evaluate the effect of this measure in terms of GHG emissions reduction.

Reduction of the costs of connecting biomethane plants (planned)

The NECP highlights the strategic role of biomethane in Italy's energy transition. To support the development of this sector, the plan proposes measures to lower the connection costs for biomethane plants to the distribution network. One key initiative is reforming the cost allocation system, shifting the financial burden from individual installations to general system costs. This approach aims to encourage the conversion of existing facilities and foster new projects, ensuring greater economic viability for producers. The effect of this measure cannot be evaluated separately from that of other biofuel measures in both energy and transport sectors, for which it serves as a strengthening tool

Tax deduction (implemented and planned update)

Tax deductions for energy renovation of buildings were introduced in Italy by the 2007 Finance Act and are still active. This is a voluntary mechanism, whereby individuals or businesses may deduct, respectively from their personal (IRPEF) or corporate (IRES) income tax, a percentage of the expenditure incurred for certain types of energy upgrading works on existing buildings. The type of measures currently in place are:

- **Superbonus:** it provides a tax deduction for deep energy and seismic retrofitting interventions of up to 110% from 2021 to 2022, decreasing to 90%, 70%, 65% for subsequent years until 2025, depending on the type of beneficiary. The measure is funded with approximately €14 billion from the National Recovery and Resilience Plan (NRRP) resources (M2C2-I.2.1), about €4.5 billion from the Complementary National Plan to the NRRP, and national resources from the 2021-2026 budget planning. As of May 2024, the

total number of certifications amounts to approximately 496,000 units, for a total of around €117 billion in investments eligible for financing (€112 billion for completed works).

- **Ecobonus:** It recognizes, until 2024, a tax deduction spread over 10 years with variable rates (50-75%) depending on the specific type of energy efficiency intervention carried out. The measure is financed with national resources from budget planning. From 2007 to December 31, 2022, over 4.6 million interventions were completed, and about €38 billion in investments were activated. From 2014 to 2020, the rate of mobilized investments was steady and slightly above €3 billion per year; in 2021 and 2022 alone, thanks in part to the credit transfer and invoice discount mechanisms, over 2 million interventions were carried out, amounting to approximately €14.4 billion in investments.
- **Bonus Casa:** It recognizes, until 2024, a 50% tax deduction spread over 10 years for individual building renovation interventions, including energy efficiency improvements.
- **Appliance Bonus:** It recognizes, until 2024, a 50% tax deduction spread over 10 years for the purchase of high-efficiency appliances.
- **Sismabonus:** It recognizes, until 2024, a tax deduction spread over 10 years with variable rates (50-85%) for interventions aimed at reducing the seismic risk of buildings, also combined with energy efficiency measures.
- **Other bonuses:** They recognize variable tax deductions (50-75%) over 5-10 years for individual non-energy-related interventions, such as the Green Bonus and the Bonus for the removal of architectural barriers. Until 2021, the Water Bonus and Electric Charging Bonus were also active, and until 2022, the Facade Bonus.

To meet the challenging goals for the residential sector by 2030 and 2050 a comprehensive reform of tax deductions is planned. This reform will address the renovation of existing residential buildings with an integrated and efficient approach, overcoming the current fragmentation of the various active deductions. An integrated approach would allow for the optimization of timeframes and renovation costs, promoting deep renovation interventions with a focus on sustainability across various areas:

- energy efficiency;
- renewable energy production;
- electrification of consumption;
- building digitalization;
- interaction with other infrastructures, such as transport systems;
- safety aspects, including seismic and fire safety.

The reform of the regulatory framework will therefore jointly address all of these aspects, providing a modulation of benefits based on the overall performance achieved by the building. This will be accomplished through interventions with varying levels of priority. The reform should have a duration of at least ten years to meet the ambitious objectives set for the residential sector. In particular, it must:

- Be primarily directed at properties subject to the obligations of Directive 1275/2024, the so-called Green Homes Directive (primary residences, low-energy-class properties, situations of energy poverty, etc.);
- Ensure benefits distributed over a maximum of 10 years;
- Allow both individual interventions and deep energy renovations (a combination of multiple interventions);
- Ensure reduced benefits for individual interventions and, for deep energy renovation interventions, increasing benefits based on the energy performance achieved, also taking into account seismic performance for high-risk areas. Energy interventions will be "leading" compared to all other interventions;
- Ensure maximum all-inclusive specific costs, both for individual interventions and for deep energy renovations, that are easy to verify and uniform across the entire national territory;
- Be supported by financial instruments, such as low-interest loans, potentially covering the total investment costs, with favorable conditions for people in situations of energy poverty. In this context, the identification of synergies with the reform of the National Energy Efficiency Fund is also planned.

The evaluation of this implemented measure was carried out using a model-based approach. A scenario was developed that incorporates the consumption saved and m² of building renovated from, Ecobonus, Bonus casa and superbonus incentives (Source: Energy Efficiency report, ENEA various years). The saved emissions were calculated by comparing the model results with and without the implementation of this scenario. The impact of this measure was 1.7 Mt CO₂eq in 2022 and it is estimated to be 1.7 Mt CO₂eq in 2030.

For the planned measure, the evaluation was also carried out by the model assuming that the comprehensive reform of tax deductions would allow the oldest and most energy-intensive buildings. The impact of this measure is estimated to be 2.5 Mt CO₂eq in 2030.

Conto Termico, Thermal Account (implemented and planned update)

The Conto Termico was introduced to incentivize the implementation of small-scale interventions aimed at increasing energy efficiency and producing thermal energy from renewable sources to private individuals and public administrations. The mechanism is regulated by the Ministerial Decree of February 16, 2016, which updates the Ministerial Decree of December 28, 2012, contributing to the achievement of national renewable energy and energy efficiency targets. The interventions eligible for incentives through the Conto Termico are aimed to promote efficiency by reducing thermal energy demand, generating the necessary energy through more efficient equipment, and, finally, using renewable sources to produce energy required for end-use applications.

From the start of the mechanism (2013) to December 31, 2023, approximately 683,000 incentive requests have been received, with €2.245 billion committed, of which:

- €821 million for interventions carried out by public administrations;

- €1.424 billion for interventions carried out by private individuals.

The process of updating the regulations for the Conto Termico is currently underway. In the draft new decree, the range of eligible beneficiaries is expanded and diversified. Regarding eligible interventions for energy efficiency, the following interventions are added:

- Installation of infrastructure elements for private electric vehicle charging, also accessible to the public;
- Installation of photovoltaic solar systems and related storage systems, either on the building or its related premises.

For both these interventions, a binding condition is required: they must be carried out in parallel with the replacement of existing winter heating systems with electric heat pump systems.

The evaluation of this measure was based on data from the NECP. The impact of the implemented measure was calculated for 2022 based on final energy savings, assuming all energy saved was natural gas. For 2030, the emission reductions associated with the planned measure were estimated, factoring in the expected savings from the thermal account update and again assuming the energy source is natural gas. The impact of this measure was 0.4 Mt CO₂eq in 2022 and it is estimated to be 2 Mt CO₂eq in 2030.

Energy Efficiency in the service sector- NRRP (implemented)

Under the the National Recovery and Resilience Plan (NRRP), Mission 2, called “Green Revolution and Ecological Transition,” aims to promote initiatives related to the ecological transition, encouraging sustainability and emissions reduction. The main measures for the service sector are (codes in brackets refer to the NRRP identification codes)⁴⁴:

- School Building Replacement and Energy Retrofit Plan (M2C3-I.1.1): The investment (€800 million) is aimed at the progressive replacement of part of the outdated school building stock, involving approximately 195 school buildings for a total of 410,000 square meters.
- Energy Efficiency of Judicial Buildings (M2C3-I.1.2): The investment (€410 million) is aimed at improving the energy efficiency of 48 judicial buildings, enhancing their historical value while ensuring seismic safety and technological efficiency.
- Improving Energy Efficiency in Cinemas, Theatres, and Museums (M1C3-I1.3): The investment (€300 million) is aimed at improving the energy efficiency of buildings in the cultural/creative sector.
- Interventions for Resilience, Territorial Enhancement, and Energy Efficiency in Municipalities (M2C4-I.2.2): The investment (€900 million) is aimed at increasing territorial resilience through a diverse set of interventions in urban areas. The works will involve

⁴⁴ <https://www.mase.gov.it/pagina/pnrr/la-struttura-del-pnrr-e-i-progetti-del-mase>

securing the territory, ensuring the safety and upgrading of buildings, improving energy efficiency, and upgrading public lighting systems.

- School Building Safety and Retrofit Plan (M4C1-I.3.3): The investment (€3.9 billion) is aimed at securing a portion of school buildings, while also progressively reducing energy consumption.
- National Innovative Program for Housing Quality (M5C2-I2.3): The investment (€2.8 billion) is aimed at the construction of new public residential buildings to reduce housing difficulties, particularly with regard to the existing public housing stock, and the revitalization of degraded areas, focusing primarily on green innovation and sustainability, including energy efficiency. The investment is expected to impact approximately 16,500 housing units.

The evaluation of this measure was carried out using a model-based approach. A scenario was developed that incorporates all the actions outlined in the NRRP related to Mission 2 aims to promote initiatives related to emission reduction and energy efficiency in the service sector. The saved emissions were calculated by comparing the model results with and without the implementation of this scenario. The impact of this is estimated to be 1 Mt CO₂eq in 2030.

White certificates (implemented and planned update)

White Certificates, also known as Energy Efficiency Certificates (EECs), are tradable titles that certify the achievement of energy savings in final energy uses through energy efficiency improvement. The mechanism also promotes the implementation of projects that involve the use of renewable energy sources for non-electric applications, considering their ability to enhance energy efficiency and generate non-renewable energy savings.

The White Certificates mechanism, which started in 2009 and was last regulated by the ministerial decree of May 21, 2021, is based on the obligation imposed on electricity and gas distributors with more than 50,000 customers to achieve a minimum annual energy savings target. These obligated parties demonstrate compliance by acquiring tradable certificates (White Certificates, or CBs) that certify energy savings in final uses, which are achieved by qualified third-party entities. Each certificate corresponds to the savings of one Ton of Oil Equivalent (TOE).

The obligation is determined based on the ratio between the amount of electricity and natural gas distributed by individual distributors and the total quantity distributed nationwide by all obligated parties. Distributors can meet their obligations either by implementing energy efficiency projects directly, for which the CBs are awarded by the Energy Services Manager (GSE), or by purchasing certificates through the CB market managed by the Energy Market Operator (GME) or through bilateral transactions.

The updating the Energy Efficiency Certificates mechanism is currently underway to enhance the measure and to ensure simplification, optimization of the methodologies for quantifying and recognizing energy savings, and reduction of the times required for approval, issuance, and

market offering of the certificates. These improvements are important to maintain the measure during the 2021-2030 period and to overcome the gradual reduction of interventions activated under the Energy Efficiency Certificates mechanism. This reduction is due to the complexity of the mechanism's functioning (access/reporting/incentive recognition phases) and to the introduction in 2018 of a cap on the economic compensation recognized for each individual Energy Efficiency Certificate produced, set at €250 per TEP.

Additionally, White Certificates are issued for the energy savings generated by High-Efficiency Cogeneration plants, including those powered by renewable energy sources and those connected to district heating networks.

The effect of this measure is estimated to be 45 MtCO₂eq in 2022 and 2.6 MtCO₂eq in 2030.

Kyoto Fund (implemented)

The Kyoto Fund is a fund aimed at financing measures for the implementation of the Kyoto Protocol. Established by Article 1, paragraphs 1110-1115, of the 2007 Financial Law, it has been active since 2012 through five different programming cycles. The Fund, managed with the support of *Cassa Depositi e Prestiti Spa*, provides loans at a subsidized interest rate of 0.25% and has an initial endowment of €635 million. From 2015 to 2018, €350 million of the Fund was allocated to the energy renovation of publicly owned school buildings. With the 2019 Budget Law, access was also extended to healthcare facilities and sports facilities, with an additional €200 million still available. As of December 31, 2021, the call for applications reserved for schools granted financing for the energy efficiency of over 200 buildings (investments of €105 million). Of these, 124 projects have been completed, totaling approximately €50 million in investments. All financed projects achieved the minimum target of improving by two energy classes.

The implementation of a reform of the Fund is envisaged within the RepowerEU framework. In particular:

- The establishment of a Fund for the decarbonization of public buildings;
- The enhancement of the financial endowment by integrating the remaining resources currently available (amounting to approximately €250 million) with additional funds from the Repower EU Program, €800 million.
- The creation of a combined mechanism for subsidized financing/grants reserved for all public administrations (e.g., local authorities, public entities, regions) to facilitate their investments in energy efficiency.

To maximize the effectiveness of the available resources and ensure a certain degree of sustainability of the instrument, it is proposed to adjust the grant portion of financing based on the additional energy savings achieved, with a maximum grant contribution of 70-80%, while the remaining portion of the investment would be covered by a subsidized loan.

The effects of this measure could not be evaluated because of the lack of sufficiently robust data.

Efficient public lighting (implemented)

In the context of public administration, an energy efficiency program will be structured, starting with public lighting as the primary focus. In this sector, the program will include a set of measures directed at local administrations, aiming to accelerate the ongoing process of replacing light sources and installing consumption monitoring systems, along with more efficient scheduling of operating hours. The 2018 Budget Law stipulated that public administrations are required to upgrade public lighting networks by December 31, 2023, ensuring at least a 50% reduction in electricity consumption compared to the 2015-2016 average.

The effects of this measure cannot be evaluated in terms of GHGs emission reduction because of the lack of sufficiently robust data.

Program for the Central Public Administration (PREPAC) and for the Public Administration (PREPA) (implemented and planned update)

The PREPAC is a program aimed to improve the energy efficiency of at least 3% of the of the Central Public Administration climatized building surface area annually, through the provision of capital grants covering 100% of eligible costs, as provided by Article 5 of Legislative Decree 102/2014. Project evaluation is supported by the Energy Services Operator (GSE) and ENEA, while the allocation of funds is handled by the Ministry of the Environment and Energy Security (MASE). The implementation phases are directly managed by the Ministry of Defense for the buildings under its jurisdiction, or by the Public Works Superintendents, with the support of the State Property Agency. The project proposals approved between 2014 and 2018 consistently achieved the energy efficiency targets, but since 2019, lower performances have been recorded. Out of approximately 310 projects approved as of April 30, 2024 (representing around €428 million in investment), 86 are in the construction and/or completion phase.

To accelerate the implementation phase of projects, as part of the NRRP (M2C3), among the measures provided by Reform 1.1 "Simplification and acceleration of procedures for energy efficiency interventions," the strengthening of the PREPAC (sub-reform 1.1d) was included. To this end, Article 19 of Decree-Law 17/2022 introduced a provision allowing the State Property Agency to support the Interregional Public Works Superintendents in the execution of interventions, also using electronic purchasing and negotiation tools. However, considering that, under the provisions of Legislative Decree 102/2014, the measure will remain active until 2030, a comprehensive reform is considered necessary, taking into account the minimum energy efficiency requirement for buildings of all local public administrations and the minimum annual energy savings obligation imposed by the Energy Efficiency Directive (EED), which is in the process of publication. It is proposed to create a mechanism for allocating this obligation at the regional level, while maintaining centralized governance by the Ministry of the Environment and Energy Security (MASE). The new program is then named PREPA since it will no longer be limited to the Central administration.

The evaluation of this measure was based on data from the NECP. The impact of the implemented measure for 2022 was calculated based on the final energy saved, assuming all savings come from natural gas. For 2030, the impact of the planned measure was estimated by considering the emission reductions expected from the new PREPA program, also assuming natural gas as the energy source. The impact of this measure was 0.2 Mt CO₂eq in 2022 and it is estimated to be 0.9 Mt CO₂eq in 2030.

CHP and district heating (implemented)

Cogeneration is currently supported by incentive schemes, rewarding the production of both heat and electricity. Italy will continue to promote the expansion of efficient district heating and cooling, leveraging the remaining economic potential in a way that aligns with other energy and environmental policy objectives, such as reducing the need for waste-to-energy and limiting biomass use to curb emissions. According to the 2015 national assessment report on the potential for high-efficiency cogeneration and efficient district heating mandated by Article 14 of the EED Directive and updated by the GSE in 2021, the economically sustainable potential for increasing energy provided by district heating is approximately 20.9 TWh of thermal energy delivered annually. This would require an expansion of district heating and cooling networks to approximately 3,700 km nationwide (+77% compared to 2018) and new connected volumes of 340 million cubic meters.

This incremental potential assessment for district heating was conducted alongside the analysis of high-efficiency cogeneration potential, primarily focusing on key sources for both purposes (district heating and high-efficiency cogeneration): natural gas, biomass, and waste. It may be beneficial to conduct a more comprehensive analysis of integrating certain technologies with district heating networks. These technologies, currently marginal in the context of district heating but potentially promising in high-density urban areas, include solar thermal, centralized heat pumps, and the recovery of thermal energy waste.

According to the policies currently in place, thermal energy delivered to users through district heating networks could reach approximately 11 TWh by 2030, while thermal energy produced through high-efficiency cogeneration would amount to around 25 TWh.

The emission saved for 2022 was calculated considering the installed power at that year for CHP, including high efficiency plants (CAR), and assuming they led to a reduced use of natural gas. For 2030, the impact of the measure is assessed assuming the installation of all the power as planned in the NECP. The impact of this measure was 1.8 MtCO₂eq in 2022 and it is estimated to be 2.8 MtCO₂eq in 2030.

Management of heating systems (update of DPR 74/2013) (planned)

Presidential Decree No. 74/2013 establishes general criteria regarding the operation, maintenance, and inspection of thermal systems, as well as the professional requirements for experts and bodies responsible for performing inspections. Among other measures, it

introduces mandatory energy efficiency checks for winter heating systems with power above 10 kW, or 12 kW for summer cooling systems, according to specific time intervals. Additionally, the decree sets operational limits for heating systems used for winter climate control, establishing the periods and methods for turning them on and off. Currently, this decree is being updated as per Article 6, paragraph 1, of Legislative Decree June 10, 2020, No. 48, which implements Directive (EU) 2018/844 on the energy performance of buildings. The draft decree updates the general criteria outlined in DPR 74/2013 to minimize administrative burdens on property owners and tenants, ensuring optimal environmental, energy, and safety performance for small thermal systems, while also simplifying administrative procedures.

The draft decree under development proposes the introduction of new provisions in comparison to DPR 74/2013, particularly in the following areas, covered in various articles of the decree:

- **Operation Criteria for Systems:** Sets operational time limits, reduces periods of activation, and updates exceptions for specific climatic conditions to ensure thermal comfort and humidity control.
- **System Logbook:** Mandates a logbook for systems with a power exceeding 10 kW (lowered to 5 kW for solid fuel systems, e.g., biomass) and plans the implementation of an electronic logbook as part of the territorial thermal system registry.
- **Energy Efficiency Checks:** Requires periodic checks for systems above 20 kW (lowered to 10 kW for solid fuel systems like biomass), adjusting inspection thresholds to increase coverage of significant systems, and introduces a dedicated “Energy Efficiency Inspection Report” model for biomass systems.
- **Regional Responsibilities:** Optimizes cost-benefit relations by standardizing the methods for submitting energy efficiency reports.
- **Information Activities:** Introduces a national information system and an annual report on the status of thermal systems.
- **Guide on Thermal System Management:** ENEA and CTI will prepare a guide with a dedicated section on managing summer climate control systems.
- These amendments aim to enhance energy efficiency by ensuring more consistent application of regulations across the national territory. The adoption process involves obtaining consent from the Unified Conference, advice from the Council of State, and approval by the Council of Ministers.

The evaluation of this measure was carried out using a model-based approach assuming a two-week reduction in the heating period for all buildings in the civil sector, starting from 2025. The difference in consumption between the standard heating period and the reduced period, with the same technological assumptions, accounts for emission savings. The impact of this measure is estimated to be 2.3 Mt CO₂eq in 2030.

National Energy Efficiency Fund (implemented and planned update)

The National Energy Efficiency Fund (FNEE), established by Article 15 of Legislative Decree 102/2014, is a fund aimed at financing energy efficiency interventions. Active since May 2019, it is regulated by the Ministerial Decree of December 22, 2017, and managed by Invitalia, with a financial endowment of approximately €350 million. The FNEE is divided into two sections: 30% of the resources are allocated to granting guarantees, and 70% to providing low-interest loans, with a rate of 0.25%. From the start of the mechanism until December 31, 2023, 24 energy efficiency projects were approved for financing, for a total value of approximately €19 million, corresponding to over €34 million in activated investments.

As part of the National Recovery and Resilience Plan (NRRP) (M2C3), among the measures provided by Reform 1.1 "Simplification and acceleration of procedures for energy efficiency interventions," the update and strengthening of the FNEE has been included (under Reform 1.1c). This reform was implemented through paragraph 514, Article 1, of Law No. 234 of December 30, 2021, which introduced a grant component as an additional tool alongside those already in place.

The effects of this measure cannot be evaluated in terms of GHG emission reduction because of the lack of sufficiently robust data. Anyway, it is important to underline that this measure is preparatory to the success of the others by facilitating investments, in particular in energy efficiency.

Renewable energy in the heating and cooling (Adopted)

Annex 3 of Legislative Decree 199/2021, implementing the REDII Directive, establishes renewable energy integration requirements for new buildings or those undergoing significant renovations. Such buildings must be designed and built to ensure, through renewable energy systems, that 60% of the energy needed for hot water production is covered, as well as 60% of the total energy needed for hot water, winter heating, and summer cooling.

The renewable energy integration requirements outlined in Legislative Decree 199/2021 do not apply when a building is connected to an efficient district heating or cooling network under Legislative Decree 102/2014 (transposing the EED), provided the district heating or cooling network fully meets the building's thermal energy needs for heating or cooling.

It should also be considered that the Decree 199/2021 introduces the so-called "Oiert" (Obligation to increase thermal renewable energy): companies selling thermal energy in the form of heat for heating and cooling to third parties shall ensure that a share of the energy sold is renewable. The threshold for this is 500 TOE per year.

For public buildings, the renewable integration requirements are increased to 65%, with mandatory installed capacity requirements further increased by 10%.

If compliance with the renewable integration requirement is technically unfeasible, a certified designer must produce a report confirming this, and a calculated primary non-renewable

energy target for heating, cooling, and hot water must still be met. The renewable energy integration requirement has improved building energy performance and increased the use of thermal renewable energy sources, but it still needs to be strengthened to expand its application and effectiveness. Consequently, Legislative Decree 199/2021 mandates that, from January 1, 2024, these obligations are to be revised at least every five years in alignment with technological advances.

In upcoming reviews, the extension of these requirements to specific categories of existing buildings, such as large commercial spaces (over 10,000 square meters) in sectors like office buildings, healthcare facilities and retail spaces, will be considered, regardless of renovation status. Additionally, the renewal of these obligations aims to simplify compliance, offering a list of eligible renewable technologies from which designers can choose based on the specific building's characteristics. Hybrid systems combining traditional and renewable technologies will also be encouraged, with synergies with existing incentives to enhance the cost-effectiveness of investments in renewable thermal energy systems.

The evaluation of this measure was carried out using a model-based approach. Emission savings have been calculated considering the expected 2030 targets for thermal energy production from renewable sources and the potential for building renovation achievable with the new incentives. The impact of this measure is estimated to be 1.5 Mt CO₂eq in 2030.

3.4.2 Policies in the Transport sector

NRRP for mobility (implemented)

Encouraging the adoption of zero-emission vehicles for private transportation and promoting passenger intermodality through the use of bicycles and public transport services. This is facilitated by policies that incentivize modal shifts, promote intermodality, and develop new infrastructure.

This initiative is part of the National Recovery and Resilience Plan (NRRP), specifically Mission 2: 'Green Revolution and Ecological Transition,' Component 2: 'Renewable Energy, Hydrogen, Power Grids, and Sustainable Mobility (M2C2),' and Investment 4: 'Sustainable Local Transport, Cycling Paths, and Rolling Stock Renewal.'

In order to support local public transport, a key role is played by "rapid mass transport," which involves high-capacity electric-powered systems (subways, trams, trolleybuses, and similar systems). Considering these needs, a significant funding program has been initiated since 2017 (the 2017 Budget Law established the investment fund). The Ministry of Infrastructure and Transport (MIT) is managing resources in this sector amounting to approximately €14 billion, to which an additional €2.2 billion from the NRRP should be added, aimed at the construction of 240 km of network equipped for rapid mass transport infrastructures.

NRPP also aims at strengthening cycling mobility in urban and metropolitan areas, with the goal of creating approximately 565 km of urban and metropolitan cycling paths by the second half of 2026. In particular, Decree No. 509/2021 allocated resources to municipalities with more

than 50,000 inhabitants that are university towns, for a total amount of €200 million, of which €150 million comes from NRRP funds and €50 million from existing legislation projects.

NRPP also includes targeted funding for enhancing various types of infrastructures both for private (e.g. charging station for electric vehicles) and public transport as well as for the renewal of the Local Public Transport (TPL) fleet. Resources have been allocated for the purchase of zero-emission buses (electric and hydrogen) and the related supporting infrastructures.

The evaluation of NRPP on transport was carried out using a model-based approach. A scenario was developed that incorporates all the actions outlined in the NRRP related to sustainable mobility, fleet renewal, and the enhancement of the electric charging infrastructure network, including cold ironing. Emission savings were calculated by comparing the model results with and without the implementation of this scenario. The impact of this measure was 0.2 Mt CO₂eq in 2022 and it is estimated to be 1.2 Mt CO₂eq in 2030.

Ecobonus for vehicles (implemented)

This measure consists of a contribution for the purchase of more efficient vehicles with low CO₂ emissions, either with or without scrapping. The contribution is recognized as a discount applied by the dealer on the invoice at the time of purchase. The discount on the purchase price is then recouped in the form of a tax credit for manufacturers and importers.

Promoted Vehicle Categories are:

- Electric, hybrid, and internal combustion vehicles with emissions up to 135 g/km of CO₂.
- Electric and non-electric motorcycles and mopeds with Euro 5 homologation or higher.
- Electric commercial vehicles.

The measure provides for allocations until 2024 as follows:

- Year 2021: €1.148 billion
- Year 2022: €630 million
- Year 2023: €630 million
- Year 2024: €640 million

The impact of this measure could not be estimated separately from the impacts of “NRRP for mobility”. Even if this measure started in 2019, because of the heavy effects of the pandemic on transport it was not possible to clearly evaluate its effects in the first years of implementation.

Ferrobonus e Marebonus (implemented)

To encourage the modal shift in freight transport towards modes characterized by lower energy consumption per ton-kilometer transported, two measures are active: Marebonus and Ferrobonus.

Marebonus provides, in accordance with Article 1, paragraph 649, of Law No. 208 of December 28, 2015, financial contributions aimed at implementing modal choices to improve and optimize the intermodal chain, thereby relieving road congestion and reducing the negative externalities of freight transport. This is achieved through greater use of Ro-Ro and Ro-Pax maritime services arriving at or departing from ports located in Italy to ports in Italy or in European Union member states or the European Economic Area. The Marebonus measure has been financed by the 2021 Budget Law (Law No. 178 of December 30, 2020) until 2026. The impact of this measure is expected to be 0.3 Mt CO₂eq in 2030 (Source: Ministry of Infrastructure and Transport)

Ferrobonus is an incentive measure for economic operators who choose combined or intermodal transport by rail as an alternative to road transport. The legal basis for this measure is established by Article 1, paragraphs 648-649 of Law No. 208/2015, which allocates state resources to companies using railways for the combined transport of goods originating from or destined for logistics hubs within the national territory or in EU member states or the European Economic Area. The Ferrobonus measure has been financed by the 2021 Budget Law (Law No. 178 of December 30, 2020) until 2026. Estimation based on data from the Ministry of Infrastructure and Transport (increase in the number of trains and occupancy rate) and the Italian Emission Inventory by ISPRA (HDV emission factor gCO₂eq/tkm). The impact of this measure is estimated to be equal to 0.3 Mt CO₂eq both in 2022 and in 2030.

Biofuels for road transportation (implemented)

In 2006, Italy introduced the obligation for suppliers of gasoline and diesel to include biofuels in their consumption, aimed at developing the supply chain and reducing emissions from the transport sector. Based on European directives, by 2020, biofuels must account for 10% of the total volumes of traditional gasoline and diesel. From 2018 to 2022, the production of biomethane and advanced biofuels was incentivized to meet the existing obligation of blending fossil fuel-derived fuels with biofuels, through a system of purchasing the produced biomethane, with the issuance of Consumption Introduction Certificates (CIC) for a duration of ten years.

Emission savings have been calculated for the years 2022 and 2030, based on the difference between the fossil fuel consumption in the reference scenario and the consumption obtained by increasing it by an amount equal to the share of biofuels in the total gasoline and diesel consumption, for each estimation year.

The effects of this measure, considering its implementation since 2006, are projected to result in a reduction of 3.1 MtCO₂eq by 2022 and 5.1 MtCO₂eq by 2030, respectively. If we consider only the Ministerial Decree of December 30, 2020, regarding biofuels (amending the decree of October 10, 2014) of updating the conditions, criteria, and implementation methods for the obligation to introduce biofuels into consumption, including advanced biofuels, the estimated effect by 2030 is reduced to 2.4 MtCO₂eq.

Sustainable mobility in urban areas (implemented)

This measure aims to promote sustainable mobility in urban areas through the Urban Plans for Sustainable Mobility (SUMP), the Incentive Programme for Sustainable Urban Mobility (PrIMUS), and the National Strategic Plan for Sustainable Mobility (PSNMS). The effects of this measure cannot be evaluated, because of the lack of sufficiently robust data and because they overlap in part with those related to the NRRP.

LNG for freight (implemented)

Development of LNG in maritime transport, port services, and road freight aims to reduce oil dependence and mitigate the environmental impact of transport. Infrastructure enhancement for the supply of LNG to be used directly in liquid form for both heavy road and maritime transport.

Legislative Decree No. 257 of December 16, 2016, implementing the "DAFI" Directive, regulates the implementation of Directive 2014/94/EU of the European Parliament and Council, dated October 22, 2014, regarding the establishment of an infrastructure for alternative fuels. Article 6 mandates that, by December 31, 2025, a sufficient number of LNG refueling points for vessels engaged in inland navigation or maritime navigation powered by LNG must be established in maritime ports, and by December 31, 2030, in inland navigation ports along the core TEN-T network. This article also stipulates that, by December 31, 2025, a sufficient number of LNG refueling points, potentially combined with compressed natural gas (CNG) refueling points, must be publicly accessible at least along the Italian routes of the core TEN-T network to ensure the circulation of heavy vehicles powered by LNG, taking into account current demand and its short-term development.

The evaluation of this measure was carried out at a model-based level, through the calculation of a scenario that simulates the development and spread of LNG in maritime transport, port services, and road freight transport. The saved emissions were obtained by calculating the difference, running the model with and without the implementation of this scenario. Due to limited availability of activity data, the impact of this measure has not been estimated for 2022, but it is expected to be 0.3 Mt CO₂ eq in 2030.

Demand shift (planned update)

Further measures on mobility demand shift according to the national energy and climate plan aim to reduce transport sector consumption and emissions through a modal shift to public transport (TPL) and a reduction in private mobility needs. Regarding passenger modal shift, an additional 3% reduction in the demand for car and motorcycle trips, in favor of rail transport and public road transport is expected. This shift is supported by policies promoting public transport (buses, subways, and trains) and restrictions on private mobility (cars) in cities. In particular, an additional 2.5% reduction in car and motorcycle trips due to the spread of smart working and the promotion of cycling and walking mobility is expected. The overall impact of

this measure is estimated to be 3.8 Mt CO₂eq in 2030. A uniform methodology has been adopted for estimating emission savings for this and the following planned measures in the transport sector. At the model level, a representative scenario was created for each measure or group of measures, and the emission reductions were assumed equal to the difference of the model result, running the model with and without the implementation of each scenario, and evaluating them individually, one at a time.

FS group industrial plan (planned)

In the 2022-2031 Industrial Plan of the Ferrovie dello Stato Italiane Group, the goal is set to double the share of rail freight traffic compared to 2019, in line with the targets of the UN 2030 Agenda. This involves increasing the current 11% share of freight that travels by rail (compared to the majority still traveling by road) to 30%, as required by Europe. This share must grow rapidly, as it is currently below the European average (19-20%), much lower than in Switzerland and Austria (around 35%), and even more so compared to the United States (46%).

The Industrial Plan 2022-2031 of Ferrovie dello Stato Italiane (FS Group) aims to achieve a 30% modal share of rail freight by 2030. The impact of this measure is expected to be 4.6 Mt CO₂eq in 2030.

Regulation (EU) 2023/851 and Regulation (EU) 2024/1610 (planned)

The measure concerns the implementation of regulations (EU) 2023/851 and (EU) 2024/1610 regarding the strengthening of CO₂ emission performance standards, respectively for new passenger cars and light commercial vehicles, and for heavy-duty vehicles.

Il Regulation (EU) 2023/851 establishes that from January 1, 2030, the following targets will apply to the entire vehicle fleet in the EU:

- a) For the average emissions of the new passenger car fleet, a target for the entire EU fleet of a 55% reduction (instead of 37.5%) compared to the 2021 target;
- b) For the average emissions of the new light commercial vehicle fleet, a target for the entire EU fleet of a 50% reduction (instead of 31%) compared to the 2021 target.

In addition, in line with the Union's increased climate ambition, a 100% emission reduction target is set for both cars and vans from 2035 onwards.

The Regulation (EU) 2024/1610 maintains the current target for 2025, which fixes a 15% reduction in emissions for heavy-duty trucks over 16 tons and sets new targets starting from 2030: a 45% emissions reduction starting in 2030 (increased from the previous 30%), 65% starting in 2035, and 90% starting in 2040.

These targets will apply to medium-duty trucks, heavy-duty trucks over 7.5 tons, and buses, as well as corresponding professional vehicles starting in 2035. Vehicles produced by small

companies and those used in mining, forestry, agriculture, and by the armed forces, police, fire services, civil protection, and medical assistance will be exempt from these obligations.

Regarding urban buses, the new rules introduce a target for zero emissions by 2035, with an intermediate target of 90% by 2030. Intercity buses will be exempt from this target, as they will be considered as coaches for the purpose of measuring emissions reduction.

Moreover, by 2027 the Commission will review the effectiveness and impact of the Regulation and consider the possibility of developing a common methodology for assessing and reporting the full lifecycle CO₂ emissions of new heavy-duty vehicles. The estimated impact of this measure is 3 Mt CO₂eq in 2030.

EV share increase (planned)

The development of electric mobility for passengers, as outlined in the National Energy and Climate Plan, aims to achieve a total of approximately 6.6 million electrified cars in circulation by 2030. The estimated impact of this measure is 3.7 Mt CO₂eq in 2030.

Biofuels for road transportation (planned update)

The implementation of the Renewable Energy Directive Recast (RED II) includes specific obligations on biofuels and other renewable sources, along with the implementation of RED III. The measure aims to promote energy from renewable sources to achieve further energy diversification and decarbonization of the transport sector. The estimated impact of this measure is 4.6 Mt CO₂eq in 2030

Hydrogen for transport (planned)

Support the penetration of hydrogen in the transport sector through incentives and regulatory requirements, with the objective of decarbonizing road and rail transport (NRRP e REPowerEU). The estimated impact of this measure is 2.1 Mt CO₂eq in 2030

3.4.3 Policies in the Industrial Process and product use sector

Regulation (EU) 2024/573 (adopted)

Within F-gases, in 2022 HFC emissions represent 2.4% of total greenhouse gases in CO₂eq, with an increase of 192% from 1990, when accounted for 0.4 Mt CO₂eq: in 2022 HFC emissions account for 9.1 Mt CO₂eq, passing from a peak of 13.6 Mt CO₂eq in 2013. The significant increase in HFC emissions since the 1990s has been driven by the growing of the use of substances replacing ODS (Ozone Depleting Substances) in the refrigeration, air conditioning (both stationary and mobile), fire extinguishers, foam and aerosol sectors.

These sectors used chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs) but the adoption of the Montreal Protocol in 1989 has progressively phased down and phased out the ODS, replaced by hydrofluorocarbons (HFCs) which, although not harmful to the ozone layer, have a high global warming potential (GWP). The increase in the production and consumption of HFCs has simultaneously led to an increase in emissions of these gases. To slow down the progressive substitution of ODS with high GWP substances, the Kigali Amendment to the Montreal Protocol, approved in 2017, led to the adoption of measures requiring the progressive reduction of production and consumption of HFCs. The European Union has been in line with the Kigali Amendment's objectives from the very beginning, having already adopted a severe HFC reduction policy in previous years, first with Regulation (EC) 842/2006, then with Regulation (EU) 517/2014 (F-gas regulation), which, among other significant measures, has imposed the phase-down of the quantity of HFCs in tons of CO₂ equivalent, placed on the market starting from 2015 to reach a reduction of 79% by 2030.

Italy immediately took action to reduce HFCs, in line with the objectives of the Kigali amendment, adopting in 2014 EU Regulation 517/2014 on fluorinated greenhouse gases, implemented with Presidential Decree no. 146, of 16 November 2018. Furthermore, with Legislative Decree no. 199 of 8 November 2021, which implements EU Directive 11/12/2018, no. 2001 (known as RED II), important provisions are dictated on energy from renewable sources, and the tools, mechanisms, incentives and institutional, financial and legal framework necessary to achieve the objectives of increasing the share of energy from renewable sources by 2030 are defined.

But the turning point, in terms of policies and measures, came on the 20th of February 2024, with the adoption of the new Regulation (EU) 2024/573 on fluorinated greenhouse gases, amending Directive (EU) 2019/1937 and replacing the Regulation (EU) 517/2014. The new F-gas Regulation (EU) 2024/573 entered into force on 11 March 2024. The new quota system generates a steeper reduction in the amounts that importers and producers may place on the EU market, encouraging the use of natural refrigerant gases with a low climate impact and in 2050, HFCs will be phased out. Among the new provisions are new limits on placing on the market for equipment containing HFCs with GWP equal to or greater than specific values, more stringent rules for the management, use, recovery and destruction of fluorinated greenhouse gases, new and more stringent requirements for the certification of people and companies carrying out installation, maintenance and repair of equipment containing HFCs, and rules on reporting and data collection on emissions. The new F-gas Regulation also provides that medical aerosols are counted within the HFC quota system.

Another policy that influences refrigerants consumption and consequently has impact on HFC emissions projections is the Conto Termico 2024, improving energy efficiency from renewable sources. Specifically, the Conto Termico 2024 provides incentives to promote the use of latest-generation technologies for small systems and is aimed at Public Administrations, businesses and private individuals, in order to allow the redevelopment of buildings with a significant reduction in energy consumption.

Finally, to effectively monitor, with consistent and quality data, emissions of fluorinated greenhouse gases and to verify the progress made in achieving the emission reduction targets, the F-gases Registry is operational, which collects and stores information on the sales of fluorinated gases (and certain equipment containing them) and on the installation, maintenance, repair and dismantling of equipment.

3.4.4 Policies in the Waste sector

Separate collection and circular economy (implemented)

In the waste sector, emissions are mainly linked to the quantity of waste produced, the share of biodegradable substances sent to landfill and the percentages of biogas recovery from biological treatments. A significant reduction in emissions should be achieved with the progressive implementation of already approved waste management objectives and plans. In fact, national legislation provides for a separate waste collection target of 60% by 2030, which is the main driver of waste management policies in Italy. Thanks to this objective (still not achieved uniformly at national level) it has been possible to obtain high percentages of urban waste recycling perfectly in line with the community recycling objective of 50% by 2020. It should be remembered that Italy has historically been at the top of the list in Europe for the percentages of recovery achieved by specific production chains, such as paper, various metals and glass.

The measure mainly responsible for the trend of separate waste collection and the reduction of organic waste in landfill is the Landfill European Directive (EC, 1999) which has been transposed into a national decree only in 2003 by the Legislative Decree 13 January 2003 n. 36 and applied to the Italian landfills since July 2005. More detailed information is available in paragraph 3.6.

The effect of this measure is estimated in 3.4 Mt CO₂eq in 2022, and it is expected to be 4.3 in 2030.

3.4.5 Policies in Agriculture sector

Policies that affect emissions from the agriculture sector, and particularly the livestock sector, include the Industrial Emissions Directive (IED), the Po River Basin Agreement and air quality plans, the Common Agricultural Policy (CAP) and rural development programs (RDPs), the Nitrates Directive, incentives for biogas and biomethane production, the Emission Ceilings Directive (NEC).

It was not possible due to lack of information to provide an assessment on a policy and measure-by-policy basis; therefore, an overall assessment was conducted for ammonia emission reduction measures, which also have an impact on GHG emissions. In addition, assessments were made of the change in emissions due to biogas production, which also includes biomethane production, based on both implemented and planned measures.

In the following, the policies mentioned are described, including the emission reduction measures and an assessment of the impact on emissions from the agriculture sector.

Industrial Emissions Directive 2010/75/EU (implemented)

The Industrial Emissions Directive (IED) 2010/75/EU, transposed by Legislative Decree 46/2014 (formerly 96/61/EC, Legislative Decree 372/1999), is a regulatory instrument that aims to avoid or minimize polluting emissions to air, water and soil, as well as waste from industrial and agricultural facilities, to achieve a high level of environmental and health protection.

Large intensive poultry or pig farms fall under the directive and are subject to integrated environmental authorization (IEA) to operate. The permit is issued to the farm by the competent authority in compliance with environmental regulations and with a commitment by the farm to adopt the Best Available Techniques (BAT). The intensive farms affected are those with more than: 40000 poultry places, 2000 production pig places over 30 kg, 750 sow places. On February 21, 2017, the BAT Conclusions (BAT-C) were published in the Official Journal of the European Community, marking the conclusion of the BAT reference document (BREF) review process on intensive livestock production. Within four years from the date of publication of BAT-C, pig and poultry farms subject to IED regulations will have to undergo the AIA permit review process and have implemented the techniques identified as BAT. The new BAT is to be implemented starting in 2021; the previous 2003 BAT was implemented by farms starting in 2007. On farms subject to AIA, the new BAT-Cs will lead to: more widespread use of reduced-protein feeding; coverage of slurry storage, where technically feasible; low-emission effluent distribution methods; while, on housings, no significant changes are expected.

The evaluation of measure IED was carried out taking into consideration the implementation of other measures (PaM2, 3 and 4) described below as well. These measures together result in the reduction of ammonia (NH₃) and GHG emissions from the agriculture sector. Regarding ammonia, these measures result in the reduction of NH₃ emissions from storage, spreading, and, to a negligible extent, also from grazing. Regarding emissions at the housing, they increase from 2007 to 2022 as the gradual replacement of fixed housing in favor of solutions that allow greater freedom of animal movement has led to increased emissions due to the increase in manure-soiled areas and bedding. In the scenarios, some penetration of feeding techniques with reduced-protein diets or multiphase feeding for pigs and poultry is expected, and some penetration of housing-related techniques due to the gradual implementation of BAT-C and the introduction of a certain percentage of adjustment also for cattle farm housings. This will also lead to a reduction in NH₃ emissions from housing in the scenarios.

In addition, NH₃ reduction measures also result in the reduction of methane (CH₄) and nitrous oxide (N₂O) emissions from the key emissive category manure management and, to a lesser extent, the key emissive category agricultural soils (which only determines N₂O emissions). This is because the NH₃ measurements of housings result in a reduction in the unit values of liquid and solid cattle and buffalo manure production with which CH₄ emission factors from manure management are calculated. In contrast, the increase in closed storage results in an

increase in CH₄ emission factors from pigs. Reductions in N₂O from manure management are driven by reductions in excreted nitrogen and reductions in NH₃ emissions from housing and storage overall. Reductions in N₂O from soils are mainly determined by reductions in indirect emissions, driven by reductions in NH₃ emissions from spreading.

The total reduction in greenhouse gas emissions from the agriculture sector projected for 2030 is 790 kt CO₂ eq.

Incentives for biogas (implemented)

Biogas production is incentivized through economic instrument regulated under ministerial decrees DM 18/12/2008, DM 06/07/2012, DM 23/06/2016; Law 145/2018; and the “milleproroghe” decree. Ministerial Decree DM 18/12/2008 finances the all-inclusive tariff of 280 euros/MWh for the period 2008-2012; it is an incentive for large plants, with installed electric power around 1 MW.

As of January 1, 2013, the main changes introduced by the July 6, 2012 DM (less remunerative system) included: the limitation of the electrical power that can be installed annually; the introduction of a ranking system (Registries); the payment of an all-inclusive tariff based on the size of the plant (decreasing as the size increases) and the matrices used; the lengthening of the all-inclusive tariff from 15 to 20 years; and the introduction of a series of bonuses for the valorization of thermal energy and recovery-reduction of the nitrogen content in the digestate produced by the plants. The decree incentivized mainly the small-scale plants fed by livestock manure and recovered by-products, with supplementation from dedicated crops up to 30% by weight. This new scheme may encourage the spread of anaerobic digestion (AD) even on dairy farms characterized by a not excessively large farm size. After the 2008 and 2013 decrees, DM 23/06/2016 incentivized electricity production from biogas with an all-inclusive tariff of 233 euros/MWh for electric sizes up to 300 kWe. Law 145/2018 extended the incentives for small plants, limiting them, however, to installations up to a maximum of 300 kWe that are part of the production cycle of an agricultural, livestock enterprise and whose feed is derived for at least 80% from manure and materials derived from the implementing farms and only the remaining 20% from their second-harvest crops. The “milleproroghe” decree, converted into Law No. 21 of February 26, 2021, extended the incentives of Law 145/2018 for 2021. The incentive period for electric biogas, reserved for farms “including consortia,” was extended in subsequent Milleproroghe Decrees 2020 and 2021 through the year 2022 with the same tariff.

The production of biogas impacts emissions from the agricultural sector because the manure used for production must be started fresh at anaerobic digestion plants, and thus the atmospheric emissions of methane and nitrous oxide that would be generated in traditional storage, in AD they are eliminated. The biogas produced by the decomposition of manure, consisting of methane and carbon dioxide, does not end up in the atmosphere but is either piped into energy production systems or, after a transformation into biomethane, fed into the grid. Therefore, increasing the amount of manure initiated to anaerobic digestion reduces

emissions from the agriculture sector, and in particular from the key emissive category manure management both CH₄ and N₂O.

N₂O emissions from soils will increase because NH₃ emissions will increase, due to increased nitrogen to soils driven by lower NH₃ emissions from storage.

A reduction in emissions was calculated considering the application of only the measure related to biogas production (as total production of biogas and biomethane), assuming that measures related to ammonia emission reduction are not implemented. In addition, a percentage of the use of livestock manure sent to anaerobic digestion (equal to 51% for cattle, 7% for pigs, and 43% for poultry) has been assumed, which will contribute, together with other agricultural and agro-industrial substrates, to the production of about 5.8 billion cubic meters of biogas by 2030. This production is in line with the funding of the NRRP, which plans to support the production of 2.3 billion cubic meters of biomethane by June 2026. Given the delay in reaching this target, it has been assumed to shift this production to 2030. In addition to NRRP funding, minor support was also assumed for biogas production for the electricity system. The effect in terms of total GHG emission reduction in the agriculture sector is projected to be 1.226 Mt CO₂ eq in 2030 and 0.324 Mt CO₂ eq for 2022. As shown in table 3.3 this measure has a remarkable effect in the energy and transport sectors where biogas is used.

Table 3.3: effects of the measure in the Energy, Transport and Agriculture sectors

	2022	2030
Effect of the measure in the Agriculture sector (MtCO₂eq)	0.3	1.2
% livestock manure sent to anaerobic digestion	16%	38%
Biogas production - bm³ biogas from agricultural matrices	3.9	5.8
CO₂ “avoided” in energy and transport sectors using biogas (MtCO₂eq)	4.3	6.4

Source: ISPRA

Po valley Agreement and Regional air quality plans (implemented)

The regulatory instrument, consisting of the Po River Basin Agreement for Air Quality Improvement and the Regional Air Quality Plans (PAIR), contains also measures to reduce emissions from the agricultural sector.

Signed in December 2013, then renewed in June 2017, it is a program agreement for the coordinated and joint adoption of measures to improve air quality in the Po River Basin. It provided for emission reduction measures to be implemented in the agricultural sector as well. In this regard, the Ministry of Agriculture developed the “Guidelines for the reduction of atmospheric emissions from agricultural and livestock activities” in 2016. These include measures to contain ammonia emissions from livestock housing and storage of cattle, pig and poultry manure and during the distribution of manure, as well as upstream measures to reduce nitrogen excretion, such as reducing the crude protein content in feed rations.

Regions have committed to supplementing their air quality plans with measures to implement the Guidelines. These measures involve the reduction of NH₃ and N₂O emissions.

Emilia-Romagna's PAIR 2020 includes measures on feeding, housing, storage, spreading, funded by the regional Agriculture Department through the 2014-2020 Rural Development Program. For the purpose of air quality protection, from January 1, 2020, farms are obliged to adopt the following measures: covering of manure storage ponds or construction of ponds with a surface area/volume ratio less than or equal to 0.2 m²/m³, if technically feasible and economically sustainable; distribution of livestock manure with low-emission methodologies; in new farms it is forbidden to store slurry in lagoons, in accordance with the provisions of Regional Regulation No. 1 of October 28, 2011, with reference to the types of effluent storage.

Lombardy's PAIR 2018 outlines that the full implementation of the Basin Agreement will result in the following:

- livestock Housing: Medium-effectiveness measures will be applied to 80% of livestock facilities;
- effluent Storage: Measures with four levels of increasing effectiveness will be implemented for effluent storage, including techniques such as below-ground slurry loading, natural crust formation, permeable floating covers, and impermeable covers. The first-level techniques will be applied to 100% of storage facilities, second-level techniques will be implemented at all cattle farms, and the highest-level techniques will be applied to at least 20% of storage;
- Agronomic Distribution of Effluent: The PAIR sets a 2020 target for agronomic practices that includes the use of underground or surface injection and fertigation techniques for at least 20% of effluent volumes, and immediate or same-day burial (within a maximum of 4 hours) for 60% of effluent. The remaining 20% will involve distribution techniques where immediate burial is not feasible (such as on permanent grasslands and standing crops), which must utilize systems that facilitate either absorption or banded ground distribution.

The evaluation of the measure is included in the evaluation of the Industrial Emissions Directive 2010/75/EU measure.

Rural development programs (RDPs) and common agricultural policy (CAP) (implemented)

Rural development programs (RDPs) and the common agricultural policy (CAP) are economic tools for also incentivizing interventions to reduce ammonia and greenhouse gas emissions from the agricultural sector.

The 2014-2020 RDPs, financed by the CAP and co-financed by national budgets, were drawn up by Italian regions and approved by the European Commission. Structural (Measure 4 - Investments) and operational (Measure 10 - Agro-climatic-environmental commitments) interventions are encouraged. The former finance investments aimed at reducing ammonia and greenhouse gas emissions with interventions on housings, storage and effluent treatment and distribution equipment. The latter give per-hectare subsidies conditional on the use of low-emission effluent distribution techniques. RDPs and the CAP are also used to finance optional measures under the various emission reduction policies.

A more complete picture comes with the RDP of the Piedmont region. For Measure 4, the interventions for which there has been the greatest demand for funding, both in terms of numbers and investment, are those related to slurry burial machines (54% of investments). From the point of view of farm types, the large prevalence of applications is for dairy cattle farms (43% of investments), followed by pig farms (26%) and beef cattle farms (10%). For Measure 10, which provides per-hectare subsidies for the use of low-emission means of effluent distribution, most areas committed by the region involved the use of means for immediate closed furrow burial on arable land (96% of areas). The evaluation of the measure is included in the Industrial Emissions Directive 2010/75/EU measure.

Nitrates Directive 91/676/UE (implemented)

The Nitrates Directive (91/676/EEC, transposed by Legislative Decree No. 152 of May 11, 1999, subsequently repealed and replaced by Legislative Decree No. 152 of April 3, 2006) is a regulatory instrument aimed at preventing water pollution from nitrates from agricultural sources. This can also have a spillover effect in relation to atmospheric emissions, with reductions in ammonia and nitrous oxide emissions.

The directive provides for the designation of Nitrate Vulnerable Zones of agricultural origin (NVZs) and the preparation and implementation of specific regional Nitrate Action Programs (NAPs) that, also referring to the provisions of Codes of Good Agricultural Practice, establish the modalities for the agronomic use of livestock manure in NVZs. Established maximum limit of 170 kg/ha/year of nitrogen from livestock manure in NVZs and 340 kgN/ha in ordinary areas.

Additionally, the Nitrates Directive has implications for atmospheric emissions. By focusing on reducing nitrogen compounds in water, it indirectly decreases nitrous oxide emissions. Furthermore, by promoting measures that enhance nitrogen efficiency in the application of livestock manure, it contributes to lowering both ammonia emissions and direct nitrous oxide emissions.

In addition, the Nitrates Directive affects all livestock categories (excluding small livestock) and therefore also involves cattle, which are not affected by the IED Directive, however. Pursuant to Article 112 of Legislative Decree No. 152 of April 3, 2006, a decree was issued April 7, 2006, setting forth general criteria and technical standards for the regional regulation of the agronomic use of livestock manure. Subsequently repealed and replaced by Ministerial Decree February 25, 2016 (DM 5046) on general criteria and technical standards for the regional regulation of the agronomic utilization of livestock manure and wastewater, as well as for the production and agronomic utilization of digestate. It establishes the criteria and parameters to be followed by the regions when drawing up NAPs. The NAPs establish spatial and temporal prohibitions, methods and techniques, maximum doses and inputs in the agronomic distribution of livestock manure, as well as criteria for the sizing and characteristics of effluent storage containers. The most recent action programs also regulate the agronomic use of digestate from biogas plants. The provisions that have the greatest effect on atmospheric emissions are those relating to the agronomic use of livestock manure and storage containers.

In the NAPs of most regions and, in particular, in the Po Valley regions, NVZs and OZs, the use of low-pressure slurry distribution media is required and the incorporation of effluent within 24 hours of spreading is required (excluding land with a crop in place or newly sown), and newly constructed slurry storage containers are required to have a cover or be made with a low surface area/volume ratio. In the Emilia-Romagna NAP contained within Regional Council Regulation No. 3 of Dec. 15, 2017, there are provisions on effluent distribution methods, minimum livestock nitrogen efficiency, and the characteristics of new slurry storage containers. The NAPs of the other Po Valley regions, which were updated following the issuance of the national measure on the agronomic use of livestock manure, Ministerial Decree 5046 of February 25, 2016, include entirely similar provisions. Reference is made to the provisions: Lombardy DGR X/5171 of May 16, 2016 and its Annex A (NAP for NVZs for the four-year period 2016-2019); Veneto DGR No. 1835 of November 25, 2016 (Third NAP); Piedmont Regional Regulation 10/R/2007, supplemented by Regional Regulation No. 2/R of March 2, 2016.

The measures already required by the NAPs with repercussions on emissions are the distribution of effluent with incorporation within 24 hours or with techniques that result in even greater emission reductions and the requirement for new slurry storage containers to have a cover or have construction characteristics (low surface area/volume ratio) that allow a reduction in ammonia emissions of at least 30%. The evaluation of the measure is included in the Industrial Emissions Directive 2010/75/EU measure.

National emission ceilings directive (NEC) n. 2016/2284/UE (implemented)

The Emission Ceilings Directive 2016/2284/EU implemented by Legislative Decree 81/2018 (national emission ceilings – NEC) is a regulatory instrument that sets national emission ceilings for acidifying, eutrophying, and ozone precursor compounds (including ammonia and PM10) from 2020 to 2029 and then from 2030, to improve the protection of the environment and human health against the harmful effects of these pollutants. It also determines reductions in N₂O. Member States shall adopt National Air Pollution Control Programs that shall contribute to the effective implementation of air quality plans. The program includes the national indicative code of good agricultural practices for controlling ammonia emissions. There are six mandatory measures in the program for agriculture related to spreading and storage. The national program was adopted in 2021, but at the moment there is still not enough data and information to develop an evaluation of this measure for 2022 and 2030.

Incentives for biomethane (implemented)

Interministerial Decree 02/03/2018 promotes the use of biomethane and other advanced biofuels in the transport sector (for the production matrices of advanced biomethane, refer to Annex 3 of Ministerial Decree 10/10/2014). To support the development of advanced biomethane, the Decree March 2, 2018, introduced the so-called “Dedicated Withdrawal,” or the withdrawal and payment of equivalent certificates of release for consumption (CICs), directly from the Gestore dei Servizi Energetici (GSE) for the first 10 years. However, the plant's

feed-in plan may also include the presence of other “organic matter” (in other words, first-crop crops), but up to a maximum of 30% by weight; in this case, the biomethane recognized as “advanced” may not exceed 70% of the total production released for consumption. It is a measure implemented from 2018 and has impacts on methane and nitrous oxide emissions. The evaluation of the measure is included in the Incentives for biogas measure.

Incentives for biomethane (update planned)

This measure refers to incentives that will need to be planned for biomethane production, which were considered in the WAM (scenario with additional measures) scenario to 2030 for the agriculture sector. In order to produce greater quantities of biomethane, it was assumed that more livestock manure will need to be sent to anaerobic digestion, which will result in reduced methane and nitrous oxide emissions. The overall percentage of livestock manure that will be used for biogas production will be 57% in 2030 and 64% in 2050, while in the reference scenario these percentages were 38% and 46% in the years 2030 and 2050, respectively. The total reduction in greenhouse gas emissions from the agriculture sector projected for 2030 is 967 kt CO₂ eq, which is 3% less than in the WEM scenario. As shown in table 3.4 this measure has a remarkable effect in the energy and transport sectors where biogas is used.

Table 3.4: additional effects of the measure in the Energy, Transport and Agriculture sectors

	2030
Effect of the measure in the Agriculture sector (MtCO₂eq)	1
% livestock manure sent to anaerobic digestion	57%
Biogas production - bm³ biogas from agricultural matrices	9.6
CO₂ “avoided” in energy and transport sectors using biogas (MtCO₂eq)	10.7

Source: ISPRA

3.4.6 Policies in the LULUCF sector

Soil carbon sequestration (implemented)

The policy affecting the LULUCF net removals is embedded under the European Common Agricultural Policy (CAP) and related rural development programs (RDPs), an economic tool for incentivizing interventions to enhance the soil carbon sequestration in mineral soils. The estimation method is based on changes in Soil Organic Content (SOC) stocks over a finite period following changes in management that impact soil organic C. According to the 2006 IPCC Guidelines⁴⁵, the change in mineral SOC stocks (vol. 4, chapter 2, eq. 2.25) is the result of a change in management practices in a unit of land across time. The SOC stock changes have been estimated considering cropland (annual crops and perennial crops) and grassland (grazing land) categories, based on management practices under the EU CAP. The list of the management practices considered, their definitions, the underlying CAP Regulations, are included in the following table 3.5.

⁴⁵ <https://www.ipcc-nggip.iges.or.jp/public/2006gl/>

Table 3.5: Management practices under cropland and grassland categories of the LULUCF sector

LULUCF category	Management practices	Definition	CAP regulations
Cropland - annual crops	Arable land (Ordinary)	A kind of agriculture that does not evidence any kind of soil carbon stock technical maintenance	
	Organic arable land	Management of waste crop; Organic manure; Extended crop rotation; Selection of better crop varieties; Cover crops	Reg. (EEC) n. 2078/92, Reg. (EC) n. 834/2007 and Reg. (EC) n. 889/2008, RDPs 2000-2006: Reg. (EC) n. 1257/99, RDPs 2007-2013: Reg. (EC) n. 1698/2005 and Reg. (EC) n. 74/2009
	Sustainable arable land	Crop rotation; Grassing; Specific erosion prevention; Cover crops; Minimum tillage	National decree on sustainable agriculture n. 2722/2008; RDPs 2000-2006: Reg. (EC) n. 1257/99; RDPs 2007-2013: Reg. (EC) n. 1698/2005 and Reg. (EC) n. 74/2009
	Set aside	Natural grassing; At least one mowing	Reg. (EEC) N. 1765/1992; National decree on cross compliance implementation n. 30125/2009 and subsequent revisions
	Conservative practices	Zero tillage; Organic manure; Grassing; Cover crops; Minimum tillage; Crop rotation	RDPs 2007-2013: Reg. (EC) n. 1698/2005 and Reg. (EC) n. 74/2009
Cropland - perennial crops	Woody crops (Ordinary)	A kind of agriculture that does not evidence any kind of soil carbon stock technical maintenance	
	Organic woody crops	Management of waste crop; Organic manure; Extended crop rotation; Selection of better crop varieties; Cover crops	Reg. (EEC) n. 2078/92, Reg. (EC) n. 834/2007 and Reg. (EC) n. 889/2008, RDPs 2000-2006: Reg. (EC) n. 1257/99, RDPs 2007-2013: Reg. (EC) n. 1698/2005 and Reg. (EC) n. 74/2009
	Sustainable management	Crop rotation; Grassing; Specific erosion prevention; Cover crops; Minimum tillage	National decree on sustainable agriculture n. 2722/2008; RDPs 2000-2006: Reg. (EC) n. 1257/99; RDPs 2007-2013: Reg. (EC) n. 1698/2005 and Reg. (EC) n. 74/2009
Grassland - grazing land	Managed grazing land (ordinary)	Renewal and/or thickening of crops; connection to zootechnics	National decree on cross compliance implementation n. 30125/2009 and subsequent revisions
Grassland - grazing land	Organic grazing land	Renewal and/or thickening of crops; connection to zootechnics	RDPs 2000-2006: Reg. (EC) n. 1257/1999; RDPs 2007 - 2013: Reg. (EC) n. 1998/2005 and Reg. (EC) n. 74/2009; Reg. (EC) n. 834/2007 and Reg. (EC) n. 889/2008; Reg. (EC) n. 1804/2007

Source: ISPRA

The annual areas subject to the abovementioned management practices, at regional level, have been estimated considering the transition to and from different management practices (i.e., managed grazing land to organic grazing land and vice versa). Land management changes have been estimated since 1971. Changes in organic carbon stocks in mineral soils have been calculated by applying formulation B of equation 2.25 (IPCC 2006; vol. 4, chapter 2). The IPCC default transition period (i.e., 20 years) has been considered.

The SOC_{ref} classification of the soils is based on the default reference SOC stocks for mineral soils (tC/ha in 0-30 cm) provided in Table 2.3 of the 2019 IPCC Refinement⁴⁶. The identification of country specific SOC_{ref} have been performed, as well as the selection of stock change factors (F_{LU}, F_{MG}, F_I), appropriate for the national circumstances (a detailed description of methodology, including stock change factors SOC_s stocks is included in the National Inventory Document, section 6.3.4 and 6.4.4).

The CO₂ removals due to the abovementioned soil carbon sequestration policy is equal to -3.2MtCO₂ in 2030.

⁴⁶ <https://www.ipcc-nggip.iges.or.jp/public/2019rf/index.html>

3.5 Summary of greenhouse gas emissions and removals

Italy submitted the national inventory document, as a stand-alone document, including the Common Reporting Tables (CRTs) for the years 1990-2022, which complete the 2024 Italian national inventory report.

In section 2.4 a summary of its GHG emissions and removals is reported, with a description of GHG emissions trends by gas and by source.

Total greenhouse gas emissions, in CO₂ equivalent, excluding emissions and removals from LULUCF, have decreased by 19.9% between 1990 and 2022, varying from 522 to 413 CO₂ equivalent million tons (Mt).

The most important greenhouse gases for 2022 are: CO₂ accounting for 82.7% of total emissions in CO₂ equivalent, CH₄ (11.1%), N₂O (3.8%). As for other greenhouse gases, HFCs account for 2.2% of total emissions, PFCs and SF₆ are both equal to about 0.1% of total emissions; the weight of NF₃ is less than 0.01%.

In 2022, the largest share of the GHG emissions is to be attributed to the energy sector (81.8%), followed by agriculture and industrial process and product use (7.4% and 5.7%, respectively), and waste sector (4.9%). Including the absolute value of net LULUCF emissions/removals, the percentage contribution of the sectors is: 77.9% for energy, 7.1% for agriculture, 5.4% for industrial process and product use, 4.9% for LULUCF and 4.6% for waste.

3.6 Projections of greenhouse gas emissions and removals

3.6.1 Introduction

In the most recent years, actions taken by Italy to mitigate climate change have been driven by the commitments taken under the Kyoto Protocol and its amendment (Doha amendment), the European Climate and Energy Package (for the period 2013-2020), the EU NDC, and the European 2030 Climate and Energy Framework and Clean energy for all Europeans package for the period 2021-2030.

Pursuant to Regulation (EU) 2018/1999 of the European Parliament and of the Council on the Governance of the Energy Union and Climate Action, in 2020 Italy submitted the first integrated national energy and climate plan (NECP) to the European Commission, and in July 2024 submitted a fully update version with new underlying assumptions. The updated plan is the result of a joint effort of the central government coordinated by the Minister of Environment and Energy Security (MASE) and it is largely based on data and information provided by ISPRA, GSE and RSE. The plan was finalized in June 2024, but the analytical process has started in March 2023.

As reported in BR 4 and NC VIII, Italy adopted new policies and measure in 2020 and 2021 to face the effects of COVID-19 pandemic. The “National Recovery and Resilience Plan” (NRRP) was adopted in July 2021 and includes several measures to tackle climate change and to pursue sustainable economic growth towards an inclusive, climate resilient and net-zero emissions future.

The Plan envisages investments and a consistent reform package, with €191.5 billion in resources being allocated through the Recovery and Resilience Facility and €30.6 billion being funded through the Complementary Fund. The NRRP has been developed around three strategic axes shared at EU level: digitalization and innovation, ecological transition, and social inclusion. It aims at repairing the economic and social damage caused by the pandemic crisis, contributing to addressing the structural weaknesses of the Italian economy, and leading the country along a path of ecological, environmental and just transition.

The NRRP policies and measures have been included in the NECP and considered in the definition of WM scenario described in this Chapter as well as all the PaMs implemented or adopted up to the end of 2022.

In July 2024, pursuant article 17 of the Regulation (EU) 2018/1999, ISPRA calculated new GHG emission projection and submitted them to the European Commission using updated historic data and macroeconomic and demographic drivers. The present BTR is based on the updated NECP and emission projections.

The base year for the projections is 2022, the projected years are from 2025 to 2040 with 5-year pace. The “With Measures” (WM) scenario considers the policies and measures implemented before December 31st, 2022, unless otherwise specified.

The “With Additional Measures” (WAM) scenario, calculated with the same methodology as the WM scenario, considers all the Policies and Measures included in the NECP that were not yet implemented before 2022.

A “Without Measures” (WOM) scenario has not been calculated, since many structural changes occurred in the period 2000-2007, linked to economic and technological changes as well as to fuel shifts, it is not possible to determine how the Italian system would have evolved without measures which also influenced those changes. In this regard, fuel shifts toward low carbon fuels for electricity generation (since 1990 there has been a steady increase of natural gas share and a corresponding decrease of oil products share) as well as the introduction of combined cycle plants, since 2000, are among the most important factors that make it impossible to evaluate how the national emissions would have evolved without any measure.

The scenarios for energy and transport sectors have been calculated with the partial equilibrium model TIMES (The Integrated MARKAL-EFOM1 System / EFOM Energy Flow Optimization Model), a model generator for local, national or multi regional economies finalized to the analysis of whole energy systems (electricity generation and consumption, heat distribution, transports, industries, civil, etc.). The model belongs to the family of MARKAL (Market Allocation, <http://www.iea-etsap.org/web/Markal.asp>) models, the so-called “3e models” (energy, economy, environment), and was developed by the International Energy Agency (IEA) under the program Energy Technology Systems Analysis Program (ETSAP). This model is recognized by the International Panel on Climate Change (IPCC).

The energy system thus simulated is composed by several different sectors and subsectors (e.g., electricity production, industrial activities, residential buildings, etc.), each one consisting of a set of technologies connected by input-output linear relationships. Inputs and outputs can be energy carriers, materials, emissions, or requests for services. TIMES is a bottom-up, demand-driven model in which each technology is identified by technical and economic parameters and the production of a good is conditioned to the effective demand by end-users.

The structure of energy scenarios is defined by variables and equations determined by input data constituting the regional database. The database contains qualitative and quantitative data describing the interaction between different components of the energy system.

TIMES identifies the optimal solution to provide energy services at the lowest cost, producing simultaneously investments in new technologies or using more intensively the available technologies in each region defined by the user. For example, an increase in electricity demand for residential use can be satisfied with a more intensive use of available power plants or through the installation of new power plants. Model choices are based on the analysis of technological characteristics of available alternatives, the cost of energy supply and environmental criteria and bounds.

CO₂, CH₄ and N₂O emissions are directly calculated by the model implemented by ISPRA using the IPCC “reference approach” methodology and national emission factors. The modelling approach avoids, in principle, the so called “double counting effect” for the implementation of

policies, so the model evaluates the impacts and interactions among measures as a package. The model outcomes indicate the mix of technologies and primary emission sources fulfilling the commodity demands of the reference scenario at the lowest possible cost. The emissions from non-energy sources have been calculated with a family of spreadsheet models designed and used by ISPRA. The overall GHG emissions and the share between ETS and ESR sectors are the results of the mentioned models implemented by ISPRA (Figure 3.2).

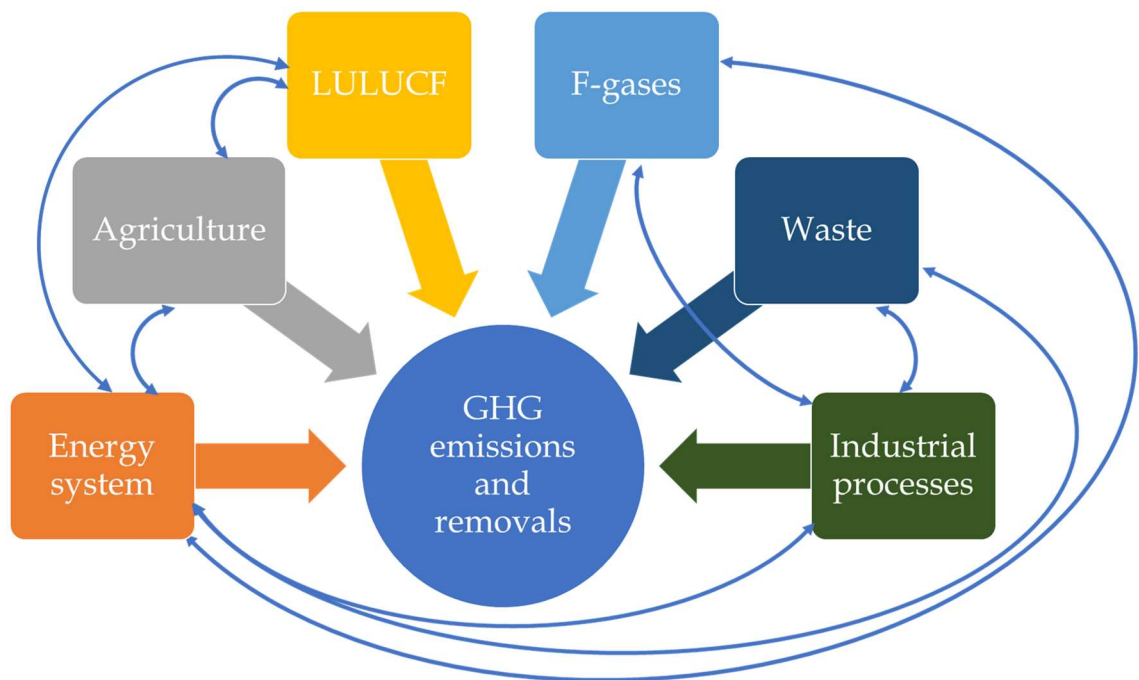


Figure 3.2 – The modelling system implemented by ISPRA for emission projections

3.6.2 Main assumptions

The expected evolution of GDP and sectoral value added, demographic trends, as well as projections of international fossil fuel prices and CO₂ emission quotas on the ETS market are of particular importance for GHG emission scenarios. The parameters used for this scenario are those provided by the EU Commission for Italy in March 2024, complemented where necessary by the details provided by the European Commission during 2021 as part of the update of the European Reference Scenario. The table 3.6 below shows assumptions for the evolution of population and GDP between 2022 and 2040: in future years, tertiary sector is expected to continue growing at higher rate than industry, further increasing its role in the Italian economy.

Table 3.6 – Main macroeconomic and demographic parameters

		2022	2025	2030	2035	2040	
GDP	mIn €2015	1,772,395	1,817,198	1,886,931	1,942,484	2,053,348	
	Average annual rate (%)	-	0.84%	0.76%	0.58%	1.12%	
Population	Millions	59.044	58.925	58.878	58.842	58.812	
	Millions of households	25.310	25.294	25.330	25.346	25.376	
Sectoral GVA	Agriculture	mIn €2015	30,555	34,342	35,028	34,905	34,919
		Average annual rate (%)	-	3.97%	0.40%	-0.07%	0.01%
	Construction	mIn €2015	85,183	72,533	75,448	75,612	76,532
		Average annual rate (%)	-	-5.22%	0.79%	0.04%	0.24%
	Services	mIn €2015	1,190,272	1,231,791	1,282,926	1,328,195	1,416,760
		Average annual rate (%)	-	1.15%	0.82%	0.70%	1.30%
	Industry	mIn €2015	256,865	264,613	271,692	276,374	286,326
		Average annual rate (%)	-	1.00%	0.53%	0.34%	0.71%

Source: EU commission, ISTAT and further elaboration by ISPRA

Table 3.6 also shows data on population and households. Despite the significant population growth from 2005 to 2015, with an annual average rate of 0.49%, a decline has been observed from 2015 to 2020 with an annual rate of -0.19%. The declining trend is expected to continue all through the time series. The number of households is used to estimate the surface area to be heated and cooled in residential buildings.

Table 3.7 shows the energy and carbon ETS international prices according to the recommended projections by the European Commission.

Energy prices show a strong decrease after 2022 peaks with slightly different trends in the future years for all the commodities.

The increase in carbon price is quite significant if compared to 2020 (+210% from 2020 to 2022) and no reduction is expected in the future.

Table 3.7 – International Energy prices and carbon prices in the existing ETS1

		2020	2022	2025	2030	2035	2040
Oil	€2023/GJ	7.6	16.7	12.4	13.9	15.4	15.8
Natural gas	€2023/GJ	3.7	35.1	9.4	9.0	8.2	10.1
Coal	€2023/GJ	1.9	10.9	4.1	4.0	3.8	3.8
Carbon price ETS1	€2023/tCO ₂	29	90	95	95	100	100
Carbon price ETS2*	€2023/tCO ₂	-	-	-	55	58	58

Source: EU commission

*Only used in the WAM scenario

The WAM scenario also introduces what is known as ETS2, the new system that from 2027 will cover CO₂ emissions from combustion in road transport, buildings and the energy and manufacturing industries that are not covered by the current ETS1. For the years after 2030, in the absence of more robust assumptions, the price was assumed to grow at a similar rate to the ETS1 allowance price.

Table 3.8 –Projected GVA average annual rate (%) for industrial sectors

Industrial sector	%			
	22-25	25-30	30-35	35-40
Iron and steel	22.2%	0.4%	-0.1%	0.0%
Non ferrous metals	17.9%	0.4%	-0.1%	0.0%
Chemicals	7.2%	0.6%	0.0%	0.2%
Non metallic minerals	-1.9%	0.7%	0.0%	0.2%
Pulp, paper and printing	5.4%	0.5%	0.0%	0.1%
Food, drink and tobacco	0.9%	0.7%	0.0%	0.2%
Textiles	-4.9%	0.1%	-0.2%	-0.2%
Engineering	0.3%	0.6%	0.8%	1.4%
Other industries	-1.6%	0.5%	0.0%	0.1%

Source: elaboration by ISPRA on EU commission

For some industrial productions more detailed analyses have been made and physical production of materials have been projected in future years, as reported in table 3.9.

Table 3.9 –Projected physical production (Mt) for selected industrial sectors

	2022	2025	2030	2035	2040	2045	2050
	(Mt)						
Iron and steel	21.6	27.8	28.3	28.2	28.1	28.5	28.7
Non ferrous metals	0.9	1.3	1.3	1.3	1.3	1.3	1.3
Cement and derived products	18.8	19.9	20.5	20.6	20.9	21.9	23.2
Glass	6.5	6.3	6.6	6.6	6.6	6.9	7.1
Paper	8.7	9.2	9.4	9.5	9.5	9.8	10.2

Source: elaboration by ISPRA on EU commission

Table 3.10 shows data of transport demand for passengers, freight, domestic navigation, and air traffic. The expected activity scenario for transport shows a sharp decline in 2020 due to the mentioned lockdown. After 2020 projections show a steady growth up to 2050. The transport demand decreases up to 2020 compared to 2015 with an annual rate of -7.9% for passengers while show a weak growth of 0.24% for goods. After 2020, up to 2050, the annual growth rate is around 1.8% for passengers and goods, with a much steeper increase until 2025 because of the end of the pandemic. In the WAM scenario the modal split remains substantially unchanged up to 2020 for passengers, whereas a significant increase in railway / ship goods transport is expected in the future. From 2020 to 2030, an increase of passenger-km in railway and public transport is expected.

Table 3.10 – Transport demand for passengers and freights in WM and WAM scenarios

Scenario	Mode of transport		2015	2020	2025	2030	2035	2040	
WM	Road	billion pass-km	820.2	554.8	823.5	858.6	884.6	923.1	
	Rail	billion pass-km	59.5	27.1	68.6	79	87.4	91	
	Passenger	Domestic aviation	Number of Landing and Take-Off cycle (LTO)	280.7	151.2	361.6	409.3	455.2	506.1
		International aviation	Number of Landing and Take-Off cycle (LTO)	425.4	172.8	560.2	635.4	713	793.6
		Total (excluding aviation)	billion pass-km	879.7	581.9	892.1	937.6	972.1	1014.1
	Freight	Road	billion ton-km	135.1	148.5	172	196	211.8	223.9
		Rail	billion ton-km	20.8	20.8	25.1	27.5	29	30.5
		Domestic navigation (inland waterways and national maritime)	billion ton-km	51.2	57.4	62	64.5	66.4	68.6
		Total	billion ton-km	207.1	226.7	259.1	288	307.2	323
	WAM	Road	billion pass-km	820.2	554.8	823.5	823.3	849.3	887.8
Rail		billion pass-km	59.5	27.1	68.6	90.7	99.2	102.8	
Passenger		Domestic aviation	Number of Landing and Take-Off cycle (LTO)	280.7	151.2	361.6	409.3	455.2	506.1
		International aviation	Number of Landing and Take-Off cycle (LTO)	425.4	172.8	560.2	635.4	713	793.6
		Total (excluding aviation)	billion pass-km	879.7	581.9	892.1	914	948.5	990.6
Freight		Road	billion ton-km	135.1	148.5	172	146.4	156.6	166
		Rail	billion ton-km	20.8	20.8	25.1	77.1	84.2	88.4
		Domestic navigation (inland waterways and national maritime)	billion ton-km	51.2	57.4	62	64.5	66.4	68.6
		Total	billion ton-km	207.1	226.7	259.1	288	307.2	323

As concerns the agriculture sector, the same methodological approach was used to define the emission scenario as was used to estimate greenhouse gas emissions in the inventory⁴⁷. According to this approach, emissions are calculated by multiplying activity data (e.g., the number of livestock raised, or the amounts of fertilizer used during the year) by emission factors (expressed, for example, generally as kilograms of pollutant relative to one livestock raised or one kilogram of fertilizer used per year). For the definition of activity data, the first step was to define the projection of livestock raised from 2025 to 2040.

Scenarios of animal stocks were estimated from a model developed by ENEA⁴⁸, based on parameters such as demographic evolution, productions and food consumption of the population. Based on these parameters, indicators were constructed and through historical evolution and the use of statistical models⁴⁹, future evolutions were estimated. Specifically, meat production data were extracted from the EUROSTAT database⁵⁰, while meat consumption data were estimated from FAO production, import, export and stock data and verified with daily per capita consumption data⁵¹.

Total meat consumption declined slightly from 2010 onward, mainly related to a reduction in beef consumption and, to a lesser extent, also pork consumption, while poultry meat consumption increased slightly. For dairy cows, the ratio of cow's milk production (accounting for about 94% of total milk produced) to total milk production was assumed to be essentially stable until 2040; the ratio of annual cow's milk production for the dairy industry to population was assumed in the scenarios to be about 250 kg per capita per year, following an upward trend observed since 2016. For laying hens, a slight increase in egg consumption per capita and a substantial stability (around unity) in the ratio of egg production to consumption (according to UNA and FAO statistics) was assumed.

Ultimately, the result in the scenarios to 2040 is a decline in cattle and pig numbers and an increase in poultry, which are the most important animal categories in terms of emission impact.

The consumption of synthetic nitrogen fertilizers significantly affects greenhouse gas emissions from the agriculture sector. This parameter was estimated based on projections by the European Synthetic Fertilizer Manufacturers' Association (Fertilizers Europe)⁵², assuming

⁴⁷ Detailed information on the methods, parameters, and emission factors used for the sector estimation process can be found in the National Inventory Document (NID) 2024.

⁴⁸ ENEA, 2006. *Valutazione del potenziale di riduzione delle emissioni di ammoniaca*. Final Report. ENEA UTS- PROT, Atmospheric Pollution Unit. September 2006; D'Elia, I., Pesci, E., 2013. *Lo scenario emissivo nazionale nella negoziazione internazionale*. ENEA Technical Report, RT/2013/10/ENEA.

⁴⁹ The future evolution of the indicators was estimated using the *Exponential Smoothing with dumped trend* model with parameters estimated by maximum likelihood and the dumping parameter set equal to 0.85.

⁵⁰ <https://ec.europa.eu/eurostat/data/database>

⁵¹ <https://www.fao.org/faostat/en/#data/FBS>

⁵² <https://www.fertilizerseurope.com/wp-content/uploads/2024/01/Forecast-2023-33-Studio-web.pdf>

an overall reduction in nitrogen consumption from 2020 to 2030 of 2%⁵³. From 2030, the value of synthetic nitrogen fertilizer consumption varies depending on projections of agricultural production. For estimation of agricultural areas and productions, refer to LULUCF sector.

In Table 3.11, the assumptions adopted for synthetic fertilizers consumption and application of manure to agricultural soils are shown. An increase of 7% of the major nitrogen input to agricultural soils has been estimated in 2020 with respect to 2015 due to an 12% increase in the consumption of synthetic fertilizers (accounting for 32% of total nitrogen inputs in 2015) and an 2% increase of the application of manure to agricultural soils (accounting for 28% of total nitrogen inputs in 2015). The estimated reduction in synthetic fertilizer consumption falls, compared to 2020⁵⁴, by 2% to 2030. Agricultural areas and productions are stable overall in the scenarios.

Table 3.11 – Assumptions used for estimating GHG emission projections from synthetic fertilizers consumption and N input from application of manure

Major N input to agricultural soils (kt-nitrogen*)	2015	2020	2025	2030	2035	2040
N input from application of synthetic fertilizers	517.9	577.5	571.7	565.9	566.1	566.8
N input from application of manure	461.6	472.6	483.4	467.6	466.5	464.6
Total consumption of N fertilizers	979.4	1,050.0	1,055.1	1,033.5	1,032.7	1,031.3

*Nitrogen content in synthetic and organic fertilizers

Source: ISPRA

In Table 3.12, assumptions for the main animal categories (cattle, swine, sheep and poultry) are shown. Cattle decreases in the scenarios, while swine rise in 2025 and then fall from 2030 and poultry rise until 2035 and then fall.

Table 3.12 – Assumptions used for GHG emissions projections with respect to the number of animals

Animal category (kheads)	2015	2020	2025	2030	2035	2040
Dairy cattle	1,826	1,638	1,570	1,528	1,507	1,495
Non-dairy cattle	3,955	4,355	3,897	3,839	3,811	3,792
Swine	8,675	8,543	8,864	8,676	8,587	8,534
Sheep	7,149	7,034	6,503	6,376	6,316	6,278
Poultry	177,392	178,907	183,123	184,202	184,514	184,341

Source: ISPRA

In the scenario estimation, the spread of possible measures to reduce ammonia and GHG emissions to 2030 was assumed. The measures considered are related to interventions on animal feeding, housing type, storage (including treatment of livestock manure in anaerobic digestion plants for biogas production), and spreading of cattle, pig and poultry manure,

⁵³ The reduction in consumption, estimated by Fertilizers Europe, was actually about 18% as it was probably affected by the sharp reduction in 2022 recorded on products distributed nationwide by sellers to wholesale and/or retail establishments, farmers, etc., surveyed by ISTAT. This reduction, according to the National Fertilizer Manufacturers Association (Assofertilizzanti), is due to a postponement of fertilizer purchases, pending a reduction in prices.

⁵⁴ The years 2021 and 2022 were two anomalous years with reductions from 2020 due to higher gas prices and temporary closure of production facilities.

according to the Animal Production Research Center study carried out on behalf of ISPRA in 2018⁵⁵. The measures considered were evaluated by taking into account what is provided in the Industrial Emissions Directive, the Nitrates Directive, nitrate action programs, regional air quality plans and in the rural development programs of the Po Valley regions. These measures are also contained in the “Guidelines for the reduction of atmospheric emissions from agricultural and livestock activities,” prepared by the Ministry of Agriculture in 2016. Similar reduction measures have also been included in the national indicative code of good agricultural practices for controlling ammonia emissions, prepared by the Ministry of Agriculture as an annex to the National Air Pollution Control Program prepared under the Emission Ceilings Directive 2016/2284/EU.

For the development of the agriculture sector scenarios, the Euro-Mediterranean Center on Climate Change (CMCC) provided data on changes in average temperatures⁵⁶ and changes in yields (of corn, rice, soybeans, wheat)⁵⁷ in the climate scenario RCP4.5 of the IPCC Fifth Assessment Report for three periods (2016-2045, 2026-2055, 2036-2065), compared with 1981-2010 period for temperatures and 1985-2015 period for yields.

Based on these data, emissions from livestock manure management, which are affected by temperature variation, and emissions from agricultural production management, which depend on changes in yields, were calculated.

Regarding biogas production, assumptions have been made about the percentage of manure sent to anaerobic digestion for biogas/biomethane production. Based on CRPA's 2018 study, by 2030, 60% of cattle and poultry manure and 10% of pig manure will be started in anaerobic digestion. Given the percentages found for 2022 (which were estimated to be 21% for cattle, 3% for pigs, and 18% for poultry), a smaller increase in these percentages was assumed than assumed by CRPA. These were estimated to be 51%, 7%, and 43% for cattle, pigs, and poultry, respectively, thus increasing the overall average percentage of manure started in anaerobic digestion from 16% in 2022 to 38% in 2030. By 2030, more livestock manure is also assumed to be used compared to the total substrates used in agricultural-derived matrices sent to

⁵⁵ CRPA, 2018. *Studio per la valutazione degli effetti sulle emissioni delle trasformazioni in corso nel settore degli allevamenti*. Report. Reggio Emilia – Italy.

⁵⁶ CMCC provided average temperature variations (annual and monthly, expressed as difference in degrees Celsius) at both provincial and national levels derived from the VHRPRO_IT database (Raffa, M., Adinolfi, M., Reder, A. et al. Very High-Resolution Projections over Italy under different CMIP5 IPCC scenarios. *Sci Data* 10, 238 (2023). <https://doi.org/10.1038/s41597-023-02144-9>), with a resolution of 2 km, considering the national territory below 1000 meters.

⁵⁷ The values provided by CMCC are obtained from the average of four process models for global crop yield simulation obtained from the ISIMIP platform (Inter-Sectoral Impact Model Intercomparison Project). The selected crop simulation models belong to the most recent group of simulations (ISIMIP3b) and are CROVER, EPIC-IIASA, PEPIC and LPJm. These models are parameterized using globally available experimental data and forced with global climate projection data. For each crop model, climate data are obtained from four state-of-the-art global climate simulation models (0.5°x 0.5°) (CMIP6): UKESM-01 LL, GFDL-ESM4, IPSL-CM6A LR, and MRI ESM2-0. The selected climate model simulations follow the ssp126 socioeconomic development scenario (+2°C GSAT in 2100).

anaerobic digestion, which in addition to manure include energy crops and agro-industrial by-products. Compared to these other organic substrates, manure has fewer volatile solids and produces less biogas. Biogas produced from agricultural matrices overall rises 48% from 2022 to 2030, from 3.9 to 5.8 billion cubic meters of biogas.

As concerns the waste sector, one of the main drivers of waste production is the population, already described above, but the reduction of emissions in the waste sector is mainly linked to the increase in separate waste collection and the subsequent recycling of the fractions collected separately. The year in which the most impactful policies and measures were applied was identified in 2005: the year in which the new law (Legislative Decree 13 January 2003 n. 36) on landfills and separate waste collection was applied in Italy. Consequently, the scenario was built according to the trend of waste management technologies in the years immediately following 2005 in relation to the trend in the years immediately preceding the same year. Obviously, the reduction of waste in landfill is strictly linked to the increase in composting and anaerobic digestion activities which have grown significantly since 2005. Activity data have been summarized in Table 3.13.

Table 3.13 - Emissions drivers from waste management

	2000	2005	2010	2015	2020	2022	2025	2030	2035	2040
Kt of waste										
Municipal solid waste (MSW) generation	28,959	31,664	32,479	29,524	28,941	29,051	29,088	29,007	28,950	29,610
Municipal solid waste (MSW) going to landfills	26,069	20,684	19,268	11,427	8,980	7,738	6,753	5,079	5,086	4,971
Waste to composting	2,834	5,551	7,031	7,288	6,819	6,435	6,793	6,666	6,539	6,412
Waste to anaerobic digestion	468	1,407	1,976	2,303	2,310	2,196	2,524	2,702	2,880	3,058

3.6.3 WM scenario

GHG emissions are calculated based on the above-mentioned parameters and modelling approach. Emissions up to 2022 are emission inventory data.

As can be seen in Figure 3.3, remarkable emission reductions already occurred up to 2020. The reduction of emissions is due to many factors, some of them structural and others only contingent. The most important structural factors for historical data are:

- increasing share of renewable in the energy mix, due to development of photovoltaic production and diffusion of biomass for heating;
- increased efficiency of electricity generation, with the entry into service of many combined cycle plants and the relevant shift to natural gas of the power sector;
- increased efficiency in the industry with a relevant electrification of the final consumption and structural changes as concerns the sector's production, with a shift towards "lighter" industry;

- increase in efficiency of final end-use devices.

As for the contingent factors it must be mentioned the economic crisis starting in 2008 and the outbreak of the SARS-Cov2 pandemic in 2020. The economic crisis caused a sharp reduction of industrial activities in 2008, but the effects lasted up to 2014. The sharp fall of emissions recorded in 2020 was due to the effects of lockdown to contrast the SARS-Cov2 pandemic. Since 2021 there was a rebound effect up to 2022.

The projection shows how from 2022 the emissions will decrease significantly up to 2040, even though with higher speed up to 2030. In 2040 the total GHGs with LULUCF are 29.2% lower than 2022 level. It should be noted that net emission are the physical emissions in the Italian territory excluding the emission reductions due to flexible mechanism.

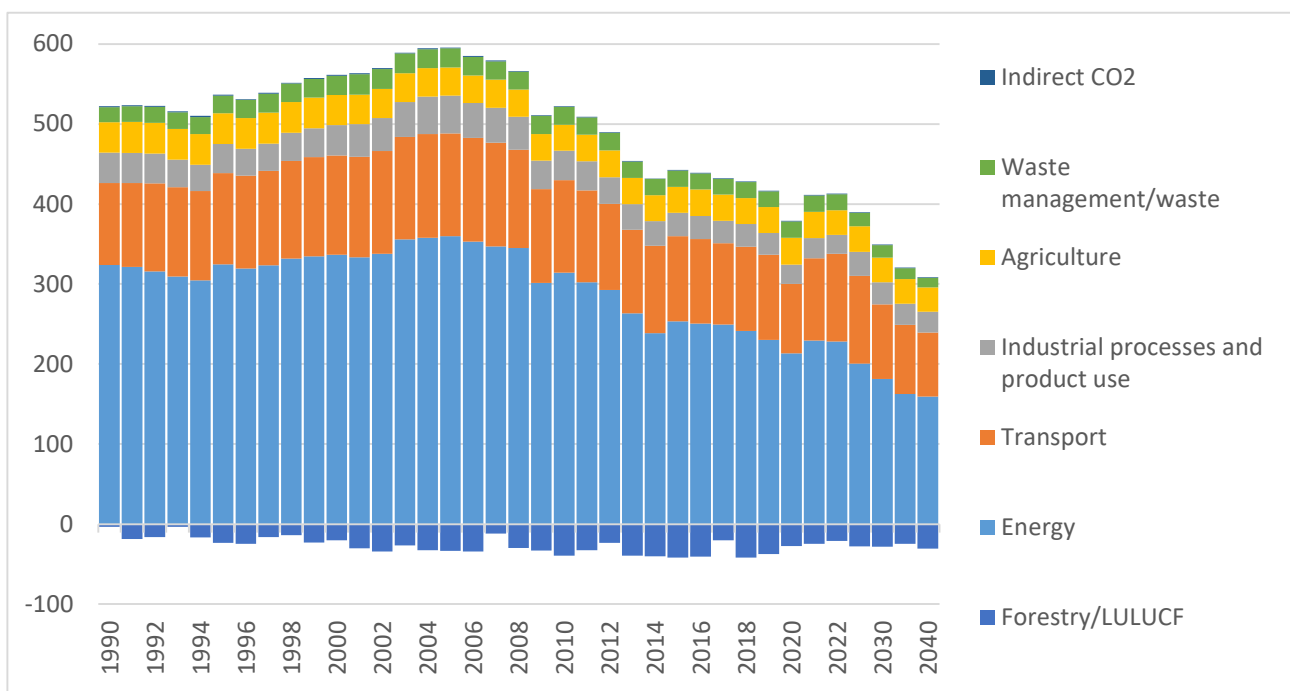


Figure 3.3 – Past and future GHG emissions per sector in the WM scenario (MtCO2eq)
Source: ISPRA

Table 3.14 shows the WM scenario projections up to 2040. Emissions are disaggregated by CTF sector. The highest decrease from 2022 to 2040 is recorded for the waste sector (-41.2%) and the energy sector (-30.2%), followed by transport with -27.2%. As for agriculture, the figures show substantial stability with a change of -0.7% from 2022 to 2040. On the other side the projected emissions by industrial processes and product use increase by 10.7% in the period 2022-2040. As for the relative stability of the emissions by the transport sector up to 2025 it should be stressed that after the pandemic the private mobility recorded a relevant boost and, without appropriate policies, private cars will continue playing a major role in the next years.

Table 3.14 - WM Scenario's GHG emissions, disaggregated by sector (MtCO₂ eq.)

Sector	2022	2025	2030	2035	2040
Energy	228.10	200.44	181.50	162.69	159.26
Transport	109.77	109.54	92.99	86.15	79.93
Industrial processes and product use	23.62	30.33	27.61	26.61	26.10
Agriculture	30.76	31.88	30.95	30.59	30.54
Forestry/LULUCF*	-21.20	-27.97	-28.38	-24.63	-30.79
Waste management/waste	20.05	16.97	15.48	13.62	11.80
Indirect CO ₂	0.73	0.75	0.76	0.76	0.77
Total with LULUCF	391.84	361.94	320.91	295.80	277.60
Total without LULUCF	413.04	389.91	349.30	320.43	308.39

* LULUCF sector is considered, including the IPCC land use classification

Source: ISPRA

In Figure 3.4 the GHGs from CRT energy sectors are reported, while Figure 3.5 shows the GHGs by non-energy sectors.

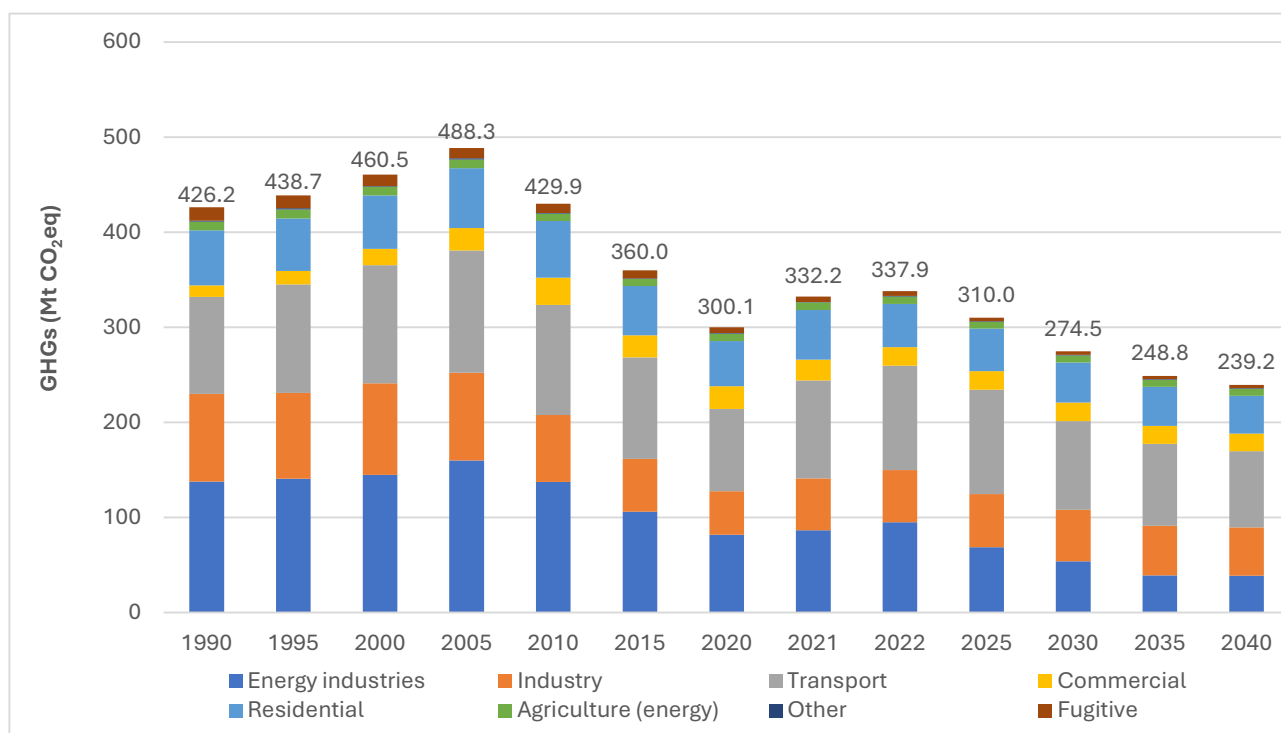


Figure 3.4 – Past and future GHG emissions per CRT energy sector (MtCO₂eq)

Source: ISPRA

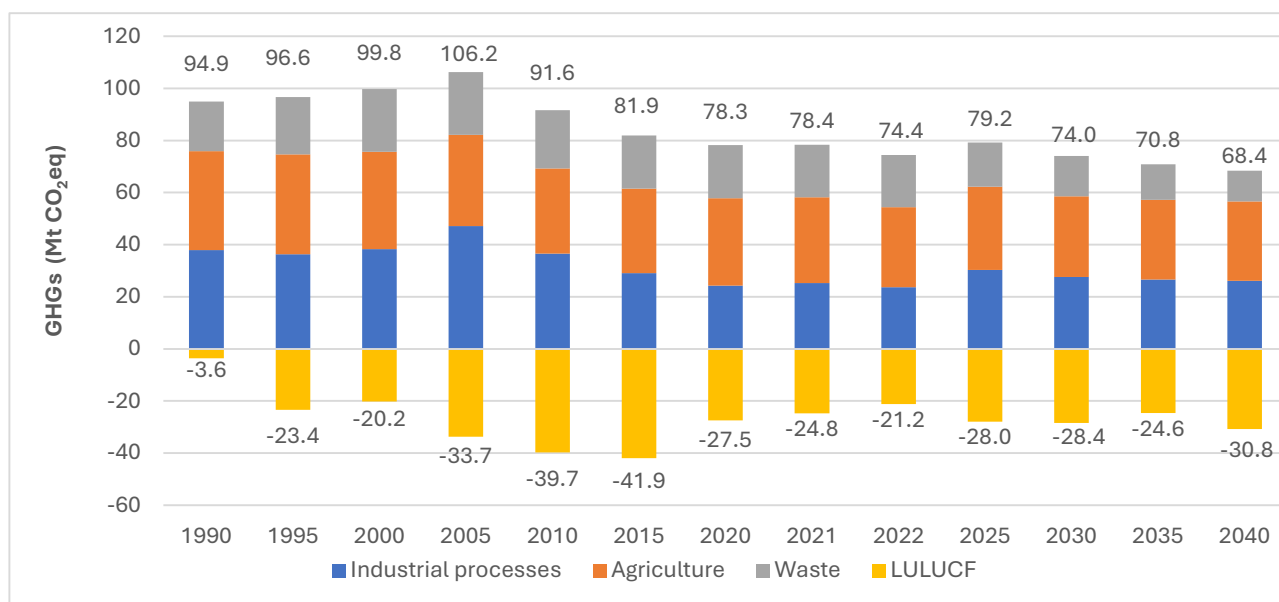


Figure 3.5 – Past and future GHG emissions per CRT no energy sectors and LULUCF (MtCO₂eq).

Source: ISPRA

Table 3.15 reports emissions by gas expressed as CO₂eq. Over the time series CO₂ emissions decrease from about 82% of total emissions in 2022 to 80% in 2040.

Table 3.15 – WM Scenario’s GHG emissions from 1990 to 2030, disaggregated by gas (MtCO₂ eq.)

Gas	2022	2025	2030	2035	2040
CO ₂ emissions including net CO ₂ from LULUCF	319.52	294.79	258.91	237.84	223.20
CO ₂ emissions excluding net CO ₂ from LULUCF	341.63	323.68	288.43	263.65	255.22
CH ₄ emissions including CH ₄ from LULUCF	46.07	41.91	39.86	37.50	35.18
CH ₄ emissions excluding CH ₄ from LULUCF	45.71	41.43	39.28	36.89	34.55
N ₂ O emissions including N ₂ O from LULUCF	16.29	17.52	17.27	17.15	16.93
N ₂ O emissions excluding N ₂ O from LULUCF	15.74	17.07	16.72	16.57	16.33
HFCs	9.09	6.95	4.18	2.72	1.71
PFCs	0.44	0.38	0.38	0.38	0.38
SF ₆	0.39	0.36	0.26	0.18	0.16
NF ₃	0.02	0.02	0.02	0.02	0.02
Unspecified mix of HFCs and PFCs	0.02	0.02	0.02	0.02	0.02
Total with LULUCF	391.84	361.94	320.91	295.80	277.60
Total without LULUCF	413.04	389.91	349.30	320.43	308.39

Source: ISPRA.

Summing up the main outcomes, the sector-by-sector analysis for the period 2022 – 2040 shows that:

- a notable emissions reduction in energy industries is projected (-59.4%) mainly due to the electricity generation; in this subcategory, emissions are directly linked to the electricity generation by fossil fuels; the relevant expansion of renewable production after 2008 contributed to the emissions reduction with an average pace of -4% per year from 2005 to

2020 furtherly accelerated in the projected years (-4.3% per year from 2022 to 2040). The emissions trend observed in the projected years is the combined result of increasing production offset by further increasing thermoelectric efficiency, renewable share, and fuel shift toward low carbon fuels as natural gas even though the increasing share of renewables is by far the most important factor;

- the projected emissions from transport will decrease by 27.2% as results of implemented measures, notwithstanding the increasing transport demand;
- emissions from residential and commercial show less relevant decrease, -12.1% and -5.5% respectively, mainly due to the efficiency increase of buildings; the emissions increase in the past is mainly linked to the expansion of services and residential building stock (second and third houses); increased house size and higher indoor temperature played an important role;
- industrial emissions register a deep decrease in the period 2005–2022 (-40.7% for energy emissions and 49.9% for industrial processes and product use); as previously mentioned such reduction is due in part to the contraction of economic activities and in part to the structural change and increase of efficiency, whose effects can be seen in the projected emissions too. Indeed, after 2022 industrial energy emissions show a much slower decreasing trend with increasing GVA (-6.6% in 2040 vs 2022), while the emissions by industrial processes and product use will increase (+10.5% in 2040 vs 2022);
- emissions from waste sector show the highest rate of reduction among sectors (-41.2% in 2040 compared to 2022) mainly due to the decrease of waste disposal in landfills;
- emissions from agriculture decrease by -10.2% on the energy side, while the sector's emissions not due to combustion are quite stable with -0.7% in 2040 compared to 2022.

3.6.3.1 Energy

The energy emissions share on total GHGs emissions without LULUCF shows a long run decreasing trend from 62% in 1990 to 55.2% in 2022. The projections show that the share should decrease up to 51.6% in 2040.

The gross inland consumption of energy (GIC) is expected to be about 139.1 Mtoe in 2030 with an average yearly decrease rate of -0.8% since 2020. A further slower decrease is projected in the next ten years up to 2040, with an average yearly decrease rate of -0.3%.

GIC started to decrease in 2005, before the economic crisis, while in the period 1990-2005 it has constantly increased with an annual average equal to +1.7%. The share of natural gas increased constantly since 1990 counterbalancing the corresponding decrease of oil share. Since 2005 there was a growing role of renewable energies, from 7.4% to 19% of gross inland consumption in 2022.

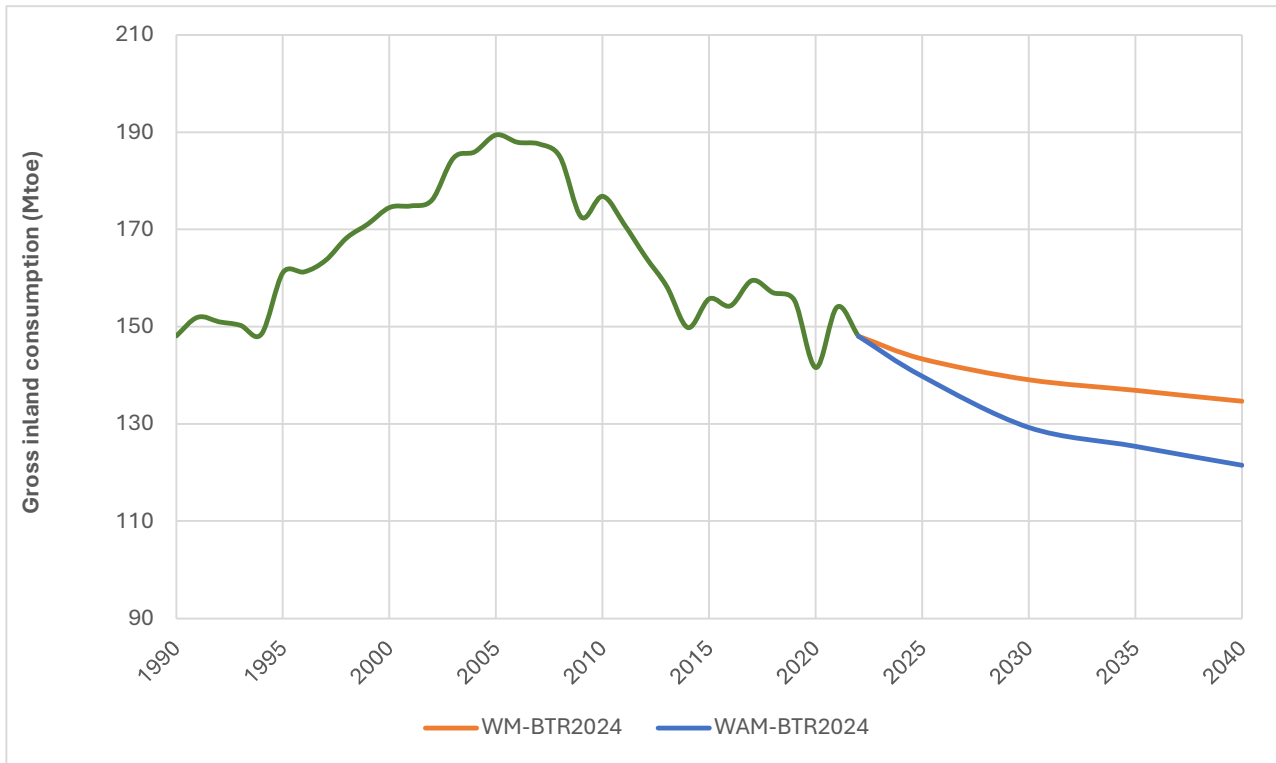


Figure 3.6 - Actual and projected gross inland consumption, Mtoe
Source: ISPRA

Energy industries

According to IPCC guidelines, the energy industries CRF category includes the electricity production from fossil fuels, refineries and the production of coke and of electricity from coal gases in integrated steel plants. Emissions due to self-generated and self-consumed electricity are not included in the energy industries as they are included among emissions by manufacturing industry. The emissions from self-generated and self-consumed electricity were relevant in the past, but in recent years they amount to less than 10% of emissions from total electricity production.

The emissions from refineries are relevant, but the lower consumption of fossil fuels by transport expected in the next years will reduce the refineries' activity. Moreover, the production of coke only accounts for small quantities of emissions, so the projected emissions from the energy industry sector are mainly linked to electricity production.

As shown in Figure 5.7, between 1990 and 2005 a noticeable increase in emissions of 16.2% has been registered by energy industries, about 1% yearly. From 2005 to 2020, emissions sharply decreased at an average annual rate of -4.4%, followed by the rebound in 2021 and 2022. The declining historical trend is driven by the reduced activity in the years of economic crisis and the increasing share of renewable sources in power sector and fuel shift towards fuels with low carbon content, as natural gas. A significant role is also played by increasing fossil fuels efficiency for electricity generation and, for 2020, the lockdown of economic activities due to the SARS-Cov2 pandemic. Further decrease of emissions is expected in the projected years up to 2040 with an annual average rate around -4.9% from 2022. Most of the

reduction should occur up 2035 with an annual average rate around -6.6%, followed by a quite stable trend (-0.3% per year in five years). The most relevant factor driving the emissions reduction is the renewable spread in the power sector. Lesser contribution is expected by efficiency factor due to limited scope remaining for technologies to increase the energy generation efficiency and for fossil fuel switch to gas.

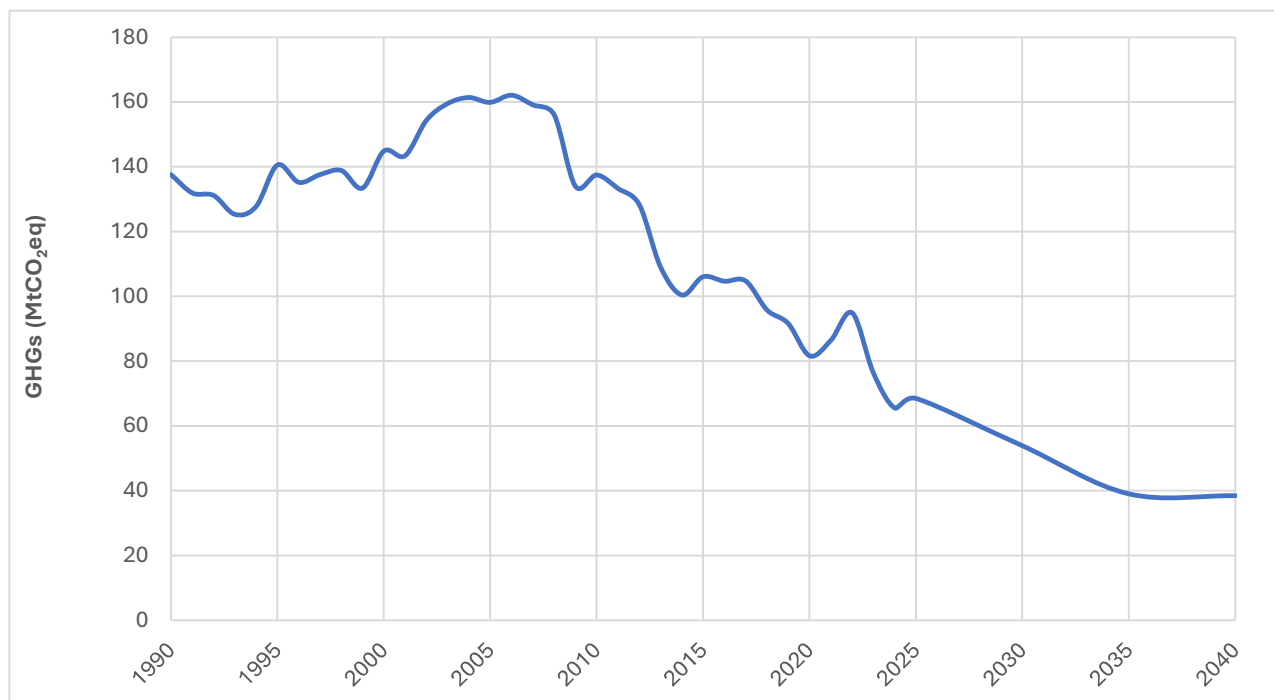


Figure 3.7 – Energy industries actual and projected GHG emissions (Mt CO₂ eq.)
Source: ISPRA

Electricity production

Data considered in this paragraph concerns all electricity generation plants, including those plants usually dedicated to the supply of electricity and heat to sectors different from 1.A.1.a (Public electricity and heat production). Historical data show a decoupling between CO₂ emissions from power plants and electricity production (Figure 5.7 and Figure 5.8). Since 1990, electricity production increased constantly up to 2008 with an average annual rate higher than CO₂ emissions. The average growth rate of gross electricity production amounted to 2.2% per year from 1990 to 2008, almost doubling the growth rate of CO₂ emissions (1.2% per year) and thus showing since 1990 a relative decoupling for the two parameters. From 2008 to 2022, while electricity production shows a long run decrease (-0.8% per year), the trends of electricity production and CO₂ emissions continue diverging (-3.2% per year for CO₂ emissions). In the historical period, 1990-2022, the emission factor decreased with an average annual rate of -1.6%. Such outcome is mainly due to the sharp development of renewable sources, followed by the contribute of efficiency increase of thermal plants and the fossil energy mix toward fuels with lower carbon content, as natural gas instead of petroleum products or solid

fuels. The last two factors were the only ones driving the decrease of the emission factor up to 2007.

The projected years show further decrease in CO₂ emissions with an average annual rate of -4% from 2022 to 2040 with a faster pace up to 2030. Since electricity production is expected to grow with an annual average rate of 0.6% from 2022 to 2040, the emission factor will decrease at an annual pace of -4.5% in the same period.

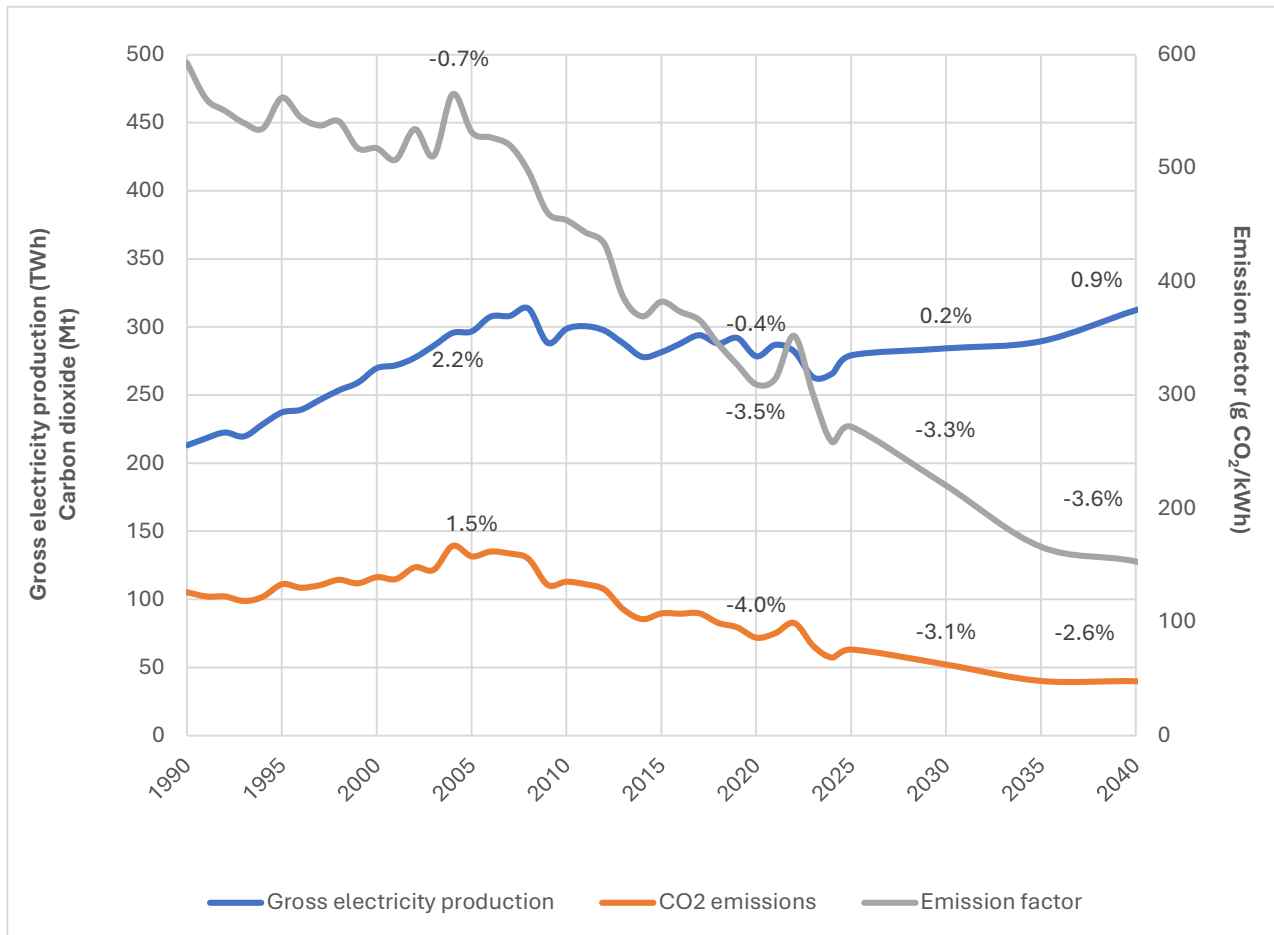


Figure 3.8 – Electricity production and CO₂ emissions from power plants. Average annual rates are reported for the periods 1990-2005, 2005-2020, 2020-2030, and 2030-2040
Source: ISPRA

Since 2008, the constant increase of renewable sources was the most relevant driving factor for the decoupling trend between electricity generation and GHGs emissions (Figure 5.8).

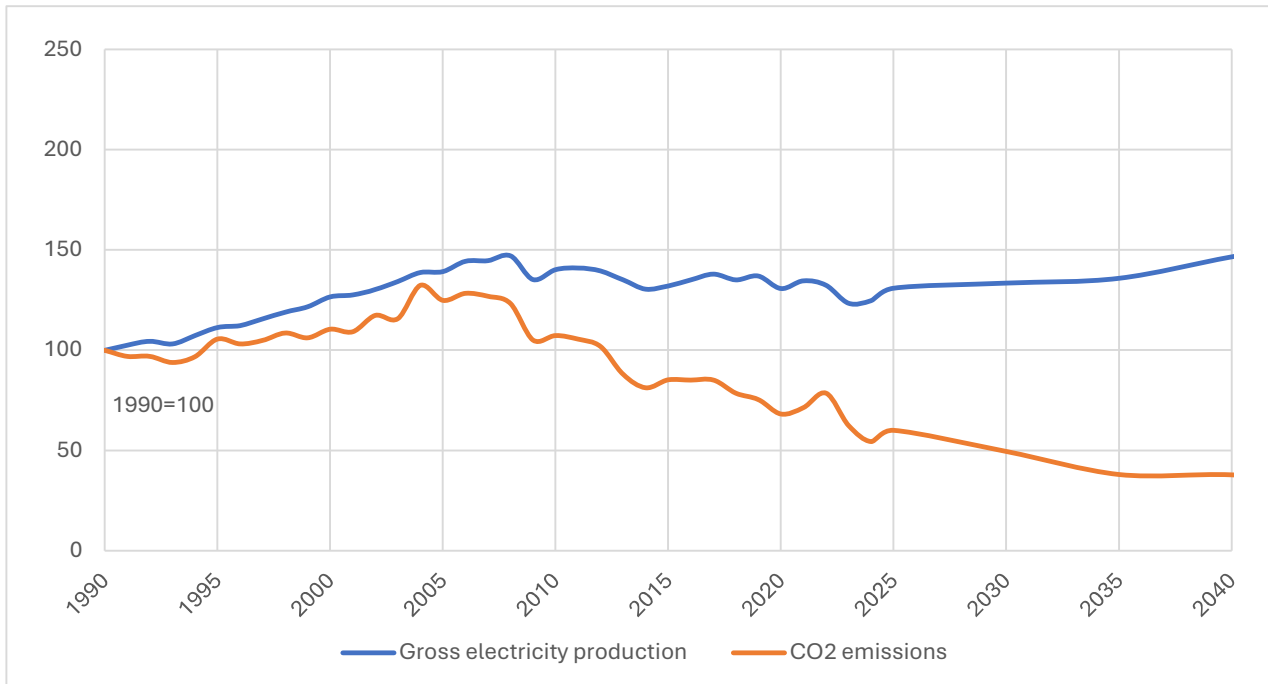


Figure 3.9 – Electricity production and CO2 emissions from power plants relative trends from 1990
Source: ISPRA

The expected increase in electricity demand in WM scenario will be covered by a strong increase in installed renewable sources power. The installed capacity in 2022 was 61 GW, with an average growth rate of about 2% per year from 1990 to 2007 and 6.9% per year in the following years up to 2022. From 1990 to 2007, hydropower was the most relevant renewable source; while since 2008, other sources, as photovoltaic and wind, have become more and more relevant. Since 2014, the annual rate of new installed capacity has slowed down, while the renewable electricity production has registered a downturn mainly due to the sharp reduction of hydropower share (Figure 5.9). The installed renewable capacity projected for 2030 and 2040 are about 87.2 GW and 121.8 GW respectively, mainly due to the increase of photovoltaic and wind.

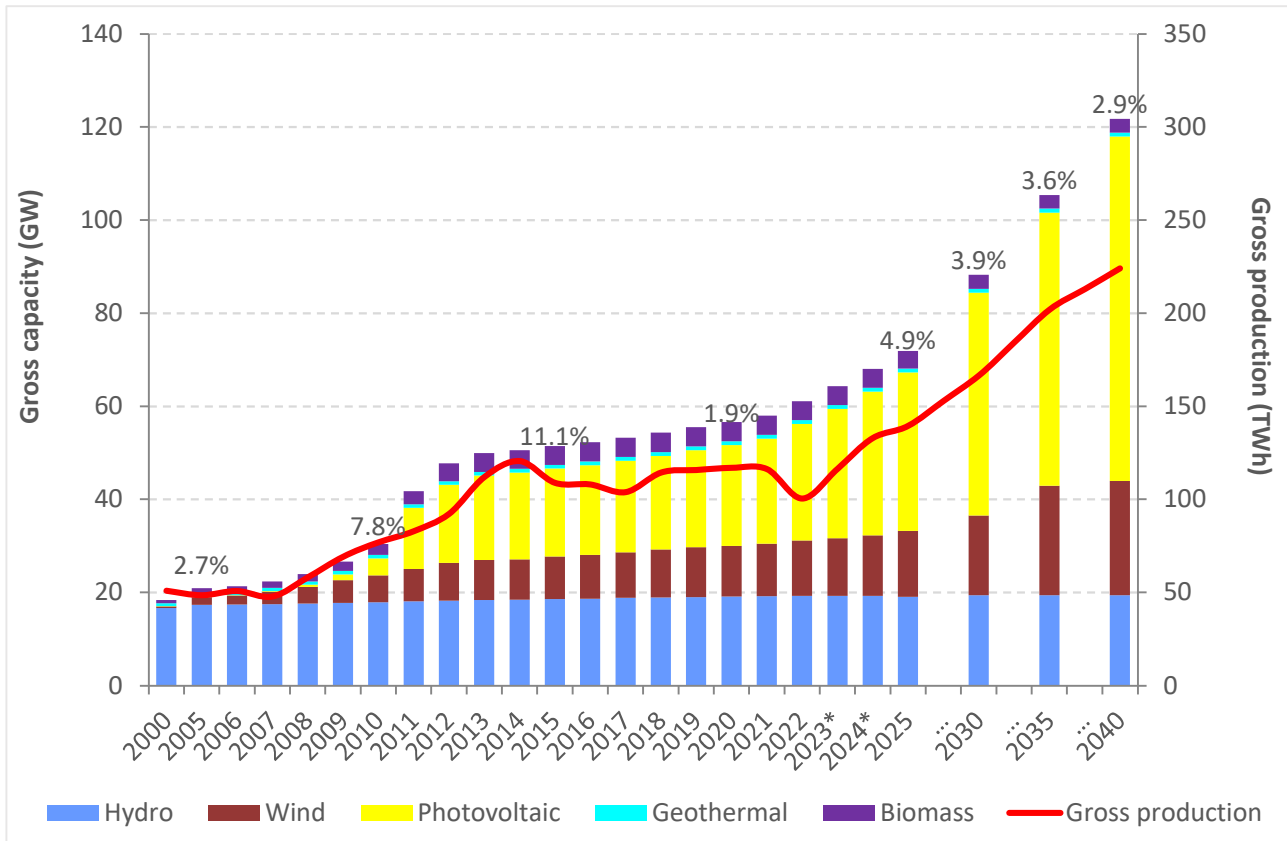


Figure 3.10 – Renewable power and gross electricity production. The percentage shows the annual average power rate
Source: ISPRA

Total gross efficient power capacity, including renewables, increased from 102.3 GW in 2008 to 128.6 GW in 2013, with a renewable share of 23.3% and 36.8%, respectively. Since 2008 up to 2013, renewable power represents the main component of new installations (26 GW out of 26.3 GW). Since 2012, a growing decommissioning of thermal capacity has been registered (about 19 GW up to 2021). In 2022, the gross efficient power capacity is 123.3 GW with 49.5% being from renewables. Data for 2023 shows the overcome of renewable on thermal fossil capacity with 51.3%.

The percentage of renewable electricity on gross electricity consumption, therefore including imported electricity and grid losses, increased from about 16% to more than 40% from 1990 to the last historical years. The fall in 2022 was due to a serious contraction of hydropower because of a particularly dry year. The projection shows further increase of renewable share up to 71% in 2040. The renewable electricity production will amount to about 166.5 TWh in 2030 and 224 TWh in 2040, out of total generation of 284.4 TWh and 312.4 TWh, respectively, while the electricity consumption will be 305.2 TWh and 315.1 TWh, respectively.

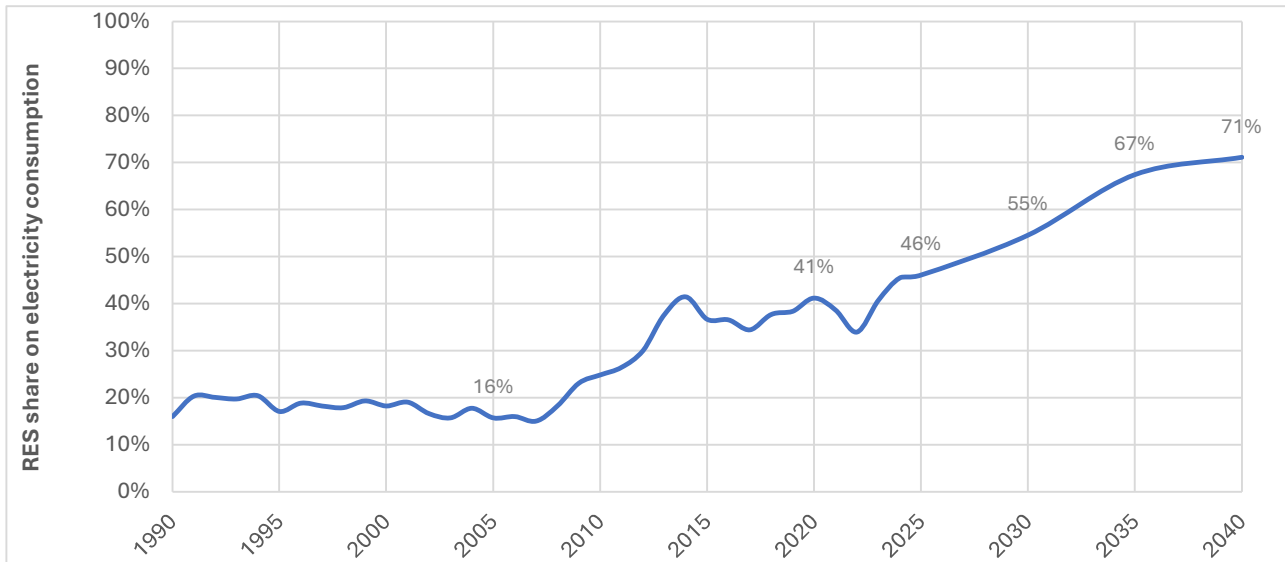


Figure 3.11 - RES share in electricity consumption
Source: ISPRA

Manufacturing industries and construction

According to section 1.A.2 of CRF, the industrial sector considered in this paragraph includes manufacturing industries and construction. Reference is made only to emissions connected to energy use, excluding process emissions reported in section 2.A-C of CRF.

As shown in Figure 3.12, emissions from energy use in manufacturing industries and construction have been declining since 1999, despite an overall increasing trend in GVA. This is well reflected in the decreasing trend in the GHG intensity, which is expected to continue also in the forthcoming years.

As reported in paragraph 2.3.2.1, in the past years the reason for the reduction of emissions from manufacturing industries and construction is the decrease in the production levels of the most energy intense subsectors (e.g. nonmetallic minerals and steel) which provide a smaller contribution to the sectoral GVA, but also the increase in efficiency, and the change in the energy mix. In the projected years no big changes are expected in the structure of the sector but a persistence of the observed trends.

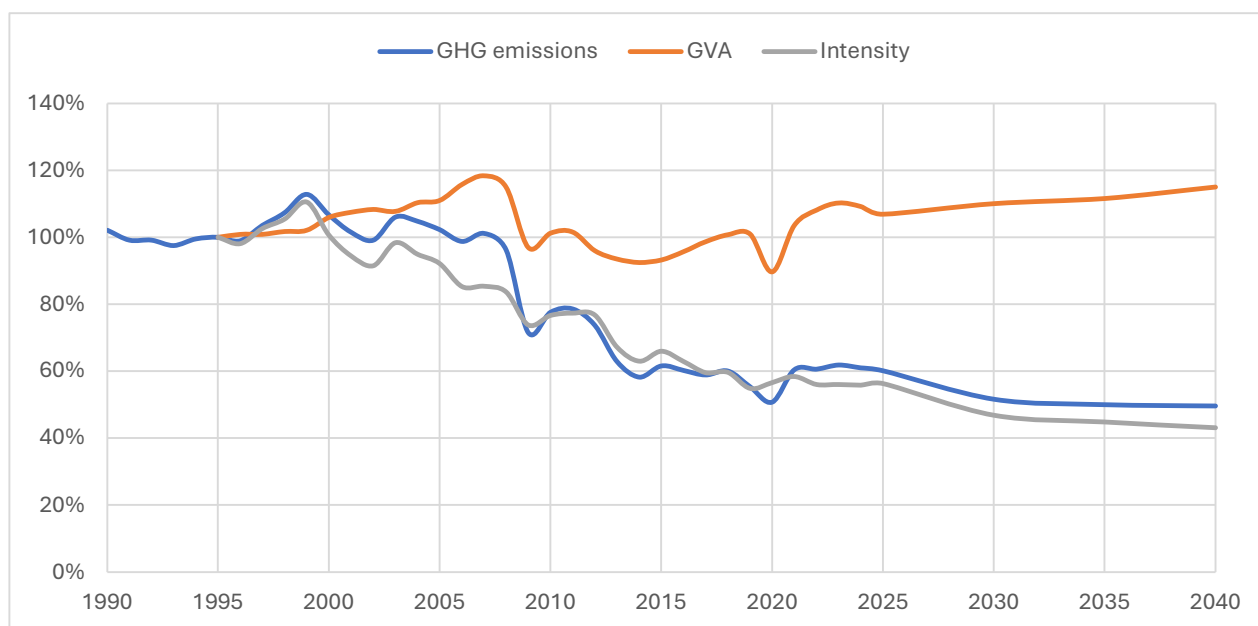


Figure 3.12 – GHG emissions, GVA and emission intensity of manufacturing industries and construction (1995=100%)
Source: ISPRA, ISTAT and European commission

Other sectors

The next table reports historical data and projections for energy final consumption in services, residential and agriculture.

Table 3.16 – Final energy consumption in other sectors (Mtoe)

	2022	2025	2030	2035	2040
Services	14.2	14.4	14.0	14.1	14.3
Residential	29.3	29.3	28.3	28.1	27.9
Agriculture	3.3	3.2	3.3	3.3	3.3

Source: National energy and climate plan

The sectors are characterized by the following features:

- agriculture: moderate penetration of gas in the agricultural sector results in slight decrease of CO₂eq missions from energy uses (from 7.9 Mt in 2022 to 7.1 Mt in 2040 due to the promotion of biofuels in agriculture energy use);
- buildings (residential and tertiary): the main driver in the residential sector is the number of households, while for services the main driver is the value added. The increase in heating demand will be offset by the estimated natural gas expansion, by higher electricity penetration, and by the expected efficiency gains according to the National Plan for Energy Efficiency and minimal standards for buildings. Another parameter considered to elaborate the energy demand of heating and cooling is the anomaly climate index. The index projections are ISPRA elaboration starting from data of the Euro Mediterranean Center on Climate Change under the EURO-Cordex project. Such effects will result in emission reductions (from 65.0 Mt CO₂eq in 2022 to 58.4 Mt CO₂eq in 2040).

3.6.3.2 Transport

The transport sector includes road and railway transportations, domestic air traffic, the national amount of international air flights (landing and take-off) and coastal navigation, as well as the consumptions in the harbor from ships travelling in international voyages. GHG emissions from transport registered a strong historical growth from 1990 to 2007 (+26.8%). Following the economic downturn, the trend has changed direction registering a reduction of 18% in the period 2007-2015. The declining trend of the sector is confirmed up to 2017 (-5% with reference to 2015) while 2018 and 2019 show a new increase of emissions (+4.7% in 2019 with reference to 2017) followed by the fall in 2020 (-18.6% with reference to 2019) due to the lockdown measures to contrast the SARS-CoV-2 pandemic. Projected emissions are expected to increase up to 2025 as rebound effect for the end of the pandemic which will especially affect the private cars use. After 2025 up to 2040, emissions reduction of 27.0% is expected.

In relation to road transport, by 2022 total GHG emissions from this category were about 91.5% of the total national emissions from transport, 29.7% of the energy sector and about 24.3% of the GHG national total. Passenger transport is responsible for about 66% of road transport emissions, while freight transport and other fuel uses account for the remaining share. The application of the Regulation (EU) No 2019/631, which set CO₂ emission performance standards for new passenger cars and new light commercial vehicles, will overcompensate the increasing demand of transport resulting in a decreasing trend of projected emissions.

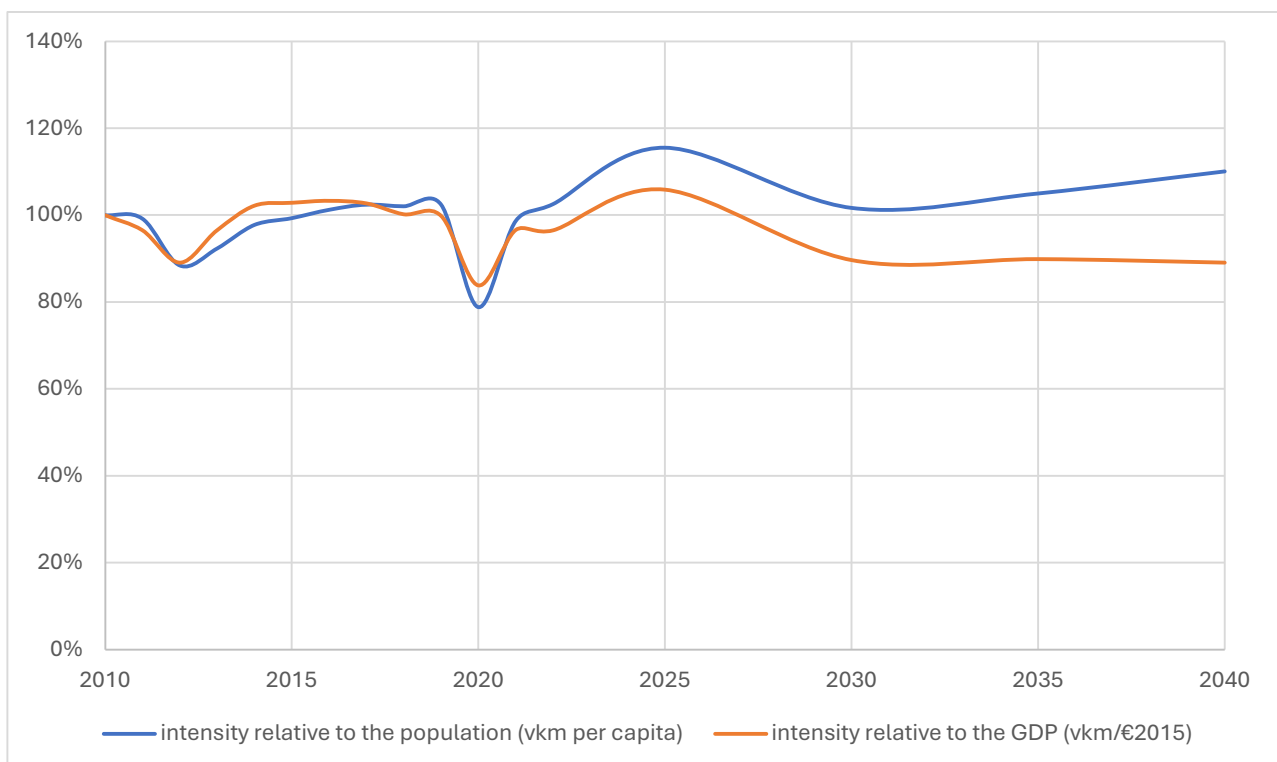


Figure 3.13 – Trends of intensity relative to the population (vkm per capita) and GDP (vkm/€2015)
Source: ISPRA

In particular, from the evolution over time of vehicle-kilometers per capita for passenger cars (Figure 3.13), the historical series shows an increasing trend, except during the economic crisis (2011-2012) and the pandemic crisis in 2020. In projection years, by 2030, the effects of the

NRRP measures are noticeable, but in the following years, up to 2040, there is again an increase in the absence of further policies aimed at limiting private mobility. In addition, in the reference scenario, it is also clear that in passenger transport, the share of private mobility remains dominant, to the detriment of public transport by road and rail (Figure 3.14).

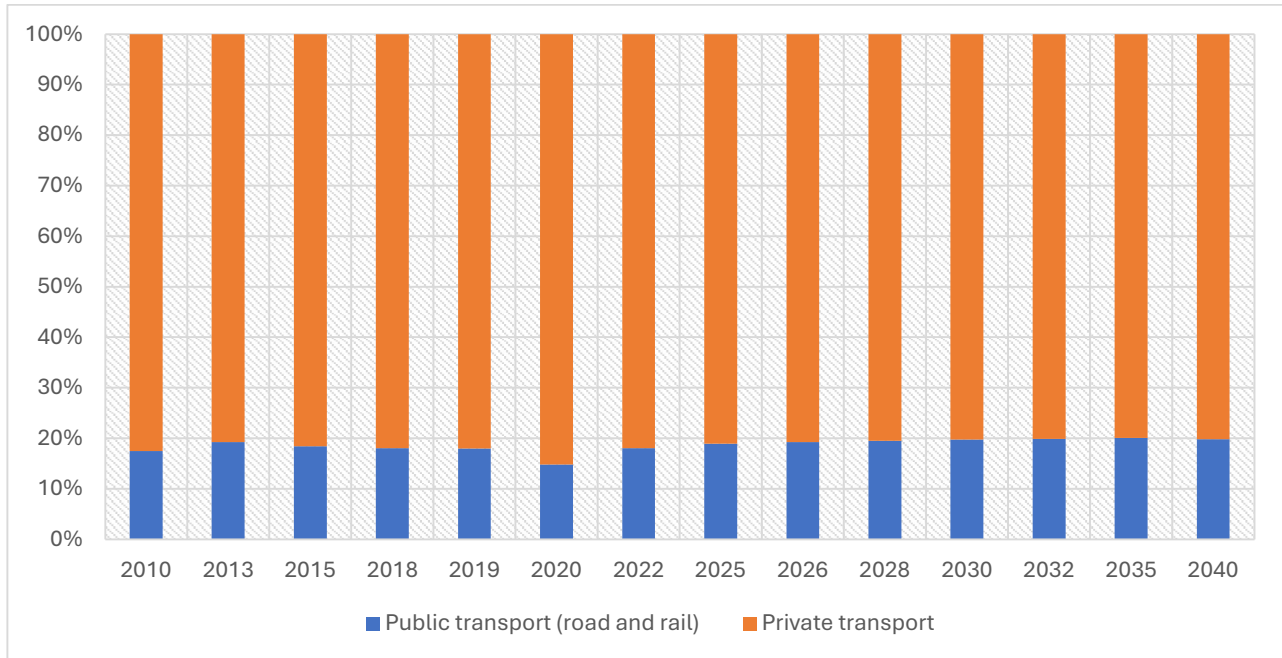


Figure 3.14– Trends of modal shift of passenger transport (%)
Source: ISPRA – elaboration on Ministry of Transport data

Similarly, for freight transport, the road freight share remains the predominant mode compared to rail or maritime transport (Figure 3.15).

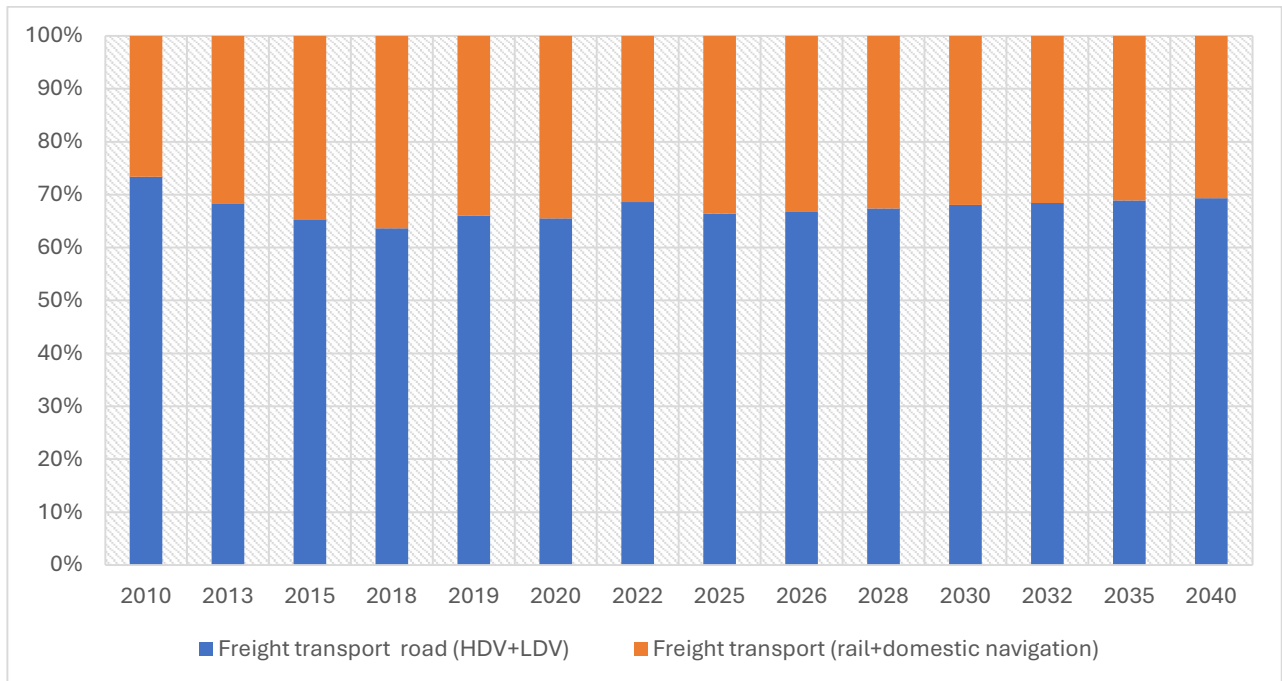


Figure 3.15– Trends of modal shift of freight transport (%)
Source: ISPRA – elaboration on Ministry of Transport data

Table 3.17 shows historical and projected emissions related to fuels sold to ships and aircrafts for international transport. For international aviation, after the fall registered in 2020 the emissions are expected to increase (+260% in the period 2020-2040). The same trend is expected for international maritime transport, projected emissions show a steady increase up to 2040 (+52% since 2020)

Table 3.17 – Emissions from international bunkers (Mt CO2 eq).

	2005	2010	2015	2020	2022	2025	2030	2035	2040
Aviation	8.5	8.9	9.6	3.8	9.2	11.7	12.0	12.8	13.8
Marine	6.7	8.2	5.0	4.2	4.3	5.8	6.1	6.2	6.4

Source: ISPRA

3.6.3.3 Industrial processes

Emission projections for industrial processes rely on the same main assumptions on GVA and physical production used for the calculation of final energy consumption of the industrial sector. Emission factors for processes have been considered constant for the whole time series assuming that no new processes and additional measures will be implemented.

For what concern F-gases projections, the expected emissions reduction derives from the implementation of successive Regulation, culminating with the adoption of the new Regulation (EU) 573/2024. Projections for Aluminium production and Fluorochemical Production have been derived from information communicated directly from industry on the basis of the present situation: for what concern Aluminium production, if at first there was a plan to restart, actually there are no perspectives of a reopening of the plant in Portovesme that has stopped the production in 2012. Regarding the production of HCFC22 used as the input for the TFM (tetrafluoroethylene monomer) that has been then used to produce different fluoropolymers and fluoroelastomers, the Company Solvay has communicated that the production of HCFC22 will remain almost constant.

About semiconductor manufacturing, projections have been derived from agreements subscribed by the European Semiconductor Industry Association. The Italian semiconductor industry has predicted a 30% reduction of PFC emissions in 2025 compared to 2010 emissions. In 2040 a further 5% reduction is expected. PFC emissions reduction technologies that are applied in factory operations include: manufacturing process optimization (reducing the amount of PFCs that are used and emitted), using alternative process PFC chemistries with lower global warming potential where possible, and installing abatement equipment systems.

For SF₆ used in magnesium and aluminum foundries and for solvent and F-gases substitutes for ozone depleting substances and other product use, projections are based on the achievement of the objectives established first by the Regulation (EU) 517/2014 and from now to onward by the new F-gas Regulation 573/2024. Worthy of remark is that the Regulation (EU) 573/2024 fixes a new quota system that generates a steeper reduction in the amounts that importers and producers may place on the EU market, and in 2050, HFCs will be phased out in the EU. Another important change introduced by the new F-Gas Regulation is that from January

1, 2025, pharmaceutical aerosols equipped with hydrofluorocarbons will have to be accounted for under the quota system from which they were previously excluded. In Table 3.18 F-gases projections up to 2040 by sector are reported.

Table 3.18 – F-gases emission scenario by sector (Mt CO₂eq.)

	2005	2010	2015	2020	2022	2025	2030	2035	2040
Chemical industry	1.41	1.17	1.39	0.38	0.30	0.30	0.30	0.30	0.30
Metal industry	0.27	0.11	0.01	0.005	0.003	0.003	0.003	0.003	0.003
Electronics industry	0.303	0.206	0.246	0.207	0.229	0.173	0.171	0.169	0.166
Product Uses as Substitutes for ODS	9.6	12.8	12.1	10.0	9.1	6.9	4.2	2.7	1.7
Other Product Manufacture and Use	0.42	0.36	0.44	0.21	0.35	0.31	0.22	0.14	0.11
Total	12.05	14.63	14.15	10.76	9.96	7.73	4.87	3.32	2.29

Source: ISPRA

As reported in table 3.19 despite their relevant role in recent years the contribution of F-gas to the sector total is expected to decline from 42% in 2022 to 9% in 2040.

On the other side, it is expected that emissions from industrial processes will increase in the coming years, due to both the projected growth of gross value added (GVA) in mineral industries and the absence of viable alternative production techniques.

Table 3.19 – Emission scenario by sector from industrial processes (Mt CO₂ eq.)

	2022	2025	2030	2035	2040
Mineral Industry	10.2	17.9	18.0	18.6	19.1
Chemical industry	1.4	2.1	2.1	2.1	2.1
Metal industry	1.6	2.1	2.2	2.1	2.1
Non-energy products from fuels and solvent use	0.3	0.3	0.3	0.3	0.3
Electronics industry	0.2	0.2	0.2	0.2	0.2
Product uses as substitutes for ODS	9.1	6.9	4.2	2.7	1.7
Other product manufacture and use	0.8	0.8	0.7	0.6	0.6
Industrial processes (total)	23.6	30.3	27.6	26.6	26.1

Source: ISPRA

3.6.3.4 Agriculture

Without considering additional measures for the years after 2030 through 2040, the reference scenario emissions for the sector are about 30.9 MtCO₂ eq and 30.5 MtCO₂ eq at 2030 and 2040, respectively.

In **Errore. L'origine riferimento non è stata trovata.**3.20, GHG emission projections are shown. A slight downward trend is observed from 2025 onwards. In 2030, emissions from the sector are reduced by 12% and 8% compared to 2005 and to 2020 respectively. In 2030, the largest reductions are in the manure management and agricultural soil categories, which

account for about 20% and 30% of annual emissions, respectively⁵⁸. The manure management category decreases by 19% and 11% and the agricultural soils category falls by 11% and 6% in 2030 compared to 2005 and 2020 respectively. The reductions are driven by decreasing livestock numbers, increasing the share of livestock manure sent to anaerobic digestion, and the implementation of ammonia emission reduction measures. In the scenarios, total greenhouse gas emissions from the agriculture sector are about 31 million tons of CO₂eq.

Table 3.20 – Emissions projections for the agriculture sector (MtCO₂ eq.)

	2005	2010	2015	2020	2025	2030	2035	2040
Agriculture	35.0	32.6	32.5	33.5	31.9	30.9	30.6	30.5

Source: ISPRA

3.6.3.5 LULUCF

The driving forces for projections are the activity data linked to the LULUCF sector; in particular, those related to forest land, cropland and grassland constitute the key variables to project emissions by sources and removals by sinks. Compliant to the requirements set out by Regulation (EU) 2023/839, the GHG emissions and removals have been estimated and projected considering the different land transitions among the six land use categories as occurring in Italy (e.g., forest land to settlements, cropland to grassland, cropland to wetlands, etc.). The land use and land use changes have been projected to 2050, as shown in Figure 3.16, on the bases of historical trends and considering:

- for agricultural areas, a growing trend is assumed until 2040 and, thereafter, a stabilization; the trend is determined by the increase in cereal areas and by the decrease of woody and industrial crops;
- for the grazing land, a decrease is expected, following the reduction of grazing animals;
- in line with the goal of limiting land consumption, the settlements area is assessed to not expand compared to current levels while the forest area grows until 2030 and then remains constant.

Consistently with the National Forestry Accounting Plan, an increase of harvesting activities has been assumed, up to a maximum of 40-45% of the annual increment, starting from the current estimated use of 33% (RAF, 2019). Furthermore, the projections of activity data for cropland and grassland categories consider the different management practices; additional information on management practices and estimation process are available in the National Inventory Document (NID) 2024.

⁵⁸ In addition, more than 40% of emissions from the agricultural sector come from methane emissions from enteric fermentation. These emissions fall in the scenarios due to the reduction in the number of livestock.

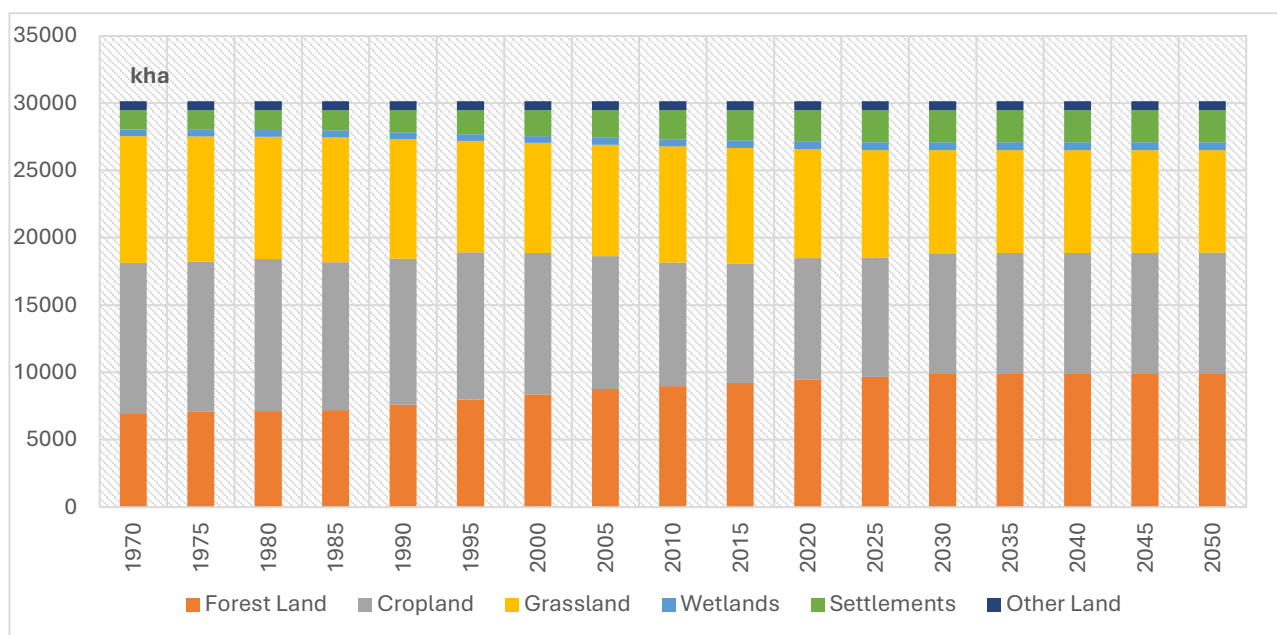


Figure 3.16 - Trends of area for the land use categories
Source: ISPRA

The GHG emissions and removals, reported in Table 3.21, have been estimated by multiplying the projected areas, under each land use subcategory (i.e. land remaining land and land converted to other land use), by and Implied Carbon Stock Factor (ICSF), deduced from the historical data of emissions and removals and land use areas (1990-2022).

Table 3.21 – GHG Emissions and CO₂ removals for LULUCF sector (MtCO₂ eq.)

	2005	2015	2020	2025	2030	2035	2040
LULUCF	-33.69	-21.20	-28.05	-28.38	-24.63	-30.79	-30.13
Forest land	-34.94	-26.05	-34.27	-35.36	-35.23	-35.11	-34.85
Cropland	-0.41	2.28	2.45	2.46	2.98	3.06	3.12
Grassland	-5.59	-1.96	-1.66	-0.86	2.54	-3.50	-2.97
Wetlands	0.01	0.00	NO	0.09	0.09	0.09	0.09
Settlements	7.75	4.82	5.75	5.51	5.19	4.84	4.61
Harvested wood products	-0.50	-0.30	-0.32	-0.22	-0.19	-0.17	-0.14

Source: ISPRA

3.6.3.6 Waste

GHG emissions from waste show a reasonable reduction rate by 2030, mainly due to the decrease in waste sent to landfills. Thanks to the evolution of waste legislation and the introduction of new forms of waste management, the amount of waste treated in mechanical-biological and composting plants, as well as in anaerobic digesters, has grown significantly. Also based on the data from the national inventory, a reduction in greenhouse gas emissions from waste incineration without energy recovery emerges. In particular, these have decreased by 78% in about three decades, from 512 ktCO₂ in 1990 to 114 ktCO₂ in 2022. These emissions include the treatment of municipal, industrial, medical waste, used oils and sludge in incinerators without energy recovery; emissions from co-incineration of waste in industrial plants, cremation of the deceased, combustion of agricultural waste and burning of

abandoned waste are also included. CH₄ and N₂O emissions from the treatment of urban and industrial wastewater show a decrease in the period 1990-2022 as in the last thirty years there has been a progressive increase in sewer coverage and consequently in the share of wastewater sent for purification, which in 2022 covers 91% of the population. This inevitably leads, as regards civil wastewater, to an increase in methane production, offset however by a greater efficiency in the capture of biogas sent for energy recovery. For industrial wastewater, however, emissions are linked to the quantity of wastewater produced, which in turn depends on industrial production itself: technological progress and the growing commitment of industry towards environmental issues have led over the years to a reduction, in some sectors, in the quantity of process water, and therefore of wastewater produced, with a consequent lower concentration of COD (chemical oxygen demand) in the discharge and, therefore, a lower production of methane emitted. The reduction of emissions in the waste sector is mainly linked to the increase in separate waste collection and the subsequent recycling of the fractions collected separately. In fact, the materials obtained from the collection and transformation of waste into new resources allow for significant emissions savings compared to the use of virgin raw materials. The net gain depends on the type of material and the quantities collected. As regards the biodegradable organic fraction of separate waste collection, the subsequent aerobic/anaerobic treatment to produce compost allows for the transformation of waste, that would otherwise be disposed of in landfill, into a soil improver rich in organic matter. It should also be considered that these treatment systems allow for the limitation of methane emissions into the atmosphere, compared to landfill. In terms of quantity, the treatment of the biodegradable organic fraction of urban waste from separate waste collection increased from 2.7 Mt in 2006 to 7.2 Mt in 2022.

Table 3.22 – Emissions projections for the waste management sector (MtCO₂ eq.)

	2000	2005	2010	2015	2020	2022	2025	2030	2035	2040
Waste management	24.1	24.1	22.4	20.3	20.5	20.1	17.0	15.5	13.6	11.8

Source: ISPRA

As regards incineration and wastewater, no hypothesis was applied for different reasons: in the case of incinerators, the low weight of CO₂ emissions from plants without energy recovery, while for wastewater management the same trend was considered valid since it was linked to issues of public health and hygiene and related regulations.

3.6.4 WAM Scenario

As per the WM scenario, GHG emissions are calculated based on the above-mentioned parameters and modelling approach. Emissions up to 2022 are emission inventory data.

As can be seen in Figure 3.17, the projection shows how from 2022 the emissions will decrease significantly up to 2040, thanks to the additional policies and measures described in paragraph 3.4. In 2040 the total GHGs including LULUCF are 47% lower than 2022 level, and 60% lower than 1990 level. It should be noted that net emission are the physical emissions in the Italian territory excluding the emission reductions due to flexible mechanism, as well as in the WM scenario.

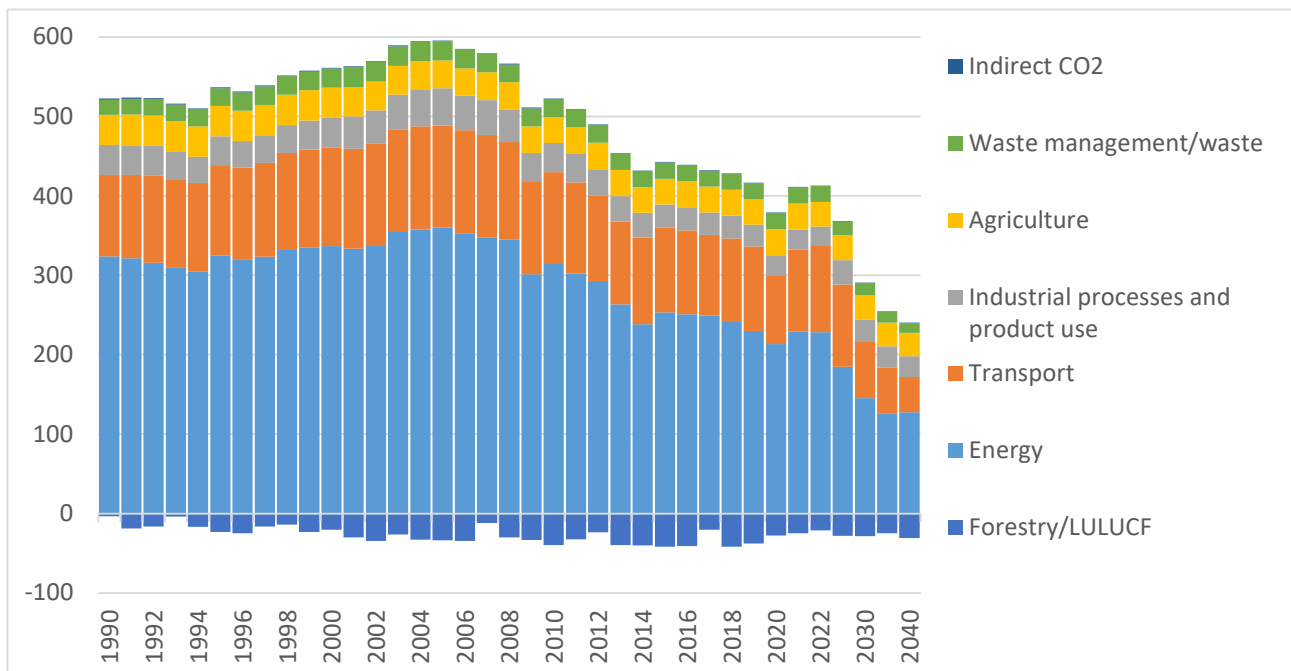


Figure 3.17 – Past and future GHG emissions per sector in the WAM scenario (MtCO2eq)
Source: ISPRA

Table 3.23 shows the WAM scenario projections up to 2040. Emissions are disaggregated by CTF sector. The highest decrease from 2022 to 2040 is recorded for the transport sector (-60%) and the energy sector (-44%). These two sectors show the highest differences in the emission reduction compared to the WM scenario: compared to that scenario additional reductions are -32% for transport and -14% for energy. As for agriculture, compared to the WM scenario, emissions are expected to decrease by an additional 3%, while for other sectors WAM and WM scenario share the same figures.

The projected share of emissions of the energy sector should decrease in 2040 up to 53.3% of national total without LULUCF, about 1.5 percentage points over the WM scenario level.

In the subsequent paragraphs only sectors with significant differences with the WM scenario are described.

Table 3.23 - WAM Scenario's GHG emissions, disaggregated by sector (MtCO₂ eq.)

Sector	1990	2022	2025	2030	2035	2040	2040 vs 1990 (%)	2040 vs 2022 (%)
Energy	324.0	228.1	184.8	145.3	126.4	127.6	-61%	-44%
Transport	102.2	109.8	103.8	71.6	57.5	44.4	-57%	-60%
Industrial processes and product use	37.9	23.6	30.3	27.6	26.6	26.1	-31%	10%
Agriculture	38.0	30.8	31.4	30.0	29.8	29.6	-22%	-4%
Forestry/LULUCF	-3.6	-21.2	-28.0	-28.4	-24.6	-30.8	745%	45%
Waste management/waste	19.0	20.1	17.0	15.5	13.6	11.8	-38%	-41%
Indirect CO₂	1.3	0.7	0.7	0.8	0.8	0.8	-41%	6%
Total with LULUCF	518.7	391.8	340.1	262.4	230.0	209.4	-60%	-47%
Total without LULUCF	522.4	413.0	368.0	290.7	254.6	240.2	-54%	-42%

Source: ISPRA

3.6.4.1 Energy

Energy industries

The emissions should decrease by 2035 with an annual average rate around -8.8% from 2022, followed by a rebound with increasing emissions by 5.1% per year in the next five years. The far more relevant driving factor of emissions reduction is the further renewable development in the power sector.

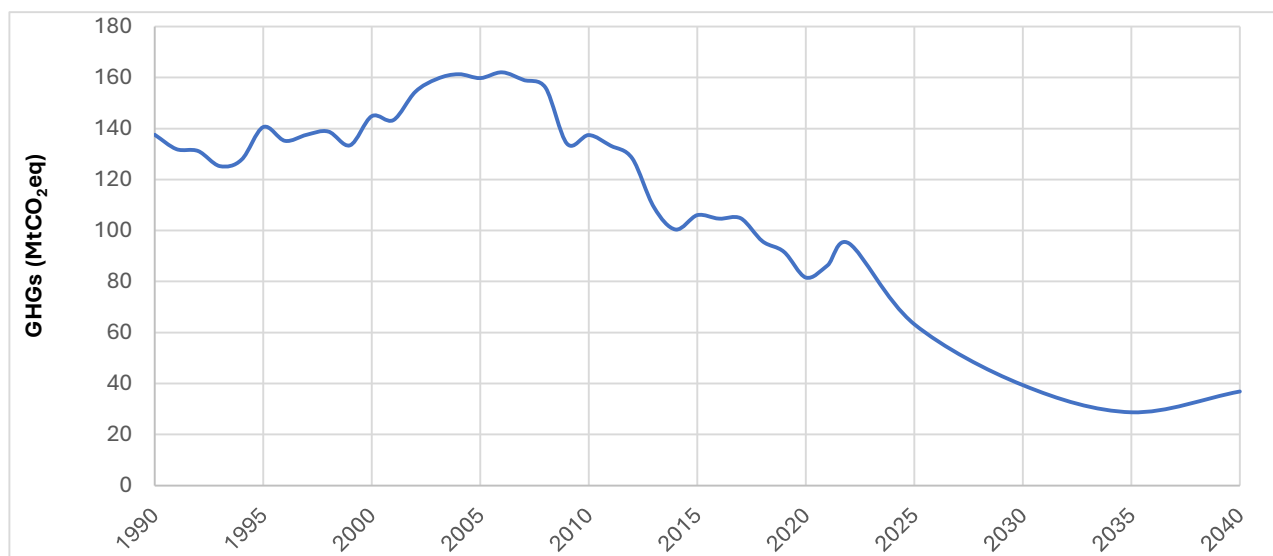


Figure 3.18 – Energy industries actual and projected GHG emissions (Mt CO₂ eq.)

Source: ISPRA

Electricity production

The projected years show the decrease in CO₂ emissions with an average annual rate of -4.3% up to 2030. The very difference with WM scenario is the speed of CO₂ reduction up 2030, which is almost double with additional measures (-9.2% per year from 2022 to 2030 in WAM against -

5.6% per year in WM). The additional measures for the electrification of final consumption push electricity production to grow faster than in WM, 6.1% per year from 2022 to 2040, consequently the emission factor will decrease at an annual pace of -6.1% in the same period. As shown in Figure 3.20 the decoupling between electricity generation and GHGs emissions in the power sector will become wider than in WM scenario.

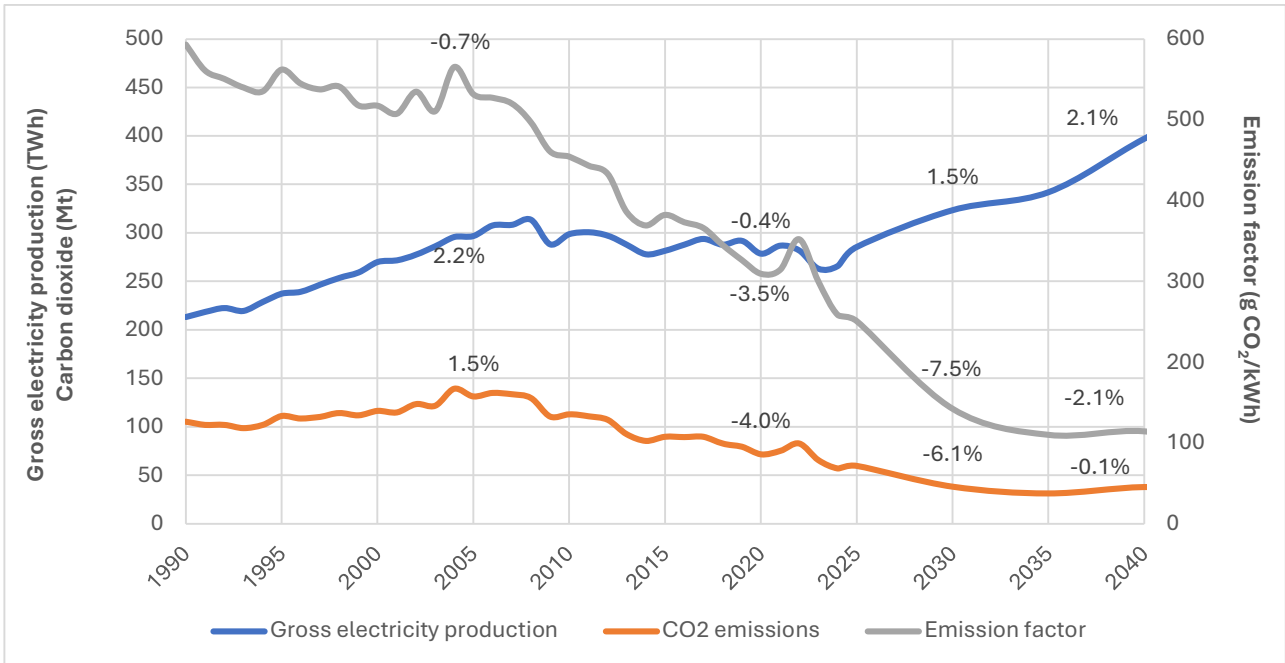


Figure 3.19 – Electricity production and CO₂ emissions from power plants. Average annual rates are reported for the periods 1990-2005, 2005-2020, 2020-2030, and 2030-2040
Source: ISPRA

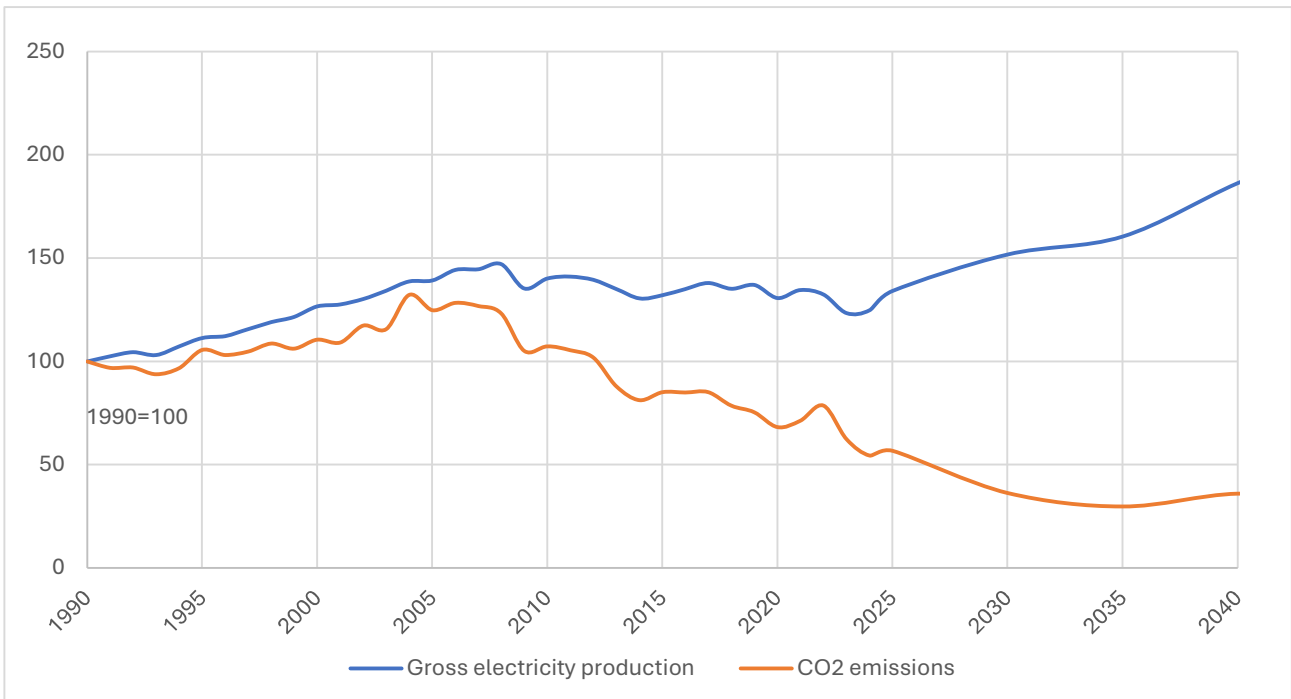


Figure 3.20 – Electricity production and CO₂ emissions from power plants relative trends from 1990
Source: ISPRA

Additional measures are mainly addressed to boost photovoltaic and wind installations which together will represent over 86% of renewable installed capacity in 2040. The renewable capacity projected for 2030 and 2040 are about 134.6 GW and 175 GW respectively.

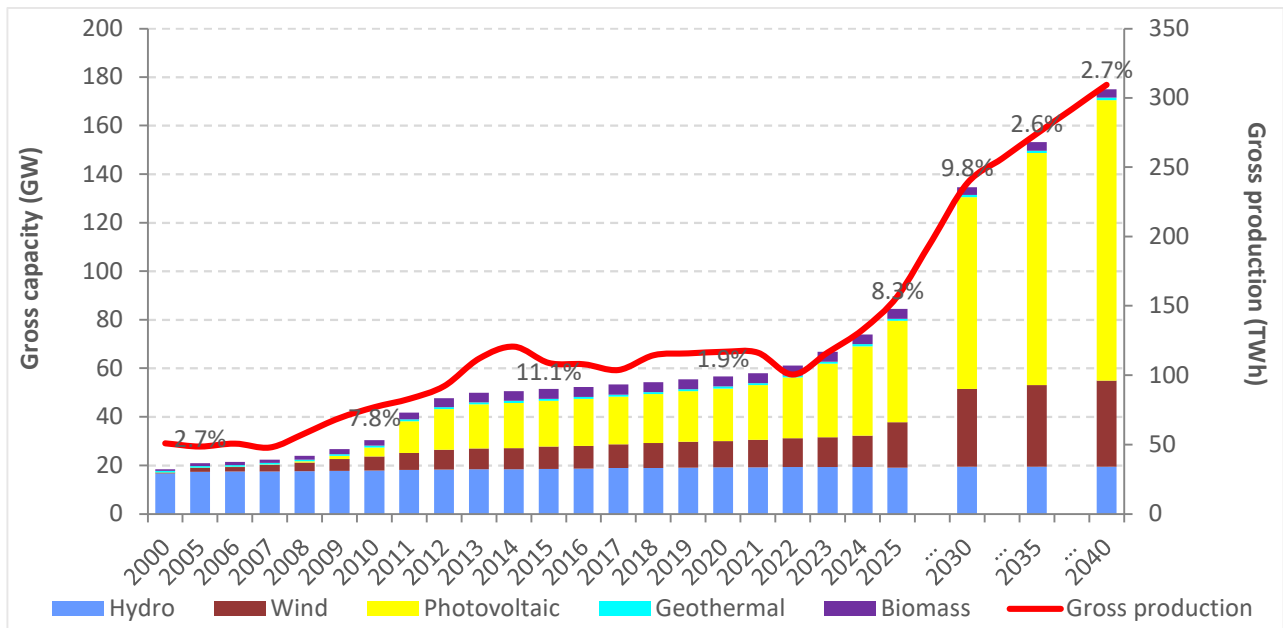


Figure 3.21 – Renewable power and gross electricity production. The percentage represents the annual
Source: ISPRA

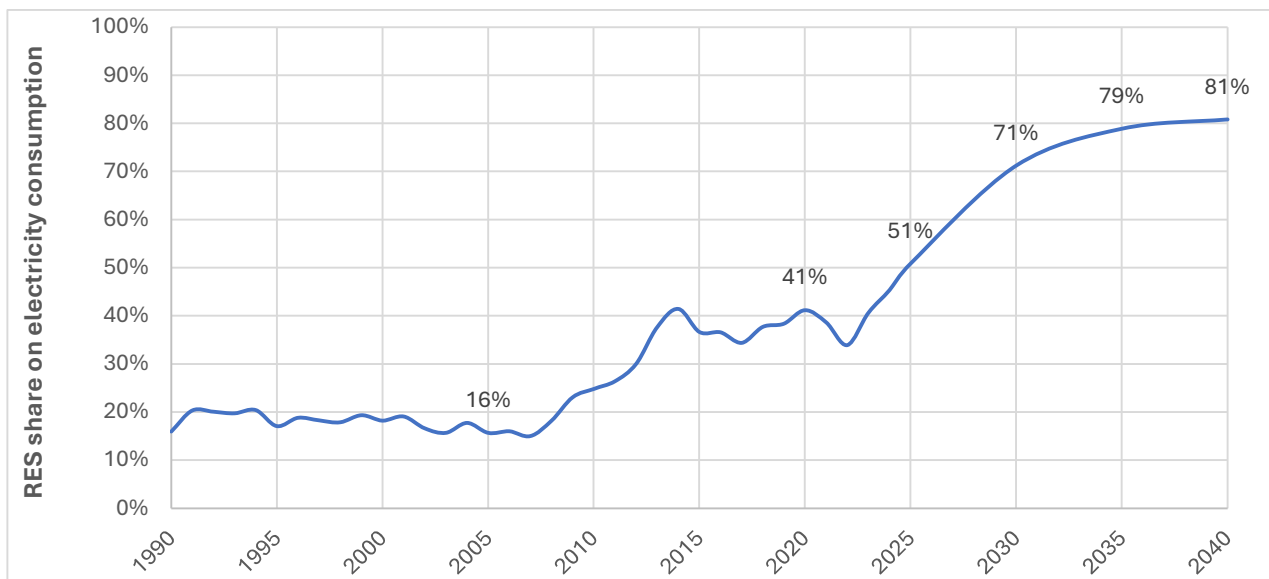


Figure 3.22 – RES share in electricity consumption in the WAM scenario
Source: ISPRA

The projection shows the increase of renewable share up to 81% in 2040, while 71% is reached in 2030, anticipating the outcome of WM reached in 2040. The renewable electricity production will amount to about 238.6 TWh in 2030 and 309.6 TWh in 2040, out of total generation of 323.6 TWh and 397 TWh, respectively, while the electricity consumption will be 335 TWh and 383 TWh, respectively. The renewable electricity production in WAM scenario is about 43% higher than WM scenario in 2030 and 38% on 2040.

Other sectors

In the WAM scenario, greenhouse gas emissions in the transport sector are expected to reach 55.5 million tons of CO₂-eq by 2030, with a 30% reduction in emissions compared to 1990 levels. Compared to the WM scenario, this represents a significant reduction in GHG emissions of 20% by 2030 (Figure 3.23).

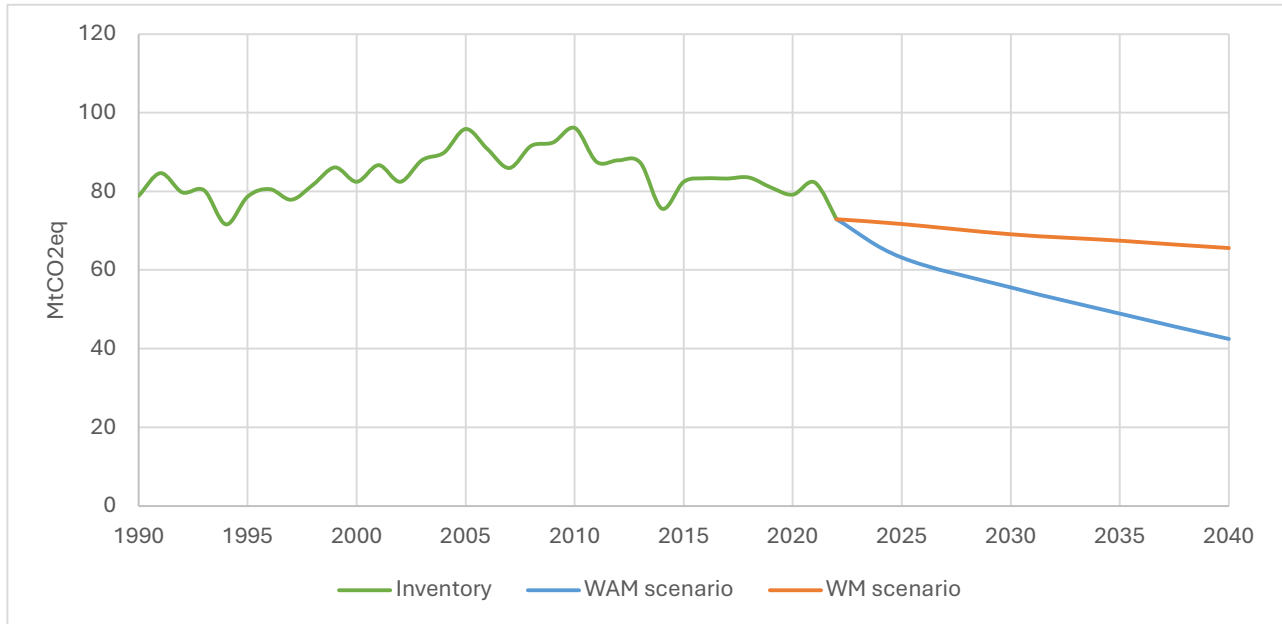


Figure 3.23 Other sector actual and projected GHG emissions (Mt CO₂ eq.)
Source: ISPRA

The emissions difference between the WM scenario and the WAM scenario in 2030 reflects the impact of planned measures to reduce greenhouse gas emissions. As described in paragraph 3.4.1, the main cause of this difference is the strengthening of existing policies and actions, with the goal of reducing energy demand through energy efficiency and increasing the use of renewable sources for heat generation. The drivers to develop energy efficiency will be technological and behavioral evolution, possible only through the maintenance and strong enhancement of the existing promotion tools. It will be also essential to update current policies in order to increase the benefit-cost ratio for the State; to this end, a reform of fiscal incentives will be implemented to identify intervention priorities and differentiate the level of assistance based on the effectiveness in improving the building's energy performance, both in terms of consumption reduction and the increase in the use of renewable sources. The leading role of the Public Administration will have great importance, for which a major efficiency plan for the real estate portfolio and energy consumption reduction will need to be launched, including the sharing of targets with regional and local authorities. It will also be important to update existing measures to include the promotion of energy efficiency in buildings of the private non-residential sector, which still holds untapped potential for savings.

Regarding the thermal renewable sector, promotion tools will continue to be coordinated with the various measures planned for energy efficiency, particularly for buildings. These

measures will include, for example, the obligation to integrate thermal renewable energy sources (RES) into buildings, the promotion of district heating, and the obligation to supply renewable heat. From a technological point will be important to continue creating a favorable framework to accelerate the decarbonization of residential consumption through widespread deployment of heat pumps in the civil sector, allowing the market to select the most efficient option for each application, while also valuing their contribution in cooling mode.

3.6.4.2 Transport

In the WAM scenario, greenhouse gas emissions in the transport sector are expected to reach 71.6 million tons of CO₂-eq by 2030, with a 30% reduction in emissions compared to 1990 levels. Compared to the WM scenario, this represents a significant reduction in GHG emissions of 23% by 2030 (Figure 3.24).

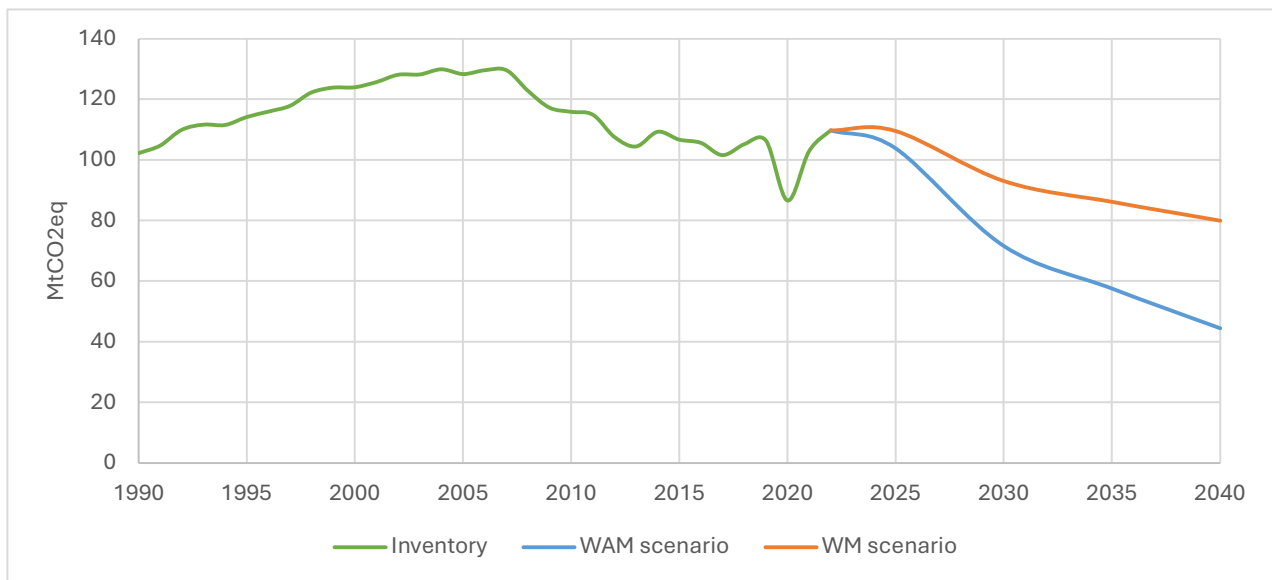


Figure 3.24 Transport sector actual and projected GHG emissions (Mt CO₂ eq.)

Source: ISPRA

For passenger transport, this decrease is primarily driven by a growing share of zero-emission vehicles (target of 6.6 million electrified cars by 2030), the renewal of the local public transport fleet, increased use of renewable fuels, and additional measures to shift mobility demand, as outlined in the National Energy and Climate Plan. Furthermore, a further reduction in private mobility is expected due to the spread of smart working and the promotion of cycling and walking. By 2030 and 2040, the modal share for road and rail public transport is expected to increase by 2 percentage points compared to the WEM scenario (Figure 3.25).

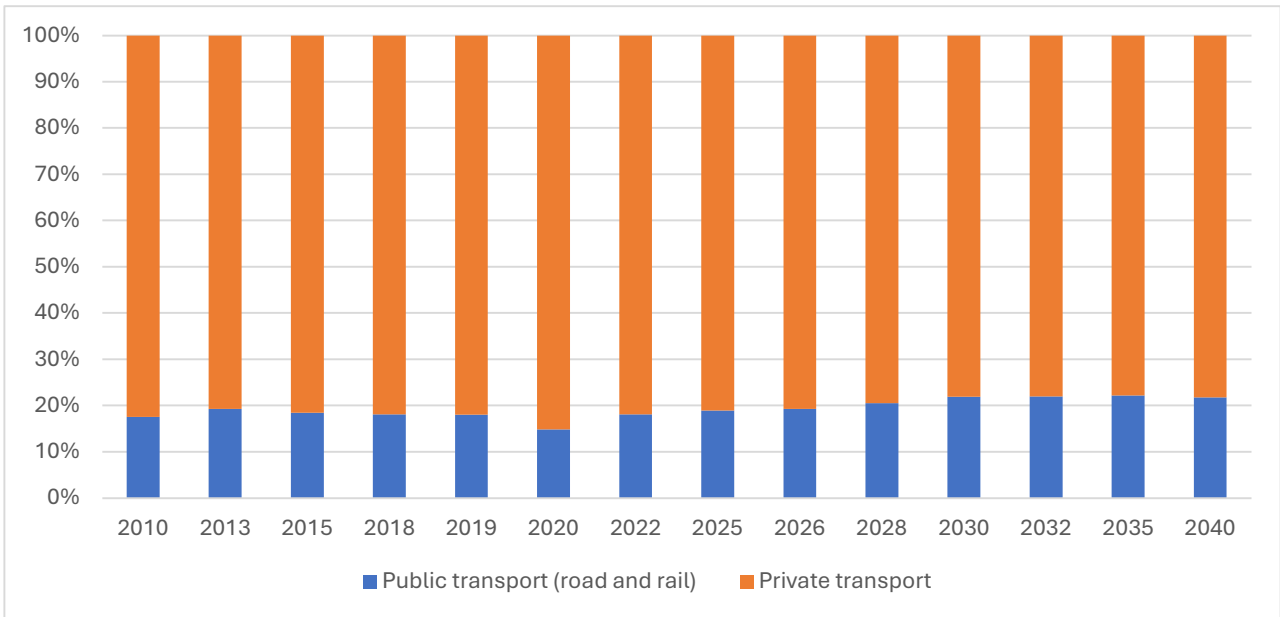


Figure 3.25 Trends of modal shift of passenger transport (%)
Source: ISPRA

The effect of the planned measures also emerges from the time trend of vehicle kilometers (vkm) for passenger cars relative to the population and GDP (Figure 3.26). By 2030, using 2010 as the base year, in the WAM scenario the intensity relative to the population is expected to be 95%, compared to 102% in the WM scenario. Similarly, the intensity relative to GDP is expected to be 84% in the WAM scenario, compared to 90% in the WM scenario (Figure 3.26).

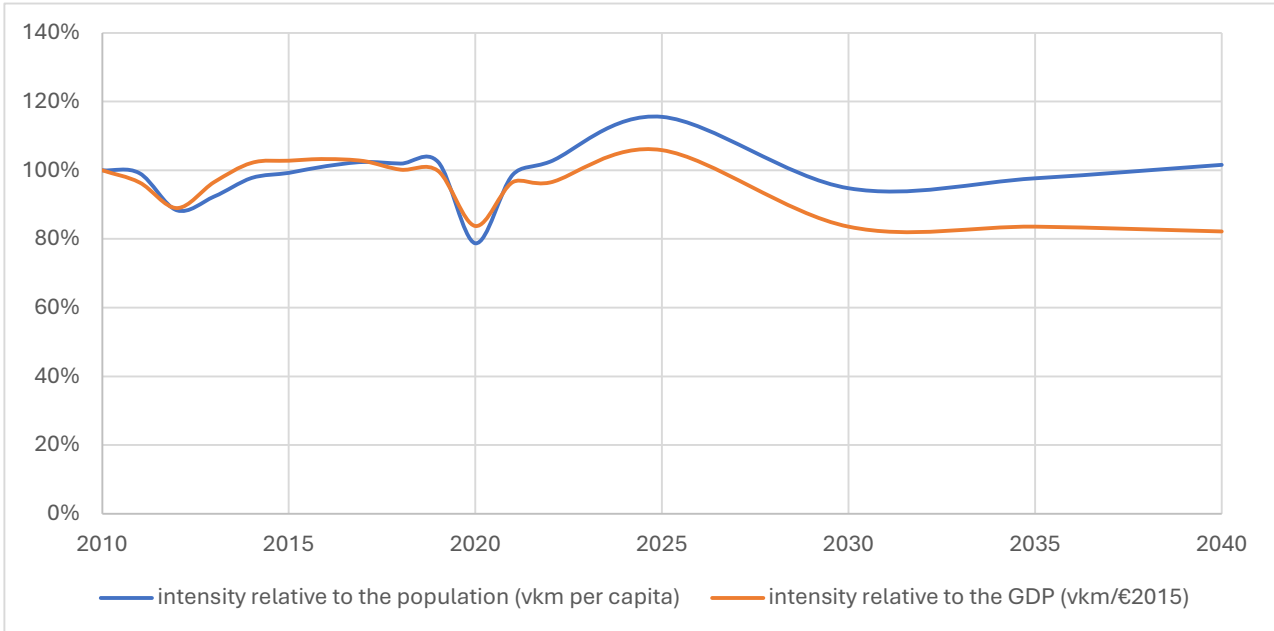


Figure 3.26 – Trends of intensity relative to the population (kvkm per capita) and GDP (vkm/k€2015)
Source: ISPRA

For freight transport, the reduction is primarily due to an increase in the modal share for rail transport (30% by 2030, Industrial Plan FS Group), incentive for the purchase of low-carbon light vehicles, reduction of empty truck trips (-5%) and the further development of biofuel use (bio diesel e bio GNL). By 2030 and 2040, there is an expected increase of 17 and 18 percentage

points, respectively, in the modal share for rail and maritime freight transport compared to the WM scenario (Figure 3.27).

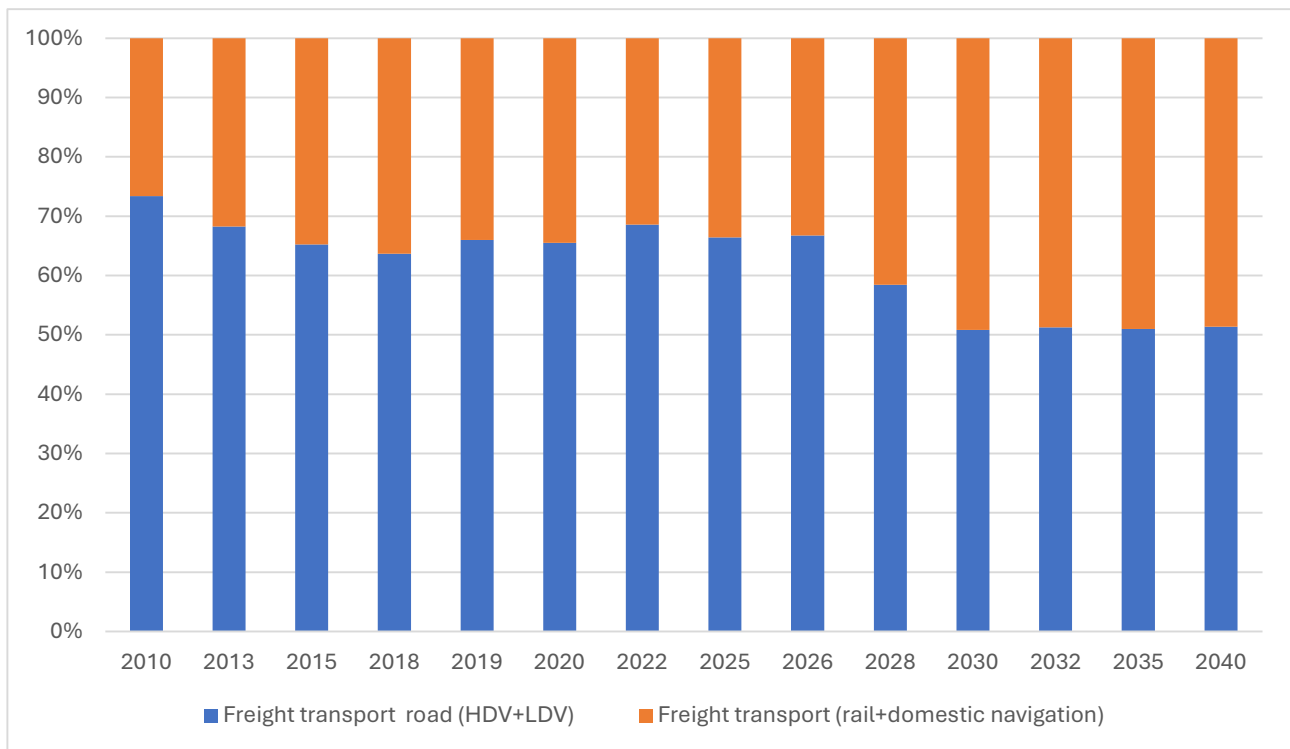


Figure 3.27 Trends of modal shift of freight transport (%)
Source: ISPRA

Between 2030 and 2040, greenhouse gas emissions from the transport sector are expected to decrease further due to a stronger penetration of zero-emission vehicles, driven by Regulation (EU) 2023/851, which sets a 100% emission reduction target for both cars and vans from 2035 onwards. Additionally, the support for the penetration of hydrogen in the road and rail transport through initiatives such as the National Recovery and Resilience Plan (NRRP) and REPowerEU will contribute to this reduction. Compared to the WM scenario, emissions will decrease by 33% in 2035 and by 44% in 2040, respectively.

3.6.4.3 Agriculture

A WAM scenario of the agriculture sector was also calculated considering an increase in biogas production. A percentage of the use of livestock manure sent to anaerobic digestion was assumed (equal to 60% for cattle, 50% for pigs, and 60% for poultry), which will contribute, together with other agricultural and agro-industrial substrates, to the production of about 9.6 billion cubic meters of biogas by 2030. Emissions from the WAM scenario for the agriculture sector are about 30.0 MtCO₂ eq and 29.6 MtCO₂ eq at 2030 and 2040 respectively, which compared to the WEM scenario represent an overall reduction in GHG emissions of 3% at both 2030 and 2040.

3.6.5 Projection results and emissions targets

The following tables 3.25 and 3.26 show emission projections for WM and WAM scenarios.

Tab 3.25 - Projections of greenhouse gas emissions and removals under the WM scenario (Mt CO₂ eq)

Sector	Most recent year in the national inventory report	Projections of GHG emissions and removals			
	2022	WM			
	2022	2025	2030	2035	2040
Energy	228.10	200.44	181.50	162.69	159.26
Transport	109.77	109.54	92.99	86.15	79.93
Industrial processes and product use	23.62	30.33	27.61	26.61	26.10
Agriculture	30.76	31.88	30.95	30.59	30.54
Forestry/LULUCF	-21.20	-27.97	-28.38	-24.63	-30.79
Waste management/waste	20.05	16.97	15.48	13.62	11.80
Indirect CO ₂	0.73	0.75	0.76	0.76	0.77
<i>Gas</i>					
CO ₂ emissions incl. LULUCF	319.52	294.79	258.91	237.84	223.20
CO ₂ emissions excl. LULUCF	341.63	323.68	288.43	263.65	255.22
CH ₄ emissions incl. LULUCF	46.07	41.91	39.86	37.50	35.18
CH ₄ emissions excl. LULUCF	45.71	41.43	39.28	36.89	34.55
N ₂ O emissions incl. LULUCF	16.29	17.52	17.27	17.15	16.93
N ₂ O emissions excl. LULUCF	15.74	17.07	16.72	16.57	16.33
HFCs	9.09	6.95	4.18	2.72	1.71
PFCs	0.44	0.38	0.38	0.38	0.38
SF ₆	0.39	0.36	0.26	0.18	0.16
NF ₃	0.02	0.02	0.02	0.02	0.02
Unspecified mix of HFCs and PFCs	0.02	0.02	0.02	0.02	0.02
Total with LULUCF	391.84	361.94	320.91	295.80	277.60
Total without LULUCF	413.04	389.91	349.30	320.43	308.39

Source: ISPRA

Tab 3.26 - Projections of greenhouse gas emissions and removals under the WAM scenario (Mt CO₂ eq)

Sector	Most recent year in the national inventory report	Projections of GHG emissions and removals			
	2022	WAM			
	2022	2025	2030	2035	2040
Energy	228.10	184.78	145.34	126.35	127.60
Transport	109.77	103.78	71.57	57.51	44.41
Industrial processes and product use	23.62	30.33	27.61	26.61	26.10
Agriculture	30.76	31.42	29.98	29.76	29.56
Forestry/LULUCF	-21.20	-27.97	-28.38	-24.63	-30.79
Waste management/waste	20.05	16.97	15.48	13.62	11.80
Indirect CO₂	0.73	0.75	0.76	0.76	0.77
Gas					
CO₂ emissions incl. LULUCF	319.52	273.87	202.38	174.47	156.80
CO₂ emissions excl. LULUCF	341.63	302.76	231.90	200.28	188.82
CH₄ emissions incl. LULUCF	46.07	41.32	38.80	36.21	34.44
CH₄ emissions excl. LULUCF	45.71	40.85	38.22	35.61	33.81
N₂O emissions incl. LULUCF	16.29	17.14	16.31	15.98	15.92
N₂O emissions excl. LULUCF	15.74	16.68	15.76	15.41	15.31
HFCs	9.09	6.95	4.18	2.72	1.71
PFCs	0.44	0.38	0.38	0.38	0.38
SF₆	0.39	0.36	0.26	0.18	0.16
NF₃	0.02	0.02	0.02	0.02	0.02
Unspecified mix of HFCs and PFCs	0.02	0.02	0.02	0.02	0.02
Total with LULUCF	391.84	340.05	262.36	229.99	209.45
Total without LULUCF	413.04	368.02	290.74	254.61	240.24

Source: ISPRA

If compared to 1990 levels the total GHG emission reduction in 2040 is expected to be -46% in the WM scenario and -60% in the WAM scenario.

Total emissions including LULUCF in the WAM scenario, compared to WM scenario, are expected to be 22% lower in 2030 and 25% lower in 2040. These reductions are the overall effect of the planned policies and measures described in paragraph 3.4, and mainly those in the Transport sector (in 2040 WAM is 44% lower than WM) and in the energy sector (in 2040 WAM is 20% lower than WM). The agriculture sector in the WAM scenario shows a reduction of 3% if compared to WM scenario in 2040, while for other sectors there are no significant differences.

The total effect in terms net GHG emission reduction of the implemented PaMs is expected to be equal to 48MtCO₂eq in 2030 (45 from Energy, Transport, Industrial processes, Agriculture and Waste, ad 3 from LULUCF), while the effect of planned ones is expected to be about 61MtCO₂eq in 2030 (from Energy, Transport, and Agriculture).

Table 3.27 – National GHGs emission scenarios and targets (Mt CO₂ eq.) under EU legislation

	1990	2005	2022	2025	2030	2035	2040
Total with LULUCF WM				361.9	320.9	295.8	277.6
Total with LULUCF WAM	518.7	561.9	391.8	340.1	262.4	230.0	209.4
Effort Sharing emissions WM			274.3	268.2	242.7	-	-
Effort Sharing emissions WAM	-	-	274.3	252.1	203.7	-	-
Effort Sharing targets	-	-	268.8	240.7	193.2	-	-
Distance from Effort Sharing targets WM				27.5	49.5	-	-
Distance from Effort Sharing targets WAM	-	-	5.5	11.4	10.5	-	-
LULUCF emissions and removals (WM/WAM)²	-3.6	-33.7	-21.2	-28.0	-28.4	-24.6	-30.8
LULUCF targets	-	-	-	0.0	-35.8	-	-
Distance from LULUCF targets	-	-	-	-28.0	7.4	-	-

Source: ISPRA

Tables 3.27 summarize the GHG emissions in both WM and WAM scenarios up to 2040 and compare them to target descending from EU regulations.

Even though both WM and WAM scenarios show significant reductions in GHG emissions, up to now Italy is not fully in line with the emission targets set by the ESR regulation for the period 2021-2030 in both scenarios.

For LULUCF a target equal to -35.8 MtCO₂eq have also been set for Italy in the revision of Regulation (EU)2018/841 and also in this case present projections are quite distant from the target.

4 INFORMATION RELATED TO CLIMATE CHANGE IMPACTS AND ADAPTATION

4.1 Adaptation strategies, policies, plans and goals⁵⁹

4.1.1 National adaptation priorities

Italy is in the so-called “Mediterranean hot spot”, an area identified as particularly vulnerable to climate change, with warming exceeding the global average increase by 20% and a reduction in precipitation in contrast to the general increase in the hydrological cycle in temperate zones between 30°N and 46°N latitude (IPCC). The Italian territory is notoriously prone to natural hazards and climate change is expected to increase climate-related hazards over the next decades. This, combined with the economic, social and environmental pressures, makes Italy one of the most vulnerable countries in Europe⁶⁰. Considerable impacts are expected because of climate change in many sectors, such as agriculture, tourism, water resources and geo-hydrological hazards, and on people, as in the case of the heat islands effect on outdoor workers and most vulnerable groups (older people, pregnant women, sick people, etc.). In this context, adaptation is a cross-cutting issue that needs synergistic actions that consider the impacts of climate change in different sectors. Therefore, the main interests are directed to: implement the National Adaptation Plan to climate change (NAP); support local administrations; disseminate and share data and knowledge on the subject through easily accessible interactive tools; develop studies, models and tools concerning specific relevant hazards to which the Italian territory is subject.

4.1.2 Challenges, gaps and barriers to adaptation

In Italy, at the national level there is still a lack of coordination, while at the sub-national level there is a great lack of homogeneity in adaptation planning and actions. Difficulties are linked to the absence of detailed data for the construction of climate frameworks and for regional and local forecasting scenarios; the lack of decision support systems to guide the decision makers in their choices; the lack of specific skills within the administrations and the need to build new governance models; the availability of funds to cover the needs of the different sectors and the difficulty to act in an integrated way.

⁵⁹ Sources: “Italy Eighth National Communication under the United Nations Framework Convention on Climate Change” (December 2022), “National climate change adaptation planning and strategies pursuant to Article 19(1) of the Governance Regulation 2018/1999” (March 2023).

⁶⁰ The key risks for the European area are mainly related to: • increased water restrictions due to reduction in water availability combined with increased water demand (e.g. for irrigation, energy and industry, domestic use), and with increased evaporative demand, particularly in southern Europe; • increased impacts related to extreme heat events on health and well-being, labor productivity, crop production, air quality, and wildfires risks; • increased economic losses and people affected by flooding in river basins and coasts.

Italy is trying to overcome these barriers through systemic actions under the NAP, aimed at defining national governance for adaptation, mainstreaming adaptation into planning at all levels, defining sectoral and cross-sectoral means for implementing adaptation measures, improving, and systemizing the knowledge framework. The steering functions of the governance structure are represented by defining roles, responsibilities and priorities for action, identifying sources of funding and identifying legislative, regulatory, and procedural barriers to adaptation.

4.1.3 Domestic adaptation policies, strategies and plans

Policies and measures taken by Italy to adapt to climate change are driven by indications stemming from the international level, through the Paris Agreement, and from the EU, in particular as set forth in the European adaptation strategy.

The first steps at the national level were taken in 2015, when the National Climate Change Adaptation Strategy (NAS)⁶¹ was adopted. The NAS analyzes the state of scientific knowledge on the impacts and vulnerability to climate change for key environmental and socioeconomic sectors and it shows proposals and criteria for action.

In 2017, Italy produced outlined the first draft of the National Adaptation Plan to implement the National Adaptation Strategy. After a participatory process, which involved public administrations at various levels, as well as researchers and stakeholders, the first draft of the NAP was then submitted to the Strategic Environmental Assessment (SEA). This procedure pointed out the need to revise the NAP. SEA process has been completed in August 2023 and the final version of the NAP has been then approved on 21st December 2023 by a decree from the Minister of Environment and Energy Security (n. 434/2023) and published on the institutional website⁶². Subsequently, it has entered into force on 21st February 2024 following its publication in the Italian Official Journal (n.42 of 20-02-2024)⁶³.

The main objective of the National Adaptation Plan is to provide Italy with a framework for the implementation of actions aimed at i.) reducing the risks associated to climate change; ii.) improving the adaptive capacity of socio-economic and natural systems and iii.) taking advantage of any opportunities that may arise with the new climate conditions.

The NAP provides therefore four systemic actions, aimed at:

- the establishment of a national governance structure for adaptation (Action 1);

⁶¹ <https://www.mase.gov.it/pagina/strategia-nazionale-di-adattamento-ai-cambiamenti-climatici>.

⁶² <https://www.mase.gov.it/notizie/clima-approvato-il-piano-nazionale-di-adattamento-ai-cambiamenti-climatici>.

⁶³ https://www.gazzettaufficiale.it/gazzetta/serie_generale/caricaDettaglio?dataPubblicazioneGazzetta=2024-02-20&numeroGazzetta=42.

- the definition of ways to include climate change adaptation principles, measures and actions in national, regional and local Plans and Programs, enhancing synergies with other national Plans (Action 2);
- the definition of sectoral and cross-sectoral ways and means of implementing NAP measures at different levels. This action includes defining possible sources of funding, as well as identifying potential barriers to adaptation (Action 3);
- the improvement and systematization of the knowledge framework on climate change impacts, vulnerabilities, and risks in Italy through the development of a research program (Action 4).

Furthermore, four relevant Annexes are part of the NAP: i.) a methodological document for the definition of regional strategies and plans; ii.) a methodological document for the definition of local strategies and plans; iii.) a descriptive document on sectoral impacts and vulnerabilities and iv.) a database of 361 adaptation actions. The database provides a portfolio of possible actions which will be selected by the different authorities in charge of implementation according to their territorial needs. Among these actions there are also activities listed in Article 8.4 of the Paris Agreement, as better argued below in paragraph d.2.

The implementation of the NAP will take place through a dedicated governance structure (Action 1), called “National Observatory for adaptation to climate change”, that will carry out the following tasks: i. updating of the NAP; ii. updating over time the adaptation actions and defining priorities for action; iii. identifying specific sources of funding and coordination and integration between national and regional planning and programming tools; iv. monitoring, reporting and evaluation activities; v. assessing the consistency with the provisions of the NAP of any proposals submitted by Regions, Local Authorities or other public bodies.

The National Observatory is expected to be composed of:

- a Committee, i.e. a collegial body with coordinating function. It will be made up of 16 members from several Ministries, the regions and the representatives of municipalities, and other institutions.
- a Secretariat, i.e. a technical and administrative support structure that will be established within the Ministry of the Environment and Energy Security.
- a Forum i.e. an advisory body. Through the Forum the involvement of stakeholders in the implementation of public policies on adaptation and in the implementation of the NAP will be ensured.

4.1.4 Progress and outcomes of adaptation action

Currently, the Ministry of Environment and Energy Security is completing the administrative process for the establishment of the National Observatory. After the establishment of its first two structures, namely the Committee and the Secretariat, the following step will be the launch of the Forum, which is a duty in charge of the Committee.

In the last years, while the Italian National Adaptation Strategy and the National Adaptation Plan to climate change were being defined, adopted and implemented, further adaptation initiatives have been carried out in the country to address certain climate events.

As part of the CReAMO PA project *Capacity building for climate change adaptation* (financed by European funds), run by Ministry of Environment and Energy Security, from 2018 to 2023, a specific line of the Project was dedicated to adaptation: Line 5 *Strengthening of administrative capacity for climate change adaptation*, that was aimed at spreading informations at regional and local level and strengthening technical and administrative capacity for developing adaptation strategies and plans.

In 2020, two guidelines aimed at supporting Italian Regions and Municipalities were drafted (and subsequently adopted in 2023 along with the NAP as Annex I and II). During its five-year term, the Ministry dealt with supporting regional and local governments in using the contents of the above-mentioned documents for the establishment of their adaptation strategies, plans and measures, consistently with national planning. As a result, the number of administrations that have adopted acts and documents on adaptation is increased significantly. Within the framework of the Project a draft project for a Charter of the Mediterranean Small Islands for climate adaptation was presented.

In 2021, a funding Programme for urban adaptation was launched by the Ministry for Environment and energy Security. This Programme is aimed at increasing the resilience of cities to the risks of climate change, in particular to heat waves, extreme rainfall and drought phenomena. This is the first initiative to set these objectives at the national level, for now intended for municipalities with a population over 60.000 inhabitants. In particular, the Programme allocates around 80 million euro for the implementation of mainly green and blue actions, but also, to a lesser extent, grey actions. In addition, the Programme includes a series of adaptive capacity building measures. In total 80 municipalities have been eligible for funding and have started interventions, which will end in 2024, unless extended.

Furthermore, in 2022, the MASE in collaboration with ISPRA has launched the National Adaptation Platform⁶⁴ which intends to foster the exchange of information between the Central Administration, Local Authorities and all stakeholders on the issue of climate change adaptation. Its overall purpose is to inform, raise awareness and make data and operational tools available to all individuals, to promote and support Local Authorities in decision-making and planning processes on the subject of adaptation, as well as to provide them with all the information contained in the National Adaptation Plan. The Platform, in particular, aims to facilitate access to and sharing of data and information on observed and future climate changes impacts and vulnerabilities of regions, natural systems, socio-economic sectors, institutional levels working on the issue, adaptation strategies and plans at different administrative levels and possible adaptation actions.

⁶⁴ <https://climadat.isprambiente.it/>

Within the framework of the commitments undertaken with the EU and in compliance with the EU guidelines on adaptation, Italy, moreover, is pursuing the objective of adaptation in the use of EU funds, also through the drafting of own guidelines aimed at providing indications for specific areas. In this regard, two relevant issues deserve to be mentioned which are respectively linked to: (1) the “climate proofing” principle, and (2) the “DNSH – Do No Significant Harm” principle.

(1) the “climate proofing” principle was outlined in the Commission document *Technical guidance on the climate proofing of infrastructure in the period 2021-2027* (2021/C 373/01). The Ministry of Environment and Energy Security, in collaboration with the Italian Presidency of the Council - Department for the Cohesion Policies and other national and EU institutions, has been involved in initiatives on the topic of climate proofing and has contributed to the drafting of the *Guidelines for the climate proofing of infrastructure projects in Italy for the period 2021-2027*⁶⁵.

(2) The Do No Significant Harm (DNSH) principle was outlined in the “Taxonomy” Regulation⁶⁶. According to Article 17 provided therein, the DNSH principle states that economic activities may not cause any significant harm to any of the 6 environmental objectives listed in Article 9, which include adaptation to climate change.

Both the Recovery and Resilience Facility (RRF) Regulation⁶⁷, on whose basis any National Recovery and Resilience Plan (NRRP) is based, and the Regulations governing the EU multiannual financial framework for the 2021-2027 cycle⁶⁸, recall Article 17 of the Taxonomy Regulation considering it as a criteria for the eligibility of the measures outlined in these instruments, for the purposes of their admissibility to financing. In order to implement this principle in the framework of the relevant measures (investments and reforms) set up under Italy’s NRRP, besides referring to the EU instruments (i.e. Commission delegated regulations, Commission DNSH technical guidance), specific instruments have been adopted at the national level:

- The *Operational Guide for compliance with the DNSH principle* was drafted by the Ministry of Finance - State General Accounting Office, with the aim to assist public administrations in the processes of orientation, gathering information and checking about the DNSH principle⁶⁹.
- A few guidelines, vademecums etc. was adopted by some Italian Ministries with the aim to support in the topic of DNSH the subjects involved in the implementation of such

65 <https://politichecoesione.governo.it/it/politica-di-coesione/la-programmazione-2021-2027/piani-e-programmi-europei-2021-2027/verifica-climatica-dei-progetti-infrastrutturali-finanziati-dalla-politica-di-coesione-2021-2027/>

66 Regulation (EU) 2020/852

67 Regulation (EU) 2021/241

68 Regulation (EU) 2021/1060 and others

69 https://www.rgs.mef.gov.it/Documenti/VERSIONE-I/CIRCOLARI/2022/33/20221006_Guida-Operativa.pdf

measures: for example, the MASE adopted its own Vademecum, namely *The DNSH principle and the analysis of climate risks in the NRRP*⁷⁰.

4.2 Impacts, vulnerability and adaptation to climate change

The national System for elaboration and dissemination of climate data (SCIA) has been realized by ISPRA. The climate indicators can be downloaded and displayed in the form of tables, diagrams and maps. Based on SCIA data, trends of mean temperature and total precipitation, as well as their extremes, are regularly updated and disseminated through the web site (<https://scia.isprambiente.it/>) and the annual report on climate state and variations over Italy, published by ISPRA. Some regions have implemented local initiatives on climate monitoring and trend evaluation, including dissemination of information via web sites and climate bulletins. Moreover since 2018 the National System for Environmental Protection⁷¹, which is composed by ISPRA and the Regional Environmental Protection Agencies, set up a national Working Group on “Impacts, vulnerability and adaptation to climate change” with the objective to define a set of climate change impact indicators. The first set of indicators was published in June 2021⁷² providing a first picture on climate change impacts at national and regional level. Thirteen of the eighteen sectors identified by NAS and NAP are represented : water resources; soil; terrestrial ecosystems; marine ecosystem; Alpine and Apennine environment; coastal areas; health; forestry; agriculture; fishing; energy; urban areas; culture heritage, and thirty-three potential impacts have been identified , of which twenty four are on natural resources and nine on socio-economic sectors.. Starting from a portfolio of 150 potential indicators a subset of 20 national indicators and 30 regional case studies have been elaborated. For each indicator the report specifies climate factors, frequency of data collection, temporal and spatial coverage, and limitations, as well as overall future trends. The indicators have heterogeneous characteristics in terms of data, consistency and length of the historical series. For some indicators, that have a long time series data, clear and significant trend has been identified. The indicators have also been published on the climate change adaptation platform (<https://climadat.isprambiente.it/dati-e-indicatori/indicatori-di-impatto-dei-cambiamenti-climatici/>). The indicators are continuously updated. In September 2024, a phase of updating and expanding the indicators was completed. Two new sectors of NAS and NAP were covered, namely aquaculture and transition ecosystems, with sixteen new indicators added. By December 2024, the dedicated page of the National Climate Change Adaptation Platform will be updated.

A summary framework relating to the most relevant aspects of climate change impacts and sectoral vulnerabilities that characterize the Italian territory was approved as Annex III along

⁷⁰ https://www.mase.gov.it/sites/default/files/PNRR/Analisi%20rischi%20climatici_Vademecum_def.pdf.

⁷¹ Established by Italian Law No. 132/2016

⁷² SNPA, Rapporto sugli indicatori di impatto dei cambiamenti climatici, 2021, <https://www.snambiente.it/temi/report-intertematici/cambiamenti-climatici/rapporto-sugli-indicatori-di-impatto-dei-cambiamenti-climatici-edizione-2021/>.

with the NAP73. The sectors covered therein are those already included in the National Adaptation Strategy, which correspond to the natural systems and socio-economic sectors most vulnerable to climate changes in Italy. In addition, a cross-sectional analysis of the socio-economic impacts of climate change is described to offer a first general vision of the economic consequences and social issues that affect society, regardless of the specific sector. This integrated approach aims to underline the interdependence and complexity of the challenges posed by change climate, emphasizing the need for strategies that consider all socio-economic involved aspects. Although not completely updated to recent years, the framework of knowledge on the climate change impacts in Italy envisaged in the abovementioned Annex III still proves to be suitable to predict the climate change impacts on different environmental, economic and social sectors.

Moreover, the NAP contains updated elements of knowledge for some sectors, while a complete update is envisaged among the systemic actions (Action 4).

4.3 Monitoring, reporting and evaluation of adaptation actions and processes

The National Adaptation Plan takes into consideration the need for a Monitoring, Reporting and Evaluation system (MRE) on adaptation (paragraph 6.2 of the NAP), as an essential element of the implementation process of the Plan. In so doing, the NAP fills an area that, prior to its entry into force (dating back to 2023), was not specifically addressed within the framework of the NAS or elsewhere. As envisaged in the NAP, following the establishment of the National Observatory (see paragraphs a.3 and a.4), a monitoring scheme will be set up also in view of the information available in the literature. In relation to the governance system designed by the NAP, the Committee of the National Observatory starts, immediately after its establishment, the activities for the implementation of the Monitoring, Reporting and Evaluation system, through the organization of roles and the quantification of the resources to be allocated to its management. Within seven months of its establishment, the Committee provides for the first integration and updating of the MRE System indicators, also starting the process of sharing the criteria for collecting and transmitting monitoring data with the Regions and the District Basin Authorities.

For each of the MRE processes, the identification of adequate indicators allows us to:

- monitor the implementation of adaptation policies, measures and actions;
- justify and monitor funding for adaptation programs based on fixed objectives;
- integrate adaptation through linkages between sectors and related indicators;
- communicate the adaptation to policy makers and other stakeholders;
- compare adaptation results at sub-national scales and across sectors of interest.

⁷³ This document was drafted over the years 2017-2018 by a large community of experts.

Regarding the indicators, for each adaptation action in the Database (Annex IV of the NAP) “progress indicators” and “effectiveness indicators” have been identified. The indicators were subsequently revised as a whole and grouped by main types of action, categories and macro-categories, although this attribution is not to be considered in a rigid manner. In fact, each indicator can be relevant for more than one type of action, category and macro-category.

The "Progress Indicators" and "Effectiveness Indicators" worksheets of the Database⁷⁴ represent a portfolio of indicators which must subsequently be refined and adapted to the territorial context, in order to provide valid support to the MRE system of the NAP. In any case, even during the implementation phase of the Plan, the list of indicators must be understood as an "in progress" set, i.e. which needs to be reviewed and updated based on new and available information, considering any changes in the overall context. The NAP includes a monitoring report every three years.

4.4 Information related to averting, minimizing and addressing loss and damage associated with climate change impacts as required under paragraphs 115 (a-c) of decision 18/CMA.1⁷⁵

4.4.1 On paragraph 115(a) of Decision 18/CMA.1 – Impacts

As anticipated in the section B, the NAP addresses in paragraph 3 the subject related to climate change impacts and sectoral vulnerability in Italy⁷⁶. Furthermore, it is foreseen an action consisting of the improvement and systematization of the knowledge framework on the impacts, vulnerabilities and risks in Italy (Action 4). This action involves the development of a specific research program aimed at identifying the different sectoral impacts (actual and potential), defining methods of analysis and evaluation of climate risks also providing in-depth analysis on specific topics such as, for example, sustainable management of water in urban areas, the impact of climate change on cultural heritage, infrastructure, on land consumption. Furthermore, this action will consider the information contained in the first European Climate Risk Assessment (EUCRA).

4.4.2 On paragraph 115(b) of Decision 18/CMA.1 – Activities

The NAP provides a national framework for implementing actions aimed at reducing the risks arising from climate change and improving the adaptation capacity of socio-economic and

⁷⁴ Annex IV “Database” of the NAP.

⁷⁵ Sources: Article 7 of the Paris Agreement, NAP and its Annex IV “Database of adaptation measures/actions”.

⁷⁶ A specific table on “Sector”, “Potential impacts” and “Future scenario” is inserted in the “Italy Eighth National Communication under the United Nations Framework Convention on Climate Change” (December 2022).

natural systems, as well as to take advantage of any opportunities that may arise with the new climatic conditions feedback.

Italy, according to the Paris Agreement, recognizes the importance of averting, minimizing and addressing loss and damage associated with the adverse effects of climate change, including extreme weather events and slow onset events. To this end, in the database (Annex IV) it is possible to identify measures that refer to the types of actions listed in the Article 8.4 of the Paris Agreement, regarding for example: the setting up of early warning systems, emergency and evacuation plans, insurances against risks related to the loss of ecosystem benefits, climate risk assessment (for example in the agriculture sector), slow onset events (such as the drought management, desertification and sea level rise). It should be considered that some types of action cut across multiple categories.

Adaptation can play a significant role in averting, minimizing and addressing loss and damage. Furthermore, the National Observatory is responsible for updating the NAP adaptation actions and identifying priorities at national level, in this framework it is also possible to introduce new activities with reference to the aforementioned article 8.4 in order to strengthen actions to prevent and reduce losses and damages.

In this context it is also useful to mention the soft measures to strengthen adaptive capacity envisaged by the Programme for urban adaptation: measures aimed at improving knowledge at local level (e.g. implementation of climate/impact/vulnerability databases, predictive ICT systems, strengthening of monitoring systems, etc.), as well as the drafting of municipal planning of adaptation to climate change tools; measures aimed at improving forecasting capacity at a local level (e.g. climate scenarios, risk analysis, etc.); awareness, training and participation measures on adaptation at the local level and on the reduction of specific vulnerability for local operators and the stakeholders.

4.4.3 On paragraph 115 (c) of Decision 18/CMA.1 - Institutional arrangements

In Italy, adaptation planning and implementation at the national level is primarily the responsibility of the Ministry of the Environment and Energy Security, however joint efforts may also involve other national authorities and sub-national authorities.

In this context the experience gained through the activities of the above-mentioned Line 5 of the Project CReIAMO PA is also significant, because it is a clear example of joint effort, developed systemically over a five-year period, between the national level and Regions and local authorities, in the framework of a multi-level governance, for strengthening the administrative capacity of sub-national authorities in the field of climate change adaptation, supporting them in planning and implementing adaptation (see paragraph a.3).

Furthermore, in the framework of the NAP, institutional collaboration and coordination among different levels is expected to be firstly ensured through the activities of the above-mentioned Committee of the National Observatory (see paragraph a.4).

Additionally, each adaptation measure/action identified in Annex 4 of the NAP provides for specific institutional actors to be involved in their implementation, such as, for example, Civil Protection, Ministries and the Regions. Therefore, institutional collaboration is a key tool for planning and implementing measures/actions of adaptation and, in addition, for preventing losses and damage resulting from climate change.

Finally, through the Forum of the Observatory (see paragraph a.4) the involvement of stakeholders in the implementation of public policies on adaptation and in the implementation of the NAP will be ensured.

As regards the financing of adaptation to climate change, guidance on the different sources of funding allocated at European, national and regional levels are provided by the NAP (see Chapter 9 "Financing adaptation to climate change" of the NAP).

Moreover, through the establishment of the National Observatory (see paragraph a.4), it is ensured that the issue of financial resources for adaptation plays a central role in the planning and implementation of adaptation measures, being suitable to facilitate the systematization and coordinated management of the funding sources available in different sectors.

In fact, it is worth noting that the National Observatory is required, among its tasks, to define priorities and to identify specific sources of financing for the implementation of adaptation actions. The resources, which will be identified in a logic of integration, are intended to be adequate to cover risk management needs in many sectors.

Currently, the financial resources that might be allocated to climate change adaptation can be drawn mainly from the funding provided by the Italian National Recovery and Resilience Plan (based on the EU Recovery and Resilience Facility) and the EU multiannual financial framework 2021-2027.

4.5 Good practices, experience and lessons learned

At the domestic and transnational level good practices, experience and lessons learned on adaptation have been developed. Below a list of different examples⁷⁷.

The CReIAMO PA⁷⁸ project, as already mentioned above, was aimed to disseminate data and knowledge to fill information gaps in Central Administrations and local authorities. All the Italian Regions and several municipalities attended to the training activities carried out for strengthening administrative capacity on adaptation.

⁷⁷ Further projects are mentioned in the "National climate change adaptation planning and strategies pursuant to Article 19(1) of the Governance Regulation 2018/1999" (March 2023).

⁷⁸ <https://www.mase.gov.it/pagina/15-rafforzamento-della-capacita-amministrativa-l-adattamento-ai-cambiamenti-climatici>

The LIFE MASTER ADAPT⁷⁹ project, *Mainstreaming experiences at regional and local level for adaptation to climate change*, was aimed to identify and test innovative tools of multi-level governance, to support Regions and local authorities in defining and developing adaptation strategies and policies. Moreover, the project provided a common methodology to support Regions to identify the main vulnerabilities and priorities and, in particular, to draw up guidelines for the governance of adaptation in urban areas.

The project on climate change adaptation in coastal areas, JOINT_SECAP *Joint strategies for Climate Change Adaptation in coastal areas*. The project built a common methodology for the definition of Joint Sustainable Energy and Climate Action Plans (SECAPs)⁸⁰ focused on sharing knowledge on climate change adaptation strategies and mitigation measures.

The CLARITY project, *Integrated Climate Adaptation Service Tools for Improving Resilience Measure Efficiency*⁸¹, provides an operational ecosystem of cloud-based climate services to calculate and present the expected effects of climate change-induced and amplified hazards at the level of risk, vulnerability, and impact functions. CLARITY offers what-if decision support functions to investigate the effects of adaptation measures and risk reduction options in the specific project context and allow the comparison of alternative strategies.

⁷⁹ <https://masteradapt.eu/?lang=en>.

⁸⁰ <https://www.italy-croatia.eu/web/jointsecap>

⁸¹ <https://clarity-h2020.eu/>

5 INFORMATION ON FINANCIAL, TECHNOLOGY DEVELOPMENT AND TRANSFER AND CAPACITY-BUILDING SUPPORT PROVIDED AND MOBILIZED UNDER ARTICLES 9–11 OF THE PARIS AGREEMENT

Italy has been providing support to developing countries for development purposes since the beginning of the history of international cooperation and assistance. Italy is a member of the Organization for Economic Cooperation and Development's Development Assistance Committee (OECD DAC), and actively supports developing countries in implementing the 2030 Agenda while integrating climate consideration into its development cooperation, as well as in the implementation of the objectives of the Convention and the Paris Agreement, including through supporting developing countries' Nationally Determined Contributions, National Adaptation Plans and other national climate planning. As a member of the G7 and the G20, Italy is active in setting priorities of action for the international community, including through holding the Presidency of the G20 in 2021. In this context, the Prime Minister Mario Draghi committed Italy⁸² to triple its climate finance contribution to 1.4 billion USD per year for the next five years. For 2022, Italy is on track to continue this effort towards tripling its climate finance by 2026.

As a key milestone, in 2022 the Italian Climate Fund has been created, and from 2023 it is fully operational, constituting a key vehicle to support developing countries in implementing adaptation and mitigation actions in line with their national climate plans.

5.1 National circumstances and institutional arrangements

The provision of support to developing countries for climate action in 2021 and 2022 was characterized by the presence of the COVID-19 pandemic and the huge difficulties in carrying out the environmental cooperation activities previously planned. The critical global situation led to the suspension of several activities including capacity building and on-site missions that had to be reprogrammed. As stated in the Three-Year Programming and Policy Document 2021–2023⁸³ of the Italian Ministry of Foreign Affairs and International Cooperation (MAECI), the profound state of crisis, often prolonged, affecting many countries, necessitates a strategy of synergistic and coordinated response, actions aimed at improving governance systems, strengthening institutions, supporting processes of prevention and a forward-looking commitment that not only assists affected populations but also reduces fragility and strengthens local capacities for crisis management and response.

In line with this strategy, Italy committed to relaunch the “Sistema Italia”, the set of common institutional, political and entrepreneurial strategies, through a recovery focused on digitization

⁸² <https://www.reuters.com/business/environment/italy-hikes-climate-finance-contribution-14-bln-per-year-next-five-yea-2021-10-31/>

⁸³ <https://www.esteri.it/wp-content/uploads/2022/07/Programming-and-policy-planning-document-2021-2023.pdf>

and green transition, encouraging at the same time the participation of the public, private and non-profit sector, as well as universities, scientific and technical research bodies and non-governmental organizations. This process translated also in multilateral cooperation and strengthened support from Italy to energy-related programs, as energy access, and access to finance.

Development cooperation and climate action in developing countries by Italy is funded by a variety of entities, the main being the MAECI (including through the Italian Agency for Development Cooperation, AICS), the MASE and the Ministry of Economy and Finance (MEF). While activities are to be implemented in coherence with the National Three-Year Development Cooperation Policy and Planning Document, every administration manages their own funding independently, including the monitoring and evaluation phase. As for the identification of financial resources, Italy relies on an annual budgetary cycle, approved every year by the Parliament. However, every year a three-years provisional public budget is also reported to the General State Accountancy and approved by law by Parliament – even though allocations are binding only for the first year thereafter.

Further, since 2015, the Italian Government continues allocating additional financial resources to the international development cooperation. On top of these resources, the commitment of Italy to tackle climate change and related support to developing countries is strongly expressed in Decree nr. 30 (DLGS n.30 13/03/2013), which defines the allocation criteria of the proceeds from auctioning of greenhouse gas emission allowances. In particular, it is established that at least 50% of those proceeds should be used to reduce greenhouse gas emissions; to adapt to the impacts of climate change; to fund research and development for reducing emissions and promote adaptation; to develop renewable energies and increase energy efficiency; to contribute to the Global Energy Efficiency and Renewable Energy Fund and to the Adaptation Fund; to provide for measures to avoid deforestation and facilitate adaptation in developing countries. The proceeds from auctioning of greenhouse gas emission allowances have been allocated as described above by the MASE, starting from 2015. These resources represent additional public climate financial resources to developing country Parties.

5.1.1 The mainstreaming approach

The Italian development cooperation aims at maximizing the impact of actions pursuing the objectives of the Convention and the Paris Agreement by ensuring that no initiative leads to the degradation of the ecosystem (“compliance”) and ensuring that an increasing number of initiatives include objectives of environmental protection, fight against climate change, biodiversity conservation, combating desertification and disaster risk reduction (“integration” and “mainstreaming”).

The Italian Development Cooperation promotes environment and climate mainstreaming across the network of field offices of the AICS through guidelines, trainings and screening tools aimed at checking whether activities may increase environmental and associated social vulnerability. AICS’s field offices were recommended to integrate climate objectives into the

identification of proposals. Specifically, for initiatives not focused on climate objectives, it was recommended to systematically explore the potential project impacts in terms of mitigation and/or adaptation, with the dual purpose of avoiding potential negative impacts, such as increased emissions and/or exposure to climate change risks, while also evaluating the opportunity to integrate measures or components able to enhance positive outcomes in terms of mitigation and adaptation. Furthermore, it was recommended to explore the correlations between climate objectives and gender equality, considering the disproportionate impact that climate change has on the lives of women and girls, as well as the positive role women can play in environmental protection as change agents and community leaders.

A mainstreaming approach to environment in development has been adopted in development cooperation run by the MAECI, through the integration of climate change into supporting the implementation of 2030 Agenda in developing countries. Target integration sectors are mainly: agriculture, food security, smart cities, biodiversity conservation, water, energy, off grid power, reforestation and biodiversity in general, land recovery and combating desertification, seas and fishing, disaster risk management, sustainable marketing supply chains, wetlands, waste. Geographical distribution reflects not only mitigation and adaptation, but also the need to address destabilization patterns in areas where environmental fragility overlaps socio-economic and/or governance weaknesses.

Awareness has evolved to recognize that climate action cannot be a separate line of intervention, but rather a horizontal approach affecting all sectors of development cooperation. This shift in perspective has also been driven by a deeper understanding of the causal links between sustainable development, the environment, human rights, and peace and security. The climate-food security nexus is a key approach for Italian development cooperation. In this context, Italy stated that one of the objectives of the Italian Climate Fund is to allocate a significant volume of resources to the nexus between climate and food systems. Another nexus that clarifies the impact of climate change and the need for an adequate response is the Water-Energy-Food-Ecosystem Nexus (WEFE Nexus); this approach, based on the interdependence between water, energy, food security and ecosystems, has been integrated into the practice of Italian cooperation projects.

The mainstreaming approach also ensures that the support provided by Italy to developing countries is in line with the long-term goals of the Paris Agreement (see letter (q) below).

5.1.2 Institutional arrangements of the environmental cooperation by MASE

In the energy sector, Italy boasted some qualifying elements linked to its industrial and entrepreneurial history, complemented by civil society's experiences and scientific and training skills developed by research and universities. Based on the heritage of experience and the actors of partner countries' knowledge, Italy promoted a clear innovation process, focused on three thematic lines with a fourth horizontal element necessary for the sustainability of the interventions:

- appropriate and sustainable technologies for local contexts;
- new models for autonomous income-generating energy activities that can be rooted in territorial contexts (BOP Model), social and cooperative entrepreneurship grafts on adequate financed mechanisms to support the emerging forms of entrepreneurship;
- development of enabling policies and regulatory mechanisms that lead to a modernization of energy governance, interpreting specific needs and local needs;
- strengthen the local level and encourage empowerment through the development of on-site technical and managerial skills and abilities and training at different levels: schools, universities, vocational courses, vocational training courses and entrepreneurial development, including institutional and political advocacy.

This commitment led to a phase of negotiation of new cooperation agreements launched under the previous period and concluded during the biennial 2021-2022. Indeed, since their standard duration was five years, many memoranda of understanding (MoUs) signed in previous years were approaching their expiry date. Thus, new agreements were proposed not only to expand the scope of cooperation, but also to increase the importance of criteria such as transparency, traceability, efficiency, effectiveness, and ownership of the initiatives promoted, in line with MASE's Actions of Address for the triennium 2020-2022. MASE continued to embark on a process to structure the workflow in specific and recognized phases, with specific supporting documents as guidelines for the elaboration, submission, monitoring, reporting and evaluation of each single initiative to be funded. The goals of these documents were:

- to rationalize the work phases, chronologically identified by both parties, to make them clear and explicit for all actors;
- to define and share with partnering countries self-explanatory templates to ensure a standard quality of documents for the different project's phases;
- to incorporate new and improved procedures in the workflow regulating relations between MASE and partner countries.

In line with the MoUs' principles and the new governance documents (Rules of Procedure and Guiding Principles for the Bilateral Cooperation Mechanism), a thorough process of reviewing all the phases of cooperation and subsequently developing new indications and formats to support the management of the entire life cycle of projects was carried out. Reference is made to the revised Work Plan and Monitoring and Evaluation Framework, the preparation of project proposals and the subsequent phases of the project cycle, until the final external technical and financial audit following the closure of the project. The proposed documents follow the Result-Based Management (RBM) approach, where medium- and long-term results are the yardstick for evaluating funded initiatives, measurable in structural changes in the environmental and socio-economic system, and closely linked to the Sustainable Development Goals (SDG) of the 2030 Agenda identified as priorities in the MoU.

5.1.3 Institutional arrangements for reporting

As for institutional arrangements for the reporting process, the MASE is the focal point to the UNFCCC, and officially submits the biennial reporting under the Convention and the Paris Agreement – specifically, the National Communication (NC, quadrennial communication, in the manner outlined in Decision 4/CP.5 and 6/CP.25) and the Biennial Report (BR, in the manner outlined in Decision 2/CP.17, 19/CP.18, and 9/CP.21); and, from this year, the Biennial Transparency Report under the Paris Agreement (BTR, in the manner outlined in Decision 18/CMA.1 and 9/CP.26). The Ministry is responsible to elaborate the reporting on support provided and mobilized to developing country Parties under the enhanced transparency framework.

As a Member State of the European Union, Italy also reports annually to the European Commission on international climate finance, following the modalities agreed in the Regulation on the Governance of the Energy Union and Climate Action (Regulation (EU) 2018/1999⁸⁴ and related Commission Implementing Regulation (EU) 2020/1208⁸⁵ on the structure, format, submission processes and review of information that Member States report.

- (a) Italy relies on specific systems and processes to identify, track and report on support provided to developing countries for climate action.

Data reported in this chapter are for the vast majority drawn from data on international development cooperation collected by the OECD DAC, with few exceptions. The data collection and assessment of climate-specificity follow a dedicated methodology, as explained in paragraph 5.2.

The process of data collection, elaboration and submission entails an exchange of information among different entities and administrations:

- Data collection through the OECD DAC format from the decentralized entities implementing development cooperation activities by MAECI, including information allowing the identification of activities specific to climate change;
- Communication of the Italian OECD DAC CRS dataset from MAECI to MASE;
- Communication of data on multilateral contributions towards MDBs and IFIs from MEF to MASE;
- Integration of dataset with climate specific funds not included in the OECD DAC CRS database by MASE;
- Consolidation of data, assessment of climate specificity of flows according to the methodology explained in section 5.2 below by MASE;
- Official reporting compilation and call for input and feedback on the draft BTR from the involved administrations by MASE;
- Submission by MASE.

⁸⁴ <https://eur-lex.europa.eu/eli/reg/2018/1999/oj>

⁸⁵ https://eur-lex.europa.eu/eli/reg_impl/2020/1208/oj

Further, internally at MASE with regard to reporting and monitoring activities of its bilateral cooperation, the Guiding Principles for the bilateral cooperation mechanism request that each project shall be monitored, through the production of periodic reports, financial and technical evaluations approved by the Joint Committee (JC) established for each bilateral agreement, including, as appropriate, field missions and onsite visits.

- (b) The current mechanism to collect and elaborate data on climate specific support to developing countries has challenges and limitations.

In fact, the use of the OECD DAC CRS presents a range of advantages in terms of data quality, comparability, responsiveness to clear definitions and the inclusion of information that allows the identification of activity including environment, mitigation or adaptation objectives.

On the other hand, the current Italian climate finance excludes a range of climate specific resources being delivered towards developing countries, including because of data aggregation of contributions by certain actors in the CRS (which does not allow the assessment of climate specificity); because of lack of capacity to measure private finance mobilized through public interventions; because of a narrow scope of the data collected through the OECD DAC CRS, which is focused on central administrations and on international development cooperation. Thus, Italy envisages to put additional efforts in the years to come to improve the quality and coverage of its climate finance data and the institutional arrangements to map and report on climate specific support to developing countries.

Further, Italy is committed to improve the monitoring and reporting of private climate finance mobilized through public interventions, particularly via the formal reporting system CRS++ of the OECD. The institutional arrangements and capacity building required for the consistent collection of such data are being currently created; therefore, we expect to enhance our ability to monitor and report private finance mobilization along with the increased intervention of the ICF.

Another limitation is embedded in the nature and purpose of the Rio Markers, which on one side allow for the identification climate specific activities funded in developing countries, as well as the degree of specificity of the objective of the activities (using “principal” or “significant”); on the other, they do not bear with them any defined way for their quantification. This leads to different approaches by providers in assigning coefficients⁸⁶, or range of coefficients. Other providers also use different approaches, not based on the Rio Markers.

⁸⁶ For further information on the coefficient used by OECD DAC members to report under the UNFCCC, see the DAC survey on “results of the survey on the coefficients applied to 2019-20 rio marker data when reporting to the un environmental conventions” [https://one.oecd.org/document/DCD/DAC/STAT\(2022\)24/REV1/en/pdf#:~:text=The%20Rio%20markers%20coefficients%20survey&text=Basis%20of%20measurement%20and%20flows,data%20submitted%20to%20the%20Conv](https://one.oecd.org/document/DCD/DAC/STAT(2022)24/REV1/en/pdf#:~:text=The%20Rio%20markers%20coefficients%20survey&text=Basis%20of%20measurement%20and%20flows,data%20submitted%20to%20the%20Conv)

- (c) Italy is building on experiences and good practices in setting the right context, including through public policy and regulatory frameworks, to incentivize further private climate financing and investment in developing countries for climate action.

The Italian Climate Fund will be an important channel to incentivize further private climate financing and investments for climate action in developing countries. The ICF in 2022 was not yet fully operational (it became operational at the end of 2023), but since then, the first initiatives have been approved. It should be noted that resources from the ICF are allocated to projects and activities through various financial instruments aimed at mobilizing additional private finance, in accordance with established internal regulations.

In parallel, Cassa Depositi e Prestiti (CDP, the Italian national development bank and manager of the ICF) is developing further initiatives to promote the mobilization of private finance within the context of its international cooperation efforts.

Further, through the environmental cooperation undertaken by MASE, with regards to the private sector involvement, as a general approach, when drafting the bilateral cooperation agreements, MASE investigates the potential contribution of the private sector, mainly regarding technologies and know-how, tailoring the agreements so to facilitate the technical and practical implementation of the projects. Two different ways for involving the private sector are integrated in the current Memoranda of Understanding (MoUs):

- Opening calls for interest to the private sector on the Ministry's website for a specific sector and for a country or a region, before organizing the technical missions and defining the needs together with the beneficiary country;
- Identifying companies holding specific technologies to implement projects already established with the beneficiary countries.

- (d) Italy prioritizes within its reporting efforts the enhanced comparability and accuracy of information on financial support provided, such as through use of international standards or harmonization with other countries, institutions and international systems.

The use of the OECD DAC CRS database as a starting point for the reporting on support provided to developing countries for climate action ensures the correspondence to agreed approaches and definitions among those countries historically providing development assistance as well as climate finance. As highlighted above, while the system has its limitation when it comes to climate finance, a range of financial and qualitative

parameters are clearly defined and harmonized among providers making use of them in the UNFCCC reporting.

Thus, the bulk of data are reported at activity level following assumptions and definitions agreed in the context of the OECD DAC, which since 1961 collects data on foreign aid and development cooperation finance. This gives the assurance of:

- harmonized definitions and methodologies on a wide range of parameters, increasing comparability of flows and other information through time and across countries using the same database;
- a thorough data quality check – the OECD undertakes continuous communication with countries when checking the data quality and asks for feedback and adjustments on the dataset.

As for the assessment of climate specificity, there isn't a harmonized approach or methodology to conduct this evaluation. A range of countries, typically OECD DAC members, rely on the quantitative use of the Rio Markers, which are embedded into the data collection system. A periodic survey⁸⁷ is undertaken in the context of the OECD DAC comparing the different approaches in the use of the Rio Markers to report to the UNFCCC. In the quantification of Rio Markers, Italy follows the approach taken by the European Commission in reporting its climate finance, included in the climate finance reporting from the European Union and its Member States, in the attempt to increase harmonization among EU Member States.

In order to increase transparency and continue working towards finding possible harmonized approaches to climate specificity among providers, the OECD DAC "Declaration on a new approach to align development cooperation with the goals of the Paris Agreement on Climate Change"⁸⁸, agreed in 2021, requested to take steps forward in providing transparency between climate and development finance. A set of analytical works has been produced, which suggests shared approaches in reporting on different parameters included in the MPGs and clarifies the relationship between climate finance and climate related development finance. Italy is active within the OECD working groups to work towards increased comparability in climate finance reporting among providers.

Finally, on one side, Italy uses a coherent methodology for climate finance reporting since 2016 finance flows. This increases comparability through time of figures and amounts. On the other, within this structured methodology, Italy constantly improved the accuracy of information reported through time, fine-tuning the approach and using more granular

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[https://one.oecd.org/document/DCD/DAC/STAT\(2022\)24/REV1/en/pdf#:~:text=The%20Rio%20markers%20coefficients%20survey&text=Basis%20of%20measurement%20and%20flows,data%20submitted%20to%20the%20Conventions.&text=Correspondence%20between%20the%20OECD%2DDAC.format%20as%20indicated%20by%20members.](https://one.oecd.org/document/DCD/DAC/STAT(2022)24/REV1/en/pdf#:~:text=The%20Rio%20markers%20coefficients%20survey&text=Basis%20of%20measurement%20and%20flows,data%20submitted%20to%20the%20Conventions.&text=Correspondence%20between%20the%20OECD%2DDAC.format%20as%20indicated%20by%20members.)

88 [https://one.oecd.org/document/DAC/CHAIR\(2021\)1/FINAL/en/pdf](https://one.oecd.org/document/DAC/CHAIR(2021)1/FINAL/en/pdf)

information when available (see section 5.2, letter (t) point (ii) on the improvement on the use of imputed multilateral shares).

As concerns national circumstances and institutional arrangements for the provision of technology development and transfer and capacity-building support, Italy promotes the inclusion of the private sector into bilateral agreements especially aimed at technology development and transfer. In the context of a bilateral agreement, the MASE would open calls for interest to the private sector on the Ministry's website for a specific sector and for a country or a region, before organizing the technical missions and defining the needs together with the beneficiary country; and identify companies holding specific technologies to implement projects already established with the beneficiary countries.

5.2 Underlying assumptions, definitions and methodologies

The following description of the underlying assumptions, definitions and methodologies used to report on support provided to developing countries for climate action by Italy is provided to enhance the transparency of reporting and the clarity of the underlying methodological assumptions.

The Italian data on support provided to developing countries for climate action are drawn from data on international development cooperation collected by the Organization for Economic Cooperation and Development's Development Assistance Committee (OECD DAC), with few exceptions. Consequently, for a range of parameters, the bulk of data reported as support provided to developing countries from Italy utilizes and follows the underlying assumptions and definitions agreed under the OECD DAC for data collected through the Creditor Reporting System (CRS). All the definitions are explained in the "Converged Statistical Reporting Directives for the Creditor Reporting System (CRS) and the Annual DAC Questionnaire"⁸⁹ and related annexes, where a synthesis and elaboration of relevant elements is reported below. Reporting directives are regularly updated through the work of the OECD DAC Working Party on International Development Finance Statistics (WPSTAT).

- (a) The chosen year for reporting is the calendar year, referring to amounts committed or disbursed in a given year from 1 January to 31st December;
- (b) The conversion rate (exchange rate) between Euros and United States dollars used are provided by the OECD⁹⁰:
 - for the year 2021, the EUR/USD exchange rate used is 0.845494 Euro,
 - for the year 2022, the EUR/USD exchange rate used is 0.949624 Euro.

⁸⁹ <https://www.oecd.org/en/data/insights/data-explainers/2024/10/resources-for-reporting-development-finance-statistics.html>

⁹⁰ <https://www.oecd.org/en/data/indicators/exchange-rates.html>

- (c) The status (committed or disbursed) is understood as the point in time when the transaction between the provider (Italy) and the recipient (developing country or multilateral institution) is recorded, from the perspective of the provider.

Commitments may be broadly defined as new amounts committed during the reporting year. A commitment is a firm written obligation by a government or official agency, backed by the appropriation or availability of the necessary funds, to provide resources of a specified amount under specified financial terms and conditions and for specified purposes for the benefit of a recipient country or a multilateral agency. Commitments are considered to be made at the date a loan or grant agreement is signed or the obligation is otherwise made known to the recipient. Bilateral commitments comprise new commitments and additions to earlier commitments. For multilateral contributions, commitments show the total amounts of multi-year agreements with multilateral institutions.

Disbursements may be broadly defined as amounts disbursed during the reporting year. A disbursement is the placement of resources at the disposal of a recipient country or agency, or in the case of climate-related expenditures funding activities outside the recipient countries, the outlay of funds by the official sector. In the case of contributions to multilateral agencies and capital subscriptions made in the form of notes and similar instruments unconditionally encashable at sight by the recipient institutions are reported in DAC statistics on a deposit basis, i.e. they should be reported as disbursements as of their date of issue, whether or not they have actually been encashed.

Commitments are often multi-year and subsequent disbursements spread over several years. In DAC statistical reporting systems, commitments, even if multi-year, are recorded in whole in the year they are signed. Subsequent disbursements of an earlier commitment are recorded annually, in the years they are transferred from providers to recipients⁹¹.

DAC statistics collect data on flows from providers to developing countries, both on a commitment and disbursement basis. For support delivered through bilateral and multi-bilateral contributions, the status used for the Italian support provided to developing countries is the commitment (committed), while for support delivered through multilateral organizations is the disbursement (disbursed).

This approach is chosen to reflect national circumstances and institutional arrangements in delivering support to developing countries. Commitments give a clearer and more realistic overview of the ongoing bilateral and multi-bilateral projects and programmes, without scattering the information related to the numerous related disbursements, delivered often in several tranches linked to the development and stages of implementation of the project.

⁹¹ Adapted from the OECD DAC [Converged Statistical Reporting Directives](https://www.oecd.org/en/data/insights/data-explainers/2024/10/resources-for-reporting-development-finance-statistics.html) (<https://www.oecd.org/en/data/insights/data-explainers/2024/10/resources-for-reporting-development-finance-statistics.html>).

In the reporting of 2022 data on bilateral flows, Italy allowed two exceptions to the above definition of commitment. In particular, the amounts related to the “Just Transition Energy Partnerships” (JETPs) in Viet Nam and Indonesia are recorded using a different reference point in time. The reference date of commitment for the JETPs is the date of the signature of the Joint Statement⁹² by the leaders of the International Partners Group (IPG) of likeminded countries, including Italy, during the G20 Presidency of Indonesia - for a commitment of €250 million on each partnership over the next 3 to 5 years. In 2023, the approved Workplan of the Italian Climate Fund includes both activities with related financial commitment.

- (d) This report measures bilateral support, including bilateral support delivered through multilateral organizations (so called multi-bilateral contributions or earmarked contribution) while it uses disbursement for core contributions to multilateral organizations. Moreover, Italy identifies activities addressing regions when they are undertaken in more than one country within a region as identified in the reporting tables, or contributions through agencies (multi-bilateral flows) targeting a specific region.

Bilateral transactions are those undertaken by a provider country directly with a developing country (country part of the DAC List of ODA Recipients⁹³) or transactions with non-governmental organizations active in development and/or climate action. Italian bilateral flows include contributions to development cooperation programmes from all the central public administrations (Ministries) and the Italian Development Cooperation Agency (AICS), the Italian Development Bank (Cassa Depositi e Prestiti), local administrations (regions and municipalities), considering all kind of implementing agencies (f.i. Universities, NGOs and religious organizations).

The definition of a multilateral contribution is based on two criteria: the multilateral character of the recipient institution and the multilateral character of the contribution. Providers’ contributions that satisfy both criteria should be recorded under the heading "multilateral": a) the recipient institution conducts all or part of its activities in favor of development and developing countries; and b) the recipient institution i) is an international agency, institution or organization whose members are governments, who are represented at the highest decision-taking level by persons acting in an official capacity and not as individuals; or ii) is a fund managed autonomously by a multilateral agency as defined in i); and c) funds are pooled so that they lose their identity and become an integral part of the recipient institution’s financial assets. Conditions a) and b) define the multilateral character of the agency. Condition c) verifies the multilateral character of

⁹² <https://www.whitehouse.gov/wp-content/uploads/2022/11/Joint-Statement-1.pdf>

⁹³ <https://www.oecd.org/content/dam/oecd/en/topics/policy-sub-issues/oda-eligibility-and-conditions/DAC-List-of-ODA-Recipients-for-reporting-2024-25-flows.pdf>

the contribution. The List of ODA-eligible international organizations⁹⁴ identifies the multilateral development institutions, core contributions to which may be reported, in full or in part, as multilateral ODA.

If it is not immediately clear whether funds provided to a multilateral organisation can be considered as pooled, determination is made on the basis of the degree of control over the disposal of the funds contributed. If, on scrutiny, it is found that the donor country has maintained control over its contributions to such an extent that the decisions regarding disposal of the funds are on balance taken at the donor's discretion, the flows concerned are recorded as multi-bilateral contributions (also referred to as "multi-bi" or "earmarked" contributions) and included in the table for bilateral contributions. Multi-bilateral contributions are often channeled through a multilateral organization either in the form of earmarked contributions to a developing country or contributions to specific purpose programmes and funds managed by the organization⁹⁵.

- (e) The funding sources, or categories of flows used in reporting the Italian support provided to developing countries for climate action constitutes for the vast majority funds classified as Official Development Assistance (ODA). Only for the year 2021, some amounts are classified as Other Official Flows (OOF).

Specifically, Official development assistance flows are defined as grants and loans to the official sector of countries and territories on the DAC List of ODA Recipients⁹⁶, International NGOs and multilateral development institutions which are provided by official agencies, including state and local governments, or by their executive agencies; and concessional in character. In DAC statistics, this implies a grant element of at least:

- 45 per cent in the case of bilateral loans to the official sector of LDCs and other LICs (calculated at a rate of discount of 9 per cent).
- 15 per cent in the case of bilateral loans to the official sector of LMICs (calculated at a rate of discount of 7 per cent).
- 10 per cent in the case of bilateral loans to the official sector of UMICs (calculated at a rate of discount of 6 per cent).
- 10 per cent in the case of loans to multilateral institutions
- 10 per cent in the case of loans to INGOs.

⁹⁴ <https://webfs.oecd.org/oda/DataCollection/Resources/OECD-ODA-Single-Table-2024-for-2023-flows.xlsx>

⁹⁵ Adapted from the OECD DAC Converged Statistical Reporting Directives: <https://www.oecd.org/en/data/insights/data-explainers/2024/10/resources-for-reporting-development-finance-statistics.html>

⁹⁶ <https://www.oecd.org/content/dam/oecd/en/topics/policy-sub-issues/oda-eligibility-and-conditions/DAC-List-of-ODA-Recipients-for-reporting-2024-25-flows.pdf>

Loans whose terms are not consistent with the IMF Debt Limits Policy and/or the World Bank's Non-Concessional Borrowing Policy/Sustainable Development Finance Policy are not reportable as ODA.

Other Official Flows (OOF), excluding officially supported export credits, are defined as transactions by the official sector which do not meet the conditions for eligibility as ODA, either because they are not primarily aimed at development, or because they are not sufficiently concessional⁹⁷. For Italian support to developing countries for climate action, amounts classified as OOF in 2021 constitutes of three shares in multi-donor funds (EGO, Regio and AREF) participated through the financial instrument of equity (see details in section 5.3).

- (f) The financial instruments reported by Italy in its climate finance in 2021 and 2022 include grants, concessional loans and equities.

Grants are transfers in cash or in kind for which no legal debt is incurred by the recipient. For ODA reporting purposes, they also include forgiveness of non-military debt and support to non-governmental organizations. Grants to multilateral agencies intended to soften the terms of the latter's lending are a direct resource outflow and are also recorded as ODA grants. Capital subscriptions are payments to multilateral agencies in the form of notes and similar instruments, unconditionally encashable at sight by the recipient institutions, and are assimilated to grants in DAC statistics.

Debt instruments require the payment of principal and/or interest in the future. Debt instruments within the Italian climate finance take the form of concessional loans. Loans are transfers in cash or in kind for which the recipient incurs legal debt (and the resulting claim is not intended to be traded). The classification as ODA of the Italian concessional loans means their terms are characterized by a level of concessionality compatible with the definition of ODA (see above).

Equity constitutes a share in the ownership of a corporation that gives the owner claims on the residual value of the corporation after creditors' claims have been met⁹⁸.

- (g) As for instruments and funding sources reported (including on how Italy has determined its climate finance to be concessional and classifiable as ODA), see respectively letters (f) and (e) above.

Italy for the first time under the UNFCCC voluntarily reports information in both textual (aggregate) and tabular (activity-level) formats on grant equivalent amounts of its climate

⁹⁷ Adapted from the OECD DAC Converged Statistical Reporting Directives: <https://www.oecd.org/en/data/insights/data-explainers/2024/10/resources-for-reporting-development-finance-statistics.html>

⁹⁸ Adapted from the OECD DAC Converged Statistical Reporting Directives: <https://www.oecd.org/en/data/insights/data-explainers/2024/10/resources-for-reporting-development-finance-statistics.html>

finance. Italy already reported this information to the European Commission from the year 2021.

The ODA grant equivalent measure is an indicator of provider's effort used in DAC statistics, and it is calculated for ODA flows.

For their grant equivalents to be counted as ODA, ODA loans must be concessional, that is bearing a grant element as referred above in letter (e). Bilateral loans to the official sector as well as loans to INGOs or multilateral institutions below the thresholds are reportable as OOF. Their grant equivalents are not reportable.

The grant element in the ODA definition is a mathematical assessment of the financial terms of a transaction or set of transactions. ODA grants bear a 100% of grant element. For loans, the grant element is calculated as the difference between the face value of a loan and the present value of the service payments the borrower will make over the lifetime of the loan, expressed as a percentage of the face value. Four factors determine the grant element: interest rate, grace period (i.e. the interval from commitment date to the date of the first payment of amortization), maturity (i.e. the interval from commitment date to the date of the last payment of amortization) and discount rate used to determine the present value of future payments. The more concessional a loan is, the higher the grant element and the greater ODA grant equivalent recorded⁹⁹.

- (h) The type of support reported by Italy in its climate finance include adaptation, mitigation and cross-cutting support. Those categories refer to the climate specificity of activities and initiatives funded by Italy, and their climate objective. For information on how climate specificity is assessed, see letter (l) below.

The approach used in defining mitigation or adaptation activities follows the definitions and eligibility criteria of "Aid targeting the objectives of the United Nations Framework Convention on Climate Change and the Paris Agreement"¹⁰⁰ elaborated in the context of the Rio Markers.

Italy considers as cross-cutting every activity addressing both mitigation and adaptation, as well as those activities in which mitigation and adaptation components are mainstreamed into projects in a range of sectors, especially agriculture.

The attribution of the type of support builds on the methodological approach for assessing climate specificity, thus:

⁹⁹ Adapted from the OECD DAC Converged Statistical Reporting Directives: <https://www.oecd.org/en/data/insights/data-explainers/2024/10/resources-for-reporting-development-finance-statistics.html>

¹⁰⁰ [https://one.oecd.org/document/DAC\(2024\)40/ADD2/FINAL/en/pdf](https://one.oecd.org/document/DAC(2024)40/ADD2/FINAL/en/pdf) page 68 and 69.

- when Rio Markers are present, the category is assigned according to the marker (adaptation or mitigation). When both mitigation and adaptation markers are present, the category is crosscutting;
- when no climate Rio Marker is present, an iterative approach to assess whether the activity is (partially) climate specific on the basis of available information is applied, as explained in letter (l) below. In short, the presence of additional markers and selected keywords provide the basis for the assessment of climate specificity.

This additional step is needed to compensate for the lack of coverage of the Rio Markers, also stemming from the limited reporting capacity of implementing entities (especially at local level) to adequately report on this aspect.

- (i) As for the sectoral classification, for bilateral and multi-bilateral support Italy refers to the five-digit purpose codes used in the OECD DAC CRS data collection system¹⁰¹.

The classification of sectors follows the categories identified in the guidelines for the Biennial Transparency Report and the National Communication for reporting to the UNFCCC and to the European Commission. The categories identified are: energy, transport, industry, agriculture, forestry, water and sanitation, and others.

The sectors identified in the OECD DAC CRS system, the related table “List of CRS purpose codes and voluntary budget identifier codes” and its updates and amendments form the basis for reporting the sectors of operations included in Italian climate finance reporting.

The aggregation of sector categories is done as follows:

- Energy: three-digit CRS codes 230 to 236 and related five-digit codes. Codes pertaining to the category “Energy generation, non-renewable sources” are not reportable as Climate Finance. As such, any developments within OECD DAC with respect to the climate valence of operations pertaining to this category are acknowledged.
- Agriculture: three-digit CRS codes 310 and 311 and related five-digit codes.
- Forestry: three-digit CRS code 312 and related 5-digit codes.
- Water and Sanitation: three-digit CRS code 140 and related 5-digit codes.
- Transport: three-digit CRS code 210 and related 5-digit codes.
- Industry: three-digit CRS codes 320 to 323 and related 5-digit codes.
- Cross-cutting: three-digit CRS codes 430 and related 5-digit codes.
- The “Other” category reported in the UNFCCC reporting tables state “Other” followed by a parenthesis in which the sector corresponding to the three-digit and/or five-digit code is made explicit. For years 2021 and 2022, the “other”

¹⁰¹ <https://web-archiv.oe.cd.org/temp/2024-06-19/57753-dacandcrscodelists.htm>

sectoral categorization includes: environment, finance, fishing, government and civil society, health, tourism, communications, disaster risk reduction, emergency response.

Operations reported in the “Refugees in Donor Countries” sectors (three-digit code 930) do not constitute climate finance.

As requested, the notation “Not applicable” (NA) is reported in case of purely multilateral contributions and bilateral activities for which sector is not available.

- (j) Information on the sub-sector at activity level is not available, due to lack of an internally agreed approach to elaborate on the sub-sector attribution, given the possibility in the OECD DAC CRS to report multiple purpose codes for each activity. While aggregation under the sector remains feasible, the attribution of a sub-sector would be in such a level of detail that poses issues on how to attribute the multiple purpose codes. Italy will work on improving its ability to provide this information as well in the next BTR.
- (k) Italy includes both in textual and tabular format whether the activities reported supported capacity-building and/or technology development and transfer objectives. In the information reported in tabular format, activities with a relevant capacity building component are identified through the “Free-standing technical co-operation” flag integrated in the OECD DAC CRS, with few adjustments where more information is available. Free-standing technical co-operation comprises activities financed by a provider country whose primary purpose is to augment the level of knowledge, skills, technical know-how or productive aptitudes of the population of developing countries, i.e. increasing their stock of human intellectual capital, or their capacity for more effective use of their existing factor endowment. It includes financing of students and trainees who are nationals of developing countries; experts, teachers, and volunteers; equipment and materials for training; research; development-oriented social and cultural programmes, etc. Associated supplies are also classified as technical co-operation¹⁰². Projects and activities involving technology transfer components, as well as the identification of support focused on transferring technologies relevant to climate action in developing countries, are tracked on a case-by-case basis. Projects and activities are identified as relevant by dedicated experts in the MASE, who analyze the database, the descriptions of the projects and investigate further relevant information to ensure the relevance of the technology transfer and capacity building components, before reporting the activities in the respective tables. Additional qualitative information is drawn from

¹⁰² Adapted from the OECD DAC Converged Statistical Reporting Directives: <https://www.oecd.org/en/data/insights/data-explainers/2024/10/resources-for-reporting-development-finance-statistics.html>

internal sources or from the (limited) description reported by the implementing entity in the CRS.

- (l) The core of Italy’s methodology for reporting on climate finance lies in how the support is identified as being climate specific. For bilateral and multi-bilateral flows, the methodology takes into account the OECD DAC Rio Markers and builds on them to consider further activities with a climate relevance. When Rio Markers are not present, additional markers and selected keywords provide the basis for the assessment of climate specificity. Since 1998, the DAC has monitored development finance flows targeting the objectives of the Rio Conventions through its Creditor Reporting System (CRS) through use of “Rio markers”. The Rio markers were originally designed to help members in their preparation of National Communications or National Reports to the Rio Conventions, by identifying activities that mainstream the Conventions’ objectives into development co-operation. DAC members are requested to indicate for each development finance activity whether or not the activity targets environmental objectives. Initially there were three Rio markers that have been in use since 1998: biodiversity, climate change mitigation, and desertification. In 2009, an additional marker was created to capture flows for climate change adaptation. It was implemented in reporting on 2010 flows. Data collection covers ODA and other official flows.

By identifying activities targeting climate change as a “principal” (value 2) or “significant” (value 1) objective, the markers provide an indication of the degree of mainstreaming of environmental considerations into development co-operation portfolios. Rio markers apply to activities as a whole, and, in marking the full value of development finance activities the markers are considered descriptive rather than strictly quantitative, but allow for an approximate quantification of development finance flows that target the Rio Convention objectives¹⁰³.

The methodological approach for assessing the climate specificity of Italian bilateral and multi-bilateral activities reported implies a careful evaluation of the information included in the Italian OECD DAC CRS, starting from, but not limited to, the consideration of activities marked with Rio Markers. In particular, Italy uses the European Commission's approach as a starting point for quantifying the amount of climate-specific projects, i.e., considering projects indicated with Rio Marker for mitigation and/or adaptation as “principal” at 100 percent of the amount, while considering the 40 percent of the amount if the indicator is “significant”. In addition, the following is considered:

- activities marked with “Aid to environment” marker at 40% of the amount as cross-cutting;

¹⁰³ For further details on the use, application, scoring system, definitions and examples please consult Annex 20 of the Converged Statistical Reporting Directives for the Creditor Reporting System (CRS) and the Annual DAC Questionnaire: [https://one.oecd.org/document/DCD/DAC\(2024\)40/ADD2/FINAL/en/pdf](https://one.oecd.org/document/DCD/DAC(2024)40/ADD2/FINAL/en/pdf)

- activities marked with “Disaster risk reduction” marker at 40% of the amount as adaptation;
- activities falling under General Environment Protection at 40% of the amount as cross-cutting; and activities falling under Agriculture and Forestry (as cross-cutting), Water (as adaptation) and Energy (as mitigation) at 100% of the amount;
- at 40% or 100% activities with relevant keywords such as “solar,” “flood,” “cyclone,” “agriculture,” “energy.”

Projects identified through this second part of the methodology are manually reviewed for their climate relevance by the experts from the Ministry of Environment, considering the guidance from the OECD DAC Rio Markers for Climate Handbook. More than half of these projects are eventually excluded.

Additional figures that are not part of the OECD DAC data because they do not meet the OECD’s definitions but are assessed to be climate specific are included after thorough assessment (see letter (c) above).

The methodology has been developed and agreed among the Italian Ministry of Environment and Energy Security (MASE) and the Ministry of Foreign Affairs and Development Co-operation (MAECI) and applied to climate finance reporting since 2017 flows.

- (m) Regarding information on the efforts taken to avoid double counting, the Italian reporting on support provided includes the following:
- (i) Avoids double counting among multiple Parties involved in the provision of support through reporting on an inflow basis to multilateral organizations – only the Italian contributions towards the institution or the fund is accounted for. Bilateral commitments are also exclusively from the Italian public budget.
 - (ii) As Italy does not report on private finance mobilized through public interventions, it does not apply any additional methodology which involves the attribution of flows among different actors;
 - (iii) Double counting is avoided between the resources reported as provided and the resources used under Article 6 of the Paris Agreement, as the EU does not use internationally transferred mitigation outcomes towards its NDC (which Italy is part of). The support provided does not include resources used under Article 6.
 - (iv) In cases where a project involves multiple recipient countries, there are two ways in which this is made explicit in the reporting:
 - the list of targeted countries, separated by a comma, is included in the “Recipient” field;
 - the “Recipient” field indicates a region or sub-region when multiple countries from a region are targeted;
 - the “Recipient” field indicated “Global” when the activity is targeted to all developing countries or when several countries in different regions are targeted. In this latter case, the description usually reports the specific countries targeted.

- (n) The Italian support to developing countries for climate action for the years 2021 and 2022 can be defined as entirely public. In short, Italy's public financial resources to assist developing countries to develop and implement actions in the field of climate change in the period 2021-2022 came from:
- the Italian Ministry of Environment and Energy Security (MASE) funds according to law June 1, 2002, n°120;
 - the Italian Ministry for Foreign Affairs and Development Co-operation (MAECI) funds for development cooperation;
 - the Italian Ministry of Economy and Finance (MEF) funds provided to multilateral institutions for environmental activities targeted for climate change;
 - other central administrations undertaking climate specific international cooperation activities through bilateral channels or multilateral agencies;
 - the proceeds from auctioning of greenhouse gas emission allowances allocated starting from 2015. According to Directive 2003/87/EC, the revenues generated from the auctioning of allowances should be used to tackle climate change in the EU and third countries;
 - the financial contribution to the Green Climate Fund (GCF) and the Adaptation Fund (AF).
- (o) For the 2021-2022 biennium, Italy does not report as climate finance any private finance mobilized through public interventions. Further capacity is being created to cope with this reporting requirement. In 2019, a pilot study on private finance mobilized by public financial interventions of Italy was produced and related figures reported in the 4th and 5th Biennial Report of Italy. This study proves that there is private finance being mobilized by Italian public interventions, while it is not yet possible to track it.
- (p) Support provided by Italy to developing country Parties for climate action seeks to effectively address the needs and priorities of developing country Parties for the implementation of the Paris Agreement, as identified in country-driven strategies and instruments, such as biennial transparency reports, NDCs and national adaptation plans, through operational approaches in conducting bilateral cooperation activities. The action of the Italian Cooperation is aimed at supporting the Partner Countries, in particular those most in need, in the formulation and implementation of National Determined Contributions and National Adaptation Plans, in order to reduce the vulnerability of local human or natural systems to the impacts of climate change, by increasing the capacity to adapt to or absorb climate stresses, shocks and climate variability, or decreasing exposure to them and to the risk of natural disasters. Concerning mitigation, interventions aim at promoting efforts to limit or reduce GHG emissions especially in the energy sector, or strengthening the capacity to capture and sequestration of these emissions. Italian development cooperation supports interventions aimed at reducing and effectively managing the risks resulting from natural

disasters and extreme climatic events, in particular through support to capacity building and the creation or strengthening of national or local structures, as well as to risk assessment, prevention and preparedness activities.

The MASE in its bilateral cooperation on climate change vulnerability, risk assessment, mitigation and adaptation with countries in Africa, Asia and Pacific, Mediterranean, Latin America and the Caribbean, and Central and Eastern Europe, makes use of a governance mechanisms based on the dialogue between partner countries and a strong ownership component of the beneficiaries. The first step in establishing the donor-recipient agreement is the signature of a Memorandum of Understanding (MoU) or a technical agreement, a high level and usually broad agreement between the two countries (usually Ministries) or entities (f.i. environmental agencies, research institutes, public banks). To implement the provisions of the MoU, ensure the efficient and effective implementation of the activities, address the needs of developing countries and enhance country ownership, the agreement establishes a Joint Committee (JC). The JC is composed by representatives of both Governments involved, and provides general direction to the established collaboration, approves work programs and budget, supervises and supports the cooperation activities by taking stock and assessing the implementation and progress of approved projects and takes financial decisions over such activities. The JC:

- adopts the Guiding Principles for the bilateral cooperation mechanism;
- approves and reviews the Work Plan of the activities, that identifies potential main areas and subjects for cooperation projects;
- adopts the Monitoring and Evaluation Framework and supervise its implementation, with the aim to promote a transparent, efficient and result-oriented approach and to guarantee ownership and accountability;
- adopts formats, templates and standard procedures for cooperation projects and initiatives;
- approves Concept Notes and Full Project Proposals, including budget and schedule, to be implemented and financed under the framework of the MoU;
- discusses appropriate procurement procedures and related standards to be applied for the supply of goods and services necessary for projects' implementation;
- supervises the correct execution of projects and activities, the achievement of their objectives and their long-term impact;
- oversees the appropriate use of funds and take relevant technical and financial decisions for the implementation of projects and activities;

To complement this approach and ensure that activities implemented are in line with the expected results, periodical site visits of national experts to monitor and assess activities on the ground are carried out. All financed projects and programs are proposed by the counterparts and reflect priorities and objectives included in the Nationally Determined Contributions (NDCs) and other relevant climate change and development strategies.

Further, to retain the flexibility needed to cope with the needs and priorities of partner countries, Italy did not commit to the use of specific instruments in extending its climate

finance, or to stick to a fixed share of allocation of climate finance to either mitigation or adaptation. In fact, this would potentially undermine the necessary consideration of needs and priorities of partner countries in both the use of financial instruments and the proportion of support dedicated to adaptation or mitigation (or other priorities). Thus:

- Italy considers to be a fair balance of funds between mitigation and adaptation the allocation that best responds to the needs and priorities of recipient countries;
- Italy supports the choice of the financial instruments to be tailored to the needs at activity and country level, depending on a range of factors, such as the climate objective (mitigation and adaptation projects present different needs of grant resources), the level of income of the recipient country, the vulnerability of the beneficiary, the main purpose of the project (mainstreaming climate action in development projects vs climate-specific funding), the robustness of the enabling environment, the level of development of financial markets and ease of access to debt resources.

(q) Italy seeks to ensure that support provided to developing country Parties for climate action is in line with the long-term goals of the Paris Agreement, by ensuring that activities supported are:

- in line with recipients' national climate change plans and development strategies;
- mainstreaming adaptation and mitigation objectives in those activities implemented in non climate specific sectors;
- addressing the needs and priorities of developing countries, through governance mechanisms in the design and implementation of the activities based on open dialogue between partner countries and effective priority setting.

Further, as shareholder of those MDBs which extend a significant amount of climate finance towards developing countries, Italy advocated for aligning multilateral public finance institutions with the goals of the Paris Agreement. Together with like-minded shareholders, Italy actively supported MDBs' efforts towards their Paris alignment and requests that MDBs set ambitious climate finance targets.

(r) Provided that there is no common definition or understanding on what is to be considered "new and additional" resources to be provided, Italy considers new and additional all resources that are newly committed and/or disbursed through the different channels and from the different sources that constitutes climate finance on an annual basis. This definition is linked to the definitions of commitment and disbursement as reported in letter (c) above. Thus, all reported figures are considered new and additional for the biennium 2021-2022.

In particular, environmental challenges tackled through the Italian international cooperation are closely interlinked, and climate change is affected, and directly and

indirectly affects, all dimensions of the environment, as well as human and ecosystem's health. In the provision of its climate finance, Italy reflects this reality of mutually supportive and synergistic objectives in the environmental realm. Italy thus actively pursues mainstreaming and integration into the broader support to developing countries for the 2030 Agenda of the objectives of mitigating and adapting to climate change, as well as reducing and managing risks related to climate change and actions to avert, minimize and address loss and damage from the impacts of climate change. Taking into account the priorities and needs expressed by developing countries in the dialogue with Italian providers, Italy would consider detrimental as well as meaningless for the effective implementation of the goals of the Paris Agreement any attempt to discern development and climate finance, especially in the provision and mobilization of support implying the realization of projects on the ground, in particular when it comes to adaptation actions. Impacts can be maximized if resources are pursuing more than one objective. Italy is undertaking effort to increase levels of development finance, together with improving mainstreaming and integration of climate action in development finance. Considering the above, this ensures no displacement in the provision of climate and development finance, just mutual reinforcements. This vision is what we consider in line with the spirit of the UNFCCC and the Paris Agreement, which also asks all Parties to pursue the consistency of all finance flows with mitigation and adaptation objectives and the provision of climate finance in the context of meaningful mitigation action and transparency on implementation.

- (s) The information on support provided by Italy to developing countries for climate action in 2021 and 2022 demonstrate a progression from previous levels in the provision of finance under the Paris Agreement. Relevant data and aggregates are presented in section 5.3 below.
- (t) Information on reporting on multilateral finance:
 - (i) Italy reports only multilateral climate-specific inflows to multilateral entities.
 - (ii) Inflows are understood as the contributions from the public budget of Italy (extended mainly through the Ministry of Economy and Finance, but also the MASE and the MAECI) towards a range of multilateral development banks, DFIs and other multilateral institutions. The methodological approach for assessing the climate specificity of multilateral contributions reported is based on the so-called "imputed multilateral shares"¹⁰⁴, provided by the OECD DAC. Multilateral providers report to the OECD DAC their climate-related development finance using the Rio markers or MDB joint approach. The imputed multilateral shares are calculated dividing the climate-related development finance of the multilateral provider for the current year (t) and previous year (t-1), over total finance committed for the current (t) and previous year (t-1). For the years 2021 and 2022, Italy for the first time makes use of

¹⁰⁴ https://webfs.oecd.org/climate/Imputed_multilateral_shares_climate.xlsx

the imputed multilateral shares by type of support, that is, distinguishing within the climate specific multilateral contribution the components related to mitigation, adaptation and both (cross-cutting). Italy applies these shares to each of the contribution (inflow) to the multilateral institution. Contributions towards multilateral organizations additional to those institutions for which the imputed multilateral share is available, are included at full amount, as they all are fully climate specific.

- (iii) Italy also reports amounts related to the “core-general” contribution to multilateral organizations. The core-general column reports the non-climate relevant part of the total contribution (inflow) towards the multilateral institution. That means, the climate specific and core general amounts for multilateral inflows are mutually exclusive, and the sum of the two (or more) amounts results in the total inflow towards the multilateral institution. The core-general figures are not included in the total climate finance provided by Italy.
- (iv) For the Italian climate finance for the biennium 2021-2022, there is no issue of attribution of multilateral climate finance, as the inflow approach has been used – thus, only amounts actually

The information on technology development and transfer was filled in by applying specific filters to the table columns to identify project information. In particular, filters relating to ‘Other (Energy)’ and ‘Mitigation’ were applied first. Then a search was made by applying the filters ‘adaptation’ and ‘water and sanitation’. Finally, further research was made by applying filters for sectors that might have a technology transfer component, such as fishing, agriculture, transport, finding other projects to be detailed with further information. Finally, as a further and final check, a search was made on the keywords ‘solar’, ‘photovoltaic’, finding further projects implemented to improve the condition of educational establishments by, among other things, installing solar panels to ensure lighting even during the evening hours. Further textual information and detailed description of ongoing projects relevant to technology development and transfer, even if not included in tabular format as no financial commitment was made in the biennium, is included in section 5.4.

The activities with a relevant capacity building component are identified through the “Free-standing technical co-operation” flag integrated in the OECD DAC CRS, with few adjustments where more information is available. See letter (k) above for further information. Further textual information and detailed description of ongoing projects relevant to capacity building, even if not included in tabular format as no financial commitment was made in the biennium, is included in section 5.5.

5.3 Information on financial support provided and mobilized under Article 9 of the Paris Agreement

Italy is keeping up efforts to scale up its international climate finance and will continue to do so. Italy’s climate finance in the period 2021-2022 increased substantially compared to previous levels. Total public climate specific support, for the biennium 2021-2022, reached 1.91 billion USD, an increase of 69% over the previous 2019-2020 biennium, when it reached 1.13 billion USD. The total Italian climate specific support for the overall period 2013-2022 amounts to 5.5 billion USD (figure 5.1). Reporting methodology employed is the same starting from 2016 finance flows¹⁰⁵, giving a high degree of comparability of figures over time. In the current biennium, Italy reports only public support provided to developing country Parties, with no component related to private finance mobilized through public interventions.

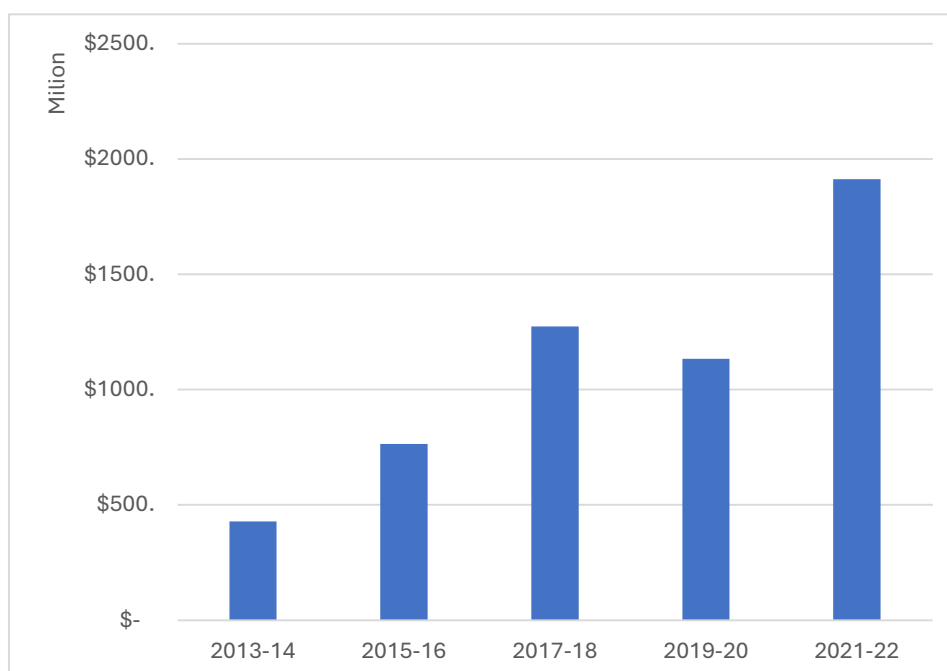


Figure 5.1 – Italian support to developing countries for climate action from 2013 to 2022

Note: An important share of climate finance is provided through the European Development Fund and through EU-funds financed by Member States, including Italy. However, funds extended through this channel are not included in the Italian figures, but are reported by the European Commission in the BTR by the European Union.

Source: MASE

The large majority of the Italian climate specific support is classified as Official Development Assistance (ODA), as defined by the Development Assistance Committee of the Organization for Economic Cooperation and Development (OECD-DAC), which means it is concessional in nature.

Italy reports only three specific amounts qualifying as Other Official Flows (OOF), meaning not extended at the level of concessionality required for those flows to qualify as ODA, for the year 2021, for less than 10% of the total climate specific support in the biennium:

¹⁰⁵ With few improvements as explained to make use of further information to enhance granularity and accuracy.

- 50 million EUR for a green bonds' investment by Cassa Depositi e Prestiti (CDP, the Italian National Development Bank) in Hsbc Real Economy Green Investment Opportunity Gem Bond Fund. The fund's brief is to invest in "green bonds" and "sustainability bonds" to be issued by corporates in emerging and developing countries over the investment period;
- 35 million EUR equity investment in the Africa Renewable Energy Fund which, in continuity with the strategy of Africa Renewable Energy Fund AREF I (vintage 2014), focuses on investments in renewable energy projects, mainly hydroelectric plants, with a geographical focus in Sub-Saharan Africa;
- 70 million EUR equity investment by CDP has in Amundi Planet – Emerging Green One, an investment fund created jointly by the International Finance Corporation (IFC), a World Bank subsidiary, to invest in "green bonds" to be issued by financial institutions in emerging and developing countries over the investment period.

Public climate specific finance from Italy is delivered, as in the past, mainly in the form of grants, with roughly 1.1 billion USD in grant resources going through bilateral and multilateral contributions for 2021 and 2022, representing the 57% of the total Italian climate finance. 33% of the total support provided has been committed or disbursed as concessional loans, while less than 10% in equity investments.

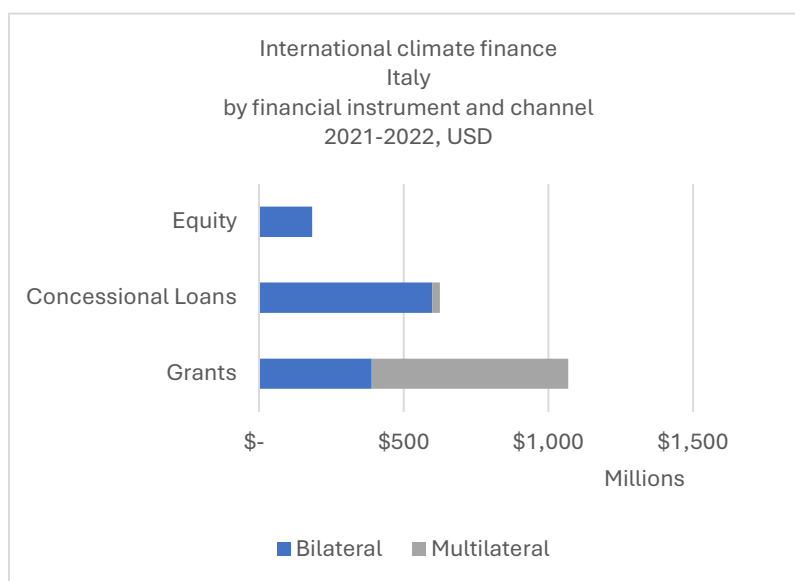


Figure 5.2 – Italian support to developing countries for climate action by financial instrument and channel of delivery
Source: MASE

The distribution between grants and concessional loans in the biennium changed with respect to 2019-2020 in favor of concessional loans. Notably, the share of grants over the total public climate finance provided has been 86.3% in 2019-2020, while dropped to 57% in this 2021-2022 biennium. The reason of this shift lies in the Italian commitment to finance the two initiatives under the Just Energy Transition Partnerships (JETPs) in Viet Nam and Indonesia, for a total amount of 500 million USD in concessional loans. The JETPs are innovative financial cooperation platforms, created in the context of the UNFCCC, aimed at supporting some coal-dependent emerging countries to shift to cleaner and more sustainable sources of energy,

taking into account the social consequences of such a transition. At present, JETPs are active with the following beneficiary countries: India, Indonesia, Senegal, South Africa, and Vietnam - and Italy has joined JETPs Indonesia and Vietnam.

Italy did not commit to the use of specific instruments in extending its climate finance. In fact, the choice of financial instruments should be tailored to the needs at activity and country level, and depends on a range of factors, such as the climate objective (mitigation and adaptation projects present different needs of grant resources), the level of income of the recipient country, the vulnerability of the beneficiary, the main purpose of the project (mainstreaming climate action in development projects vs climate-specific funding), the robustness of the enabling environment, the level of development of financial markets and ease of access to debt resources.

Italy provides support to developing countries for mitigation and adaptation activities, as well as for activities targeting both objectives (cross-cutting). For the biennium 2021-2022, compared to the previous years, resources allocated to both adaptation and mitigation dramatically increased, respectively from 180.6 million in 2019-20 to 432 million USD in 2021-22, and from 125.5 million to 832.2 million USD.

The composition of the Italian climate finance has been historically characterized by significant amounts allocated to cross-cutting activities. For the 2021-2022 biennium, the methodological improvement of attributing imputed multilateral shares by type of support increases the transparency and clarity of the multilateral figures reported, allocating resources to the relevant category instead of classified as cross-cutting.

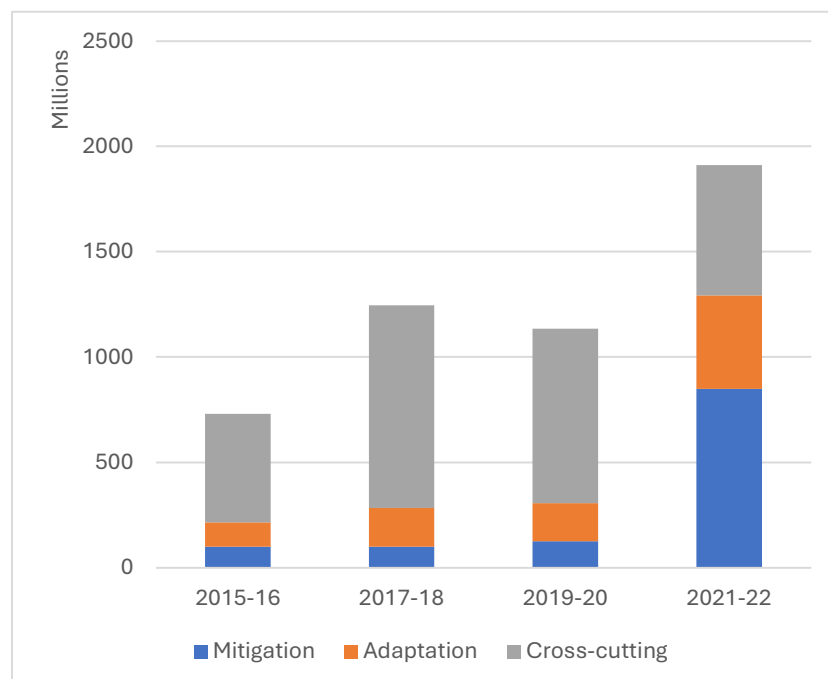


Figure 5.3 – Italian support to developing countries for climate action by type of support (USD)
Source: MASE

In the provision of public financial resources, Italy aims at striking a fair balance between mitigation and adaptation over time. For the 2021-2022 biennium, climate finance allocated to adaptation represents 39% of the total public climate finance¹⁰⁶.

In 2019-2020, this share was 52.4%. The current share is affected by the large commitments related to mitigation for the JETPs in 2022. However, since 2015, the share of climate finance allocated to adaptation has been always higher than 50%, with a peak of 56% in 2020.

Italy envisages to continue reporting a significant part of its international climate finance as cross cutting, as Italy considers key to address climate action in synergy with other objectives. This is maximizing impact on the ground, especially when it comes to adaptation actions, which necessarily should (and increasingly) be embedded into infrastructure, agriculture and other activities on the ground.

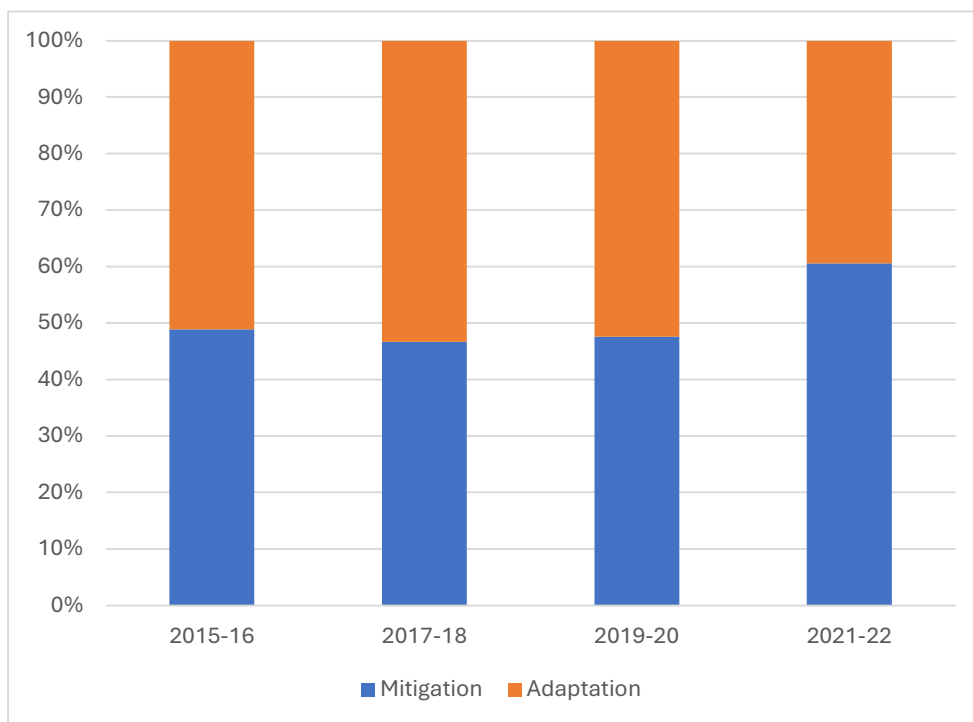


Figure 5.4 – Italian support to developing countries for climate action by type of support as percentage distribution
Source: MASE

Italy did not commit to a fixed share of allocation of climate finance to either mitigation or adaptation, as it would potentially undermine the necessary consideration of needs and priorities of partner countries. Thus, Italy considers to be a fair balance of funds between mitigation and adaptation the allocation which best responds to the needs and priorities of recipient countries.

¹⁰⁶ Considering cross-cutting activities equally allocated between the two objectives.

A significant amount of support to adaptation is channeled through multilateral institutions (see figure 5.5). In 2022, among others, Italy disbursed 10 million EUR to the Adaptation Fund.

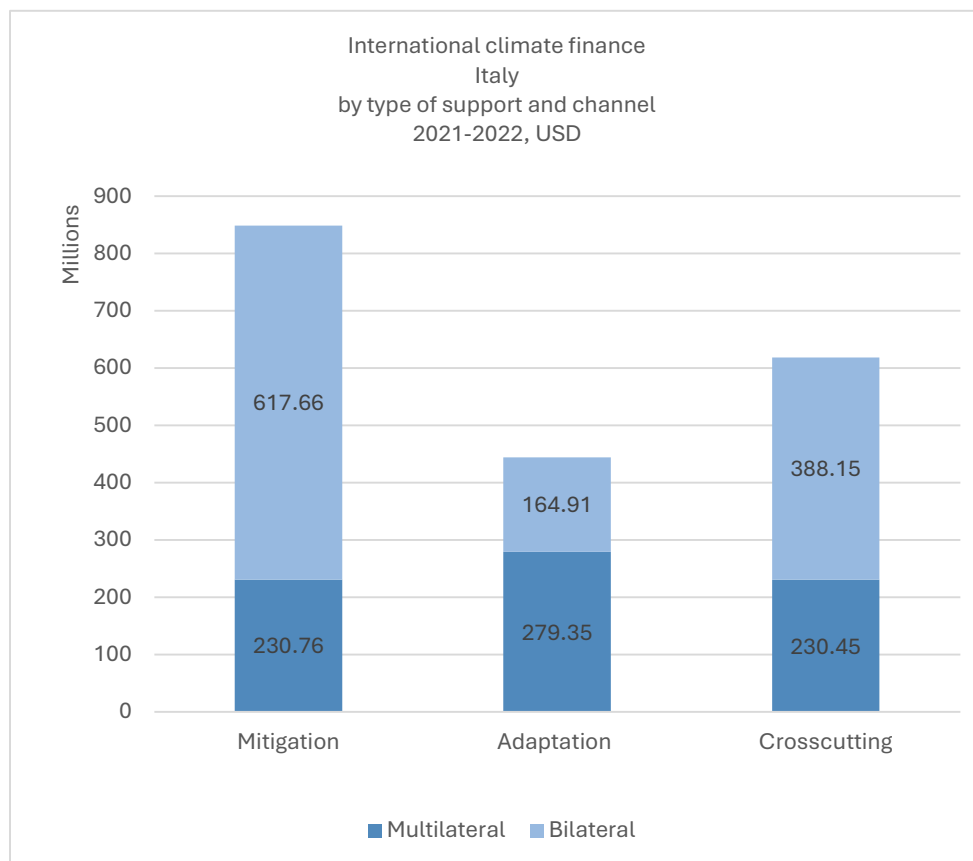


Figure 5.5 – Italian support to developing countries for climate action by type of support and channel of delivery
Source: MASE

Italy reports for the first time, voluntarily, information on the **grant equivalent** value of its support provided to developing countries for climate action. The information is not complete especially for bilateral contributions, that is, the grant equivalent value is not reported for all the activities included in the biennium, even if theoretically a grant equivalent amount can be calculated. With these premises, the reported grant equivalent value for bilateral support provided is 208.850.889 USD (17.8% of the total bilateral commitments), while for the multilateral support provided amounts to 690.060.384 USD (almost the totality of multilateral contributions, 99.7%). The total grant equivalent value of the support provided by Italy, with available information, amounts to 898.911.273 USD, on average, the 47% of the total support provided in the biennium.

Data on Italian climate finance (see figure 5.3) demonstrate that efforts in 2021-2022 biennium represents a progression beyond previous efforts in the provision and mobilization of finance under the Paris Agreement.

5.3.1. Bilateral, regional and other channels

The information on support provided by Italy through bilateral, regional and other (bilateral) channels is reported in tabular format through the ETF Tool, for the two reporting years 2021 and 2022 without overlapping with the previous reporting periods. Tables include the identification and information on projects including capacity building and technology transfer components or focused on these two aspects.

This section provides a simple analysis of the aggregates as reported in tabular format, as well as detailed information on bilateral support provided by MASE and AICS, with specific information on the resources channeled through those institutions and descriptions of bilateral projects and activities undertaken.

5.3.1.1 Overview of aggregates

Italy reports in tabular format relevant information for the previous two reporting years on bilateral and regional financial support provided.

Total bilateral support committed, allocated to countries, regions or to all developing countries, reached 1.170.726.402 USD in the biennium 2021-2022. Respectively Italy committed 373.856.611 USD in 2021 and 796.869.791 USD in 2022, more than doubling the amount of resources committed both from 2021 to 2022 as well as with respect to the previous biennium (+113%), as shown in figure 5.6.

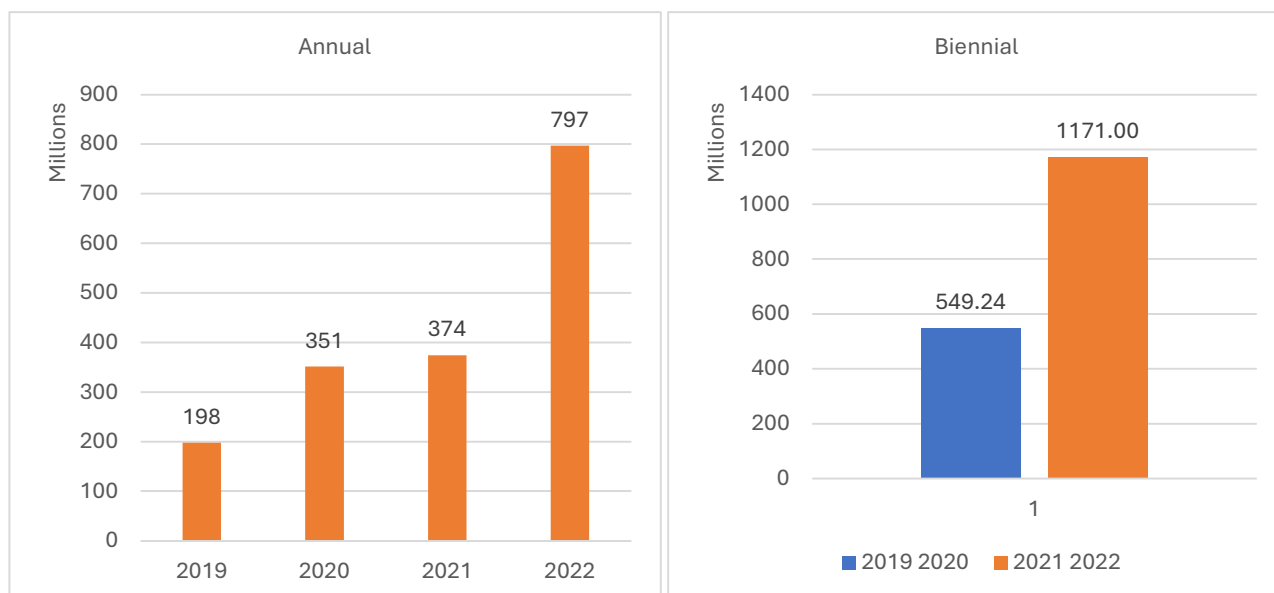


Figure 5.6 – Italian bilateral climate finance by type of support
Source: Ministry of Environment and Energy Security

Bilateral climate specific support by Italy is allocated for mitigation, adaptation and cross-cutting activities, respectively for the 52.7%, 14.1% and 33.2% for 2021-2022 biennium (figure 5.7). As previously mentioned, the Italian commitments for the JETPs in Indonesia and Viet Nam

have a significant impact on figures in terms of type of support, towards mitigation, and financial instrument, towards concessional loans.

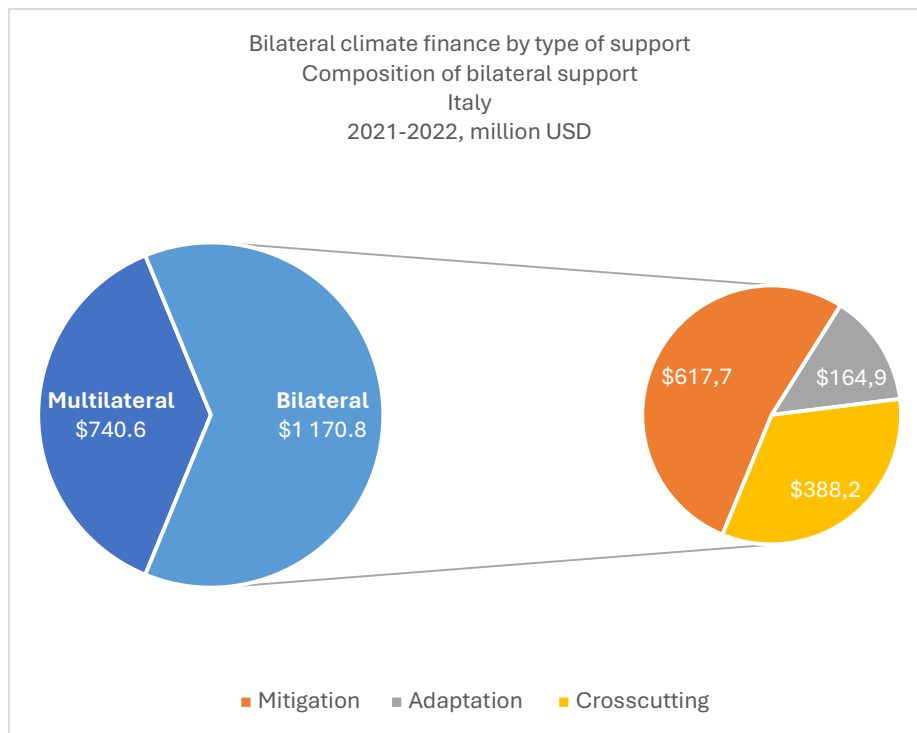


Figure 5.7 – Italian bilateral climate finance by type of support
Source: MASE

Italian bilateral climate finance committed in the biennium constitutes by roughly a half in concessional loans, while the 33% is committed in form of grants and 16% in equity investments. The bilateral concessional loans committed by Italy are overall related to only 5 initiatives:

- The two Just Energy Transition Partnerships in Indonesia and Viet Nam (with the largest amount of 500 million USD);
- A new credit facility through African Multilateral Development Bank (Africa Finance Corporation - AFC) to support climate change;
- An initiative in United Republic of Tanzania for Enhancing Higher Learning in Technical Institutions in Tanzania to Contribute in Achieving Sustainable Development Goals;
- A concessional loan for a programme to support sustainable development projects in the Caribbean community (CARICOM) countries.

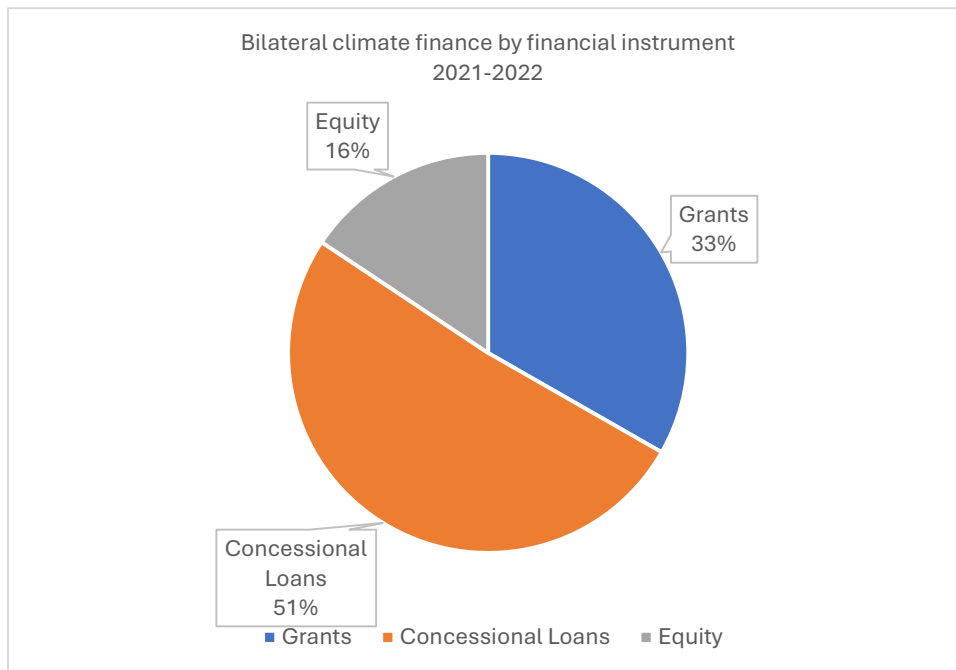


Figure 5.8 – Italian bilateral climate finance by financial instrument
Source: MASE

Distribution of bilateral activities across sectors is dominated by the energy sector with the highest amount (50.3%), followed by water and sanitation (15%) and agriculture (8.7% and 338 projects).

Looking at the average size of the projects by sector, data show that the average amount for a project in the education sector is small, around 80 000 USD; while the average amount is highest for projects in the water and sanitation sector (more than 1 million USD per project) and intervention for emergency response (around 850k USD).

As previously mentioned, the information on the grant equivalent value of bilateral commitments is patchy, that is, the grant equivalent value is not reported for all the activities included in the biennium, even if theoretically a grant equivalent amount can be calculated.

A specific example is the commitments made to the JETPs: in this case, it was not possible to compute the grant equivalent value, as at that point in time it was clear that the financial instrument used will have been the concessional loans (thus, with a grant element embedded), but the specific terms of the concessional loan were not yet clear – making it impossible to report on the grant equivalent value.

With these premises, the reported grant equivalent value for bilateral support provided is 208.850.889 USD (17.8% of the total bilateral commitments). In 316 bilateral and multi-bilateral projects, the value of the grant equivalent is lower than the total committed value, while in 548 projects the whole committed value corresponds to the grant equivalent. For 408 activities, the grant equivalent value is either 0 or not reported.

Table 5.1 – Bilateral climate finance by sector, 2021-2022

Sectors	Commitments (USD)	Number of projects
Energy	588 610 299.94	74
Water and Sanitation	176 769 419.15	170
Agriculture	101 500 579.65	338
Cross-cutting	77 872 192.83	96
Other (Emergency response)	75 231 081.53	89
Other (Environment)	46 479 966.30	95
Other (Government and civil society)	25 601 406.18	100
Education	16 315 611.94	83
Other (Health)	10 604 019.55	48
Industry	7 301 552.97	12
Other (Finance)	7 033 983.92	18
Forestry	6 514 341.89	9
Other (Education)	6 458 781.02	81
Other (Disaster Risk Reduction)	5 384 830.31	8
Other (Fishing)	4 699 471.72	11
Other (Trade)	1 655 836.71	1
Other (Tourism)	990 203.01	4
Transport	587 421.02	7
Other (Food Security Assistance)	178 072.23	1
Other (Communications)	156 240.79	3
Other (General Budget Support)	9 206.45	1
NA	10 771 883.81	34
Total bilateral commitments	1 170 726 402.91	1283

source: MASE

As for income distribution of bilateral support provided to developing countries, Italy allocated in the 2021-2022 biennium 158.6 million USD to 36 Least Developed Countries¹⁰⁷, the 13.5% of the total bilateral commitments and the 19.8% of the bilateral support allocated to specific countries (excluding support to regions or to all developing countries in general).

For LDCs, the majority of support regarded adaptation (73.9 million USD) and cross-cutting (67.4 million USD) activities. Furthermore, the 17.3% of bilateral country-level support was allocated to Low Income countries, 41.3% to Lower Middle Income Countries and 41.4% to Upper Middle Income Countries¹⁰⁸.

¹⁰⁷ Afghanistan, Angola, Bangladesh, Benin, Burkina Faso, Burundi, Cambodia, Central African Republic, Chad, Democratic Republic of the Congo, Djibouti, Eritrea, Ethiopia, Gambia, Guinea, Guinea-Bissau, Haiti, Madagascar, Malawi, Mali, Mauritania, Mozambique, Myanmar, Nepal, Niger, Rwanda, Senegal, Sierra Leone, Somalia, South Sudan, Sudan, Togo, Uganda, United Republic of Tanzania, Vanuatu, Zambia.

¹⁰⁸ According to the World Bank income classification.

10.2% of the country level support is allocated to landlocked developing countries. Finally, Italian bilateral country support goes to fragile countries¹⁰⁹, among which the 7.4% to extremely fragile countries¹¹⁰.

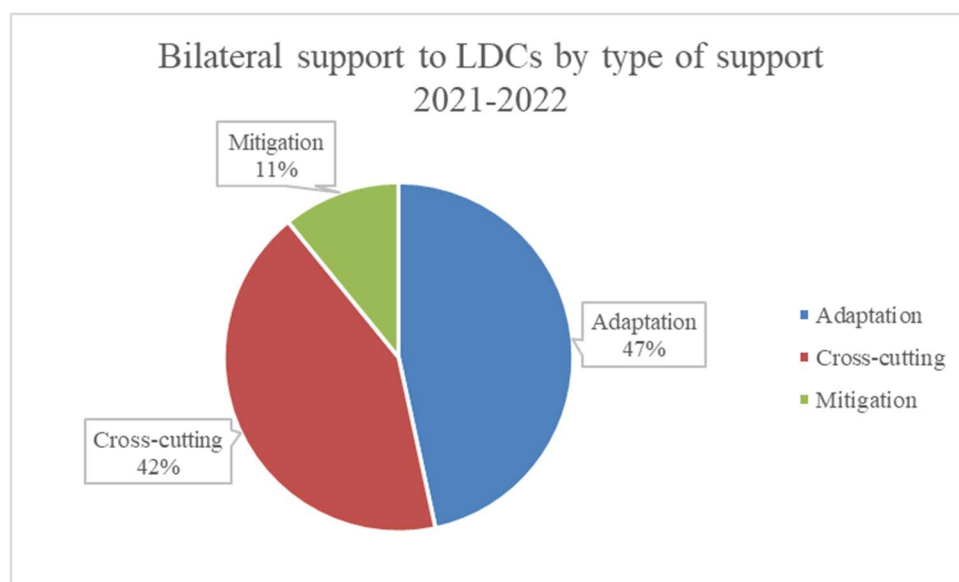


Figure 5.9 – Italian bilateral climate finance for Least Developed Countries by type of support
Source: MASE

Bilateral support allocated to regions rather than to specific countries represent the minority of Italian bilateral support, overall representing the 11% of total bilateral support to developing countries (Table 5.2). Regional support is lower in amount than support allocated to activities that address the group of developing countries as a whole – identified as global - which often classifies as multi-bilateral support.

Table 5.2 – Italian bilateral climate finance by region, and global

Regions	Commitments USD
Global	
Africa	101 549 808
Asia	1 309 813
Europe	2 037 054
Latin America and the Caribbean	22 227 013
Oceania	1 182 740
Total regional	128 306 430
Global	214 746 615

Source: Ministry of Environment and Energy Security

¹⁰⁹ According to OECD classification: Angola, Bangladesh, Burkina Faso, Cambodia, Cameroon Côte d'Ivoire, Djibouti, Eritrea, Ethiopia, Gambia, Guatemala, Guinea, Guinea-Bissau, Honduras, Iran (Islamic Republic of), Kenya, Libya, Madagascar, Mali, Mauritania, Mozambique, Myanmar, Nicaragua, Niger, Nigeria, Pakistan, Sierra Leone, Tajikistan, Togo, Uganda, United Republic of Tanzania, Venezuela (Bolivarian Republic of), Zambia, Zimbabwe

¹¹⁰ According to OECD classification: Afghanistan, Burundi, Central African Republic, Chad, Congo, Democratic Republic of the Congo, Haiti, Iraq, Somalia, South Sudan, Sudan, Syrian Arab Republic

5.3.1.2 Bilateral cooperation from the Italian Ministry of Environment and Energy Security (MASE)

The bilateral cooperation undertaken by MASE aims to support the efforts of developing countries, particularly those that are most vulnerable and have the lowest rate of development (so-called LDCs, Least Developed Countries), in protecting the environment, combating climate change and sustainable development.

In particular, the former Italian Ministry of Ecological Transition, now Italian Ministry of the Environment and Energy Security (MASE), in 2022 expanded and strengthened its role in the energy field, at national and international level, taking over tasks which were previously assigned to the Ministry of Economic Development. Following the strategy for international environmental cooperation outlined in the Policy Priorities for 2022 and for the three-year period 2022-24¹¹¹, MASE continued its commitment to pursue ambitious objectives at a multilateral, regional and bilateral level, under the three Rio Conventions: on Climate Change (UNFCCC), on Biological Diversity (CBD) and to Combat Desertification (UNCCD), as well as under the 2030 Agenda for Sustainable Development. The Italian budgetary law 2022 established the Italian Climate Fund (ICF), under the responsibility of the Ministry of Environment and Energy Security (MASE). The ICF contributes to the achievement of the objectives established by the international agreements on climate and environmental protection of which Italy is part. The ICF has a total endowment of 4 billion euros (with a top-up funding of 400mn euros from the budgetary law 2024) and represents Italy's main public national instrument dedicated to international commitments on global climate finance. For more details, see Box 1.

During the reporting period 2021-2022, MASE bilateral cooperation was based on mutual collaboration agreements, on accountability, transparency and respect on the priorities of the beneficiary countries, generally concluded with the Ministries of the Environment. Priority was given to Africa, particularly the Sahel region, the Mediterranean basin, the Small Island States (SIDS), the Latin America and ASEAN countries' areas. MASE cooperation policy in the Sahel, geared towards tackling climate change effects, root causes of extreme poverty, creating the grass-root conditions for economic opportunity and human development to flourish. Thus, strengthened cooperation activities with the Sahel Countries are also aimed at managing the environmental migration phenomena of people moving from the African continent. In this connection, MASE agreed to provide a contribution to UNCCD for the realization of an initiative that aims at strengthening the resilience to climate change and desertification of communities in the Sahel Region - Burkina Faso, Ghana and Niger- through the rehabilitation of degraded lands, while creating income-generating activities.

111

https://www.mase.gov.it/sites/default/files/archivio/allegati/trasparenza_valutazione_merito/ATTIGENERALI/2021/2021-11-12_decr_464_decreto_e_atto_indirizzo_priorita_politiche_2022-2024.pdf

Box 1**The Italian Climate Fund (ICF)**

The Fund has decided to allocate at least 75% of its resources to Africa and the Middle East and North Africa (MENA) area. This choice is in line with the Italy's foreign policy orientations and reflects a commitment towards promoting sustainable development in these regions. The ICF can support a wide range of financial interventions aimed at mitigating and adapting to climate change and provide support to all countries receiving official development assistance identified by the OECD Development Assistance Committee. To be eligible, interventions must have climate mitigation and/or adaptation as objective. Even if projects reducing greenhouse gas emissions and improving the capacity to absorb the impacts of climate change will be selected as a priority, projects to protect biodiversity and combat desertification will also be eligible. The fields of intervention are, among others: agriculture, energy, transport and water infrastructure. The ICF will optimize the use of national public resources, in line with the best practices of international development financing institutions, with a view to being additional, also catalyzing private capital in those contexts in which it would be difficult to channel resources. The ICF can also provide grants for technical assistance to prepare and/or evaluate projects financed by the Fund, thus represents a highly relevant tool for encouraging the development of solid partnerships. Furthermore, to maximize the effectiveness of the interventions, priority will be given to operations directed towards sovereign counterparts and projects aimed at attracting private sector investments. This approach aims to ensure greater effectiveness in the implementation of climate policies and to encourage full involvement of key actors. The approach adopted through the 2023 Workplan focuses on three main lines of action: the launch of a technical assistance activity to encourage the development and structuring of new projects in collaboration with the administrations involved; the promotion of private sector investments in developing countries, both through direct financing and through support for local counterparts; the implementation of a promotion plan for the Fund, aimed at generating new high-impact initiatives in priority areas, establishing partnerships with other financial actors in the climate and development sector. Since November 2023, the ICF has been fully operational and has already approved interventions for a total of approximately 553mn (552.7) euros.

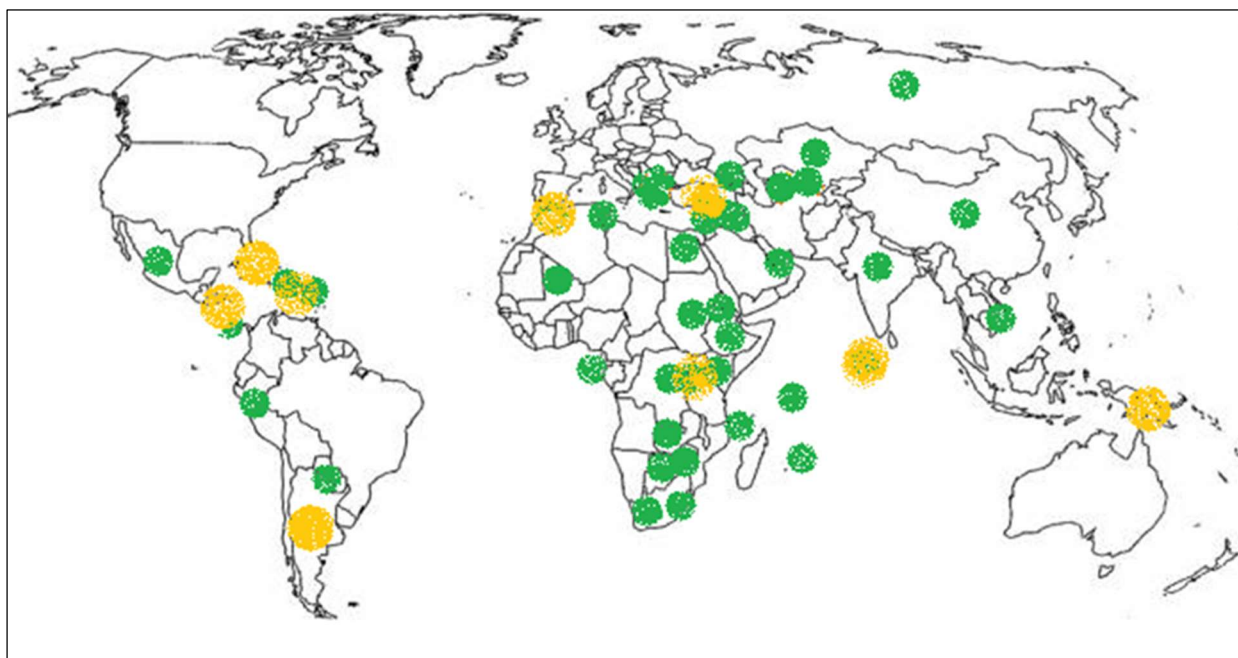
In terms of bilateral cooperation promoted by MASE during the reporting period, 9 new MoUs in the field of sustainable development were signed that, together with the ongoing 36 agreements still in force made a total of 45 active MoUs. The goal was to support mitigation and adaptation actions, to facilitate access to climate finance, to provide capacity building and technology transfer. The strategy underlying the identification of priority countries was defined jointly with the MAECI.

Thematic sectors of interest were mainly those related to the energy transition, mitigation and adaptation to climate change, biodiversity protection, land recovery and water access.

The following is a list of geographical areas involved in MASE cooperation activities:

- Sub-Saharan Africa: Botswana, Cameroon, Congo DRC, Eswatini, Ethiopia, Djibouti, Lesotho, Kenya, Mali, Mauritania, Mozambique, Rwanda, South Africa, Sudan, Zambia, Union of the Comoros, Sao Tomè and Príncipe, Seychelles, Mauritius);
- Middle East and North Africa -MENA: Morocco, Tunisia, Palestine, Jordan, Lebanon, Kurdistan (Iraq), Arab Emirates;
- Partnerships: PSIDS, CARICOM;

- Asian region: Maldives, India, China, Vietnam
- Central and South America: Argentina, Chile, Costa Rica, Cuba, Mexico, Paraguay, Peru;
- Central and Eastern European countries: Serbia, Turkmenistan, Uzbekistan.



Countries with ongoing agreements: Congo DRC, Eswatini, Ethiopia, Djibouti, Lesotho, Kenya, Mali, South Africa, Sudan, Zambia, Costa Rica, Mexico, Paraguay, Peru, Dominican Republic, Turkmenistan, Kazakhstan, Uzbekistan, Russian Federation, Albania, Montenegro, Georgia, Tunisia, Palestine, Jordan, Lebanon, Kurdistan (Iraq), United Arab Emirates, Union of Comoros, Seychelles, Sao Tome and Principe, Mauritius, PSIDS, India, China, Vietnam.

Countries with agreements signed in 2021-2022: Argentina, CARICOM (Belize, Antigua e Barbuda, Saint Lucia, Saint Kitts e Nevis), Cuba, Morocco, Turkey, Azerbaijan, Armenia, Maldives, Rwanda.

Figure 5.9 – Bilateral cooperation agreements of the MASE, 2021-2022
Source: Ministry of Environment and Energy Security

In terms of figures, climate specific bilateral commitments from MASE in the biennium 2021-2022 amounted to 10.302.466,60 USD (with 19.285.982,49 USD disbursed).

The following paragraphs provide a few examples of the wealth of projects and activities ongoing between MASE and the cooperation partner countries as a result of the 45 active MoU's. The activities reflected the needs, ownership and priorities of developing countries' Counterparties, including the Nationally Determined Contributions (NDCs) and other relevant climate change and development strategies.

Sub-Saharan African region

During the reporting period, Africa continued to represent a priority for the MASE cooperation activities, with 95% of the funds committed for cooperation activities with African countries.

In 2021 and 2022, in addition to the ongoing MoUs, negotiations with several other countries were carried out to extend MASE environmental cooperation activities in the region such as:

Burkina Faso, Botswana, Rwanda, Sudan, Namibia, Mozambique, Cameroon, Chad, Niger, Nigeria and Mauritania.

The following paragraphs provide a few examples of relevant initiatives foreseen by bilateral cooperation in the biennial in Democratic Republic of Congo, Eswatini, Ethiopia, Rwanda, Sudan and Union of the Comoros.

Under the MoU on cooperation in the field of climate change vulnerability, risk assessment, adaptation and mitigation signed between MASE and the Ministry of Environment, Nature Conservation and Sustainable Development of the Democratic Republic of the Congo (DRC) in 2016, the project “Bukavu Green Community as pioneers of an integral and sustainable development in Democratic Republic of Congo”, among others, was implemented. The initiative, concluded in 2022, envisaged energy efficiency measures and the installation of power generation sites to serve local institutions and communities. The first photovoltaic plant, built in the area of the Sant’Egidio Peace Centre in Bukavu, produced energy for the surrounding area and supplied electricity to the city's largest high school and the nearby university campus. A second plant was built in Goma to serve a primary school and the surrounding neighborhood. The initiative also included technical training of local engineers and the creation of a start-up in the green economy sector. [MASE contribution: EUR 999.478].

In November 2021, a new MoU on cooperation in the field of sustainable development was signed with the Rwandan Ministry of Environment, in continuation of the previous MoU signed in 2016, which led to the implementation, among others, of the “Sustainable urban wetlands development within Kigali City” project. The initiative, ended in 2022, contributed to the ecosystemic restoration of a degraded urban wetland area of 121 hectares on the outskirts of Kigali, which became the Nyandungu eco-tourism Park. It also contributed to the strengthening of the national technical and institutional expertise on urban wetland management, solid urban waste management and Environmental Impact Assessment. [MASE contribution: EUR 1.016.000].

The MASE also signed a “Contribution Agreement with the Global Green Growth Institute (GGGI) on climate change vulnerability, mitigation & adaptation in Rwanda”. The objective of the agreement, ended in 2021, was to support the Rwandan Government in: NDCs and green growth strategy implementation through technical assistance for projects development; the strengthening of private sector engagement and business-to-business exchange; capacity building and knowledge sharing. [MASE contribution: EUR 300.000].

In 2022 MASE and the Ministry of Production, Environment, Energy, Industry and Craftsmanship of the Union of the Comoros signed a new MoU on cooperation in the field of sustainable development, in continuation of the previous MoU signed in 2016, which led to the creation of the “Integrated Plan for the management of urban waste in the Union of Comoros”. The project aimed to build an integrated urban solid waste management system and to develop a national model based on circular economy. In this paradigm, waste was treated as an economic resource, enhancing the recovery and recycling of materials and waste that ended up in landfills. The project also had the goal of creating new job opportunities in the sectors of green

economy and material recovery. Training courses were developed for local personnel responsible for waste management and the first shipment of equipment for the construction of the biogas plant took place. In 2021- 2022, no resources were mobilised for this initiative.

Other ongoing projects in the region in the 2021-2022 biennium are:

- “Systèmes décentralisés hors réseau basé sur les sources renouvelables” – DRC
- “Sustainable Energy Services for Rural DRC” – DRC
- “Fossil fuel free and green building of the Raleigh Fitkin Memorial Hospital” – Eswatini
- “Strengthen Swaziland early warning system and climate services” – Eswatini
- “Sustainable Water Supply System in Rural Areas of Somali and Afar Regional States of Ethiopia” – Ethiopia
- “Climate Smart Integrated Rural Development Project in the Pastoralist area of Ethiopia” – Ethiopia
- “Improved green culture and climate change resilience within Rwandan rural communities” – Rwanda
- “Solar pumps for sustainable livelihood” – Sudan

Middle East and North Africa (MENA) region

MASE’ cooperation in the region is coherent with the national and international environmental objectives. Projects across the region are mainly related to supporting Partners in implementing their NDC’s by operating on energy, natural resources management, green jobs, climate smart agriculture, biodiversity. Capacity building, institutional building and technology transfer are the three pillars of MASE’ action in the region.

In 2021-2022 biennium, 2 MoUs were active between MASE and the Government of Tunisia. One with the Ministry of Energy, Mines and Renewable Energy, led to the implementation of the “Promo-Isol” project, establishing a financing mechanism for the promotion of thermal insulation roofs in the individual housing; as well as the initiative “PROMO-FRIGO”, concerning the establishment of a financing mechanism to replace refrigerators older than 10 years. The other with the Ministry of Agriculture, Water Resources and Fisheries, led to the implementation of the project “Renewable Energy for Agricultural and Rural Development”, aimed at supporting the development of solar-powered systems for irrigation, water production and drinking water (water treatment through desalination and phytodepuration processes). A capacity-building component was realized by training young graduates, with the aim of promoting the growth of small and medium enterprises in the renewable energy sector. The activities involved the Regions of Kasserine, Gafsa, Sidi Bouzid, Kairouan, Sousse and Sfax in the south-central part of the country.

Regarding the three projects approved in Lebanon namely: "Heat Pump project Phase 1"; “Maximizing energy savings from energy efficient home appliances” and “Supporting Lebanese Center of Energy Conservation in implementing Technical Cooperation Agreement on Sustainable Development” no funds were mobilized during the period 2021-22, due to the

Lebanese economic crisis. In fact, the Lebanese bank froze MASE's transferred funds, making impossible to proceed with projects' implementation. Thus, ongoing projects in the energy sector were rescheduled to close in 2025.

Other ongoing projects in the region for 2021-2022 biennium:

- Programme intégré d'éducation à l'environnement et au développement durable dans les établissements scolaires – Morocco
- Mise en place de la filière de valorisation des déchets de construction et de démolition dans la Commune de Marrakech – Morocco
- Programme de Promotion de l'entrepreneuriat vert – Morocco
- Gestion intégrée des zones côtières de la Région Rabat-Salé-Kenitra – Morocco
- Implementing Climate-Smart Agriculture practices in Tunisia
- Revision and updating of the National Biodiversity Strategy of Palestine and related Action Plan and Preparing the Sixth National Report - Palestine
- Installation of Solar PV Systems for Municipalities in the Hashemite Kingdom of Jordan
- Enhancement of Kurdistan Automatic Weather Observation Network - Kurdistan regional government of Iraq

Pacific Small Island Developing States – PSIDS

The Partnership between Italy and the Pacific Small Island Developing States was launched fifteen years ago to implement a cooperation programme for addressing the key global challenges related to climate change: adaptation to the adverse effects of climate change and mitigation of harmful emissions generated by energy utilization.

In December 2018, under the Italy's leadership, the PSIDS partnership was extended until 2023 with an additional investment of USD 15 million to enhance the scope of the activities to be financed under the terms of the MoU governing the Pacific SIDS/Italy and to make the Partnership fully instrumental to the implementation of the Paris Agreement with particular reference to:

- Develop conservation measures for coastal and marine areas affected by the negative impacts of climate change, especially those that are particularly significant for their biodiversity and for providing ecosystem services;
- Strengthen the national managerial and organizational capacity as well as governance in the areas of protection and conservation of marine biodiversity;
- Develop programmes and projects that enhance ecosystem resilience and increase the contribution of biodiversity to carbon stocks through conservation and restoration measures;
- Develop measures to minimize and address the impacts of ocean acidification.

In 2021 - 2022, the Partnership included four donors (Italy, Austria, Luxemburg and Spain) and fourteen Pacific SIDS (Cook Islands, Fiji, Kiribati, Micronesia, Marshall Islands, Nauru, Niue, Solomon Islands, Palau, Papua New Guinea, Samoa, Tonga, Tuvalu and Vanuatu).

Ongoing projects in the biennium have been implemented in the Maldives, under the MoU on climate change, vulnerability, risk assessment, adaptation, and mitigation, signed with the Ministry of Environment and Energy of the Republic of Maldives. Three projects were carried out from 2021 to 2022, namely:

- OpERATE - “Ocean Energy Resources Assessment for Maldives”. The project was approved on March 10, 2016, during the First Meeting of the Joint Committee in Rome and formally launched in July 2017. Its main objective was to perform a detailed assessment of the energy potential residing in 214 marine currents in the Maldivian archipelago, and to individuate technological solutions to exploit it. With ENEA as the implementing agency of the project, it encompassed the following activities: the development, for the first time, of high-resolution three-dimensional models of marine circulation in the Maldivian Archipelago and in selected atolls; the use of these numerical models to analyze the variability of the circulation in the area in detail, the selection of the most favorable sites for energy extraction; the deployment of instruments to measure currents at the identified locations; and the assessment of the energy potential of the most favourable sites. Currently, the project faces delay due to challenges encountered by the Ministry for the Environment and Energy of the Republic of Maldives in procuring necessary equipment and securing a vessel for current monitoring operations. [Budget: € 866,245].
- WAVE4M - “Development of a sea state forecasting system for the Maldivian Archipelago”. The project, approved during the Third Meeting of the Joint Committee in Malé on October 12, 2017, officially commenced on March 1, 2018. Its main objective was to develop an operational wave forecast model for the Maldivian Archipelago, and to consistently provide boundary conditions through two main activities: the development and verification of the regional wave model and the creation of an operating system producing daily forecasts on the sea status. ENEA was serving as the implementing agency of this initiative. Following a no-cost extension granted on March 1, 2022, project activities were rescheduled in accordance with the updated timeline. These include completing WP3 (“Implementation of the operative system”), WP4 (“Porting of the wave forecast system”), WP5 (“Training”), and WP6 (“Product Viewing Platform at MMS”). [Budget: € 605,270].
- “Implementation of an Integrated Meteorological and Climatological Information and Decision Support System at the Maldives Meteorological Service (MMS)”. The project was approved on September 6, 2018, during the Fourth Meeting of the Joint Committee in Bangkok. Its main objective was to strengthen the Maldives network of meteorological monitoring, early warning and disaster prevention. With ENEA being the implementing agency for the project, it marked the completion of the Maldives Meteorological Service (MMS) laboratory system for the integrated management of all meteorological and oceanographic data. It enhanced the warning and information dissemination systems, thus providing robust support for decision-making while reinforcing the national institutional framework for disaster risk reduction and climate resilience. The technical execution of activities outlined in the project’s Work Packages has been completed. The remaining tasks

are focused on Project Management activities required for project closure, including reporting, processing payments, and finalizing administrative procedures (WP 1.3, Project Management and Coordination: Reporting, processing payments and project closure). [Budget: € 903,745].

Caribbean Community (CARICOM) and Central-Latin America Countries

CARICOM States

The Caribbean region remains a priority to MASE considering that the Small Island Developing States (SIDS) face well-known structural and systemic vulnerabilities, due to their remote location, small size, the peculiarities of their economies and human, technical and financial limitations, worsened due to the Covid-19 pandemic. Therefore, during 2021, MASE began to expand and renew its cooperation activities through the negotiation of a new MoU of cooperation in the field of sustainable development with the Caribbean Countries. It was the clear continuation of a fruitful collaboration already began under the previous MoU signed between MASE and 11 CARICOM States starting in 2015 and already expired for all countries. At the end of the reporting period (2022) four countries adhered to the agreement: Belize, Antigua Barbuda, Saint Lucia and Saint Kitts and Nevis.

Ongoing projects in the biennium have been implemented in the area, under the above-mentioned MoU. During the reporting period, five projects concluded their activities, and three projects were carried out, as shown in the table below.

Table 5.3 – List of projects in the CARICOM area

<i>COUNTRY</i>	<i>PROJECT</i>	<i>MASE FUNDS (\$)</i>	<i>STATUS</i>
Antigua and Barbuda	Electric School Bus Pilot	625.000	Concluded
	Grid Interactive Solar PV-Systems of Schools and Clinics in Antigua	825.000	Concluded
Belize	Reducing the Carbon footprint of S. Ignacio and five surrounding Villages in the Cayo District	1.150.000	Concluded
Dominica	Installation of a 75 KW grid-tied with battery backup Solar PV System at the DOWASCO Sewer Treatment Plant	491.050	Concluded
Grenada	Extending water availability to the rural areas of Carriacou using SWRO Desalinization powered by a PV Renewable Energy System	1.850.000	Ongoing
Guyana	Transitioning to national energy security: Bartica as a model Green Town	650.000	Concluded
St. Kitts and Nevis	The piloting of the Public-school bus transportation system for St. Kitts using Renewable Energy	564.000	Ongoing
St. Lucia	Solar Carport and electric vehicle	486.675	Ongoing

Source: MASE

Central and Latin America

During the biennium 2021-22, MASE continued its cooperation activities in the framework of the 7 MoUs active in the region, of which 5 agreements previously signed (Costa Rica, Mexico,

Paraguay, Peru, and Dominican Republic) and 2 new MoUs in the field of sustainable development (Argentina and Cuba).

In November 2022, MASE and the Ministry of Environment and Sustainable Development of Argentina (MAyDS) signed a new MoU on Sustainable Development. The 5-year MoU will expire on 10th November 2027. In the framework of the previous MoU, the initiative “Strengthening Fire Early Warning and Statistics Systems in Argentina” was approved. The goal of the project is to improve information management, early warning, and public communications of the Argentine fire management service. More specific and detailed information on land use change, people's lifestyles and climate change will be provided to develop new fire management strategies. At the same time, new technologies allowing to anticipate high fire-risk situations and efficiently communicate with the local population will be acquired. [Budget: € 880,175].

Following the negotiation of a new Agreement, on November 2022 a new MoU on cooperation on sustainable development between MASE and the Ministry of Science, Technology and Environment of Cuba (CITMA) was signed, in continuation of the ongoing collaboration since 2017. Three projects were carried out from 2021 to 2022, namely:

- “Strengthening the Cuban Marine Meteorological System (Maritime Surveillance)”. The scope is to improve the efficacy of the Cuban Marine Meteorological System to address extreme events and the spillage of oil derivatives from ships in the Caribbean Sea, and introducing new hydro-meteorological and environmental services, through the acquisition of high-resolution satellite data and capacity-building. [Budget: €1.204.216].
 - Feasibility study on central coast front of the city of Havana: adaptation proposals for the climate change challenges (Engineering Solution Malecón). The aim is to identify and propose, through field research, modelling and technical, economic and environmental feasibility studies, possible engineering solutions to improve Havana coast front’s level of protection against current and future climate change risks, especially coastal erosion. [Budget: €1.856.184].
 - “Improve national capacities for the introduction and use of innovative and advanced technologies and tools that strengthen vulnerability, risk, adaptation and mitigation assessments of climate change in Cuban marine ecosystems (EcoAtlas)”. The objective is strengthening national capacities to apply innovative methodologies for the elaboration of habitat maps to support monitoring, surveillance and early warning systems, and to evaluate the sea energy potential as renewable energy source. [Budget: €1.055.545]
- Under the MoU on cooperation in the field of climate change vulnerability, risk assessment, adaptation, and mitigation signed between MASE and the Ministry of Environment of Peru (MINAM) in 2016, the Project “Strengthening NDCs in Peru” was implemented. The objective is to contribute to the achievement of transformational change by addressing enabling conditions to implement adaptation and mitigation commitments as tools for delivering sustainable and

equitable climate-resilient development. The project addresses the priority sectors identified in Peru's NDC: agriculture, forests, other land use and land use change (AFOLU), and water resources. It adopts an inclusive approach that incorporates the three levels of government (national, regional, local) as well as participation from academia, civil society, private sector and international cooperation. It also integrates gender and intercultural approaches. [Budget: €2.000.000]

Central and Eastern European countries: Serbia, Turkmenistan and Uzbekistan

During the biennial, MASE had three active MoUs in the area: i) with the Serbian Ministry of Agriculture and Environmental Protection; ii) with the Ministry of Agriculture and Environment Protection of Turkmenistan; iii) with the State Committee on Ecology and Environmental Protection of Uzbekistan. However, no initiatives were implemented under this framework.

Bilateral Cooperation with International Organizations

MASE pursues the objective of international environmental cooperation also through collaboration with international organizations, especially within the United Nations network. It regarded specific support to the partner countries for the elaboration/implementation of initiatives or the development of thematic initiatives in specific geographical areas. The collaboration in the biennium 2021-2022 was underway with:

- United Nations Development Programme (UNDP). Numerous financing agreements were in place for activities aimed at promoting sustainable development, renewable energies and development cooperation, as well as the establishment and operation of the Centre for Climate Sustainable Development in Africa.
- United Nations Environmental Programme (UNEP). MASE participated in various initiatives, especially in the Mediterranean and East area, on the topics of energy efficiency and renewable sources and with which the entrustment of pilot activities of the project "Digital Demand-Driven Electricity Networks (3DEN)" carried out in collaboration with the IEA under the Clean Energy Transitions Programme (CETP) initiative was negotiated. Also, it is worth mentioning the contribution of MASE to the UNEP's District Energy in Cities Initiative, supporting the project "District Energy in Tunisia and Morocco". The project aimed at supporting energy efficiency through the promotion of modern energy systems, thus reducing electricity consumption for air conditioning and buildings' primary energy consumptions and integrating renewable energy sources. In the reporting period, the collaboration was extended to 2023. [Budget: €455.000]
- United Nations Convention to Combat Desertification (UNCCD). The collaboration was underway for the realization of the Project "Creating Lands of Opportunities: Transforming Livelihoods through Landscape Restoration in the Sahel" - 36 months to be held in three countries: Burkina Faso, Ghana, Niger - promoting economic development policies based on land recovery from desertification.

- In 2021-2022, MASE continued its collaboration with UNCCD for the realization of the Project. The initiative, entirely funded by MASE with a total contribution of EUR 6,000,000, aimed at strengthening the resilience of communities in Burkina Faso, Ghana and Niger to climate change and desertification through the rehabilitation of degraded lands, while improving livelihoods and creating income-generating activities. Expected long-term results were the restoration of estimated 20.000 hectares of degraded lands and 300.000 beneficiaries reached from the social impacts of new sustainable sources of income. In order to reach expected results, project activities included, among others, the provision of renewable energy systems for domestic use and for economic activities. The field actions were also supported through an extensive capacity-building programme, encompassing workshops and seminars on land management, climate-smart village approach, agricultural good practices and techniques, business development. In the reporting period, the second instalment of payment of MASE funds, amounting to EUR 2,500,000, was transferred to UNCCD. [Budget: €6,000,000]
- United Nations Industrial Development Organization (UNIDO). The collaboration was focused on the ongoing Project “Fostering international partnerships between companies and/or institutions operating in the energy and environment sectors”. that aimed to promote international partnership between SMEs and institutions in the energy/environmental sectors. In 2021-2022, MASE also continued its collaboration for the realization of the project, entirely funded by MASE aimed at supporting the commercialization and scale-up of sustainable energy and environmental technologies and projects in Small and Medium-sized Enterprises (SMEs) in 7 partner countries in Africa, Asia and Latin America in seven countries (Botswana, Cuba, Ethiopia, Kazakhstan, Kenya, Morocco, Peru) through capacity-building and facilitation of access to finance. In the framework of the project, UNIDO provided capacity-building and technical assistance to SMEs to identify and develop high-impact innovations and investment projects in the sustainable energy and environmental sector. Specifically in the reporting period and among other activities, UNIDO launched the FIPEE Call for High Impact Cleantech, which led to the selection of SMEs which benefited from a 4-month training and business coaching program. During the biennial, the second instalment of payment of MASE funds, amounting to EUR 812,900, was transferred to UNIDO. [Budget: €1,625,800]
- Office of the Special Envoy for Sustainable Development of the Secretary-General of the United Nations. This collaboration was renewed and expanded to promote activities for dissemination and implementation of the goals and targets of the 2030 Agenda for Sustainable Development (see data sheet on banks and development funds).

5.3.1.3 Bilateral cooperation from the Italian Agency for Development Cooperation (AICS)

The Italian Agency for Development Cooperation carries out, within the framework of the policy guidelines of the Ministry of Foreign Affairs, the technical-operational activities related to the preliminary study, formulation, financing, management and control phases of international

development cooperation initiatives¹¹². As for the bilateral climate-related ODA managed by the Italian Agency for Development Cooperation (AICS), adaptation-related ODA more than double mitigation-related ODA and activities pursuing both mitigation and adaptation remain the largest share, reflecting that climate is a cross-cutting priority for Italy’s development programs. Support for adaptation focuses on sectors closely linked to the ecosystem, such as agriculture, forestry and fishing, water supply and sanitation or disaster risk reduction. Africa absorbs the largest share of climate-related ODA, in line with the priority assigned by the Italian development cooperation to Africa. A significant integration of gender equality objectives into climate related ODA is also observed, reflecting the increasing acknowledgment of the gender-environmental sustainability nexus. Bilateral commitments by AICS have been fairly stable over the two years of the biennium 2021-2022, in the context of a sharp rise in the committed amount for development cooperation in 2022 (figure 5.8) – thus presenting a decrease in percentage terms for the year 2022, from 31% to 16% of the total.

Regarding the methodology for data collection, for the period 2021-2022, AICS extracted and assessed only climate-marked activities. Climate-specific financial flows were reported at face value, no coefficients were applied in this process.

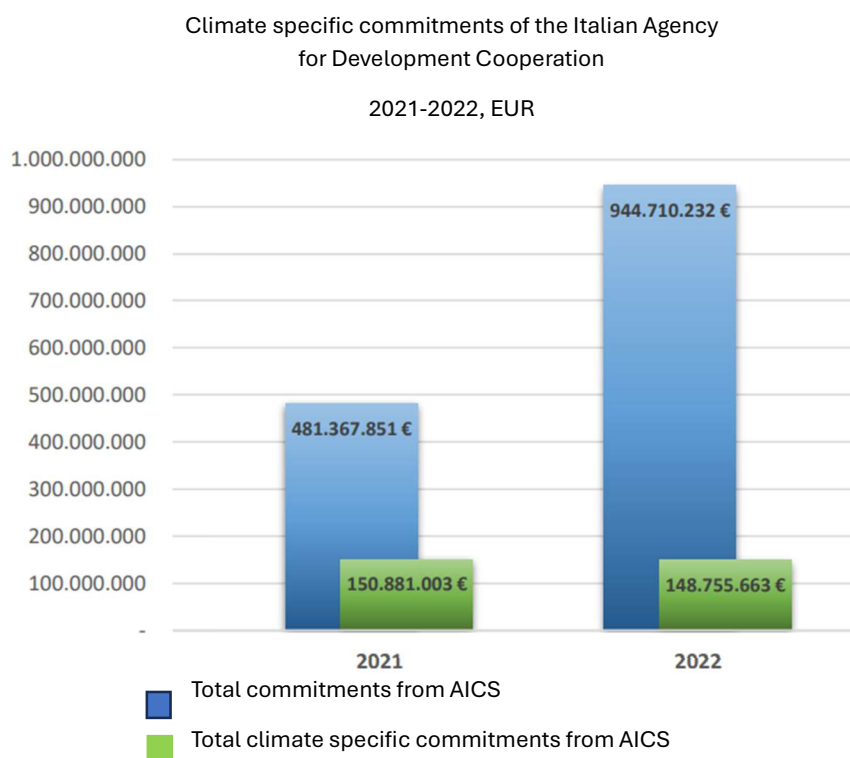


Figure 5.8 – Climate specific commitments from AICS over the total commitments of AICS for development cooperation activities

Source: Italian Agency for Development Cooperation

¹¹² Art. 17 Law 125/2014

In the biennium, the majority of climate specific activities were addressing both adaptation and mitigation objectives, thus committed as cross-cutting. In percentage terms, the distribution of projects between the different types of support is stable over the period, with a share between 52% and 62% for cross-cutting activities, followed by adaptation between 27% and 35% and mitigation around 11-13% (figure 5.9).

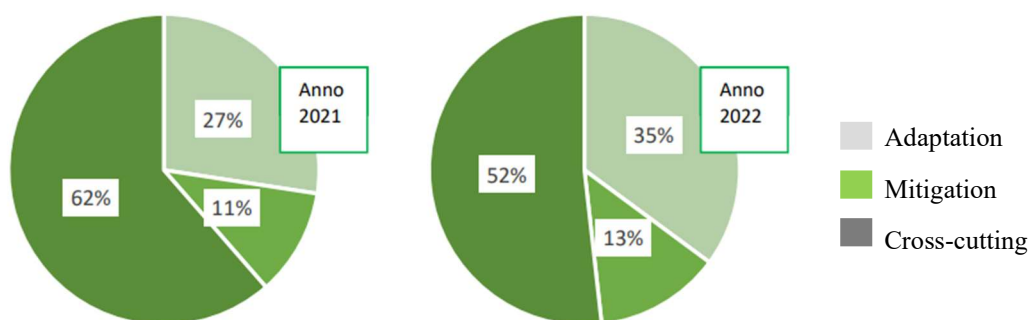


Figure 5.9 – Distribution of commitments of the AICS across type of support

Source: Italian Agency for Development Cooperation

As regards the geographical distribution of bilateral climate specific cooperation, data confirms the priority that Italian cooperation attributes to Africa. (Figure 5.10).

In the period analysed, Sub-Saharan Africa was the main beneficiary region of the climate funding managed by AICS, receiving respectively 45% and 54% of the total funding in 2021 and 2022. In Africa as a whole, the percentages rise respectively to 52% and 66% in the years.

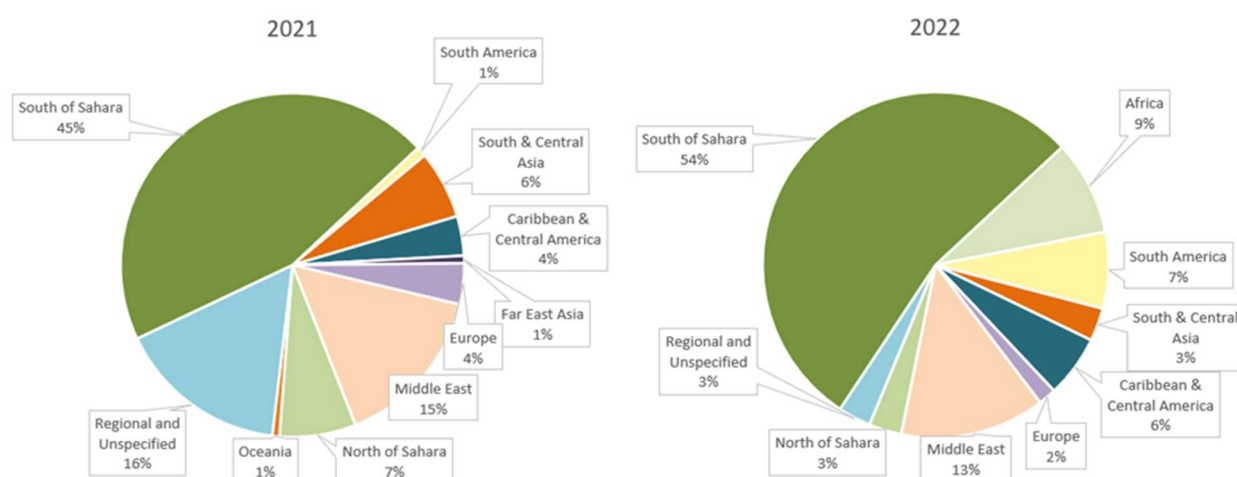


Figure 5.10 - Geographical distribution of bilateral climate specific cooperation of AICS, 2021 and 2022

Source: Italian Agency for Development Cooperation

The percentage distribution of climate commitments from AICS to countries classified by income group (Figure 5.11), shows that LDCs are the main beneficiaries of AICS' bilateral cooperation, followed by Upper Middle-Income Countries (UMIC). The same distribution occurs whether only the Rio marker for adaptation, or only the Rio marker for mitigation, is considered, or in the case of cross-cutting activity.

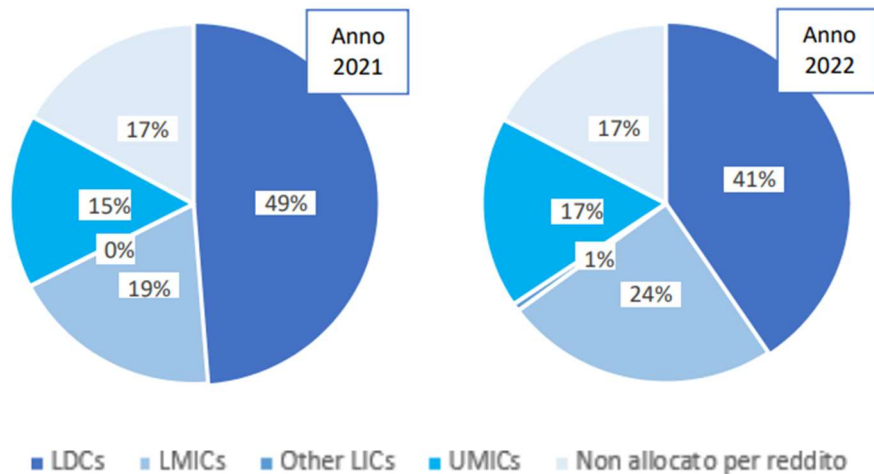


Figure 5.11 – Climate specific commitments from AICS by recipients' income group, 2021-2022
Source: Italian Agency for Development Cooperation

In particular, in relation to the Rio marker for adaptation, the LDCs show a relevant concentration of climate-related commitment, with values ranging from 23% in 2022 to 57% in 2021.

5.3.2. Multilateral contributions

The information on support provided by Italy through multilateral organizations is reported in tabular format through the ETF Tool, for the two reporting years 2021 and 2022 without overlapping with the previous reporting periods. This section provides a simple analysis of the aggregates as reported in tabular format, as well as detailed information on support provided through multilateral organizations from the MASE, with specific information on the resources channeled through multilateral development banks, international financial institutions and other development finance institutions, as well as UN Agencies.

5.3.2.1 Overview of aggregates

Italy reports in tabular format relevant information for the previous two reporting years on multilateral financial support provided.

Total support disbursed to multilateral organizations, allocated to countries, regions or to all developing countries, reached 740.561.037 USD in the biennium 2021-2022. Respectively, Italy committed 480.306.231 USD in 2021 and 260.254.807 USD in 2022. The apparent decrease in resources channeled through multilaterals by Italy is due to the nature of disbursement. Indeed, in 2021 more resources, also committed in different years, have been disbursed that generates a large variability and year-to-year fluctuations due to non-linear payment schedules. In 2022 Italy committed and disbursed a 10 million EUR contribution to the Adaptation Fund.

Italy contributes annually to a range of Multilateral Development Banks (MDBs). Although there is no direct control over the activities of these institutions, Italy implements its climate policies through the coordinated efforts of its representatives on the Boards of Directors, the Ministry of Economy and Finance (MEF), the Ministry of Foreign Affairs and International Cooperation (MAECI), and the Ministry of the Environment and Energy Security (MASE). By providing strategic, political, and technical support, Italy ensures that these institutions align with its climate finance objectives.

Through the MEF, Italy contributes via capital increases. Resources for MDBs' capital increases are ordinarily allocated on a multi-year basis. The main institutions Italy usually provides inflows to for capital increases are: (i) the International Bank for Reconstruction and Development (IBRD) and the International Finance Corporation (IFC), both part of the World Bank Group; the African Development Bank (AfDB); the Asian Development Bank (AsDB); the Interamerican Development Bank (IDB) and the Inter-American Investment Corporation (IIC); the Asian Infrastructure Investment Bank (AIIB), the Caribbean Development Bank (CDB). Resources for MDBs' Capital Increases are ordinarily allocated on a multi-year basis. In 2021-22, Italy contributed to capital increases of IBRD, IFC, AfDB and IIC. In addition, the MEF contributes to the concessional arms of the aforementioned banks, with contributions paid periodically during replenishment cycles and variable payment installments over time. These concessional arms include the International Development Association (IDA), the concessional arm of the World Bank Group; the African Development Fund (AfDF); the Asian Development Fund (AsDF); and the Special Development Fund (SDF) within the Caribbean Development Bank (CDB) group. Resources were allocated to these institutions in 2021-22.

In 2021-22, MEF also contributed to the replenishments of thematic vertical funds focused primarily on climate and the environment, such as the Global Environment Facility (GEF) and the International Fund for Agriculture Development (IFAD). Moreover, in December 2021 MEF contributed significantly to the Climate Investment Fund (CIF), to capitalize the Nature People and Climate Investment Program (NPC Program) whose objectives reflect the three key priorities of the Italian Presidency of the G20 in 2021 - People Planet and Prosperity -. The Program is critical to increase support for investments in Nature-based Solutions (NBS) for the sustainable use of land and other ecosystems, both in the public and private sector interventions.

Italy also contributes regularly to the Green Climate Fund (GCF), as well as to key UN Agencies focused on agriculture and sustainable food systems, including the Food and Agriculture Organization (FAO) and the World Food Programme (WFP). Italy also provides both mandatory and voluntary funding to the UNFCCC and related bodies and programmes.

Soft loans are managed through an off-budget, self-financing, Revolving Fund.

Table 5.4 – List of multilateral entities funded by Italy in 2021-2022

Multilateral institutions
Adaptation Fund
African Development Bank (AfDB)
African Development Fund (AfDF)
Asian Development Fund (AsDF)
Council of Europe Development Bank (CEB)
CIHEAM - International Centre for Advanced Mediterranean Agronomic Studies
Climate Investment Funds (CIF)
Development Bank of Latin America
FAO - Food and Agricultural Organisation
Global Environment Facility (GEF)
Green Climate Fund (GCF)
Interamerican Development Bank (IDB), Inter-American Investment Corporation (IIC)
IFAD
IFAD - International Fund for Agricultural Development
IPCC - Intergovernmental Panel on Climate Change
Multilateral Fund for the Implementation of the Montreal Protocol
UNFCCC Standing Committee on Finance (SCF)
UNCCD - Convention to Combat Desertification
UNDP - United Nations Development Programme
UNFCCC - United Nations Framework Convention on Climate Change
UNIDO - United Nations Industrial Development Organisation
World Bank International Finance Corporation (IFC)
World Bank International Development Association (IDA)
World Bank International Bank for Reconstruction and Development (IBRD)
World Food Programme (WFP)

Source: Ministry of Environment and Energy Security

Multilateral climate specific support by Italy is allocated for mitigation, adaptation and cross-cutting activities, respectively for the 31%, 38% and 31% for 2021-2022 biennium (figure 5.12). As previously mentioned, Italy for the first time reports using imputed multilateral shares by type of support, increasing the ability to allocate inflows to multilateral institutions outside the “cross-cutting” category only, improving accuracy of information.

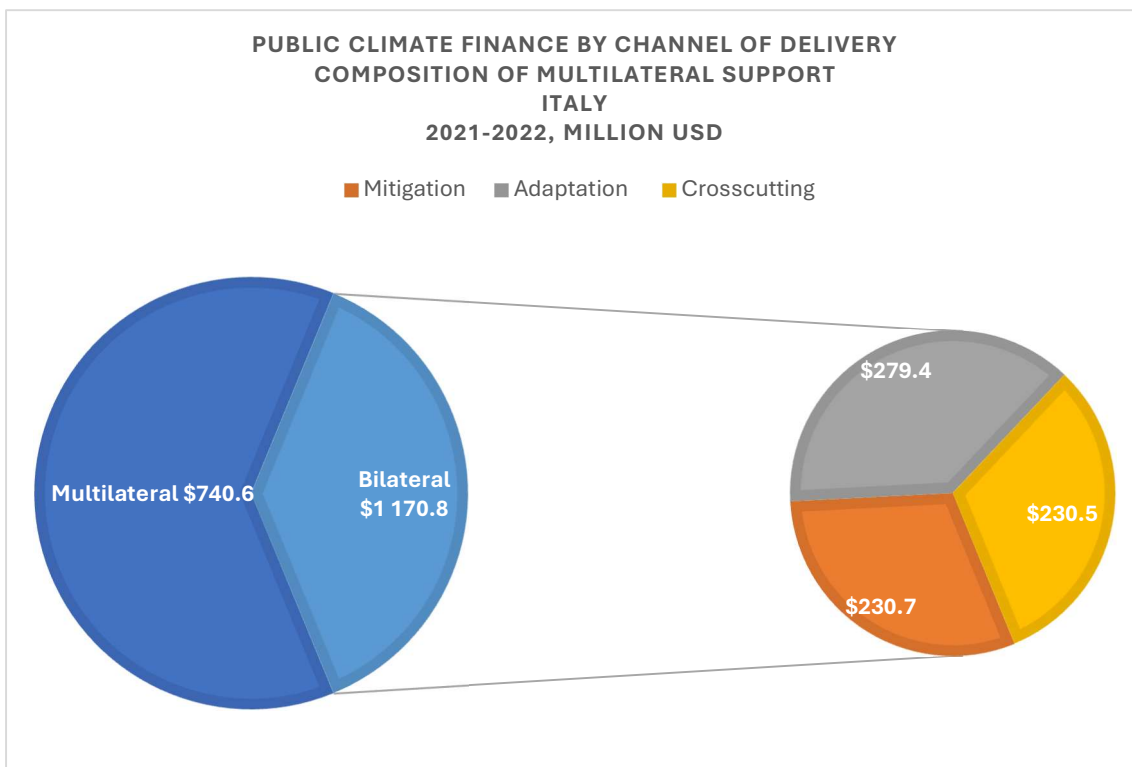


Figure 5.12 – Italian multilateral climate finance by type of support
Source: Ministry of Environment and Energy Security

Italy provides to multilateral institutions resources as grant resources for the 96% of the amount – only the 4% of the total multilateral support is in form of concessional loans, delivered to the Development Bank of Latin America for 15.4 million USD. Further, almost the totality of the multilateral inflows, given the nature of contributions and how the multilateral pooling of funds work, are not allocable by sector.

5.3.2.2 Multilateral cooperation from the Italian Ministry of Environment and Energy Security (MASE)

Climate specific multilateral cooperation with developing countries in the biennium 2021-2022 from MASE amounted to 80,256,735.92 USD (89,256,735.92 USD disbursed) allocated between multilateral cooperation funds with IFIs and multilateral programmes.

Cooperation with International Financial Institutions - IFIs

During the reporting period, MASE strengthened its multilateral cooperation through contributions to funds managed by the main International Financing Institutions (IFIs) in order to accelerate transformative climate action in developing countries through a country-owned partnership approach and the use of climate investment expertise. In fact, 72% of the multilateral funds disbursed by MASE in the years 2021-22 were channeled through IFIs while 28% was devoted to other multilateral programmes.

In particular, during the period 2021-2022, MASE continued supporting the World Bank Group (WB) through the Program “Promoting Africa’s Green and Climate Resilient Development

(AGREED)”, to help African countries to prepare and seek financing for programs and projects contributing to the implementation of the National Determined Contributions (NDCs). The governments of the beneficiary countries are supported in the identification of possible funding and in the preparation of projects and programs through technical assistance and capacity building activities.

At the same time, MASE expanded its geographical areas of collaboration beyond Africa to the whole world and added for the African continent a component on the promotion of renewable energy. Through the energy component, MASE promoted the spread of renewable energy, energy efficiency and the participation of the private sector. Priority has been given to technical assistance in support of investments and activities related to renewable energy on and off grid, energy efficiency, storage systems and integration of non-programmable renewable energy (VRE).

MASE also contributed to the Energy Sector Management Assistance Programme (ESMAP), a global partnership between the World Bank, development partners and philanthropic foundations to help low/middle income countries accelerate the energy transition needed to achieve Sustainable Development Goal 7 (SDG7) which aims to ensure access to affordable, reliable, sustainable, and modern energy for all. The main activities concerned: energy data analytics. clean cooking, electricity access, renewable energy.

Further, the UN Secretary-General’s Office and MASE established in 2021 a Multi Partner Trust Fund (MPTF), through a joint programme "Financing a Green Inclusive and Sustainable Recovery" to promote the 2030 Agenda for Sustainable Development and the Paris Agreement. The United Nations Environment Agency is a key partner of the United Nations.

Year 2021 marked the second of the African Development Bank – AfDB transformations of the Sustainable Energy Fund for Africa (SEFA) into a larger multi-instrument facility (aka SEFA 2.0) in the context of persistent challenges created by the COVID-19 pandemic. SEFA continued its work to consolidate operations, built a robust multi-year pipeline, strengthened the team, developed a new branding identity and increased outreach through various platforms. On the lending front, SEFA promoted innovative projects and programmes in renewable energy and energy access, approving USD 29 million in funding to seven projects across the concessional investments and technical assistance¹¹³ approval of eight projects for a combined funding amount of USD 46.5 million, enabling investments expected to generate 241 MW in new capacity, approximately 5,000 new electricity connections, 5,952,418 tCO₂ of GHG emissions reductions and creating around 745 new jobs.

One of the key highlights of the 2021 was the launch of the third call for proposals (CFP3) on Gender Equality and Climate Resilience (GECR), which led to the shortlisting of 10 project proposals that were seeking to address unequal access of women and men to the resources needed to adapt to climate change and mitigate greenhouse gas emissions. Additionally, these

¹¹³ <https://www.afdb.org/en/topics-and-sectors/initiatives-partnerships/sustainable-energy-fund-for-africa>

projects were expected to address how gender roles adequately and proportionally influenced the ability of women and men communities to participate in climate strategies/actions.

The project on “Promoting climate- smart agriculture in Rwanda for improved rural livelihoods and agro-biodiversity conservation” was approved by the Technical Committee (TC) in June 2021.

In 2022, the Fund’s governing committees approved 12 new projects for a total amount of USD 8,25 million. Furthermore, in 2022, the Bank and the donors amended the scope of the Fund, and extended the duration to 2027, to ensure it remained responsive to the increasing needs of the continent and aligned with the Glasgow Climate Pact.

In the Latin America area, MASE has been collaborating since 2017, with the Inter-American Development Bank (IDB) through a US\$5.6 million grant contribution to the Sustainable Energy Facility for the Eastern Caribbean Expanded (SEF-Expanded). The programme, managed by the Caribbean Development Bank (CDB) and co-financed by the Green Climate Fund (GCF), aimed to overcome financial, technical, and institutional barriers to the development of geothermal energy in the five Eastern Caribbean countries with the highest potential: Dominica, Grenada, Saint Kitts and Nevis, Saint Lucia, and Saint Vincent and the Grenadines. Specifically, the Italian contribution focused on the execution of pre-feasibility studies and small exploratory drills, and the provision of technical assistance for the regulatory framework, institutional strengthening, and local capacity development.

The SEF-Expanded was part of a broader programme, the Sustainable Energy Facility for the Eastern Caribbean Programme (SEF-Programme), that aimed at reducing the dependence on fossil fuels in the energy matrices in the five countries mentioned above, plus Antigua & Barbuda, in the following areas of intervention: Energy Efficiency Investment Developments (EE); Geothermal Energy Investment Development (GE); Other Renewable energy investment (RE) in Antigua & Barbuda (solar pv); Technical Assistance for governments (TA), local stakeholders and the executor. It was approved in two tranches: the first, referred to as SEF-2015, brought together funds from the IDB, CDB, GEF and CTF; the second tranche, SEF-Expanded, brought together funds from the GCF and MASE. Additional funds were made available from the European Union, DFID, and the Abu Dhabi Fund for Development (parallel financing). The total SEF-Programme budget was US\$ 217.47 million, including loans (56%), contingent recovery grants (16%), and grants (28%). By the end of 2022, expenditures were a total of US\$67.10 million (23%).

With specific reference to the Italian contribution, as of December 2022, the activities work plan included the execution of drilling tests in Grenada (CP1 - US\$3,7 million) and technical assistance, advisory and capacity building services – like ESIA, market assessments, regulatory reviews – at the regional level (CP 2 - US\$1.9 million). Disbursed funds were US\$0.676 million (12% of ITA contribution), all on CP2.

Cooperation with Multilateral Programmes

MASE, the International Energy Agency (IEA) and UNEP are cooperating since 2020 on the Digital Demand-Driven Electricity Networks Initiative (3DEN) with a focus on leveraging digital technologies to modernize electricity systems and support decarbonization in the developing countries and emerging economies. The initiative aimed to mitigate risks associated with growing electrification, such as energy insecurity, increased transmission and distribution losses, and missed cost-saving opportunities.

Throughout the initiative's duration, 3DEN supported the development of policy reforms, regulatory frameworks, business models, and large-scale technology investments necessary for modernizing power systems. It produced several groundbreaking 3DEN reports and contributed to 60+ publications to highlight actionable tools and guidance, with a particular focus of emerging markets and developing economies, to inform decision-making on power infrastructure investments and digitalization efforts informing high-level discussions at COP, G7, G20 and CEM.

The initiative also engaged diverse stakeholders through 100+ webinars, workshops, conferences and meetings showcasing best practices and pilot projects to demonstrate how digital solutions could optimize energy systems and improve resilience and efficiency.

In parallel, to test the different approaches on how digitalization can contribute on-the-ground to support flexible and resilient energy systems, UNEP successfully implemented the following pilot projects to demonstrate how digital solutions and innovative business approaches can optimize energy systems in different contexts:

- **India:** The Panitek pilot focused on creating a cloud-based digital twin for the electric grid in New Delhi. This project enabled real-time data monitoring for over 5,000 consumers. It developed tools like smart plugs, automated demand response systems, and battery energy storage systems while mapping the network infrastructure in New Delhi, enabling monitoring and optimisation of the power system infrastructure.
- **Colombia:** The Enelflex pilot aimed to solve grid constraints in Bogotá through demand response mechanisms. It successfully integrated remote terminal units into the grid system and engaged high-usage customer participation. The project is on track to enable a stable energy supply for over 322,000 customers and recommended regulatory updates to scale up such measures.
- **Brazil:** The D2FX pilot in Fortaleza focused on optimising residential energy use through digital tools. It installed smart meters and solar systems in its social housing complex, engaging households in energy-saving practices via a gamified app. The pilot shows the potential to enhance grid capacity and consumer engagement in energy efficiency.
- **Morocco:** The Les Eaux, Minérales d'Oulmès pilot enhanced industrial energy efficiency at two major bottling sites, accounting for 96% of their energy consumption. The project enabled energy consumption reduction by 20% between 2022 and 2024 - saving over 10,000 MWh and is on track to reduce LEMO's CO₂ emissions by 50% by 2030.

As indicated in the G7 Climate, Energy and Environment Communique adopted on 29th-30th April 2024 in Turin, the G7 Ministers of Climate and Energy welcomed the role of Digital Demand-Driven Electricity Networks (3DEN) Initiative in synergizing international collaboration on smart and digital technologies, in particular with emerging market and developing economies. To this end, as also indicated at the IEA 9th Annual Global Conference on Energy Efficiency, a significant demand for phase II of the 3DEN Initiative has been underlined.

To meet the increasing demand and further our progress in advancing digital, resilient, and smart clean energy systems, phase II of the 3DEN initiative will be launched in 2025. This will build upon the lessons learned from phase I and replicate project activities across several African countries, in line with the G7 Italian Presidency's direction.

Since the establishment of 3den 19 million euro have been disbursed. For the reporting period (2021-2022) 6.500 million euro have been disbursed to UNEP.

5.3.3. Information on finance mobilized through public interventions

For the 2021-2022 biennium, Italy does not report as climate finance any private finance mobilized through public interventions. Further capacity is being created to cope with this reporting requirement. In 2019, a pilot study on private finance mobilized by public financial interventions of Italy was produced and related figures reported in the 4th and 5th Biennial Report of Italy. This study proves that there is private finance being mobilized by Italian public interventions, while it is not yet possible to track it.

Italy is committed to improve the monitoring and reporting of private climate finance mobilized through public interventions, particularly via the formal reporting system CRS++ of the OECD. The institutional arrangements and capacity building required for the consistent collection of such data are being currently created; therefore, we expect to enhance our ability to monitor and report private finance mobilization along with the increased intervention of the ICF.

5.4 Information on support for technology development and transfer provided under Article 10 of the Paris Agreement

Italy reports on support provided to technology development and transfer in tabular format, identifying 83 relevant projects for the biennium 2021-2022, 74 of which related to the provision and installation of solar or photovoltaic systems. These examples of relevant projects focused on technological development and transfer are implemented in 32 countries, mainly in Africa (19 countries and 2 regions).

Enhancing climate technology development and transfer to developing countries for adaptation and mitigation actions and increase energy efficiency is crucial for addressing the global challenges of energy security, climate change and economic development with the aim to improve resilience to climate change and to reduce GHG emissions. In recent years, as indicated in the above specific paragraph on bilateral cooperation undertaken by MASE, Italy

has significantly intensified the number of Memoranda of Understanding with developing countries to implement projects related to mitigation and adaptation measures, which foresee the transfer of technologies according to the needs and specific circumstances of the receiving countries. All the projects under the ongoing and renovated MoUs (implemented, under implementation or planned), considered knowledge transfer and adequate and specific training courses for the installation and maintenance of the equipment (soft technologies) jointly with the essential transfer of technologies (hard technologies).

During the implementation phases, people from the beneficiary country are involved in the installation and start-up operation of the plants. Following this phase, tailored training programmes were organized to ensure proper control, function and routine maintenance.

Indeed, JC¹¹⁴ supervises the implementation of projects, assessing the technology transfer, the realization of training courses and the implementation of all activities to facilitate the development of policies, regulations, and the overall institutional activities required to enhance development and technology transfer.

For the implementation of some projects, technologies have to be adapted to the endogenous characteristics of the beneficiary country. In particular, and by way of example, in a project implemented in Burkina Faso on the development of food processing activities and promotion of local food, a processing center for the production of quality peanut butter has been set up a small building equipped with manual and modified solar-powered machinery necessary for the processing of local raw materials. In another project implemented in Senegal has been developed a mobile module for the production of dehydrated and vacuum-packed mangoes. The project is aimed at transforming the mango directly on the harvest site in the rural areas of Ziguinchor, Kaolack, Bandia in Senegal. Farmers of these communities will be able to access the services of a mobile processing unit installed in a 20 feet container and powered thanks to a "zero" impact photovoltaic energy system. The use of the mobile structure on the territory will allow to follow the seasonality of the mango which, starting from mid-April, matures in the southernmost area of the Country and over the months in the northernmost areas. In addition, training courses were provided to accompany young people and women to learn the principles of the circular economy and Fair Trade and to promote the marketing of products in the organic circuit.

With regards to private sector involvement, as a general approach, when drafting the bilateral cooperation agreements, MASE investigates the potential contribution of the private sector, mainly technologies core and expertise, and tailors their rules in the technical and practical implementation of the projects. Two different ways for involving the private sector were proposed:

¹¹⁴ For further details on the mechanism for environmental cooperation by MASE see section 5.1 under Institutional arrangements of the environmental cooperation by MASE and section 5.2 letter (p).

- consisted in publishing on the Ministry's website calls for interest in a specific sector and for a country or a region before organizing the technical missions and defining the needs with the beneficiary country;
- concerned the identification of companies holding specific technologies to implement projects already established with the beneficiary countries.

Finally, MASE promoted and organized seminars, workshops and events related to bilateral cooperation and technology transfer, involving companies from the pertinent sectors and organizing business-to-business meetings.

The table below lists MASE' projects implemented (ongoing/concluded) during the reporting period of 2021-2022 in different regions focused in the area of technology transfer.

Table 5.5 – Technology transfer: implemented projects

Region	n	State	Project's title	MASE contribution	Status
Sub-Saharan region	1	Eswatini	Strengthen Swaziland early warning system and climate services (*)	970 880 EUR	Ongoing
	2	Eswatini	Fossil fuel free and green building of the Raleigh Fitkin Memorial Hospital	2 204 372 EUR	Ongoing
MENA region	3	Jordan	Installation of Solar PV Systems for Municipalities in the Hashemite Kingdom of Jordan	3 622 100 EUR	Ongoing
	4	Kurdistan regional government of Iraq	Enhancement of Kurdistan Automatic Weather Observation Network	3 541 000 EUR	Ongoing
	5	Lebanon	Maximizing energy savings from energy efficient home appliances (*)	1 619 375 EUR	Ongoing
Pacific SIDS	6	Vanuatu	Irrigation for a Resilient and Sustainable Agriculture	244 336 USD	Ongoing
CARICOM	7	Dominica	Installation of a 75 KW grid-tied with battery backup Solar PV System at the DOWASCO Sewer Treatment Plant	491 050 USD	Near to be concluded

Note: (*) The initiatives involve both capacity building and technology transfer

Source: MASE

A brief description of each project is provided

- 1) “Strengthen Swaziland early warning system and climate services” - The project aimed at enhancing the national weather forecast and alerting system through installation of new meteorological and hydrometric stations; equipment of the Department of Meteorology with advanced forecasting systems; adoption of a Common Alerting Protocol at the national level.
- 2) “Fossil fuel free and green building of the Raleigh Fitkin Memorial Hospital”. The project’s objective was the energy requalification of the Raleigh Fitkin Memorial Hospital, ensuring its energy self-sufficiency and the reduction of climate-altering emissions.
- 3) Installation of Solar PV Systems for Municipalities in the Hashemite Kingdom of Jordan. The objective of the project was to install up to 100 solar systems in public facilities, averaging 30 kilowatts peak (kWp) each, in Jordan’s Municipalities. The goal was to reduce electricity costs, while at the same time protecting the environment by reducing carbon emissions and fulfil Jordan’s NDCs obligations according to UN/ Paris agreement.

- 4) Enhancement of Kurdistan Automatic Weather Observation Network. The project aimed to improve the existing meteorological network in Kurdistan by installing up to 52 automatic weather stations and 3 non-contact discharge measurement stations. It also included the exchange of expertise and capacity building activities (training courses).
- 5) Maximizing energy savings from energy efficient home appliances. The project emerged in response to the latest NEEAP (National Energy Efficiency Action Plan 2016-2020) that set a target of 1.5 TWh of savings to be achieved by 2020. This included 149 GWh of savings in buildings, of which 55.6 GWh from energy efficient equipment. In order to achieve these savings, the LCEC defined various energy efficiency initiatives to be implemented for the period 2016- 2020. Among them, there is the use of energy efficient equipment. The project consisted of the distribution of rebates to end-users directly or through local retailer shops to incentivize the purchase of highly energy-efficient equipment. The new financing mechanism targeted directly end-users and increased the environmental awareness of the wider public.
- 6) Irrigation for a Resilient and Sustainable Agriculture. The project involves the installation of water-saving and solar-powered irrigation systems on 6 farms located in the North Sea. Islands of Efate, Santo and Tanna in the Republic of Vanuatu. Farms were chosen based on availability of water in the subsoil form. Vanuatu Ministry of Agriculture. Each irrigation system will consist of a well with PVC coating, pipes, and pump. Immersion, drip irrigation systems, photovoltaic panels resistant to a wind of 120 km/h and inverters. A 10-metre area will be irrigated. hectares. The project will be a demonstration (the results will be disseminated through dedicated web pages on the website of the Ministry. of Agriculture of Vanuatu) and will allow to sell on the market local products that are now imported from abroad, lowering. Consequently costs. The non-use or reduced use of diesel generators will save 30% of the environmental input (tons of CO₂ each year). The reduced import of products from abroad (mainly from Australia and New Zealand) will allow. Save an additional 250 tonnes of CO₂ per year.
- 7) The project seeks to reduce and or eliminate the disruption to the functioning of the Dominica's Dowasco system operations from the impacts of tropical storms such as Erika in 2015 and other more recent extreme weather events. Given the IPCC projections that the Caribbean region and Dominica will and continues to experience the effects of extreme weather events on a more frequent basis, the project builds the resilience of its potable water distribution network and sewerage systems to ensure more reliable and efficient operations. This project is intended to alleviate this situation by penetrating with a "green" renewable infrastructure, by installing a PV system that will provide about 52% of the power needed on a day-to-day operation and provide backup power in the event of a disruption in the grid supply as experienced with almost every extreme weather event. The intention is to completely eliminate the use of fossil fuel power for the facility and to have it completely powered by renewable energy sources. The aims of the project are to:
 - reduce the energy cost associated with water production and sewerage treatment facilities;
 - decrease Dowasco's carbon footprint;

- be used as a model and possibly replicable pilot project in adjacent territories of the island;
- build the resilience of the water production and sewerage treatment systems to the impacts of climate change and climate variability.

5.5 Information on capacity-building support provided under Article 11 of the Paris Agreement

Capacity building is a horizontal component of climate specific support from Italy, and it is an inextricable component of almost all the bilateral projects on the ground. Italy significantly contributes, with financial and in-kind resources, to increasing capacities in developing countries related to all technology development and transfer activities, as well as to increase reporting capacity through ICAT initiative. Several bilateral projects are focused on capacity building, and most bilateral cooperation projects include a mandatory capacity building component.

(a) Strategies employed to provide capacity-building support, including case studies.

Italy adopts an integrated and multi-level approach to capacity-building, leveraging collaboration among local actors, public institutions, and international partners. The largest financial contributions are allocated to high-impact, scalable interventions. One notable example is the SMART CLIMATE project in Malawi, with a budget of €2.56 million. This project promotes climate resilience through the introduction of Climate Smart Agriculture (CSA) techniques, strengthening the skills of local farmers and introducing technologies for efficient water and soil management. Another flagship project is e-GEOS, with a €2.17 million contribution, which focuses on transferring advanced Earth observation technologies and geoinformation systems to partner countries. By using satellite imagery and geospatial data, local institutions are equipped to enhance climate risk monitoring and implement data-driven adaptation measures. Additionally, the SDG 2 Food Security Initiative (€2.15 million) strengthens agricultural value chains and enhances local production capacity, supporting food security and promoting policy development for the inclusion of smallholder farmers.

Smaller-scale projects also employ targeted and effective strategies. The SUMUD project in Palestine (€1.41 million) aims to promote economic autonomy for micro and small enterprises (MSMEs) through the development of cooperative business models. Similarly, the WASTE or RESOURCE project (€1.44 million) transforms waste into economic resources, supporting the circular economy and creating social enterprises. These smaller initiatives demonstrate Italy's commitment to comprehensive capacity-building, even at the microeconomic level.

(b) Italy's capacity-building support is designed to be responsive to the emerging needs and priorities of developing countries. It focuses on key areas such as mitigation, adaptation, and technology transfer. The SMART CLIMATE project in Malawi addresses the urgent need

to strengthen food security and reduce climate vulnerability. By introducing CSA techniques, the project improves local farmers' adaptive capacity, bridging knowledge gaps and ensuring access to modern water management technologies. Similarly, the e-GEOS initiative responds to the need for enhanced climate risk monitoring. This project equips local governments with tools for remote sensing and geospatial analysis, thereby improving early warning systems and disaster risk management. Another major initiative is the Project to Support Public Policy Development (€1.95 million), which addresses the need for better governance and policy frameworks in developing countries. This project provides capacity-building support to government officials, equipping them with evidence-based tools for planning and policy development. Smaller initiatives are equally responsive to local needs. For example, the SUMUD project in Palestine supports economic inclusion by addressing the need for greater access to finance and market opportunities for vulnerable populations. Similarly, the Lebanon Capacity-Building Project (€1.6 million) addresses the country's need for sustainable water management and urban planning, equipping local authorities with technical skills to enhance territorial governance.

- (c) Italy's capacity-building support is grounded in policy frameworks that align with the Sustainable Development Goals (SDGs) and promote sustainability, inclusion, and local ownership. The Public Policy Support Project (€1.95 million) exemplifies this approach, fostering evidence-based policymaking and facilitating the creation of public-private partnerships (PPPs) in developing countries. By supporting institutional capacity-building, Italy strengthens the ability of local authorities to design and implement sustainable development policies. Another key policy initiative is the WASTE or RESOURCE project (€1.44 million), which strengthens local waste management policies by promoting circular economy principles.

This approach enables local authorities to shift from waste disposal models to resource recovery systems. The SDG 2 Food Security Initiative supports the development of food security policies aimed at enhancing agricultural value chains and promoting the inclusion of smallholder farmers. Through capacity-building support, local authorities are better positioned to address food security challenges and create policy environments that support sustainable agriculture. Smaller projects also contribute to policy development. The SUMUD project in Palestine supports policy dialogue on social and economic inclusion, while the Lebanon Capacity-Building Project focuses on water resource management policies and sustainable urban planning. These interventions illustrate Italy's commitment to supporting the development of policies that foster sustainability, equity, and resilience.

- (d) Involvement of stakeholders.

Multi-stakeholder engagement is a central feature of Italy's capacity-building model. The SMART CLIMATE project in Malawi exemplifies this approach, engaging local farmers' associations, local government authorities, and international technical partners to ensure the sustainability of the project's outcomes. This participatory approach allows for co-design, local ownership, and the replicability of best practices.

Similarly, the e-GEOS initiative fosters stakeholder involvement by engaging local governments, civil protection agencies, and academic institutions. These partnerships strengthen the capacity of public sector actors to manage geospatial data and leverage Earth observation technologies. The SUMUD project in Palestine creates a platform for collaboration among local microenterprises, cooperatives, and civil society organizations, promoting inclusive economic development and fostering social cohesion.

Stakeholder engagement is also evident in the Lebanon Capacity-Building Project, where local municipalities, academic institutions, and government agencies are brought together to co-design sustainable urban planning and water resource management solutions. The WASTE or RESOURCE project facilitates partnerships with local waste management authorities, social enterprises, and community organizations to create a sustainable circular economy model. Across all initiatives, Italy's approach ensures that stakeholders play a meaningful role in the design, implementation, and monitoring of capacity-building interventions.

- (e) How support for capacity-building actions in developing country Parties that was provided promotes the sharing of lessons learned and best practices

Italy emphasizes knowledge sharing and the dissemination of best practices as a key element of its capacity-building support. Through the SMART CLIMATE project, local farmers in Malawi gain access to CSA techniques, which are documented and shared with other communities to facilitate replication. This knowledge exchange strengthens community-based climate resilience, creating a lasting impact beyond the project's initial scope.

The e-GEOS initiative promotes the transfer of knowledge and technical know-how on geospatial technologies. Local government authorities are trained to use remote sensing data and geospatial analysis tools, while technical workshops and capacity-building sessions provide ongoing opportunities for peer-to-peer learning. The transfer of skills enables local authorities to take ownership of climate risk monitoring systems, ensuring long-term sustainability.

The WASTE or RESOURCE project encourages the exchange of best practices on circular economy models. Local waste management authorities and social enterprises are trained to adopt innovative resource recovery approaches. By sharing experiences and success stories, the project promotes knowledge dissemination and the scalability of successful models. In Palestine, the SUMUD project creates a learning environment for microenterprises and cooperatives to exchange experiences in business development and financial management. This sharing of lessons learned is supported through capacity-building workshops and the development of community-based business models.

The Public Policy Support Project also plays a role in promoting the sharing of best practices in policymaking. It provides government officials with access to peer networks and regional platforms where lessons from Italy's experience in sustainable development and evidence-based policymaking are shared. The Lebanon Capacity-Building Project further facilitates the exchange of knowledge and best practices in water management and

sustainable urban planning. Local authorities, universities, and research institutions work together to design integrated solutions that can be replicated in other regions.

- (f) Since its previous report, Italy has implemented a wide range of capacity-building activities, both large-scale and smaller targeted interventions. Quantitatively, the largest financial contributions have been allocated to flagship projects such as SMART CLIMATE in Malawi (€2.56 million), e-GEOS (€2.17 million), and the SDG 2 Food Security Initiative (€2.15 million). These projects collectively support climate adaptation, food security, and technology transfer.

In qualitative terms, Italy's capacity-building efforts have been characterized by multi-stakeholder engagement, participatory approaches, and sustainability-focused outcomes. For example, the SUMUD project in Palestine (€1.41 million) promotes economic inclusion through micro and small enterprises, while the WASTE or RESOURCE project (€1.44 million) advances circular economy principles. Smaller initiatives, like the Lebanon Capacity-Building Project (€1.6 million), focus on sustainable water management and urban planning. Italy's capacity-building support addresses the urgent priorities of developing country Parties, aligns with the SDGs, and promotes the sustainability of development outcomes.

In summary, Italy's capacity-building approach is distinguished by its commitment to multi-stakeholder collaboration, alignment with national priorities, and the promotion of knowledge sharing. By focusing on large-scale interventions while supporting smaller, context-specific projects, Italy ensures a comprehensive and adaptable approach that addresses the diverse capacity-building needs of developing countries.

Specific projects dedicated to all developing countries are being undertaken by the MASE: the Initiative for Climate Action Transparency (ICAT) and Youth4Capacity Programme. The Capacity Award Program to Advance Capabilities and Institutional Training in one Year (CAPACITY) is dedicated to SIDS and LDCs.

Box 2

Initiative for Climate Action Transparency (ICAT)

The Initiative for Climate Action Transparency (ICAT) was launched in November 2015 to support improved transparency and capacity building under the Paris Agreement. ICAT assists developing countries in enhancing their capacity to measure, report, and verify (MRV) greenhouse gas emissions reductions and adaptation actions, thereby fostering effective climate policies and actions. Supported by several donor countries and organizations, in November 2015, it received a financial contribution of 5 million euros by the now Ministry of Environment and Energy Security to the associated UNOPS Trust Fund. A further 5 million euros have been agreed upon for the period 2021-2026 through the amendment of the project agreement in 2021.

ICAT aims to strengthen the transparency and effectiveness of climate policies by providing policymakers with tools and support to assess the impacts of their climate actions. This initiative enhances evidence-based policymaking, enabling countries to implement and monitor their Nationally Determined Contributions (NDCs) under the Paris Agreement.

ICAT operates as a multi-stakeholder partnership, integrating methodological guidance, capacity-building, and knowledge-sharing. The initiative collaborates with technical experts and partner countries to develop and apply globally applicable methodologies and tools, ensuring that activities are country-led and tailored to national priorities.

Since its inception, ICAT has implemented the following key activities:

- **Development of Methodologies and Tools:** ICAT has produced a series of guidance documents to support transparency and climate action, providing a "toolbox" of methods for assessing emissions reductions and the sustainable development impacts of policies.
- **Country Support:** ICAT works directly with over 50 developing countries, building and sustaining national expertise to advance transparency policies and frameworks for MRV of emissions reductions and adaptation actions.
- **Knowledge Sharing:** The initiative facilitates the exchange of experiences and lessons learned among countries, enhancing the global understanding of effective climate action transparency.

ICAT's activities align with the Biennial Transparency Report (BTR) guidelines by:

- **Enhancing National Circumstances and Institutional Arrangements:** Supporting countries in developing robust transparency frameworks in line with Article 13 of the Paris Agreement.
- **Providing Methodological Approaches:** Offering guidance documents that assist countries in assessing greenhouse gas emissions, sustainable development, and transformational impacts of policies.
- **Facilitating Stakeholder Engagement:** Encouraging the involvement of various stakeholders, including governments, donor agencies, businesses, research institutions, and NGOs, in the transparency process.

Key Achievements and Results

- **Capacity Building:** ICAT has engaged with over 50 partner countries, enhancing their capacities to build and manage data and transparency systems.
- **Policy Influence:** The initiative has contributed to the development and refinement of policies and measures in NDCs of 20 partner countries.
- **Knowledge Products:** ICAT has developed various tools and methodologies, such as the Greenhouse Gas Abatement Cost Model (GACMO), to support countries in their transparency efforts.

Challenges and Lessons Learned

- **Institutional Capacity:** Building and sustaining national expertise requires continuous engagement and support.
- **Data Management:** Ensuring the availability and quality of data is crucial for effective transparency and policy evaluation.
- **Stakeholder Coordination:** Effective climate action transparency necessitates the involvement of multiple stakeholders, requiring robust coordination mechanisms.

ICAT plans to continue its support to countries in building their transparency frameworks, aiming for sustained improvements in the administrative, legislative, and institutional transparency infrastructure. The initiative will focus on facilitating effective decision-making and policy design rooted in credible data, thereby contributing to the global effort in combating climate change.

Box 3**Summary of Youth4Capacity Programme Activities under the MoU between the Italian Ministry of Ecological Transition and the UNFCCC Secretariat**

The "Youth4Capacity" Programme, established under a Memorandum of Understanding (MoU) signed in June 2022 between the Italian Ministry of Ecological Transition (now Ministry of Environment and Energy Security) and the UNFCCC Secretariat, aims to strengthen youth capacities, especially in developing countries, to engage effectively in climate change processes. The Youth4Capacity Programme seeks to empower youth from developing countries by enhancing their skills and knowledge on climate change mitigation, adaptation, and advocacy. This is achieved through training, mentorship, and knowledge-sharing opportunities, all aligned with the Sustainable Development Goals (SDGs).

A Joint Committee, comprising three representatives from each Party, ensures the development, coordination, and implementation of the programme. This structure guarantees accountability, systematic progress reviews, and alignment with other initiatives, such as Youth4Climate.

During the second half of 2022, the following key activities have been implemented under the Youth4Capacity Programme:

- Knowledge Enhancement Events: Webinars, training sessions, and virtual workshops, often conducted in collaboration with the Paris Committee on Capacity-Building (PCCB), provided platforms for youth to exchange lessons learned and best practices.
- Outreach and Awareness Campaigns: Dedicated social media channels and knowledge-sharing platforms supported the visibility of the Youth4Climate initiative and encouraged peer learning among youth from diverse regions.

Italy committed EUR 2.5 million to the Youth4Capacity Programme, disbursed in annual installments of EUR 500,000 over five years.

The Youth4Capacity Programme adheres to BTR reporting guidelines through the following elements:

- National Circumstances and Institutional Arrangements: The Joint Committee oversees the programme's development and ensures alignment with the objectives of Article 11 of the Paris Agreement.
- Methodological Approaches: Activities are reported annually using a structured, transparent approach that includes both narrative and tabular formats.
- Capacity-Building Strategy: Activities are responsive to regional needs and focus on capacity gaps in mitigation, adaptation, and advocacy, as required by the Paris Agreement.
- Stakeholder Engagement: Active involvement of youth, experts, and stakeholders from academia, civil society, and government ensures comprehensive capacity-building support.

Challenges and Lessons Learned

- Connectivity Barriers: Limited internet access in certain regions affected participation in virtual sessions.
- Youth Engagement: Sustaining youth participation required continuous follow-up and engagement post-training.
- Good Practices: Region-specific capacity-building activities proved more relevant and impactful, and mentorship opportunities supported youth's professional growth and technical skills.

To maximize impact, the Youth4Capacity Programme will continue its capacity-building activities until 2027. Efforts will focus on enhancing engagement through tailored training, expanded mentorship opportunities, and fostering public-private partnerships to support youth's involvement in climate action.

Box 4**Memorandum of Understanding (MoU) between the UNFCCC Secretariat and the Italian Ministry of Environment and Energy Security****SIDS and LDCs**

The Memorandum of Understanding (MoU) between the Secretariat of the United Nations Framework Convention on Climate Change (UNFCCC) and the previous Ministry for the Environment, Land and Sea, now Ministry of Environment and Energy Security, was signed in November 2017 for an initial period of five years. Despite the official duration, so it was active and ongoing in 2021 and 2022. The MoU is still in effect due to cost savings and delays caused by the COVID-19 pandemic, ensuring continued support for its objectives beyond the originally agreed timeline.

The primary goal of this MoU was to establish the “Capacity Award Program to Advance Capabilities and Institutional Training in one Year (CAPACITY)” Fellowship Programme. This initiative aimed to strengthen the institutional capacities of Small Island Developing States (SIDS) and Least Developed Countries (LDCs) by fostering local expertise on climate change through dedicated training and development opportunities. The programme supported the engagement of fellows within the UNFCCC Secretariat in Bonn, Germany, enabling them to contribute to and benefit from international climate processes.

Under the Fellowship Programme, the following key activities have been undertaken:

- **Capacity Building:** Development of local professional expertise in SIDS and LDCs to support their climate change mitigation and adaptation efforts.
- **Training and Knowledge Transfer:** Training of fellows on UNFCCC processes, enabling them to contribute to international climate negotiations and institutional capacity-building in their home countries.
- **Advisory Support:** An Advisory Committee, composed of UNFCCC Secretariat representatives, facilitates the selection and support of fellows during the programme.

The Italian Ministry of Environment and Energy Security served as the primary financial donor for the Fellowship Programme, committing €2.5 million for its implementation. While other donors may also contribute, Italy’s support remains central.

Reporting requirements include:

- **Fellow Reports:** Each fellow is required to submit a final report at the conclusion of their fellowship.
- **UNFCCC Secretariat Reports:** The Secretariat provides a final programme report within six months after the programme’s completion, covering objectives achieved, challenges encountered, and recommendations for future initiatives.
- **Financial Reports:** Certified annual and final financial statements are submitted to ensure accountability and transparency regarding the use of funds.

Both Parties have designated official representatives to oversee the implementation and administration of the MoU. The MoU reflects a strong commitment to capacity-building in vulnerable countries, enhancing their ability to engage in climate negotiations and implement climate policies. Its ongoing status, extended beyond the original term, underscores the enduring importance of this collaboration, especially in light of the unforeseen impacts of the COVID-19 pandemic. This partnership not only promotes sustainable development in SIDS and LDCs but also strengthens Italy’s role as a key supporter of global climate action. The project has been extended to 2025.

The table below lists MASE' projects implemented (ongoing/concluded) during the reporting period of 2021-2022 in different regions focused on capacity building.

Table 5.6 – Capacity building: implemented projects

Region	n	State	Project's title	MASE contribution	Status
Sub-Saharan region	1	Congo DRC	Sustainable Energy Services for Rural DRC(*)	1 195 654 EUR	Ongoing
	2	Rwanda	Sustainable urban wetlands development within Kigali City	1 016 000 EUR	Concluded in 2022
	3	Eswatini	Strengthening Swaziland early warning system and climate services (*)	970 880 EUR	Ongoing
MENA region	4	Palestine	Revision and updating of the National Biodiversity Strategy of Palestine and related Action Plan and Preparing the Sixth National Report	198 643 EUR	Concluded in 2022
	5	Lebanon	*Maximizing energy savings from energy efficient home appliances	1 619 375 EUR	Ongoing
Pacific SIDS	6	Palau	Phase 2 of the PNMS Project: Examining the potential effects of climate change on the distribution, long-term movement and local fisheries productivity of pelagic and nearshore resources in the pNmS.	245 000 USD	Ongoing
	7	Palau	Resilient Water Infrastructure. Increasing Palau's resilience to extreme drought events: Taking action for long-term adaptation to the impacts of climate change.	320 000 USD	Ongoing
	8	Micronesia	Proposal to support the development of the Federate States of Micronesia's updated nationally determined contribution for 2020.	162 500 USD	Ongoing
	9	Micronesia	Proposal to support the development of the Federate States of Micronesia's updated nationally determined contribution for 2020.	284 625 USD	Ongoing
CARICOM	10	Belize	Completing the Operationalization of the Caribbean Community Climate Change Centre Airborne LIDAR System	600 000 USD	Ongoing
	11	St. Lucia	Implementation of a Geo-information Centre in the Caribbean Island of Saint-Lucia	2 170 000 EUR	Ongoing

Note: (*) The initiatives involve both capacity building and technology transfer

Source: MASE

A brief description of each project is provided below.

- 1) “Sustainable Energy Services for Rural DRC”. The project aimed to ensure access to energy in four rural villages (Kashara, Kimomo, Muliampo and Mulinga) on the island of Idjwi, South Kivu province. It involved the installation of a hybrid photovoltaic-hydroelectric plant and the associated distribution line.
- 2) “Sustainable urban wetlands development within Kigali City”. The initiative, ended in 2022, contributed to the eco-systemic restoration of a degraded urban wetland area of 121 hectares on the outskirts of Kigali, which became the Nyandungu eco-tourism park. It also contributed to the strengthening of the national technical and institutional expertise on urban wetland management, solid urban waste management and Environmental Impact Assessment.
- 3) “Strengthen Swaziland early warning system and climate services”. The project aimed at enhancing the national weather forecast and alerting systems through installation of new meteorological and hydrometric stations; equipment of the Department of Meteorology

with advanced forecasting systems; adoption of a Common Alerting Protocol at the national level.

- 4) Revision and updating of the National Biodiversity Strategy of Palestine and related Action Plan and Preparing the Sixth National Report. Due to the impact of climate change, Palestine is experiencing a constant degradation of natural habitats and associated ecosystems, leading to biodiversity loss. Freshwater basins and forest areas are at the highest risk of degradation. This fragility is exacerbated by inadequate policies (poor planning and management of natural resources, insufficient conservation measures, limited scientific data, poorly trained personnel). The project aims to support Palestine in reviewing and updating the National Biodiversity Strategy and its implementation plans. Activities include preparing the Sixth National Report on the implementation of the Convention on Biological Diversity (CBD), analyzing national contributions to biodiversity conservation, and developing and adopting a new National Biodiversity Strategy and Action Plan (NBSAP).
- 5) See project nr.5 description under technology transfer.
- 6) to 9) With particular reference to Italy's support to SIDS for capacity building, it is worth mentioning the "Italy AOSIS Capacity building Programme" that Italy has been carried out since 2017 with the "Alliance of Small Island States" (AOSIS) which represents 28% of developing countries and 20% of the total United Nations membership, making it a significant advocate for the interests and unique challenges faced by small island nations on the global stage. Italy has been promoting a capacity-building program in collaboration with AOSIS, titled the AOSIS Fellowship Programme. The Programme is a key initiative supporting the capacity building of Small Island Developing States (SIDS) to strengthen their participation in international negotiations and global decision-making processes and support the governments of SIDS states. It provides young professionals from SIDS with the necessary skills and expertise to address critical issues such as climate change, sustainable development, and ocean governance. With a focus on developing negotiation and diplomacy skills, the Fellowship ensures that SIDS are well-equipped to advocate for their priorities and address their unique vulnerabilities on the global stage. The Programme combines academic training, delivered by New York University, with practical experiences, enabling fellows to actively engage in multilateral negotiations. Efforts were made in 2020 to expand and strengthen the fellowship program by extending its duration to three years and increasing the number of annual fellows to ten. These changes laid the foundation for a more structured partnership, which was formalized in October 2021 with the signing of the Memorandum of Understanding for the "Italy-AOSIS Fellowship Programme 2022-2024," fully funded by the Italian Ministry of Environment and Energy Security (MASE). The total budget for the reporting period of 2021-2022 is EUR 903,150, funded by MASE. In 2022, the "Italy-AOSIS Fellowship Programme" was honored with the prestigious "UN Small Island Developing States Partnership Award" by UN-DESA. In December 2022, the first year of the programme was successfully completed, with 10 young professionals participating as representatives of the three regional groups within AOSIS: Pacific Small Island Developing

States (PSIDS), the Caribbean Community (CARICOM), and the Atlantic, Indian Ocean, and South China Sea (AIS).

- 10) Completing the Operationalization of the Caribbean Community Climate Change Centre Airborne LIDAR System. The project aims to make operational the LIDAR aerial remote sensing system operated by the Caribbean Community Climate Change Center (CCCCC). Using topographic and bathymetric surveys, LIDAR allows models to be developed for extreme weather forecasting and risk management, thus providing accurate information on coastal areas most vulnerable to climate change, including the coral reef. In particular, the project aims to: instal the LIDAR on the aircraft, align and calibrate the system, operate baseline surveys, data loading and processing. The project is preparatory to the elaboration of the project: "Climate Change Information Systems for supporting Ridge to Reef Adaptation and Disaster Risk Reduction". The project involves several activities on training and maintenance of the LIDAR system.
- 11) Implementation of a Geo-information Centre in the Caribbean Island of Saint-Lucia. The Project aims to support the implementation of the National Strategy for Adaptation to Climate Change of Saint Lucia Government, within the International Adaptation Policy Framework with a state-of-the-art Information Center that provides advanced capabilities for multi-faceted hydro-meteorological risk management, sea pollution and forest resources control. The proposed solution for the Geo-Information Centre foresees the following Early Warning System, tailored and designed for:
 - Early Warning Alerting, that combines information and data derived from multiple ground and satellite sources in order to deliver a unified picture:
 - Local meteorological information, by radar with 120 Km of radius on medium high intensity phenomena;
 - Hydraulic information through hydro models, exploiting the already existing hydrometric networks in St. Lucia:
 - o one operated by the Water Resource Management Agency (WRMA) for hydrometric data collection
 - o one operated by the Meteorological Office (Met Office) for early warning and weather forecasting
 - Flood mapping capability, for post event damage assessment, based on the analysis of both SAR and optical satellite images, freshly acquired during the peak of the event and immediately after.

The Geo-information Centre will be tailored and designed in order to create a capability to generate and deliver products and services, starting from satellite data, radar satellite data, in situ data, meteorological data and other ancillary information.

Indeed, the solution combines information derived from multiple ground and satellite data sources to deliver a unified picture concerning upcoming extreme weather events and their potential impact over the island.

The Information Center set up, the relevant services, the training and local operational capability included in the Project will contribute to St. Lucia disaster risk reduction process.

6 IMPROVEMENTS IN REPORTING OVER TIME

According to paragraph 7 of the MPGs, the subject of this chapter is ‘information on areas of improvement in relation to its reporting pursuant to chapters II, III, IV, V and VI’. These areas of improvement may be identified by the Party or by the technical expert review team. This chapter will become more important in the second and subsequent BTRs.

As this is the first BTR reported by Italy and the review thereof has yet to take place, there are currently not yet any specific areas of improvement as identified by the technical expert review team that can be listed in this chapter.

Nonetheless, in line with paragraph 7 of the MPGs, there are still areas of improvement that can be identified by the Party itself. Considering the main findings of the technical review of Italy's eighth national communication and fifth biennial report, which align with the enhanced transparency framework of the Paris Agreement, significant improvements have been made by Italy.

In its first Biennial Transparency Report (BTR), Italy improved the quality, granularity, accuracy and completeness of information reported with respect to the fifth Biennial Report and the eighth National Communication.

Improvements of the reporting

Regarding mitigation actions and their effects, the ERT noted that Italy did not provide in BR5 information on estimated emission reduction impacts for most of its PaMs. Italy reported “NE” for 2030 and “0” for 2020 for all implemented PaMs, and “IE” (without indicating where the impact is included in the custom footnote) for most planned PaMs. In the textual part of the BR5 some information was presented for planned PaMs reported as “IE”.

The ERT recommended that Italy include the missing estimates of the impacts of its mitigation actions or provide adequate justification for reporting “0” and “NE” in the textual part of the BR and/or in the custom footnote in CTF table; include corresponding explanations in the custom footnote in CTF table and/or in the textual part of the BR on the use of “IE”; and ensure consistency between the textual part of the BR and CTF table by presenting the correct information on sectors affected in the textual part of the BR.

In the present BTR and CTF tables all implemented and planned PaMs have been evaluated in terms of mitigation impacts, except some whose effects were considered negligible. In the CTF table 5, custom footnotes provide information on where the impact is included when the notation key “IE” is used. In the textual part of the BTR more extensive explanations are provided.

Regarding information on financial, technology development and transfer and capacity-building support provided and mobilized under Articles 9–11 of the Paris Agreement, the first BTR of Italy includes an enhanced analysis of the aggregates with respect to the fifth Biennial Report and the eighth National Communication, extending the information on income and

sectoral distribution of resources and further graphical information. Further, two sections dedicated to separate analysis of bilateral and multilateral contributions are included, enhancing the granularity of information with respect to previous reports.

Extensive and improved information on underlying assumptions, definitions and methodologies are provided following the enhanced guidance of the MPGs, providing more details on the methodology used to assess climate specificity and on the reference definitions used.

As elaborated in the methodological section, Italy for the first time uses imputed multilateral shares by type of support to report on multilateral support provided, allowing for the specific allocation to either mitigation or adaptation of several of the inflows, thus reporting more accurate information on the respective proportion of inflows which were previously reported as cross-cutting.

Improvements in internal processes of monitoring and evaluation

MASE strengthened and expanded existing instruments for the monitoring and evaluation of international environmental cooperation activities, as indicated in the Ministerial Decree 170 of 7/8/2020. During the reporting period, MASE began elaborating a structural framework to monitor and evaluate the effectiveness, transparency, accountability and efficiency of its interventions, through monitoring and environmental assessments.

Important efforts were undertaken by MASE in the biennium 2021-22 to enhance knowledge on reporting standards related to its international cooperation initiatives. On 2021 MASE and the Institute for Environmental Protection and Research (ISPRA) signed an agreement with the purpose of setting up a fully digitalized and web-based platform for Project Cycle Management (PCM) to manage bilateral projects and multilateral programs (with International Organizations and International Financial Institutions). To this end, a set of methodologies and instruments were developed, that are on par with the best-in-class international and European principles and techniques for PCM and Monitoring, Evaluation and Reporting activities, such as the Results-Based Management (RBM) and the MEAL framework. Such methodologies and instruments are embedded in the digital system.

The main objectives of the collaboration were:

- Definition of methodologies for monitoring and evaluation of initiatives, through a system of benchmarks and indicators for *ex-ante*, *in-progress* and *ex-post* evaluation, including for the purpose of drawing up "environmental rating" indexes;
- Procedures and statistics for monitoring projects and programmes implemented in a database.
- Elaboration of evaluation models, to be implemented through periodic reporting schemes.

The system integrates functions of database (to store projects/programs information) and provides a comprehensive toolbox for the Monitoring – Evaluation – Accountability – Learning (MEAL) functions. The key products developed and embedded in the PCM platform are:

- an inventory of pre-designed performance indicators, which will make progress-tracking of interventions consistent over time and comparable;
- a Likert-scale questionnaire for ex ante, in itinere and ex post/final evaluations, encompassing criteria and terms of reference internationally deemed as pivotal (e.g. OECD-DAC evaluation criteria);
- tools for risk analysis.

All the instruments above generate high quality, detailed/synthetic information and analytics on the environmental cooperation initiatives financed by MASE, structured in different report templates (e.g. detailed technical monitoring report, evaluation report, minimal report for outreach and communication purposes). The knowledge produced will enhance the “Accountability” and “Learning” parts of the MEAL framework, for better transparency towards stakeholders and better management of current and future initiatives, capitalizing on good practices. To this regard the platform represents a solid step forward for MASE in terms of monitoring, evaluating and reporting of all the cooperation initiatives.

The system will become fully operative in 2025 and is currently under testing and refinement.

Improvements in internal processes of Rio Markers assignment

AICS has introduced significant enhancements to internal processes to ensure the accurate and consistent assignment of Rio Markers across its grants.

Since the last quarter of 2023, AICS has implemented a pilot procedure to review Rio Marker assignments during the project proposal phase. This process requires the Environment and Land Use Office at HQ to vet the markers assigned by project officers before final financing approval. The procedure enhances accountability and ensures markers are applied consistently and accurately across all proposals.

AICS has delivered targeted training sessions on the use of Rio Markers to technical staff at headquarters, country offices, and newly recruited personnel. These sessions included a dedicated module on Policy and Rio Markers as part of an online training on data for ODA reporting. The training recording is accessible via the organization’s internal communication platform, enabling continuous learning and reference.

Additionally, guidelines in Italian on the use of environment-related markers (Policy and Rio), based on the DAC Statistical Reporting Directives and the Climate Markers Handbook have been developed and distributed to HQ units and country offices. These resources aim to standardize practices and ensure alignment with international directives.

7 ANY OTHER INFORMATION

Italy, in its climate action, pursues and contributes to the goal of the Paris Agreement of making finance flows consistent with a pathway towards low GHG emissions and climate-resilient development (Article 2.1(c) of the Paris Agreement), through a range of national initiatives and policies aimed at aligning financial flows (national and international) with mitigation and adaptation objectives.

For example, taking into account the goals of the European Green Deal and the ongoing G20 initiatives and the National Recovery and Resilience Plan, in late 2022 the Ministry of Economy and Finance (MEF) promoted the establishment of a “Platform on sustainable finance”¹¹⁵ involving the Ministry of Environment and Energy Security (MASE), the Ministry of Business and Made in Italy, the Bank of Italy, the National Commission for Companies and the Stock Exchange (CONSOB), the Insurance Supervisory Institute (IVASS) and the Commission for the Supervision of Pension Funds (COVIP). The initiative aims to foster the mobilization of private resources, through the capital market, to support the sustainable transition in Italy, within the framework of European and international commitments. By coordinating and exchanging views among supervisory authorities, sharing best practices, and conducting analyses and in-depth studies, the Platform aims, in particular, to offer concrete solutions to remove obstacles to private investment in sustainability. The Table also aims to be a forum for interaction and open dialogue with public and private stakeholders.

For 2023, the Table identified as priorities issues related to:

- The identification and availability of climate and natural hazards data, through mapping and overcoming the fragmentation of existing local and national private and public databases;
- Sustainability disclosure prepared by unlisted Small and Medium Enterprises, including sustainability financial education¹¹⁶;
- Insurance protection for environmental and climate risks.

Based on these priorities, four Working Groups have been organized in which various stakeholders participate.

As a first result of the work conducted within the Sustainable Finance Platform, the “Document for Sustainability Dialogue between SMEs and Banks” was released. Its aim is to facilitate communication between small and medium-sized enterprises (SMEs) and banks regarding environmental, social, and governance (ESG) sustainability aspects. Although unlisted SMEs are not formally required to provide ESG information, they often receive such requests from large corporate clients and financial institutions. The Document seeks to standardize and

¹¹⁵

https://www.dt.mef.gov.it/it/attivita_istituzionali/sistema_bancario_finanziario/finanza_sostenibile/Tavolo_finanza_sostenibile

¹¹⁶

https://www.dt.mef.gov.it/export/sites/sitodt/modules/documenti_it/sistema_bancario/dialogo_sostenibilita/Documento-per-il-dialogo-di-sostenibilita-tra-PMI-e-Banche.pdf

simplify these requests, thereby reducing the burden on SMEs and enhancing the quality of the information provided. The Document is the outcome of extensive dialogue among the Sustainable Finance Platform, industry experts, consultants engaged through the Technical Support Instrument program funded by the European Commission, and various stakeholders. It underwent a public consultation process, which concluded on August 2, 2024. Compared to the initial draft, the final version has been simplified and clarified. The Document can be accessed via this link. On the same page, you will also find the results of the public consultation, which helped shape the final content, and the Brochure, a summary of all the work carried out.

Central banks can make an important contribution to the transition, helping the financial system become more resilient to the risks stemming from environmental, social and governance (ESG) factors, and smoothing, within the scope of their mandate, the transition to a more sustainable economy.

The Bank of Italy has long been engaged at national and international level¹¹⁷ in assessing the implications of these risks for the economic and the financial system and in taking the sustainable development goals into account in discharging its institutional functions. It does so in its various roles as supervisor of financial intermediaries, research centre¹¹⁸, monetary authority¹¹⁹, and promoter of a culture of financial education and sustainability among the general public and firms¹²⁰. Over the last several years, the Bank of Italy has also unrolled a programme to reduce its environmental footprint¹²¹ and, to integrate ESG profiles in corporate governance¹²² with the long-term goal of net-zero carbon emissions.

On the latter, since 2019, the Bank of Italy has started to use ESG criteria in the management of its non-policy portfolios. In the Sustainable Investment Charter¹²³, published in 2021, it sets out the Bank's vision of sustainability, contains principles and benchmarks for the sustainable management of its financial investments and indicates precise commitments through which it intends to give substance to its action in favour of a sustainable economic growth model. In the Charter, the Bank defined three strategic lines of action: (a) to promote the dissemination of information on sustainability by issuers and operators in the financial system; (b) to integrate ESG principles in the management of its investments, thus contributing to the dissemination of good practices in this field; (c) to publish data and analyses on sustainable finance, to

¹¹⁷ <https://www.bancaditalia.it/focus/sostenibilita/vigilanza-sostenibilita/index.html>

¹¹⁸ <https://www.bancaditalia.it/focus/sostenibilita/studi-convegni/index.html>

¹¹⁹ <https://www.bancaditalia.it/focus/sostenibilita/politica-monetaria/index.html>

¹²⁰ <https://www.bancaditalia.it/focus/sostenibilita/educazione-finanziaria/index.html>

¹²¹ <https://www.bancaditalia.it/focus/sostenibilita/impatto-ambientale/index.html>

¹²² <https://www.bancaditalia.it/focus/sostenibilita/impegno-sociale/index.html>

¹²³ <https://www.bancaditalia.it/compiti/riserve-portafoglio-rischi/cis/CIS-ita.pdf>

periodically communicate the results achieved, and to contribute to the dissemination of ESG culture in the financial system and among citizens.

The bank, since 2021, published periodic reports¹²⁴ fulfilling the commitment, made with the publication of the Charter, to provide information on the methodologies applied to take ESG risks into account in the Bank's non-policy investment activity and the results achieved. The Report is inspired by the recommendations developed by the Task Force on Climate-related Financial Disclosures (TCFD) and the Guide to Climate Risk Disclosure by Central Banks, published by the Network for Greening the Financial System (NGFS), of which the Bank has been a member since 2019. The Report devotes a chapter to each of the four profiles outlined by the TCFD: (a) governance mechanisms; (b) strategy; (c) risk management; (d) indicators and results.

The Charter is also inspired by the recommendations of the Network for Greening the Financial System¹²⁵, in which the Bank has been an active participant since 2019, and by the common position that has emerged in the Eurosystem¹²⁶ for the application of sustainable and responsible investment criteria to non-monetary policy portfolios.

¹²⁴ <https://www.bancaditalia.it/pubblicazioni/rapporto-investimenti-sostenibili/2023/index.html>

¹²⁵ <https://www.ngfs.net/en>

¹²⁶ <https://www.bancaditalia.it/media/notizia/l-eurosistema-ha-concordato-una-posizione-comune-per-la-sostenibilita-climatica-degli-investimenti-nei-portafogli/?com.dotmarketing.htmlpage.language=102>