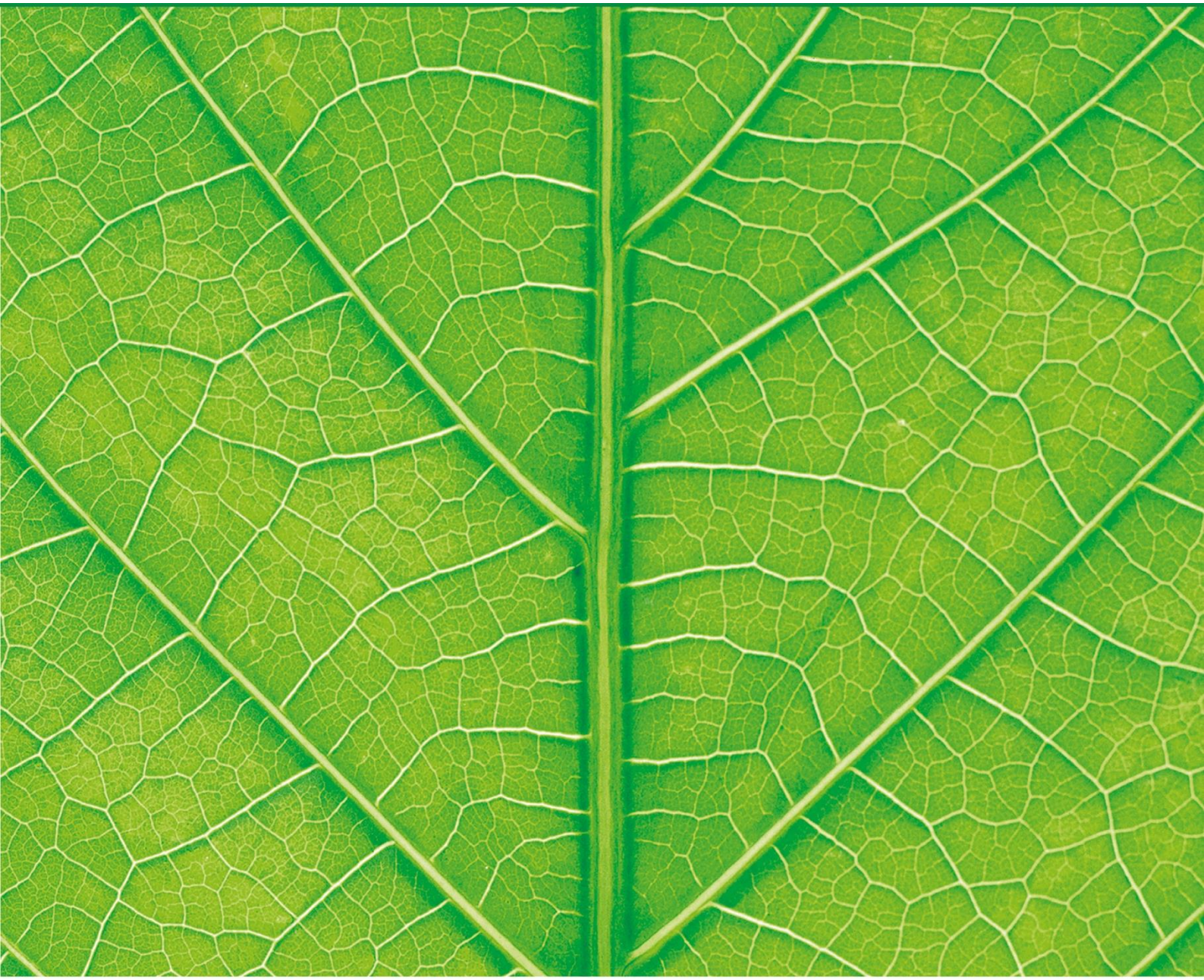
BTP Green

Allocation and Impact Report

BTP Green

2022



Ministero dell'Economia e delle Finanze

REPUBBLICA ITALIANA

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Introduction

In March 2021, the Italian government entered the green bond market for the first time by launching the **2045 BTP Green**, of which two tranches were issued for a total nominal value of EUR 13,500 million and for a net proceed of EUR 13,265.13 million. The first issue achieved a record number of bids for inaugural sovereign Green Bond issues in Europe with the participation of approximately 530 investors, more than half of whom were ESG investors; total demand amounted to more than EUR 80 billion. Market interest was also confirmed when the second tranche was issued in October 2021, with the participation of around 350 investors, of which almost half were ESG investors.

This Report illustrates the allocation of the proceeds of the above mentioned issues, which was carried out in accordance with the criteria set out in the Framework for BTP Green issues (Green Bond Framework – **GBF**) published on 25 February 2021.

The amounts collected were allocated to the State budget expenditure for the 2018-2021 four-year period with reference to the six categories indicated in the **GBF**:

1. Renewable sources for electricity and heat production
2. Energy efficiency
3. Transport
4. Pollution prevention and control and circular economy
5. Protection of the environment and biological diversity
6. Research

With reference to the destination of the expenditures indicated in the budget chapters of the different ministries, the disbursements made for each year of the period considered have been grouped by homogeneous purposes and classified within the six categories.

This document provides, where already available, the positive environmental impact actually observed – or in any case assessable with scientific criteria – of the interventions made possible by the expenditure considered here.

In particular, the Report provides:

- a description of the expenditures aimed at improving environmental conditions in line with the United Nations Sustainable Development Goals pursuant to the "**Green Bond Principles**" issued by the International Capital Market Association (ICMA) in June 2018 and, as far as possible, with the environmental objectives of EU Regulation No. 852 of 2020 (known as **EU Taxonomy**);
- a detailed analysis of green programmes and projects according to their financial nature (tax benefits, capital expenditures and current expenditures), their time breakdown over the 2018-2021 four-year period and their relative weight in the allocated total;
- the methodology and assumptions underlying environmental impact assessments.

The institutional framework set up to allow an efficient process of identification and collection of eligible data for green bonds issuances is provided by the Interministerial Committee for the monitoring and publication of the information necessary for the issuance of sovereign Green Bonds (hereinafter "Committee") established by the Italian Prime Ministerial Decree issued on 9 October 2020, in compliance with the provisions of the Italian Stability Law for 2020 (Italian Law No. 160 of 27 December 2019).

This Committee, which is chaired by the representative of the Italian Ministry of Economy and Finance, namely the Director General of Public Debt **Davide Iacovoni**, is composed of representatives of the Presidency of the Italian Council of Ministers and of the following Italian Ministries[1]:

- Italian Ministry of Ecological Transition;
- Italian Ministry of Economy and Finance;
- Italian Ministry of Sustainable Infrastructure and Mobility;
- Italian Ministry of Economic Development;
- Italian Ministry of Agriculture and Forestry;
- Italian Ministry of University and Research;
- Italian Ministry of Culture.

As provided for by the abovementioned Italian Prime Ministerial Decree, the Ministries participating in the Committee cooperate with the structure of the Department of the Treasury at the Italian Ministry of Economy and Finance in order to identify the eligible expenses and ensure the ongoing transmission of the information necessary to trace and monitor the use of the sums disbursed through the activation of the necessary institutional collaborations.
The Ministries involved ensure that any changes in the regulatory framework concerning the types of expenditure included among those for which the information transmitted to the Department of the Treasury is processed are examined by the Committee well in advance of approval; the aim is to guarantee the stability of interventions with a positive environmental impact financed by the State budget.
This information flow ensures the reporting of the effective use of the funds, as well as the monitoring of the environmental impact of the expenditures listed in the GBF.
Specifically, the approach taken implies that the proceeds from the **2045 BTP Green** are to be used exclusively for expenditure already made in the year of issue of the bond (2021) and in the three preceding years (2018-2020).
It should also be noted that the proceeds raised from the issue of the **2045 BTP Green** were entirely allocated to eligible green expenditure.

Criteria for selecting eligible expenditure

The process of selecting eligible expenditures for the issuance of green BTPs started with an analysis of the State budget aimed at identifying expenditure chapters whose headings suggested the possibility of positive environmental effects. This was verified by cross-referencing the economic classification with the COFOG[2] classification by mission, programme, centre of responsibility and action. When such a cross-check revealed congruence with the purposes of the ICMA principles, the chapters thus selected constituted the basis for dialogue between the structure of the Department of the Treasury and the representatives of the Ministries that make up the Committee, which are competent with respect to the management of such chapters.

These representatives were asked to verify compliance with the environmental objectives pursued, the absence of direct funding channels on the same chapters (so as to avoid any possibility of double counting with the proceeds of the issue of green BTPs), the ability of the administration to timely monitor the path of expenditure and the effective use of the sums for the purposes intended.

In order to obtain the most streamlined and organic picture of the information gathered, bilateral discussions were also initiated between the structure of the Department of the Treasury and the internal offices of each Ministry, as identified through the indications provided by the Committee members.

[1] The Ministries participating in the Committee are listed under the names currently in force, reflecting the changes in their respective competences. In the Italian Prime Ministerial Decree of 9 October 2020, they are listed with their former names.
[2] *Classification Of Function Of Government* (COFOG) is an international classification system of public expenditure by function used in national accounts.

Once these discussions had ensured that all these conditions had been met, the relevant expenditure was included among those eligible; after the bond issues, all the information on the outcome of the intervention and, where already measurable, on its environmental impacts was collected, so as to allow the drafting of this Report.

Italian Ministry of Economy and Finance

May 2022

Milestones

Dec 2019	**2020 Budget Law (Italian Law No. 160 of 27 December 2019)** The issue of green government bonds is part of Italy's green new deal strategy. The Budget Law also provides for the establishment of an Interministerial Committee to support the Department of the Treasury in the selection, monitoring and reporting of green expenditure.
Nov 2020	***Establishment of the Interministerial Committee for Green Government Bonds*** set up by the Italian Prime Ministerial Decree of 9 October 2020
Feb 2021	**Publication of the Italian Sovereign Green Bond Framework and the Second Party Opinion**
Mar 2021	**First issue of the April 2045 BTP Green**
Sep 2021	**Identification of expenses related to the first issue of the April 2045 BTP Green**
Oct 2021	**Reopening of the April 2045 BTP Green**
May 2022	**Publication of the Allocation and Impact Report**

Part I. Resource allocation

This section outlines the allocation of the net proceeds raised in 2021 from the issues of the **2045 BTP Green**, with respect to the **6 categories** of green expenditure incurred by the Italian State, as drawn up on the basis of the European environmental objectives expressed by the EU Taxonomy of Sustainable Activities[3] and indicated in the **GBF** published on 25 February 2021.

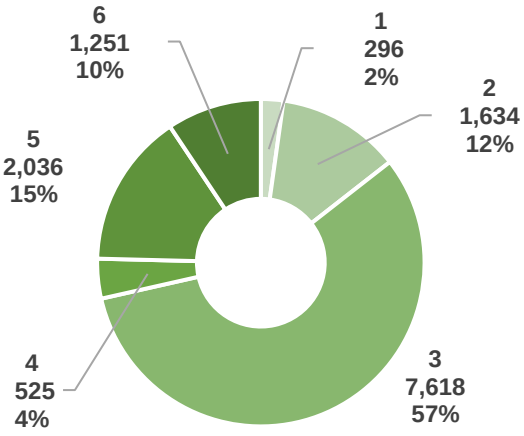
1	Renewable sources for electricity and heat production
2	Energy efficiency
3	Transport
4	Pollution prevention and control and circular economy
5	Protection of the environment and biological diversity
6	Research

Eligible expenditures, as selected from the Italian State budget and relating to the year of issue of the first two tranches of the **2045 BTP *Green***, namely the year 2021, and the three preceding years, namely 2018, 2019 and 2020, amount to **EUR 13.36 billion**, against **EUR 13.26 billion** in net proceeds from the **2045 BTP Green**.

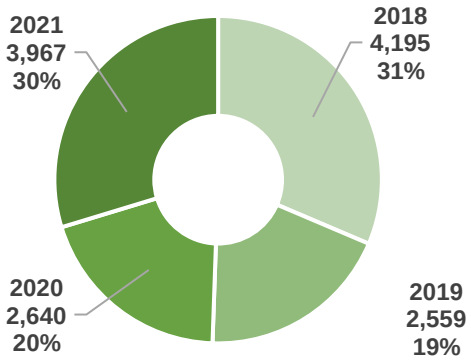
Total 2018-2021 green expenditures
EUR 13.36 billion

Total 2045 BTP Green net proceeds
EUR 13.26 billion

Breakdown by expenditure category



Breakdown of expenditure by year



(values expressed in EUR million)

[3] Regulation (EU) 2020/852 of 18 June 2020.

Cat.	Category description	2018	2019	2020	2021	Total
- 1 -	**Renewable sources for electricity and heat production**	**59,600,000**	**123,000,000**	**54,210,000**	**59,600,000**	**296,410,000**
1.1	*Tax benefits for energy from renewable sources*	59,600,000	123,000,000	54,210,000	59,600,000	296,410,000
- 2 -	**Energy efficiency**	**1,634,200,000**	**-**	**-**	**-**	**1,634,200,000**
2.1	*Tax benefits for energy efficiency in buildings*	1,634,200,000	-	-	-	1,634,200,000
- 3 -	**Transport**	**1,541,829,911**	**1,585,533,631**	**1,726,065,913**	**2,764,543,739**	**7,617,973,193**
3.1	*Subways*	189,812,933	50,496,099	126,519,786	257,749,971	624,578,790
3.2	*Freight transport subsidies (rail)*	22,890,186	135,395,645	99,906,193	232,756,325	490,948,349
3.3	*Interventions for rapid mass transport*	23,227,928	98,666,507	96,893,860	109,088,405	327,876,701
3.4	*Expenditures and contributions for railway infrastructure and High Speed (HS)/ High Capacity (HC) lines*	1,299,478,049	1,299,404,776	1,400,798,404	2,160,800,502	6,160,481,731
3.5	*Padano-Veneto waterway system*	6,420,815	1,570,604	1,947,669	4,148,534	14,087,622
- 4 -	**Pollution prevention and control and circular economy**	**109,176,691**	**113,043,223**	**176,964,268**	**125,563,585**	**524,747,766**
4.1	*Measures to combat marine pollution*	47,551,863	31,616,683	41,830,413	45,597,893	166,596,852
4.2	*Plans for environmental recovery and integrated waste cycle*	4,865,840	6,175,244	59,941,609	43,503,959	114,486,652
4.3	*Water purification interventions*	55,391,800	75,236,295	70,645,565	33,549,169	234,822,828
4.4	*Depollution and improvement of air quality*	1,367,188	15,000	4,546,681	2,912,564	8,841,433
- 5 -	**Protection of the environment and biological diversity**	**522,738,787**	**437,623,093**	**512,010,705**	**563,694,528**	**2,036,067,113**
5.1	*MO.S.E. and safeguarding of the Venetian Lagoon*	213,210,000	37,698,614	56,857,170	53,943,836	361,709,619
5.2	*Water infrastructures*	65,073,683	120,560,187	69,739,718	196,823,664	452,197,252
5.3	*Protected Marine Areas, National Parks and State Nature Reserves*	77,795,295	76,352,491	72,867,609	421,398	227,436,794
5.4	*Soil protection and interventions against hydrogeological instability*	166,659,809	203,011,801	312,546,208	312,505,629	994,723,447
- 6 -	**Research**	**327,656,169**	**299,482,833**	**170,912,429**	**453,327,605**	**1,251,379,036**
6.1	*Contribution to ENEA*	211,133,248	276,463,410	141,180,591	453,327,605	1,082,104,854
6.2	*Contribution to the Euro-Mediterranean Centre for Climate Change*	5,000,000	5,000,000	5,000,000	-	15,000,000
6.3	*Contribution to ECMWF*	5,226,913	5,741,456	6,037,263	-	17,005,632
6.4	*OGS contribution to support scientific research at the Antarctic base*	13,000,000	-	4,000,000	-	17,000,000
6.5	*ITER-DTT nuclear fusion project*	-	-	10,000,000	-	10,000,000
6.6	*Interventions to promote sustainable development*	3,078,146	10,277,966	4,694,575	-	18,050,687
6.7	*CNR-IRBIM contribution: Anton Dohrin Zoological Station of Naples*	-	2,000,000	-	-	2,000,000
6.8	*ISPRA contributions*	90,217,863	-	-	-	90,217,863
	Total categories	**4,195,201,558**	**2,558,682,779**	**2,640,163,314**	**3,966,729,456**	**13,360,777,108**

Of the total green expenditure indicated as eligible, during the 2018-2021 four-year period, the **transport** category (category 3) constitutes the largest item (amounting to EUR 7.62 billion), accounting for **57.0%** of total expenditure. A large part of this category is attributable to capital investments (railway infrastructure, electrification of railway sections, construction of new sections of the High Speed/High Capacity rail network – HS/HC), and to contributions in support of railway mobility (people and goods).

The second largest category of expenditure concerns the **protection of the environment and biological diversity** (category 5), which accounts for **15.2%** of total expenditure over the 2018-2021 four-year period (i.e., EUR 2.04 billion). This category primarily includes measures to protect the soil and combat hydrogeological instability, investments in water infrastructures, as well as expenditures for the construction of the Experimental Electromechanical Module (MO.S.E.).

The **energy efficiency** category (category 2), here represented by a series of subsidies granted for expenditure incurred for improving the energy efficiency of buildings, accounted for **12.2%** of the total expenditure reported (i.e., EUR 1.63 billion).

Considerable weight was given to **research** (category 6) with **9.4%** of total expenditure (equal to EUR 1.25 billion), whereby the National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA) represents the largest item in this expenditure category. Finally, **pollution prevention and control and circular economy** measures (category 4) and **incentives for the production of energy from renewable sources** (category 1) make up, respectively, **3.9%** (equal to EUR 525 million) and **2.2%** (equal to EUR 296 million) of the total green expenditure reported in the 2018-2021 four-year period.

Expenditure has been allocated consistently over the 2018-2021 time horizon, with a slight prevalence for 2018 (with **31.4%** of total expenditure) and 2021 (with **29.7%** of total expenditure).

In some cases the amount relating to certain categories or specific items of expenditure is allocated only with reference to the first few years of the period considered, although disbursements are also made in subsequent years; in fact, the main purpose was to maintain a balance in the distribution between the various categories, which would have been compromised by including some particularly significant expenditure for the entire four-year period. However, the relevant disbursements will be taken into account in future issues of green BTPs.

Eligible expenditures include tax expenditures, capital expenditures, current expenditures, and transfers (e.g., subsidies) to entities outside or within the public administration, to the extent that they are financed by general taxation and contribute to the achievement of the environmental objectives outlined by the EU taxonomy of sustainable activities. On the other hand, expenses, or portions thereof, for which the Italian State has specifically dedicated forms of revenue or funding are not considered eligible. In particular, the budget chapters or the part of them that, following discussions with the competent Ministries, are financed with the resources deriving from the Recovery and Resilience Facility have been excluded, thus avoiding any double counting. Furthermore, chapters with potential criticalities in monitoring and reporting were, in whole or in part, excluded.

Finally, net proceeds from sovereign green bond issuance can be allocated to public agencies, public and private enterprises, local authorities, education and research institutions, as well as households.

1. Renewable sources for electricity and heat production

Energy from renewable sources for companies

1 Renewable sources for electricity and heat production

Italy has long made the development of renewable sources one of the priorities of its energy policy, together with the promotion of energy efficiency. The main objectives of this strategy are:

- increased security of energy supplies;
- reduced energy costs for businesses and citizens;
- promotion of innovative technological supply chains;
- environmental protection (by reducing pollutant and climate-changing emissions).

In this context, there are numerous support mechanisms that can ensure a return on investment in various renewable energy and energy efficiency sectors and foster the growth of industrial sectors. In particular, measures to support the production of electricity from plants powered by renewable sources include:

- **exemption from payment of excise duty** on electricity that is independently produced and consumed by companies;
- a **mechanism of incentives** for newly built plants producing electricity from renewable energy sources (such as on-shore wind farms, photovoltaic, hydroelectric and sewage treatment gas plants), which are granted on the basis of the net electricity produced and fed into the grid by the plant[4].

Due to their use, the assets financed by these measures comply with the threshold of 100 gCO_2e/kWh established in the GBF.

In the 2018-2021 four-year period, only the abovementioned measure of exemption from the payment of the excise duty was considered for the allocation of revenues.

The proceeds collected from the first two tranches of the **2045 BTP Green** have not been allocated to incentive measures for hydrogen production. This possibility, in accordance with the GBF, may relate to future issues of sovereign green bonds.

Finally, the category excludes expenditures on energy production from land with high carbon stock, land with high biodiversity value, and conversion from forest and cropland.

Allocation (EUR)	2018	2019	2020	2021	Total
Tax benefits for energy from renewable sources	59,600,000	123,000,000	54,210,000	59,600,000	**296,410,000**
Incentives for hydrogen production	-	-	-	-	**-**

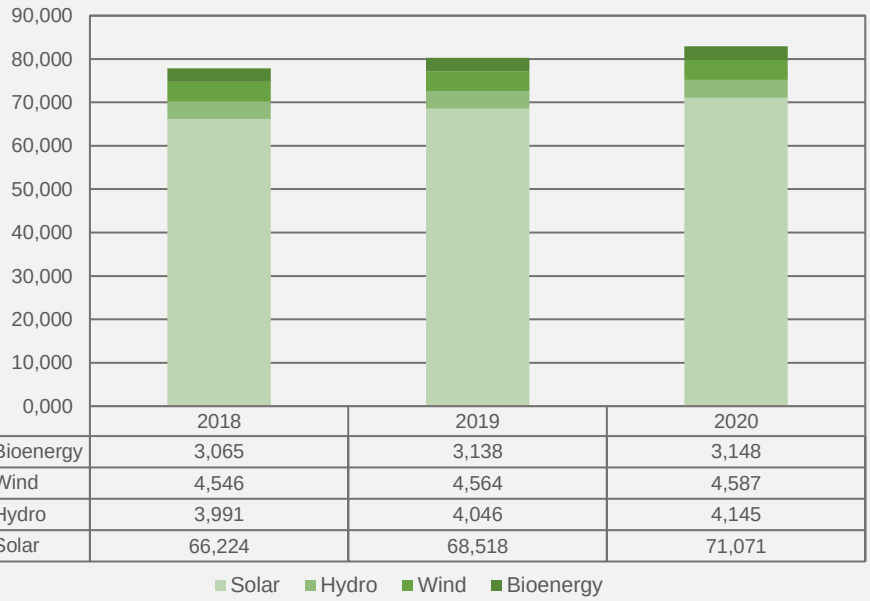
[4] The electricity produced is calculated as the lower of net production (which in turn is equal to gross production reduced by consumption of auxiliary services, line losses and transformation losses) and the electricity fed into the grid, as measured by the exchange meter.
Two different incentive mechanisms are envisaged, depending on the power of the plant built: an all-inclusive tariff, consisting of a single tariff, corresponding to the due tariff, which also remunerates the electricity withdrawn by the Electricity Service Operator (*Gestore del Servizio Elettrico*, GSE); an incentive, calculated as the difference between the due tariff and the hourly zonal energy price, given that the energy produced remains at the operator's disposal. The all-inclusive tariffs and incentives are paid by the GSE from the date of commercial operation, for a specific period for each type of plant equal to its useful life. The date of commercial operation can be chosen by the operator, as long as it is within 18 months of the plant becoming operational.
Further information is available at https://www.gse.it/servizi-per-te/fonti-rinnovabili/fer-elettriche/incentivi-dm-04-07-2019.

EU environmental goal	▪ Climate change mitigation
UN - Sustainable Development Goals	
Subcategories of eligible expenditure subject to allocation	Expenditure on the development of renewable and other low-carbon energy such as solar, wind, wave, tidal or geothermal energy, hydropower, biomass or biomass products, methane from abandoned coal mines and fuel cells.

Tax benefits for energy from renewable sources

Resources earmarked for the exemption from payment of excise duty for electricity produced by plants operated with renewable sources in accordance with the relevant regulations in force[5], with available power greater than 20 kW, consumed by self-production companies in premises and places other than homes. In this regard, in Italy in 2020 there were **82,951** renewable energy power plants in operation with an available power greater than 20 kW (for quantities of electricity equal to 4,336,893,772 kWh), the majority of which (around 86%) were solar power plants: the distribution by type of renewable source used is provided below.

Number of production plants from renewable sources



	2018	2019	2020
Bioenergy	3,065	3,138	3,148
Wind	4,546	4,564	4,587
Hydro	3,991	4,046	4,145
Solar	66,224	68,518	71,071

Note: *number of plants producing electricity from renewable sources, greater than than 20 kW, operating in Italy in 2018.* **Source**: *Electricity Service Operator (GSE).*

[5] The rules for the application of excise duties on electricity are contained in Articles 52 *et seq*. of the Consolidated Law on Excise Duties (TUA). The exemption considered herein is provided pursuant to Article 52(3)(B) of the TUA.

2. Energy efficiency

2 Energy efficiency

An objective of great importance for Italy is to make an extraordinary commitment to increasing energy efficiency and reducing energy consumption. Such a strategy will also make a decisive contribution to achieving the targets for reducing climate-changing emissions and covering total energy consumption with renewable sources.
In pursuing this strategy, a fundamental role is played by interventions aimed at supporting the renovation of residential and non-residential buildings, both public and private, in order to obtain a decarbonised and highly energy-efficient building stock, through the transformation of existing buildings into nearly zero-energy buildings.

In particular, on the basis of the expenses incurred in the 2018-2021 four-year period, which are potentially eligible in this category, the incentive measure for the energy requalification of the building stock, called "**Ecobonus**", has been identified[6].

This incentive measure has provided for disbursements throughout the 2018-2021 reporting period. However, in order to maintain as balanced a distribution as possible between the various expenditure categories, when allocating the proceeds of the **2045 BTP Green**, the choice was made to consider the amount pertaining to the "**Ecobonus**" measure only for the year 2018. The disbursements referring to the 2019-2021 period will thus be taken into account in future issues of green government bonds.

Finally, the revenues reported here have not been allocated to interventions for the implementation of smart grids for the management of increased renewable energy production, the prevention of SF_6 gas leaks and the implementation of heating networks with a minimum 50% renewable energy constraint. According to the GBF, these expenditure items can be financed by future issues of green government bonds.

Allocation (EUR)	2018	2019	2020	2021	Total
Tax benefits for energy efficiency in buildings	1,634,200,000	-	-	-	**1,634,200,000**
Smart grids for energy management	-	-	-	-	**-**
SF_6 gas leakage prevention measures	-	-	-	-	**-**

EU environmental goal	▪ Climate change mitigation

[6] As detailed later in the section on the "environmental impact assessment of green projects", the **"Ecobonus"** measure has produced significant results in terms of energy savings and tonnes of CO_2 avoided: for the year 2018 alone, the measure involved more than 334,000 interventions (corresponding to EUR 3.3 billion of investments), with energy savings of 1,156 GWh/year and 283 tonnes of CO_2 avoided/year. It should be noted that the **"Ecobonus"** measure does not include, among the minimum criteria for admission to the deduction, the improvement of at least two levels on the Italian energy efficiency scale. This reference - indicated in the GBF - only concerns the measure of energy requalification of the Italian building stock called "**Superbonus 110%",** which was subsequently decided by the Government to be financed under the Recovery and Resilience Facility and consequently, in order to avoid double counting, was not considered when allocating the proceeds of the **2045 BTP Green.**

UN – Sustainable Development Goals

Subcategories of eligible expenditure subject to allocation

Tax expenses incurred for energy requalification interventions in buildings of any cadastral category, aimed at accelerating the efficiency enhancement of existing buildings and the diffusion of requalification interventions also through the use of innovative technologies. The thresholds established by the law[7] apply when selecting expenditure on the energy efficiency of buildings[8].

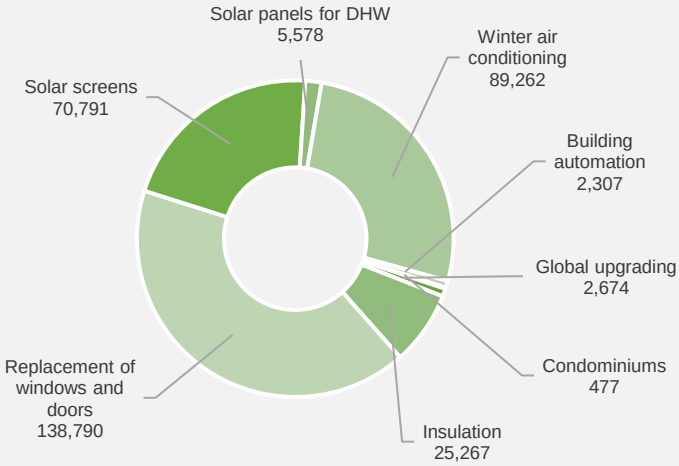
Tax benefits for energy efficiency in buildings

Resources earmarked for the granting of tax deductions for expenditures on the energy requalification of Italy's building stock, "**Ecobonus**" measure. This measure incentivises the following interventions, among others:

- global energy upgrading;
- insulation;
- replacement of windows and doors;
- solar screens;
- solar panels for the production of domestic hot water (DHW);
- winter air conditioning;
- installation of building automation systems.

Access to the deduction is conditional on the drawing up of a certificate – Energy Performance Certificate (*Attestato di Prestazione Energetica*, *A.P.E.*) – certifying the improvements made. For the sake of completeness, the distribution of energy efficiency measures carried out in 2018 is shown below.

2018 energy efficiency measures



Source: *Enea.*

[7] https://www.efficienzaenergetica.enea.it/media/attachments/2020/06/19/d.-lgs-n.-48-del-10-giugno-2020.pdf
[8] https://www.mise.gov.it/images/stories/normativa/DM_Linee_guida_APE.pdf

3. Transport

Work in progress in the construction sites of the Genoa-Milan High Speed railway (courtesy of Webuild image library)

3 Transport

Interventions in the transport sector play a central role in the pursuit of the EU's climate change mitigation objective. The interventions made by the Italian State in the transport sector are particularly significant, both in quantitative and qualitative terms, and have covered different areas, including:

- **investing in upgrading and improving the rail network** in order to reduce greenhouse gas emissions and continue along the path of decarbonisation and ecological transition, with rail transport playing a key role in this process;
- **increasing public transport** in order to reduce the use of individual vehicles and thus reduce air pollution, particularly in cities, due to the emission not only of CO_2 but also of other harmful gases and fine particles;
- **reducing the share of freight transport by road** mainly through investments and/or compensation mechanisms for companies operating in the freight transport service.

With reference to public passenger transport by rail, the allocation of proceeds in the 2018-2021 four-year period primarily regarded investments aimed, where possible, at favouring the use of electric traction by upgrading and modernising existing rail infrastructures and vehicles (most of the Italian rail network is already powered by electricity, but efficiency can still be improved). Similarly, in the case of public road transport, resources have been allocated where possible to replace the public transport fleet with electrically powered vehicles. Alternatively, in cases where electric traction does not yet appear feasible (e.g., through the construction of underground railways, trolleybuses, etc.), actions have been taken to replace old polluting vehicles with latest-generation fossil-fuel models that ensure significant improvements in terms of emissions.

With regard to **freight transport** measures were implemented during the period considered, such as the STFM (*Supporto Traffico Ferroviario Merci*) *e Ferrobonus* measure, with the aim of encouraging the diversion of freight traffic from the road network to the rail network. At the same time, inland waterway navigation has also been enhanced in order to reduce the share of freight transport by road, which is a critical aspect of the country's transport system that requires to be overcome.

Finally, the green bond proceeds reported here have not been earmarked for incentives for the purchase of hybrid or electric cars by individuals or companies, nor for spending on maritime transport. In accordance with the GBF, these expenditure items can be financed by future issues of green government bonds.

Allocation (EUR)	2018	2019	2020	2021	Total
Subways	189,812,933	50,496,099	126,519,786	257,749,971	**624,578,790**
Freight contributions (rail)	22,890,186	135,395,645	99,906,193	232,756,325	**490,948,349**
Interventions for rapid mass transport	23,227,928	98,666,507	96,893,860	109,088,405	**327,876,701**
Expenditure and contributions on railway infrastructure and HS/HC lines	1,299,478,049	1,299,404,776	1,400,798,404	2,160,800,502	**6,160,481,731**
Padano-Veneto waterway system	6,420,815	1,570,604	1,947,669	4,148,534	**14,087,622**

Incentives for the purchase of hybrid or electric cars by individuals or companies	-	-	-	-	-
Maritime transport costs	-	-	-	-	-

EU environmental goal	▪ Climate change mitigation
UN - Sustainable Development Goals	
Subcategories of eligible expenditure subject to allocation	**Subways:** Resources earmarked for the construction and upgrading of **subway lines** in order to promote public mobility in urban areas, thereby improving the overall performance of public transport through a modal shift from private car use to public transport, with benefits in terms of atmospheric pollutant emissions. In the 2018-2021 period, examples of funded interventions include: Lines M1, M4 and M5 of the Milan underground; Line C of the Rome underground; Line 1 of the Naples underground; Line 1 of the Turin underground. **Freight contributions (rail):** Resources earmarked for the granting of subsidies to railway undertakings in order to encourage the transport of goods by rail instead of more polluting competing modes of transport. In detail, in the 2018-2021 period, the measures financed were: ▪ **STFM measure**. This measure provides for a compensation for companies operating in the freight transport service for the additional costs incurred in using the railway infrastructure in certain areas of the country (southern regions) and an environmental contribution throughout the country for the external costs saved by the railway mode compared to competing and more polluting modes. ▪ ***Ferrobonus* measure**. The aim is to shift freight traffic from the road network to the rail network by promoting the use of intermodal transport and transhipment to and from logistical hubs, through an economic incentive for rail service commissioning companies and multimodal rail operators. In view of the fact that freight rail traffic in Italy is largely developed on electrified railway lines (with a share of around 90% in 2020), it is reasonable to consider that the eligibility criterion expressed in the GBF for this type of intervention is respected, whereby the emissions per tonne-kilometre ($gCO_2e/t.km$) for goods trains must be less than 50% of the reference average indicated in the "CO_2 Heavy Duty Regulation". **Interventions for rapid mass transport:** ▪ Expenditures on the purchase of **electrically powered public transport vehicles for rail and road**. These vehicles are characterised by reserved lanes, high capacity and the ability to maintain high commercial speeds. ▪ With regard to **public road transport**, investments have been made in the purchase of new generation, less polluting vehicles, intended to promote public mobility as an alternative to private car mobility. Electric or diesel Euro 6 vehicles have been purchased, in line with the provisions of Directive 2014/84/EU (DAFI). **Expenditures and contributions on railway infrastructure and HS/HC lines:** ▪ Investments dedicated to the **completion of the non-electrified part of the national rail network.** Currently, in Italy there are about 5,000 kilometers of non-electrified secondary lines (mainly concerning regional transport and less-travelled routes), which represent about 19% of the overall national rail network expressed in kilometers.

- Expenditures and contributions for the improvement of the national railway infrastructure, including through **investments on the High Speed/High Capacity (HS/HC) network**, in order to allow a significant reduction in journey times and produce a significant modal shift from other modes of transport, such as road and air, both for passenger transport (investments in HS lines) and for freight transport (investments in HC lines). Modal shifts from more polluting modes bring about environmental benefits in terms of reductions in CO_2 and pollutant emissions.

Padano-Veneto waterway system:
Resources for investment in the Padano-Veneto waterway system, which is part of the so-called "Mediterranean Corridor No. 3", a commercial waterway link of over 300 kilometres between Milan and Venice, included among the projects of interest for the development of the trans-European transport network[9], whose development and revitalisation can have a significant impact on decarbonisation and modal shift. In fact, inland waterway transport is a more sustainable choice than road and rail and substantially comparable to maritime transport in terms of lower emissions of carbon monoxide (CO) and volatile organic compounds (VOC).

[9] The amounts included for this expenditure are lower than those communicated in September in a first provisional allocation of the proceeds of the first issue to State budget disbursements. In fact, the latter corresponded to the amortisation instalments of mortgages granted for this work at the expense of the State. On the other hand, the actual disbursements were very low, since most of the works had already been completed.

4. Pollution prevention and control and circular economy

Patrol activity of a naval unit belonging to the fleet of the company affiliated with the Ministry of ecological transition, for the prevention and fight against marine pollution

4 Pollution prevention and control and circular economy

In order to ensure the financing of investments and the development of intervention programmes in the area of **pollution prevention and control and circular economy**, the Italian Republic has established three different funds:

- the Fund for financing investments and developing the country's infrastructure, which was established by the 2017 Italian Budget Law;
- the Fund aimed at relaunching the investments of the central State Administrations and the development of the country, which was established by the 2019 Italian Budget Law;
- the Fund aimed at relaunching investments by central government administrations and the development of the country, which is intended, in particular, for the circular economy, the decarbonisation of the economy, the reduction of emissions, energy saving, environmental sustainability and, in general, for investment programmes and projects of an innovative nature, including through contributions to enterprises, with high sustainability and which take into account social impacts, as established by the 2020 Italian Budget Law.

This category includes also interventions and **investments on integrated water systems**[10], which, together with the management component of water supply and proper distribution (which is relevant for the environmental protection category), envisage a significant share related to wastewater treatment. Information on the precise distinction of these two components within the expenditure is often lacking or still difficult to find. In these cases, it was decided to allocate the expenditure for these measures equally between categories 4 and 5.

On the basis of the expenditure made in the 2018-2021 four-year period, it was therefore possible to group the interventions into four main strands:

- Combating marine pollution;
- Plans for environmental recovery and integrated waste cycle;
- Water purification interventions;
- De-pollution and improvement of air quality.

Finally, this category does not include expenditure on the financing of incineration, landfill, waste-to-energy and desalination plants.

Allocation (EUR)	2018	2019	2020	2021	Total
Combating marine pollution	47,551,863	31,616,683	41,830,413	45,597,893	166,596,852
Plans for environmental recovery and integrated waste cycle	4,865,840	6,175,244	59,941,609	43,503,959	114,486,652
Water purification interventions	55,391,800	75,236,295	70,645,565	33,549,169	234,822,828
De-pollution and improvement of air quality	1,367,188	15,000	4,546,681	2,912,564	8,841,433

[10] These systems are present throughout the country. State funding has been directed to infrastructures in many regions (Abruzzo, Basilicata, Calabria, Sicily, Sardinia, Tuscany, Marche, Umbria, Piedmont, Liguria, Veneto, Friuli-Venezia Giulia, Emilia Romagna, Lombardy).

EU environmental goal	▪ Sustainable use and protection of water resources and the marine environment; ▪ Transition to a circular economy; ▪ Pollution prevention and control; ▪ Protection, enhancement and restoration of biodiversity, ecosystems and environmental services.
UN - Sustainable Development Goals	
Subcategories of eligible expenditure	**Combating marine pollution:** ▪ **Marine anti-pollution activities against hydrocarbons and toxic substances,** mainly regulated by Italian Law 979/82 containing "*Provisions for the defence of the sea*", which provides for the activation at national level of a system aimed at preventing and combating marine pollution, in compliance with the provisions of international conventions, to which Italy has adhered. ▪ **Anti-pollution services for the marine environment.** The measure aims at strengthening the protection of marine ecosystems also through training activities for people working in the tourism sector to promote environmentally sustainable activities, as well as theoretical and practical training of personnel to deal with the stranding of oil products on the coasts. ▪ **Programmes for monitoring marine systems** aimed at achieving the Good Environmental Status (GES) of the waters also through the environmental sustainability of the activities impacting on the marine environment. The monitoring activity is aimed at verifying the achievement of GES as well as the related environmental targets and the effectiveness of the measures identified. Projects are implemented through operational agreements between the Italian Ministry of Ecological Transition, the Institute for Environmental Protection and Research (ISPRA) and the Regional Agencies for Environmental Protection (ARPA). ▪ **Supervision and safety control activities, also of an environmental nature, of hydrocarbon exploration and production plants at sea,** also carried out by means of specific agreements with university bodies and other entities operating in the research sector (such as, for example, the CNR, the National Institute of Geophysics and Volcanology, Ricerca sul Sistema Energetico S.p.A.), as well as with the Headquarters of the Coast Guard Captaincies Corps in order to promote supervision and control activities of hydrocarbon exploration and production plants at sea. **Plans for environmental recovery and integrated waste cycle**: ▪ **Tax credit for asbestos abatement work.** The measure provides for a tax credit for companies that have carried out asbestos abatement work on assets and production facilities located in the territory of the State equal to 50 per cent of the expenses incurred for such work[11]. ▪ **Securing and remediation of areas included in Sites of National Interest** (*Siti di Interesse Nazionale*, S.I.N.)[12]. ▪ **Environmental compensation and reclamation initiatives in support of the integrated waste cycle and reclamation and/or securing of landfill sites.** This category includes securing and remediating the landfill site for solid urban waste (*Rifiuti Solidi Urbani*, R.S.U.) at Ca' Filissine in the municipality of Pescantina (Verona) and the

[11] Italian Law No. 221/2015 on "Provisions on environmental matters to promote green economy measures and limit the excessive use of natural resources", Article 56 "Provisions on asbestos abatement interventions".
[12] https://www.mite.gov.it/sites/default/files/bonifiche/presentazione_2020.pdf.

environmental compensation and remediation initiative in support of the integrated waste cycle of the Campania Region.

Water purification works:

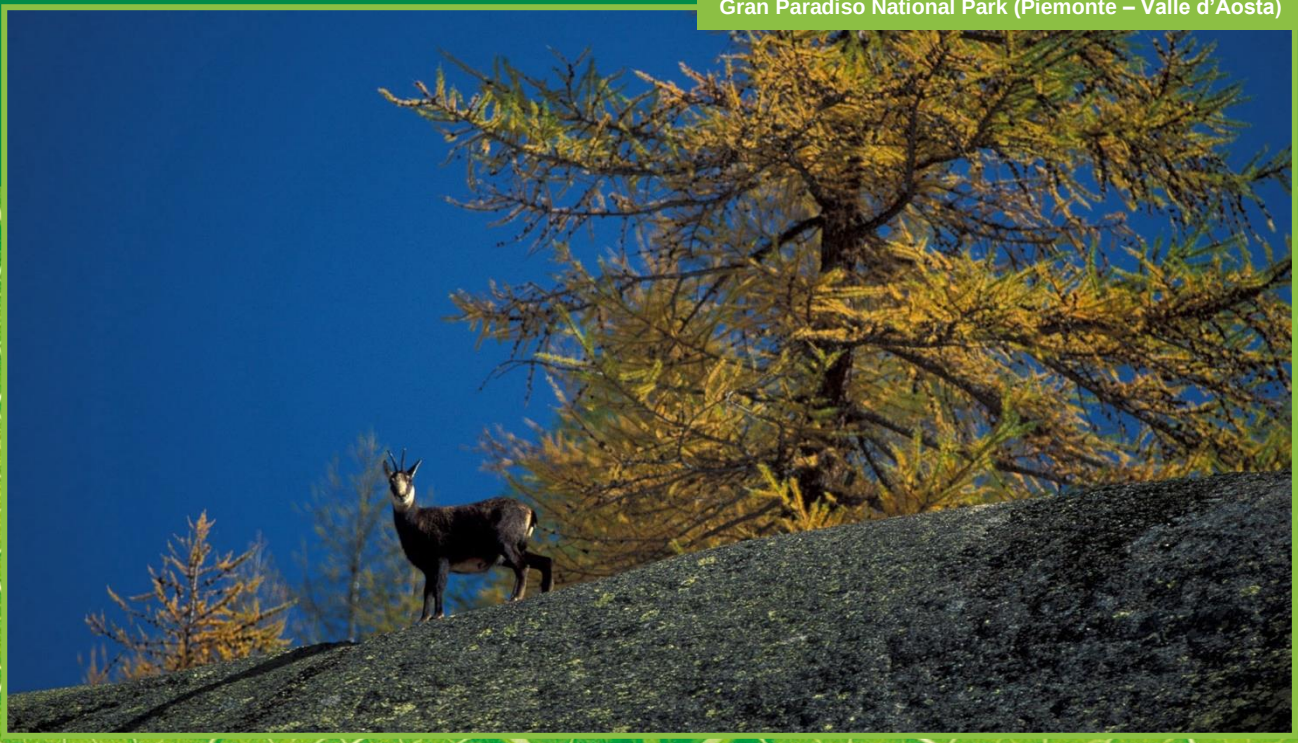
- **Adaptation of sewerage systems, collection, treatment and purification of waste water**. This includes:
  - work on the Crostolo torrent in Mancasale (RE), financed as part of the Extraordinary Sewage Collection Plan;
  - the construction of new sewerage and purification works for Lake Garda, involving the decommissioning of the sublacustrine pipeline and the subsequent construction of a new sewerage and purification scheme;
  - implementation and completion of works relating to the sewerage and urban waste water treatment systems for agglomerations (with a population of more than 2,000) subject to EU litigation for failure to comply with Directive 91/271/EEC and aimed at overcoming the infringement procedures initiated by the European Commission (51 sewerage and/or water treatment works planned and financed);
  - within the integrated water systems in several regions, the share relating to the construction and upgrading and optimisation of sewage treatment plants.
- **Protection of water and integrated management of water resources.** This includes transfers for the construction of Cr(VI) treatment plants and plants for the reduction, filtration and removal of hexavalent chromium in drinking water.
- **Interventions to clean up groundwater from perfluoroalkyl substances (PFAS).** In 2018, a state of emergency was declared in relation to the contamination of groundwater by PFAS substances in the territories of the provinces of Vicenza, Verona and Padua and the PFAS Commissioner was appointed with the task of preparing and implementing a "plan of emergency interventions". In implementation of this plan, seven emergency measures were launched, of which four are currently being implemented and three are at the planning stage.

De-pollution and improvement of air quality:

- **"Special Networks" collaboration agreement**. Collaboration agreement between the Italian Ministry of Ecology, the CNR - Institute on Atmospheric Pollution (CNR-IIA), ENEA and the Italian National Institute of Health, pursuant to Italian Legislative Decree 155/200. The agreement is aimed at starting up "*special*" air quality monitoring networks in order to collect additional information with respect to those already regularly obtained by the regional monitoring networks (such as the chemical specification of particulate matter, mercury concentrations and depositions, PAH and metal depositions, ozone precursors and concentrations of other PAHs in addition to benzo(a)pyrene) with the ultimate objective of making the national monitoring network compliant with the provisions of national and European sector legislation[13].
- **Purchase and installation of dedicated cameras for road traffic control in the Po Valley regions**. The measures were prepared as part of the "new programme agreement for the coordinated and joint adoption of measures to improve air quality", which involved the Regions of Emilia-Romagna, Lombardy, Piedmont and Veneto. The measures included limiting the circulation of the most polluting diesel vehicles, as well as providing incentives to replace the most polluting vehicles in an area, such as the Po Valley basin, which is highly critical to the environment and where more than 23 million people (40% of the Italian population) live.

[13] http://www.retispeciali.it/.

5. Protection of the environment and biological diversity



Gran Paradiso National Park (Piemonte – Valle d'Aosta)

5 Protection of the environment and biological diversity

The fundamental importance of preserving and protecting biodiversity is one of the pillars of the European Green Deal. The main and now well-known direct causes of biodiversity loss – land consumption, hydrogeological instability, overexploitation of marine resources and climate change – show just how endangered our living environment is. Indeed, natural resources and the number of species at risk of extinction has never been so high in the history of mankind: from the early 1980s to the present day, the planet's wildlife has been reduced by 60% as a result of human activities, and almost three quarters of the earth's surface has undergone profound alterations, partly due to climate change. Thanks to its geographical location in the centre of the Mediterranean basin, Italy enjoys a rich and precious diversity of animal and plant species, which are subject to real and pressing threats. In this sense, the preservation of nature, through the protection and restoration of wetlands, the sustainable management of marine areas and protected natural areas, becomes crucial for the reduction of polluting and climate-changing emissions and the adaptation to climate change.

Marine protected area – Carbonara (Cagliari – Sardegna)

Allocation (EUR)	2018	2019	2020	2021	Total
MO.S.E. and protection of the Venetian lagoon	213,210,000	37,698,614	56,857,170	53,943,836	**361,709,619**
Water infrastructures	65,073,683	120,560,187	69,739,718	196,823,664	**452,197,252**
Marine Protected Areas, National Parks and State Nature Reserves	77,795,295	76,352,491	72,867,609	421,398	**227,436,794**
Soil protection and action against hydrogeological instability	166,659,809	203,011,801	312,546,208	312,505,629	**994,723,447**

EU environmental goal	▪ Adaptation to climate change; ▪ Sustainable use and protection of water resources and the marine environment; ▪ Protection, enhancement and restoration of biodiversity, ecosystems and environmental services; ▪ Protection of the environment and biodiversity.
UN - Sustainable Development Goals	
Subcategories of eligible expenditure subject to allocation	Expenditure on the following programmes and/or projects. **MO.S.E. and protection of the Venetian lagoon[14]:** The project MO.S.E. was created to address and solve the environmental problems of the Venetian lagoon through: ▪ interventions for the morphological recovery of the lagoon; ▪ interventions to halt degradation; ▪ interventions for the defence from the sea during high waters; ▪ interventions to isolate the lagoon from the sea and thus achieve complete protection of built-up areas from flooding. Overall, these measures aim at preserving the lagoon environment and have been studied in a unified and coordinated manner by adopting solutions capable of contributing to environmental improvement. This approach governed the entire process of studying, selecting and finally developing the design of the flood defence barriers. The objective of installing barriers is to isolate the lagoon from the sea in adverse marine weather situations; the solutions adopted are the result of numerous studies and research aimed at selecting the most compatible options with the surrounding environment. This method was adopted for the study of the types of sluice gates, for the positioning of the barriers, for their configuration, for the systems for moving the barriers and for the definition of the decision-making procedures. For each alternative, the effects on hydraulics and on lagoon and coastal morphology, water quality, existing ecosystems in the intervention areas, commercial and industrial ports, fishing, recreation, emergency vessels, safety and reliability of construction methods were examined. Innovative solutions have thus been identified, with the choice of steel gates hinged to the foundation structures; all the systems are located in areas that are never reached by water and all the metal parts can be reached for maintenance work, drawn up on the basis of detailed maintenance plans, which also include the possibility of replacement where necessary. Finally, redundancy of the systems has been introduced, with their automatic management, to ensure the operation of the system even in the event of a failure. **Water infrastructures:** Expenditures allocated to mitigation of drought-related damages and to promote the upgrading and adaptation of water infrastructures, also in order to increase the resilience of water systems to climate change and reduce the dispersion of water resources. In particular, significant resources have been earmarked for the improvement and upgrading of the country's water infrastructure as part of:

[14] Also for this expenditure, the amounts included are lower than those communicated in September in the initial allocation of the proceeds of the first issue to State budget disbursements. In fact, part of the latter corresponded to the amortisation instalments of mortgages granted for this investment by the State. On the other hand, it turned out that the actual disbursements were less significant because the work had reached a more advanced stage of completion than the corresponding amortisation schedule. For this reason, the most significant amount relates to the first year of the period considered (2018).

- integrated water systems, part of which is intended for purification purposes[15];
- improvement and upgrading of the aqueduct network;
- collection and distribution of drinking water;
- management of dams and minor reservoirs, which are essential to compensate for seasonal variations in water availability and for irrigation purposes.

More specifically, in the 2018-2021 period, significant interventions involved several areas in central Italy (e.g., Abruzzo and Molise), southern Italy (e.g., Campania, Puglia, Basilicata and Calabria) and the islands (e.g., Sicily and Sardinia).

Marine Protected Areas, National Parks and State Nature Reserves:
Faced with a constant increase in pressures on biodiversity, **National Parks**, **State Nature Reserves** and **Marine Protected Areas** (MPAs) are an important element for the conservation and protection of environments of greater naturalistic value. In the last 10 years, Italy has strengthened actions aimed at the conservation of these areas through the identification and legislative provision of new territorial areas, both on land and at sea, worthy of protection, addressing and increasing actions aimed at their conservation, as well as through the allocation of specific items of expenditure in the State budge, in a transversal way, to the whole system of national protected areas.

- **Resources earmarked for operating expenditures,** as well as costs for staff assigned to national protected areas, such as the current 24 National Park, 29 Marine Protected Areas, and 2 underwater parks of Baia e Gaiola.
- **Interventions aimed at building and/or restoring dry stone walls.** Dry-stone walls are a powerful tool against erosion phenomena. They are the guardians of traditional local agriculture, and therefore of traditional cultivation and building techniques. These structures are a landscape element of particular beauty and significance, whose global importance has been recognised by UNESCO. This recognition involves Cinque Terre, the Amalfi Coast and Pantelleria. The priority is the mitigation of hydrogeological instability and the maintenance of habitats of particular interest for biodiversity (e.g., habitats of life and refuge for lichens, reptiles, birds, invertebrates and amphibians), ensuring the maintenance of the land.
- **Interventions aimed at making the protected areas accessible through the enhancement, strengthening and maintenance of the path network.** These interventions are an activity of primary importance for the national protected areas and for their sustainable use also through a correct and governed access to the protected areas. The intervention allows an up-to-date mapping of the network of paths and a detailed knowledge of their condition, favouring the necessary activities of maintenance and possible strengthening.
- **Investments in MPAs** aimed at preserving the natural heritage and biodiversity of protected marine environments, mainly refer to:
  - the extraordinary maintenance and/or restoration of the signposts necessary to give precise knowledge of the delimitation and zoning of the protected area;
  - the implementation and/or restoration of mooring fields to protect the seabed;
  - the purchase and/or extraordinary maintenance of nautical and terrestrial means of service of the MPA;
  - purchase of equipment and instruments for the management, surveillance and scientific monitoring of the MPA;
  - dissemination, awareness and promotion activities.

Soil protection and action against hydrogeological instability:
In 2019, Italy approved the **National Plan for hydrogeological risk mitigation**, restoration and protection of the environmental resource, structured in the following areas of intervention: *i)* emergency measures; *ii)* prevention measures; *iii)* maintenance and restoration measures; *iv)* simplification measures; *v)* governance and organisational strengthening measures.

In order to implement this strategy, a **2019 Master Plan** and a **2020 Master Plan** were drawn up in which infrastructure projects and interventions were identified, differing in function and size, aimed at mitigating hydrogeological risk.

[15] Expenditure on the construction of integrated water systems, where part of the interventions are for purification purposes, has been split between category 4, sub-category "*water purification interventions*", and category 5, sub-category "*water infrastructures"*.

In order to verify the status of implementation of these plans, it is specified that the monitoring of the interventions related to the **2019 Master Plan** is carried out through the **KRONOS** system[16], whereas the **2020 Master Plan** uses the **ReNDiS** system[17].

[16] https://www.mite.gov.it/sites/default/files/archivio/allegati/POA/POA_FSC_guida_operativa_KRONOS_versione_aggiornata_10052021.pdf
[17] https://www.isprambiente.gov.it/it/progetti/cartella-progetti-in-corso/suolo-e-territorio-1/rendis-repertorio-nazionale-degli-interventi-per-la-difesa-del-suolo

6. Research

Icebreaking vessel “Laura Bassi” for oceanographic research
(copyright National Antarctic Research Program - PNRA)

6 Research

In the Italian government budget, a number of expenditure headings finance scientific research - especially basic research - which provides the substratum for wide-ranging knowledge and technology developments that are difficult to sustain by private parties cultivating sectoral interests. A significant part of this research expenditure relates to the study of environmental phenomena and problems, and the identification of technologies and projects to increase sustainability in this area.

Public research is often organised in permanent centres and institutes, and is carried out on an ongoing basis, although there is no lack of specific projects on which it can focus from time to time. Therefore, the related operating costs generally allow for the regular development of this type of activity.

Allocation (Euro)	2018	2019	2020	2021	Total
Contribution to ENEA	211,133,248	276,463,410	141,180,591	453,327,605	**1,082,104,854**
Contribution to the Euro-Mediterranean Centre for Climate Change	5,000,000	5,000,000	5,000,000	-	**15,000,000**
Participation in the ECMWF	5,226,913	5,741,456	6,037,263	-	**17,005,632**
ITER-DTT nuclear fusion project	-	-	10,000,000	-	**10,000,000**
Interventions to promote sustainable development	3,078,146	10,277,966	4,694,575	-	**18,050,687**
OGS contribution to support scientific research at the Antarctic base	13,000,000	-	4,000,000	-	**17,000,000**
Contribution to CNR-IRBIM: Anton Dohrn Zoological Station of Naples	-	2,000,000	-	-	**2,000,000**
Contribution to ISPRA	90,217,863	-	-	-	**90,217,863**

EU environmental goal	▪ All goals
UN - Sustainable Development Goals	
Subcategories of eligible expenditure subject to allocation	**ENEA** One of the subjects to which an ordinary contribution from the State is allocated is the **National Agency for New Technologies, Energy and Sustainable Economic Development** (**ENEA**) which is a public law body dedicated to research and technological innovation, as well as to the provision of advanced services to businesses, public administration and citizens in the fields of energy, environment and sustainable economic development, and which also acts as the National Agency for Energy Efficiency. ENEA's scientific research and technological development activities are carried out through wide-ranging competences, advanced plant and equipment infrastructures located almost

uniformly in the north, centre and south of the country at **9 Centres** and **5 Laboratories** of research.

The Research Centres include several areas of multidisciplinary scientific and technological expertise and give the Agency a speciality within the context of research bodies, but also the possibility of linking up with the territory in an interconnected manner, with a capacity to respond promptly and effectively to local problems, as demonstrated in various situations of natural disasters or environmental and territorial crises occurred in the country.

The strategic direction of activities is outlined according to **four areas of competence**, each of which reports to a department:

- Energy efficiency;
- Energy technologies;
- Fusion and nuclear technologies for nuclear safety;
- Sustainability of production and territorial systems.

More specific functions are entrusted to three **Technical Units**: the Radiation Protection Institute, the White Certificates Unit and the Antarctica Technical Unit.

All ENEA's activities fall within the framework of national legislation aimed at increasing resource efficiency and environmental protection, and many are also part of European and international cooperation initiatives. The four Departments, each within their respective spheres of competence, provide support to central and local government administration for an efficient implementation of the various plans and initiatives.

In particular, the **Department Energy Efficiency Unit** (DUEE) is engaged in the development of new energy efficiency methods, tools and products for industry, the tertiary sector and the residential sector. In particular, in the 2018-2021 four-year period, a platform of advanced and innovative services for local public administrations was created and made operational, through which assistance and technical-economic validation for integrated building energy requalification projects is provided. The DUEE is also involved in training, aimed both at the professional qualification of operators in the sector, but also extended to a wider audience, in order to create a correct energy awareness. In particular, it completed a training and information plan in the 2018-2020 three-year period.

The **Department of Energy Technologies** (DTE) carries out research and technological development in the fields of renewable energy sources, energy efficiency technologies and end-use of energy. In particular, during the period under review, research focused on: new types of semi-transparent solar cells; technologies for the reliable control of combined renewable-accumulation systems; innovations in the area of concentrating solar power, with the patenting of a high-efficiency linear cavity receiver up to 700°C; the study of innovative gas/steam systems, the testing of a prototype - already realised at the Casaccia Centre - of new turbines and other innovative components of parabolic solar disk technology; advanced heat exchange technologies and innovative heat pumps; fast-charging systems for electric mobility (both public and private); technologies for the decarbonisation of fossil fuels; production of chemicals and fuels from CO_2.
Another line of research concerned activities on bioenergy, biorefinery and green chemistry, with a particular emphasis on the conversion of biomass from thistle and guayule crops into sugars suitable for the production of green chemicals, and the production on a pre-industrial scale of second-generation sugars, lignin and hemicellulose from softwood biomass and residual straw for the production of synthetic intermediates for the chemical industry. Work has also focused on improvements in processes for the production of ethanol for glycerol fuel, innovative anaerobic digestion processes with high conversion efficiency for the production of biogas/biomethane from non-conventional residual biomass, and the development of bio-composition materials for construction.

The **Department of Sustainability of Production and Territorial Systems** (SSPT) carries out activities in the fields of new production and consumption systems based on a sustainable supply and use of resources, reduction/elimination of emissions and related impacts, land management, including marine-coastal areas, and mitigation of hydrogeological and seismic risks.
The lines of activity in these areas have been aimed at developing new sustainable economic models, as well as actions to combat climate change (also in implementation of the Paris Agreement, including the transfer of appropriate methodologies and technologies to developing countries) and mitigating the negative effects of natural and man-made hazards. In particular, during the period under review, 11 working groups were activated, which developed 20 integrated project proposals for the efficient use of resources and closing cycles, as well as

methods, models and technologies for: health protection, circular economy, land safety, material processes for sustainability, reduction of anthropogenic impacts and natural risks, protection and enhancement of land and natural capital, biotechnology and agro-industry. A scientific-technological hub has also been set up to support the production system, creating a distributed platform aimed at the promotion of industrial and civil waste and waste water, and the recovery and recycling of high-value and secondary raw materials, as well as the enhancement of agro-industrial systems, with a focus on biotechnology and traceability.

The **Department of Fusion and Nuclear Safety Technologies** (FSN) has as its mission the development of nuclear technologies and ionising and non-ionising radiation. The sectors are as follows: *(i)* nuclear fusion; *(ii)* nuclear applications; *(iii)* nuclear safety; *(iv)* ionising and non-ionising radiation applications. In all these areas, the FSN is engaged in technology transfer to industry and, in cooperation with universities, in education and training. In addition, the department acts as the Primary Metrological Institute in the field of ionising radiation, maintaining and developing sample measurement equipment in line with internationally recommended standards.

Other ENEA activities in the context of **international agreements** are also relevant, among which stands out the activity carried out by the Antarctica Technical Unit (**Unità Tecnica Antartide**), which organizes and implements, as executive body for the logistic aspects, the Italian Expeditions under the National Programme of research in Antarctica, mainly consisting in the planning, realization and management of the activities in operational zone, material sourcing, as well as maintenance of the equipment and of the scientific instruments installed on the Italian Base in Antarctica (*Mario Zucchelli Station*) and on the Italian-French Base Concordia.

Contribution to the Euro-Mediterranean Centre for Climate Change

The **Euro-Mediterranean Centre on Climate Change (CMCC)**[18] is a public research organisation whose mission is "*to investigate and model our climate system and its interactions with society and the environment to provide reliable, rigorous, and timely scientific results, stimulate sustainable growth, protect the environment, and to develop science driven adaptation and mitigation policies in a changing climate*". The CMCC draws on the extensive applied research experience of its members and institutional partners: National Institute of Geophysics and Volcanology , University of Salento, Italian Aerospace Research Centre, Ca' Foscari University of Venice, University of Sassari, University of Tuscia, Polytechnic of Milan, Resources for the future, University of Bologna.
CMCC is a member of the United Nations *Global Compact*[19] and collaborates with the best international centres specialised in advanced and applied climate research, with a portfolio of 411 projects, many of which are coordinated by CMCC, which uses the *SuperComputing Center* installed in Lecce in the "*Ecotekne*" University Campus. In particular, a new high-powered parallel scalar computing system called "*Zeus*" was installed in 2019, and in 2020 alone, 139 research proposals were submitted, of which 28 have already been funded and 37 are being evaluated.

Participation in the ECMWF

The **ECMWF (European Centre for Medium-Range Weather Forecasts**) is an intergovernmental organisation supported by 20 European member states and 14 cooperative states that aims to provide accurate global medium-term (up to 15 days) and seasonal weather forecasts for up to 12 months. The organisation is also characterised by the production of scientific and technical research aimed at improving these forecasts, as well as the collection and preservation of meteorological data. In the 2018-2021 reporting period, grants were made to **ECMWF** for participation in a number of projects, including: *Copernicus Climate data Store* (CDS), *Copernicus Emergency Management Service* (CEMS), Ocean *Re-Analysis System 5* (Ocean5), *S2S pilot*.

[18] http://www.cmcc.it
[19] The UN *Global Compact* is the world's largest strategic corporate citizenship initiative. It was born out of a desire to promote a sustainable global economy: one that respects human and labour rights, protects the environment and combats corruption (https://globalcompactnetwork.org/it/il-global-compact-ita/global-compact/introduzione.html).

ITER-DTT nuclear fusion project

In 2020, a funding of EUR 10 million was provided to the ENEA's **Department of Fusion and Nuclear Safety Technologies** (FSN) for research activities focused on the European ITER project within the programme managed by Eurofusion (a European consortium of which ENEA is a member) and on the new *DTT (Divertor Tokamk Test*) infrastructure.

Interventions to promote sustainable development

Grants to academic institutions, public and private research bodies, departments, institutes or similar, research organisations, consortia, inter-university consortia and foundations for research projects and training activities on environmental sustainability and sustainable development. Examples of resource allocation in the 2018-2020 period are: environmental sustainability research project to reduce climate-changing emissions (University of Perugia and Interuniversity Centre for Research on Pollution by Physical Agents); contributions to the Sustainable Development Foundation for the 2018 Green Economy States General initiative; research projects to support the implementation of the "SNSvS2 Call" National Strategy for Sustainable Development; support activities for the implementation, updating and revision of the National Strategy for Sustainable Development (University of Roma Tre).

OGS contribution to support scientific research at the Antarctic base

In the 2018-2021 reporting period, resources were spent on research programmes in the Arctic and Antarctic through special grants to the **National Institute of Oceanography and Experimental Geophysics (OGS**) and for the implementation of the aforementioned **Arctic Research Programme (PRA**). In particular, the OGS funding in 2019 bought and equipped the icebreaker ship *Laura Bassi*, which carried out the XXXV Antarctic campaign in the Ross Sea, which in a first phase enhanced the logistics of the Italian *Mario Zucchelli Station* and, in 2020, conducted substantial oceanographic research. Work was carried out on the *Laura Bassi* vessel to achieve the *Polar Code* certification, and the bilge water treatment system for the prevention of marine pollution (MARPOL) was implemented.

The scientific objectives pursued under the PRA cover five thematic areas: *(i)* quantitative understanding of the processes responsible for "*Arctic Amplification*"; *(ii)* characterisation of changes in the composition, dynamics, stability and vertical structure of the atmosphere and water column of the Arctic seas; *(iii)* changes in Arctic marine and terrestrial ecosystems; *(iv)* paleoclimatic reconstructions; *(v)* effects of climate and environmental changes on the well-being, health and safety of people living in the Arctic. These objectives have been pursued through calls for research projects and the support of measurement activities and the construction of new infrastructure and instrumentation, as well as the creation of a data infrastructure, support for higher education and **Italian participation into the Arctic Council** and other international organisations and programmes.

Contribution to CNR-IRBIM: Anton Dohrn Zoological Station of Naples

In 2019, a EUR 2 million grant was awarded to the **National Institute of Marine Biology and Biotechnology (Istituto Nazionale di Biologia e Biotecnologie marine)** in favour of **the Anton Dohrn Zoological Station of Naples (SZN)**, enabling an investment in upgrading, modernising and improving energy efficiency, expanding and improving the operating facilities of the Naples aquarium, a research infrastructure for the breeding and welfare of marine organisms, as well as upgrading the headquarters in Naples and the sea turtle recovery and study centre headquarters in Portici, and purchasing various scientific equipment and facilities.

ISPRA

The **Italian Institute for Environmental Protection and Research (ISPRA**) performs technical and scientific functions, both directly and in support of the Ministry of Ecological Transition, for the most effective planning and implementation of national environmental policies and for the sustainability of pressures on the environment.

The Institute carries out research, experimentation and control, monitoring, evaluation, inspection, technical and scientific assistance, strategic consultancy, environmental information management and environmental training, including post-graduate training. In these

areas it produces scenarios, reports, analyses and studies, working in constant liaison and collaborating with the many scientific bodies in the sector (other Public research bodies, scientific societies, universities, etc.). This activity is carried out by working with similar EU and international institutions and by ensuring the national transmission of environmental data in compliance with EU environmental legislation. ISPRA is responsible for the technical coordination of the **National System for the Protection of the Environment** (SNPA), implemented in cooperation with a network of the environmental protection agencies of the regions and autonomous provinces of Trento and Bolzano.

ISPRA also carries out environmental monitoring and assessment activities to collect data and evidence on the state of the Italian environment. The collection of data and evidence is carried out by the **Agencies** part of the SNPA, which, with their widespread presence throughout Italy, are able to take numerous samples and carry out laboratory analyses, whose results they communicate to ISPRA. Other data are collected by means of observations from within the **Copernicus Programme**.
Of particular note is ISPRA's certification activity, which covers 3 areas accredited by the Single National Accreditation Body appointed by the Italian government (**Accredia**):

- The Metrology Area is recognised as an accredited testing laboratory for carrying out, in accordance with uni **CEI EN ISO/IEC 17025:2018** standard (general requirements for the competence of testing and calibration laboratories), 21 tests for the determination of chemical and physical parameters on surface and waste water, in ambient air, in synthetic gas mixtures, in $PM_{2.5}$ particulate matter deposited on air sampling filters and on soil and sediment;
- The Metrology Area recognised as an accredited producer of certified reference materials in soil/sediment environmental matrix (CRM), in accordance with **CEI EN ISO 17034:2017** uni standard (General requirements for the competence of reference material producers);
- The Metrology Area recognised as an organiser of interlaboratory proficiency testing, in accordance with **CEI EN ISO/IEC 17043:2010** uni standard (Conformity assessment - general requirements for interlaboratory proficiency testing) for PM_{10} and $PM_{2.5}$ in ambient air, nitrogen oxides and ozone in purified ambient air, anions and cations in aqueous matrix, metals in soil and sediments, toxicity assessment with ecotoxicological tests on aqueous matrix and taxonomic recognition on slides of benthic diatoms. The latter accreditation enables ISPRA to assess the performance of SNPA laboratories, thus ensuring the quality and comparability of national environmental analytical data. Audits carried out for this purpose during the reporting period confirmed that the results of ARPA laboratories are rigorous and reliable[20].

[20] https://www.isprambiente.gov.it/it/attivita/CN-LAB/aree/area-metrologia/confronti-interlaboratorio.

Part II. Environmental impact assessment of green projects

1 Renewable sources for production of electrical and thermal energy

1.1 Reporting and impact analysis of tax expenditures for electricity and heat production from renewable sources

Description of the measure

The Consolidated Act (*Testo Unico Accise*) of the legislative provisions concerning taxes on production and consumption and related criminal and administrative sanctions, approved by the Italian Legislative Decree No. 504 of 26 October 1995 (hereinafter referred to as TUA) provides, in Article 52, paragraph 3, letter b) that electricity produced by plants operated from renewable sources pursuant to the applicable legislation, with available power greater than 20 kW, consumed by self-production companies in premises and places other than homes, is exempt from excise duty.

This exemption was included in the TUA by the Italian Legislative Decree No. 26 of 2 February 2007, which transposed the provisions of the Directive 2003/96/EC of 27 October 2003, whose Article 15 provides that, without prejudice to other Community provisions, Member States may apply, under fiscal control, total or partial exemptions or reductions in the level of taxation to electricity of solar, wind, wave, tidal or geothermal origin, of hydraulic origin produced in hydroelectric plants, generated from biomass or products obtained from biomass, from methane emitted from abandoned coal mines and from fuel cells.

In particular, the Directive 2003/96/EC, while allowing Member States the necessary flexibility to define and implement policies tailored to their national context, recognises that taxation of energy products and, where appropriate, electricity is one of the instruments available to achieve the objectives of the Kyoto Protocol, ratified by Italy as a party to the United Nations Framework Convention on Climate Change.

However, it should be pointed out that electricity production plants powered by renewable energy sources also benefit from other incentives, governed by Ministerial Decree of 7 April 2019, which are provided and managed by GSE.

This decree classifies the plants eligible for incentives into four groups according to type, renewable energy source and category of intervention:

- **Group A**: includes:
  - "on-shore" wind plants of new construction, complete reconstruction, reactivation or upgrading;
  - photovoltaics of new construction.
- **Group A-2**: includes newly built photovoltaic systems whose modules are installed to replace roofs of buildings and farm buildings on which asbestos or eternit has been completely removed.
- **Group B**: includes:
  - hydroelectric plants of new construction, complete reconstruction (excluding plants on aqueducts), reactivation or upgrading;
  - gases plants, with residual from new, reactivated or upgraded sewage treatment processes.
- **Group C**: includes plants that have been totally or partially refurbished:
  - On-shore wind plants

- Hydroelectric plants
- Gas plants, with residual gases from purification processes.

Impact analysis

The table shows some *performance* indicators concerning the measure. In particular, the declarations of electricity consumption submitted to the Customs and Monopolies Agency show the quantities of electricity produced by plants operated from renewable sources, in accordance with the relevant legislation in force, with available power greater than 20 kW, consumed by self-production companies in premises and places other than homes, which have benefited from the exemption. The total number of such plants was provided by the GSE.

Table 1 - Performance indicators

Performance indicators	Year		
	2018	2019	2020
Number of utilities	77,826	80,266	82,951
Quantities of electrical energy (kWh)	4,928,967,897	9,860,954,468	4,336,893,772

Ex-post environmental impact assessment indicator

For the purpose of assessing the environmental performance linked to the use of the proceeds of the green bonds, the indicator used is the reduction expressed in tonnes of CO_2 emissions determined by the production of electricity with plants powered by renewable sources, with available power greater than 20 kW, consumed by self-generation companies in premises and places other than homes.

The methodology adopted in this paper, in line with the work of EEA[21] (2015), is based on the assumption that, in the absence of incentives, the amount of electricity produced from renewable sources would have been produced from the usual fossil mix, resulting in the release of CO_2 into the environment. Avoided emissions are then calculated in terms of the product of electricity generated from renewable sources and the average annual emission factor from fossil sources.

In ISPRA's 2021 report[22], entitled "*Indicators of efficiency and decarbonisation of the national electricity system and the electricity sector*", the annual emission factor (expressed in gCO_2/kWh) for gross national thermoelectric production is reported as 495.0 gCO_2/kWh in 2018, 462.2 gCO_2/kWh in 2019, and 449.1 gCO_2/kWh in 2020. These annual emission factors are calculated excluding electricity produced from biodegradable waste, biogas and biomass of plant origin. These values, multiplied by the quantities of electricity produced by plants benefitting from the exemption referred to in Art. 52, paragraph 3, letter b) of the TUA, taken from the declarations of electricity consumption for the same year, allows to calculate CO_2 emissions that have not been generated as a result of the use of electricity produced by plants powered by renewable sources, with available power greater than 20 kW, consumed by self-production companies in premises and places other than homes.

Therefore, assuming that renewable sources have a zero emission balance and that, in the absence of energy produced from renewable sources, electricity produced from fossil sources would have been used, CO_2 emissions avoided for the years are estimated (see table 2 below).

[21] EEA - European Environment Agency https://www.eea.europa.eu.
[22] https://www.isprambiente.gov.it/it/archivio/notizie-e-novita-normative/notizie-ispra/2021/pubblicazioni/rapporti/indicatori-di-efficienza-e-decarbonizzazione-del-sistema-energetico-nazionale-e-del-settore-elettrico

Table 2 - Environmental impact assessment

Environmental impact indicator	Year		
	2018	2019	2020
Avoided emissions ($t.CO_2$)	2,439,839	4,557,733	1,947,698

2 Energy Efficiency

2.1 Reporting and impact analysis of tax expenditures for energy efficiency works of buildings

Description of the measure

The tax relief, granted for expenses incurred for energy requalification interventions in buildings of any cadastral category, including rural buildings, is aimed at improving the efficiency of existing buildings and the diffusion of upgrading interventions, also through the use of innovative technologies. The deduction percentages vary depending on the year in which the work was carried out and whether it concerns a single property unit or condominium buildings. Specifically, the total amount of the deduction, to be spread over 10 equal annual instalments, in 2019 was determined according to the following percentages:

- 55% of expenses incurred until 5 June 2013;
- 65% of expenditure incurred from 6 June 2013 to 31 December 2019 for interventions on individual building units[23];
- 65% of the expenses incurred starting from 6 June 2013 to 31 December 2021 for interventions on the common parts of condominium buildings, and for those involving all the building units of which the individual condominium is composed[24];
- 65% of the expenses incurred from 1 January 2018 to 31 December 2019 for the purchase and installation of micro-cogenerators to replace systems that save at least 20% of primary energy, the replacement of winter air conditioning systems with systems equipped with hybrid appliances, and the purchase and installation of condensation air heaters.

Since 2017, additional deductions have been granted for expenses incurred between 1 January 2017 and 31 December 2021 by residents amounting to:

- 70%, if the interventions concern the building envelope with an incidence of more than 25% of the gross dispersing surface of the same building;
- 75%, for interventions aimed at improving winter and summer energy performance and achieving at least the average quality indicated in the decree of the Minister for Economic Development of 26 June 2015 (National guidelines for energy certification).

It should be noted that the 70% and 75% deductions for interventions on common parts increase if they are carried out in buildings belonging to the seismic zones rated 1, 2 or 3, and if they are aimed at reducing seismic risk. In particular, it is possible to benefit from a deduction of 80% if the works lead to a lower seismic risk class, and 85% in case of reduction of 2 or more risk classes.

[23] It is reduced to 50% if the expenses have been incurred starting from 1 January 2018 and are related to the purchase and installation of windows and frames, solar screens, replacement of winter air conditioning systems with systems equipped with condensing boilers rated at least class A, or with systems equipped with heat generators powered by combustible biomass. Condensing boilers are allowed to continue to benefit from the 65% deduction if they are equipped with advanced thermoregulation systems.

[24] Also in this case, the deduction is reduced to 50% for expenses incurred starting from 1 January 2018 concerning the purchase and installation of windows including frames, solar screens, or the replacement of winter air conditioning systems with systems equipped with condensing boilers rated at least class A, or with systems equipped with heat generators powered by combustible biomass.

Impact analysis

Table 3 shows some performance indicators concerning the measure, such as the number of interventions carried out during 2018 and the energy savings achieved. In particular, in 2018 they amount to 1,156 GWh/year and are associated with interventions that present the best cost-effectiveness (about 33% for the replacement of windows and doors and 28% for the insulation of floors and walls with a sustained cost of respectively 0.10 and 0.09 €/kWh of energy saved).

Table 3: Energy efficiency measures in 2018

Type of intervention	n.	%	€M	%	GWh/year	%	Useful life	€/kWh
Condominiums	477	0.14%	55,5	1.67%	18.3	1.58%	30	EUR 0.10
Global upgrading	2,674	0.80%	249	7.47%	72	6.20%	30	EUR 0.11
Envelop insulation	25,267	7.55%	901	27.05%	326	28.18%	30	EUR 0.09
Replacement of windows and doors	138,790	41.45%	1,072	32.18%	381	32.97%	30	EUR 0.10
Solar screens	70,791	21.05%	128	3.84%	14	1.22%	30	EUR 0.26
Solar panels for DHW	5,578	1.67%	36	1.09%	28	2.42%	15	EUR 0.09
Winter air conditioning	89,262	26.66%	873	26.20%	309	26.73%	15	EUR 0.20
Building automation	2,307	0.69%	17	0.50%	8	0.69%	10	EUR 0.19
Total	**335,146**	**100%**	**3,331**	**100%**	**1,156.3**	**100%**		

***Source**: Enea*

Ex-post environmental impact assessment indicator

In order to make the ex-post monitoring of the environmental performance of the measure in question easy to read, a further indicator, expressed in **tonnes of CO_2 avoided annually,** is proposed. This indicator has the advantage of making explicit the contribution of the measure in climate terms, without presenting particular complexities in terms of methodology and computation.

For the purpose of estimating the indicator, the emission data reported in the historical series of greenhouse gases published annually by ISPRA were used. In particular, ISPRA's Inventory Report reports a specific emission factor (expressed in $t.CO_2/TJ$) for emissions from the residential sector related to energy consumption.

This indicator, expressed in $t.CO_2$/year avoided, has been calibrated using ENEA data on energy savings, as shown in table 4 for the year 2018[25].

[25] The detailed calculation methodology is reported here: data reported by ISPRA (2021) were used: "National Inventory Report 2021" - in Tables 3.32 and 3.33 on greenhouse gas emissions and estimated energy consumption in TJ of the residential sector for the 1990-2019 historical series. Greenhouse gas emission and fuel combustion data in TeraJoules, subsequently converted to Terawatt hours, were considered for the years 2018 and 2019. The energy savings achieved as a result of the investment in energy refurbishment (for 2018 and 2019, 1,156.3 GWh and 1,253.9 GWh respectively) are multiplied by an emission factor determined by the ratio between CO_2 emissions from energy consumption in the residential sector and the amount of energy consumed. In order to make the calculation fully consistent in environmental terms, all emission sources in the residential sector have been considered: liquid, gaseous and biomass fuels.

Table 4: Avoided t.CO_2 emissions in 2018

ENEA	GWh savings 2018	Avoided t.CO_2 2018
Condominiums	18.3	4,485.41
Global upgrading	72.0	17,647.51
Envelop insulation	326.0	79,904.01
Replacement of windows and doors	381.0	93,384.75
Solar screens	14.0	3,431.46
Solar panels for DHW	28.0	6,862.92
Winter air conditioning	309.0	75,737.24
Building Automation	8.0	1,960.83
Total	1,156.3	283,414.1

As illustrated, in 2018 this measure helped to avoid the emission of more than 283 thousand tonnes of CO_2.

3 Transport

3.1 Support measure for rail freight transport (STFM)

The current regulatory framework (Article 1, paragraph 294, Italian Law No. 190 of 23 December 2014[26]) provides for a grant to each railway applying for a **contribution proportional to the train-km performed** on the National Railway Infrastructure (Infrastruttura Ferroviaria Nazionale, NFI) and within the limit of available resources, (EUR 100 million per year, **two separate contributions** aimed respectively at compensating *(i)* the **additional costs** that railway companies incur for the use of the infrastructure in the connections **from and to the south** and for the **ferrying of freight trains**, and *(ii)* part of the **external costs** that the railway mode allows to save on the entire national territory, compared to competing and more polluting transports.

Traffic volume and determination of contributions

The Ministry of Sustainable Infrastructure and Mobility has determined the allocation of the contribution among the various beneficiary railway companies, as per specified in Article 3 of Annex 2 of Executive Decree No. 16 of 7 April 2017[27]: contributions shall be granted both as **compensation for the additional costs for the use of the rail infrastructure**, incurred by rail transport but not by other, more polluting, modes of transport, and as partial **compensation for the lower external costs incurred compared with other, more polluting, modes of transport**.

To summarise:

- in 2018, against a total volume of reported rail freight traffic of approximately 46.9 million train-kilometre, a total contribution of EUR 99.905 million was paid out;
- in 2019, against a total volume of reported rail freight traffic of approximately 48.3 million train-kilometre, a total contribution of EUR 99.107 million was paid out.

Impact analysis and evaluation of the measure

The analysis of the impacts and the assessment of the effects of the measure on rail traffic were carried out in continuity with the methodology already adopted for the analyses of the 2015-2017 period.
The methodology used to estimate the impacts on rail traffic of the measure uses the particular structure of the measure based on a kilometric contribution granted to trains from/to the regions of the South and an additional one granted to all freight train routes on the national infrastructure. In particular, assuming that the elasticity of demand with respect to the contribution is uniform across all rail routes, and assuming

[26] The measure, introduced by Italian Law No. 190 of 23 December 2014, was authorised by the European Commission with the aforementioned Decision C(2016)8480 final for the years 2015, 2016, 2017, authorisation then extended to the years 2018 and 2019 with the European Commission Decision C(2017) 7279 final of 25.10.2017, and lastly to the years 2020, 2021 and 2022 by Decision C(2019) 8217 final of 15 November 2019.Article 47, paragraph 11-ter3, of Italian Decree-Law No. 50 of 24 April 2017, converted with amendments by Italian Law No. 96 of 21 June 2017, extended the measure for the 2018 - 2019 two-year period under the same conditions and modalities. Article 1, paragraph 297 of Italian Law No. 145 of 30 December 2018 extended the measure for the 2020 - 2022 three-year period under the same conditions and modalities defined by Interministerial Decree 566/2020.

[27] I. A unitary contribution of EUR 1.30/train-kilometre for rail freight services to/from the regions of Lazio, Abruzzo, Campania, Molise, Apulia, Calabria and Basilicata for 2018 and 2019;
II. A unitary contribution of EUR 1.83/train- kilometre for rail freight services to or from Sicily or Sardinia, and involving the ferrying of trains for 2018 and 2019;
III. A unitary contribution for all rail freight services carried out on the national rail infrastructure, in any case not exceeding the limit of EUR 2.50/train-kilometre and obtained by distributing the resources remaining from the budget allocation after granting the contributions referred to in the two previous points for the 2018 and 2019 period.

that, in the absence of contributions, the evolution of demand would have been homogeneous on all continental routes (i.e. with the exception of trains going to islands), it is possible to identify the impact of the "infrastructure" component of the measure in the growth differential between "southern" and "other regions" traffic.

Table 5 - Rail freight traffic volumes 2014-2019 in Italy by macro-region

Regions	2014	2015	2016	2017	2018	2019	Δ 2014-19
Islands	3.32	2.84	2.67	2.34	2.13	2.39	-28%
Southern (*)	12.06	13.72	14.65	15.13	15.33	16.18	+34%
Sub-Total (Islands + Southern)	**15.37**	**16.55**	**17.32**	**17.47**	**17.47**	**18.57**	**+21%**
Other	28.39	28.97	29.39	29.86	29.75	30.15	+6%
Total (Italy)	**43.76**	**45.52**	**46.70**	**47.33**	**47.22**	**48.73**	**+11%**

Note: (*) Abruzzo, Molise, Lazio, Campania, Puglia, Basilicata, Calabria. Values expressed in millions of "train-kilometre".
Source: 2018-2019 Report Year - Rail Freight Support Measure (STFM), Ministry of Sustainable Infrastructure and Mobility

Table 5 shows the kilometres travelled by freight trains broken down by macro-region, as identified in the measure.
In particular, for the trains "ferried to and from the islands" the incentive granted is made up of a specific and pre-determined component to compensate for the higher costs of infrastructure and ferrying and, in the scheme when fully operational, of an "environmental" component which is also the same in the other clusters and which varies from year to year depending on the residual resources available. For "southern" trains, i.e. with origin and/or destination in southern regions, in addition to the environmental component, the incentive consists of a specific and pre-determined component to compensate for extra infrastructure costs. For all other freight trains, i.e. those with origin and destination in other regions, the measure provides only for the "environmental" contribution.

Ultimately, by considering the contribution as a reduction in operating costs, **the elasticity of rail demand** with respect to operating costs can be **estimated**, i.e. the percentage change in demand induced by a contribution of one per cent of total operating costs:

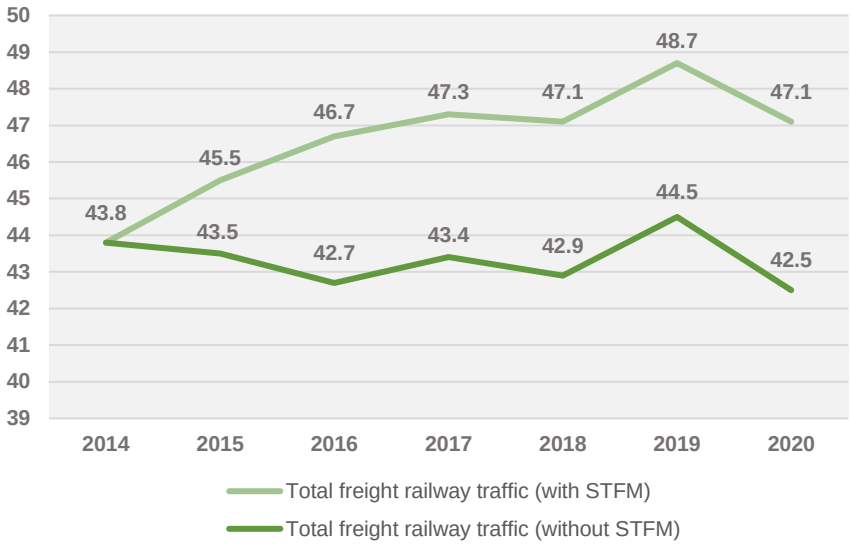
$$e = \frac{\Delta d \,/\, d}{C_{nm} \,/\, (C_E * d)}$$

$with$:

$\Delta d = train - kilometre\ induced\ by\ STFM$
$d = train - kilometre\ without\ STFM$
$C_{nm} = STFM\ contribution$
$C_E = operating\ costs\ of\ freight\ railway\ undertakings.$

The implementation of the adopted estimation methodologies shows that the measure would have produced an increase in rail traffic over the period 2015-2020 of a total of 22.7 million train-kilometre, of which 4.2 million for 2018 and 4.2 million for 2019, corresponding to an increase of 9.9% in train-kilometres in 2018 and 9.4% in 2019 (chart 1).

Chart 1 - STFM measure: impacts on traffic



Note: Values expressed in millions of "train-kilometre".
Source: 2018-2019 Report Year – Rail Freight Support Measure (STFM), Ministry of Sustainable Infrastructure and Mobility

Assuming that these effects are mainly due to a modal shift, rather than the induction of additional demand, it is also possible to estimate the reduction in road freight traffic induced by the measure.
Table 6 shows the data assumed for the conversion from train-kilometres to tonne-kilometres, and the corresponding figure for road freight traffic and, finally, the result in percentage terms. With the exception of the first year under transitional arrangements, the standard can be credited with a decrease in heavy road traffic of between 1.8% and 1.4%.

Table 6 - Impacts of the STFM measure in terms of reduction of road freight traffic

Impacts of the STFM	2014	2015	2016	2017	2018	2019	2020
Total freight railway traffic with the STFM [a]	43.8	45.5	46.7	47.3\	47.1	48.7	47.1
Total freight railway traffic without the STFM [a]	43.8	43.5	42.7	43.4	42.9	44.5	42.8
Impact of the STFM [a]	-	2.05	4.01	3.95	4.23	4.23	4.23
Impact of the STFM on Total freight railway traffic without the STFM (%)	-	4.7%	9.4%	9.1%	9.9%	9.5%	9.9%
Total freight road traffic [b]	117,813	116,820	112,639	119,687	124,915	137,986	128,218
Tonne of freight per train [c]	487.7	483.1	510.6	496.4	484.3	440.0	484.0
Million of tonne-kilometre subtract from freight road traffic	-	988	2,048	1,961	2,051	1,863	2,050
Freight road traffic reduction due to the STFM (%)	-	0.8%	1.8%	1.6%	1.6%	1.4%	1.6%
External cost reduction due to the STFM [d]	-	30.6	63.5	60.8	63.6	57.8	63.5

Note: (a) Values expressed in millions of train-kilometre. (b) Based on CNIT 2019-2020 data; values expressed in millions of tonne-kilometres. (c) Based on CNIT 2019-2020 data; the 2020 value is equal to the average value for the period 2014-2019. (d) Values expressed in millions of EUR. **Source**: RAM studies. 2018-2019 Report Year – Rail Freight Support Measure) (STFM), Ministry of Sustainable Infrastructure and Mobility.

Finally, using the average external costs per mode of transport in the EU28 as of 2016 reported in the *Handbook of external costs in transport 2019*, which report a differential between rail and road of 3.1 ¢€/t.-km, it is estimated that the modal *shift* attributable to the measure has resulted in lower external impacts totalling EUR 340 million in the 2015-2020 period, of which almost EUR 64 million in 2018 and almost EUR 58 million in 2019.

3.2 Infrastructure grants to FS

Description

The continuous growth of HS/HC services has led to a profound transformation in people's lifestyles and work and in mobility across the country. High-speed trains have reduced distances, with significant positive effects on the national economy (GDP and employment), the development of the transport system, tourism and the property market in urban centres. The HS/HC network has, in many cases, halved travel times, producing a modal shift from other modes of transport (e.g. road and air) with tangible benefits for the environment, linked to the reduction of CO_2 emitted into the atmosphere.

New high speed line Tortona-Genova "Terzo Valico"

"Voltri Brignole infrastructure upgrade", "Milano-Genova HS/HC line: Terzo Valico dei Giovi" and "Genova-Campasso upgrade" projects have been unified in a single project ("Genova and Terzo valico dei Giovi junction") with the new "Sblocca Cantieri (Unblocking construction sites)" Italian Law 55/19, in order to ensure the connection of the last mile between Terzo Valico and Porto Storico.
The economic progress programme, redefined after the unification of the interventions in the Single Project at Whole Life Cost amounts to EUR 7,461 million, from funding sources under 2020-2021 update of the 2017-2021 Programme contract signed between RFI and the Ministry of Sustainable Infrastructure and Mobility.

The benefits of the work

The implementation of the project will bring benefits for the transport of people and goods with a reduction in pollution. The transfer of a large share of traffic from road to rail, in line with European objectives, will give Ligurian ports a competitive advantage over those in northern Europe.
The significant reduction in the number of heavy-duty vehicles crossing the Apennines will lead to a reduction in greenhouse gas emissions of millions of tonnes, considering that rail transport is at least four-to-five times less polluting than road transport. Compared to road transport, there will be a 29% reduction in energy consumption and a 55% reduction in CO_2 emissions into the atmosphere.

Respect for the environment in the implementation of the work

The Terzo Valico project is designed and built to be fully integrated with the urban and suburban area, both during construction and operation. Particular attention has been paid to the location and design of the construction sites, which have been built and set up with unique and diversified characteristics based on their location and proximity to inhabited centres, in order to best integrate into the surrounding environment, in full respect of nature, the territory and local communities.
The implementation of the project, which is mainly underground, involves handling large volumes of excavated material (about 15 million m^3). Since these materials cannot be totally reused in the implementation of the project, they are used for the environmental upgrading of former abandoned quarries in the areas crossed by the railway line. In particular, the Terzo Valico Single Project provides for the upgrading of 12 disused quarry sites, which will therefore be returned to the community.

For the protection of workers and the environment, the environmental quality of the excavated material and the concentration of asbestos is checked by applying strict protocols defined by the competent bodies.
In order to verify the possible impacts of the project on the surrounding environment, the Construction Consortium (Consorzio di realizzazione, COCIV) monitors all the environmental components affected by the works. This monitoring is carried out by specialised companies, according to the procedures set out in the Environmental Monitoring project approved by the competent bodies, and the activities are constantly supervised by the Terzo Valico Environmental Observatory.

HS/HC Naples-Bari route

Within the framework of the new structure of trans-European corridors (TEN-T) defined by the European Commission on 19 October 2011, the development of the Naples-Bari route has been identified as a priority, which specifically falls within the *Core Network* - Scandinavia-Mediterranean Corridor (Scan-Med Corridor). Under the new structure, this corridor is one of the main transport arteries of the single European market, and its investments are intended to eliminate bottlenecks in the rail network and modernise its infrastructure and technology. The upgrading of the Naples-Bari route is the first major investment programme to extend the benefits of the HS system to southern regions.

The construction of the Scan-Med Corridor will connect the most important regions of the European Union from a socio-economic point of view, representing 48% of GDP and approximately 15% of the total population. According to the corridor's Work Plan, the construction of this major European infrastructure artery by 2030 will lead to a 30% increase in freight transported in Europe in terms of tonne-kilometres.

Various studies confirm that expanding rail transport services has a **positive impact on the environment** by **reducing road traffic volumes**. The rail mode is the one that, on average, generates the lowest external costs compared to all other modes, in terms of both passenger and freight traffic, even to a greater extent when considering trains with electric drive.

As part of the Cost-Benefit Analysis (CBA) of the Naples-Bari route, specific metrics were drawn up to assess and quantify the **externalities** associated with the project, which are more widely recognised in the transport sector, including: **air pollution** (local emissions), **effects on climate change** (reduction of greenhouse gas emissions), **noise pollution**[28]. In addition, an assessment based on sustainability criteria was drawn up and is detailed below.

Air pollution: reducing emissions at local level

Methodology adopted and results

The impacts resulting from the emissions of the following types of pollutants into the atmosphere due to combustion processes of road vehicles are considered: Nitrogen oxides (NO_x); Sulphur dioxide (SO_2); Non-methane volatile organic compounds (NMVOC); Particulate matter ($PM_{2.5}$).

[28] For identifying these externalities related to the different modes of transport, reference was made to the methodology and values suggested in: "Update of the Handbook on External Costs of Transport - DG MOVE, 2014" updating the previous "Handbook on estimation of external costs in the transport sector-IMPACT" study (CE Delft et Al for EC DG TREN,2008) referring also to the values calculated in "External Costs of Transport in Europe" (CE Delft, Infras, Fraunhofer ISI, 2011); Guidelines for assessing investments in public works – MIT 2016".

For the annual calculation of pollution externalities, reference was made to the emissions, expressed in tonnes/vehicle.km, generated by the circulation of road vehicles and applying the unit cost per tonne emitted, according to the following formula:

$$\left(emissions\ in\ tonnes\ per\ km\ *\ \frac{total\ vehicles}{km\ driven}\right) *\ \frac{cost\ €}{tonne\ emitted}$$

For the emission factors, expressed in grams per vehicle-km, reference was made to the database "Average emission factors of road transport in Italy 2015", estimated by ISPRA[29] on the basis of the "EMEP/EEA air pollutant emission inventory guidebook 2016". The estimate of average unit emissions (per vehicle.km) takes into account the gradual introduction of less polluting vehicles. In particular, representative emission values have been estimated for "non-urban" routes, considering the vehicle fleet circulating in the Campania and Puglia regions and its evolution starting from the 2010-2016 consistency data from ACI sources, and also:

- for passenger car traffic, the type of fuel used (petrol, diesel and other environmentally friendly fuels) and engine size were taken into account;
- with regard to road freight transport, the values associated with 16-32 tonne diesel "HGV" vehicles were taken into account, which is the category most representative of the Italian circulating fleet in relation to the average load assumed in this analysis.

The following average values were calculated for 2024 and 2047, and a linear evolution was assumed for the intermediate years (Table 7)

Table 7 - Average emission factors for road mode

Vehicle Type	Year	Emission factors			
		SO_2	NO_x	NMVOC	$PM_{2,5}$
Car	2024	0.0005	0.2982	0.0273	0.0115
	2047	0.0005	0.1714	0.0178	0.0010
Heavy-duty vehicle (HGV)	2024	0.0027	2.8140	0.1038	0.0603
	2047	0.0025	1.3549	0.0560	0.0269

Note: Values expressed in expressed in grams per vehicle-kilometres (g.v.km).

The average emissions in grams per vehicle-kilometres (g.v.km) per passenger car and heavy-duty vehicle have been multiplied by the estimated decreasing changes in vehicle-km on the road, thus obtaining the total annual emissions that can be avoided thanks to the activation of the new railway work and the consequent modal diversion from road to rail.

[29] ISPRA, a public research body under the supervision of the Ministry of the Environment and the Protection of Land and Sea, produces an annual national inventory of atmospheric emissions as a tool for verifying the commitments undertaken at international level on the protection of the atmospheric environment, such as the Framework Convention on Climate Change (UNFCCC), the Kyoto Protocol, the Geneva Convention on Transboundary Air Pollution (UNECE-CLRTAP) and the European Directives on the limitation of emissions.

The following table shows "avoided" emissions in terms of total tonnes for each type of pollutant, indicating the point figure for some years and the cumulative figure for the entire 2023-2047 time frame[30]

Table 8 - "Avoided" pollutant emissions

Vehicle Type	Period	Total tonnes per period			
		SO_2	NO_x	NMVOC	$PM_{2,5}$
Car	2026	-0.6	-320.4	-29.5	-11.8
	2035	-0.6	-265.0	-25.4	-7.2
	2047	-0.6	-191.2	-19.9	-1.1
	2023-2047	**-12.4**	**-5,683.4**	**-548.4**	**-144.3**
Heavy-duty vehicle (HGV)	2026	-0.1	-143.4	-5.3	-3.1
	2035	-0.1	-113.0	-4.3	-2.4
	2047	-0.1	-72.3	-3.0	-1.4
	2023-2047	**-0.3**	**-2,372.7**	**-91.4**	**-49.5**
Total 2023-2047		**-15.4**	**-8,056.1**	**-639.8**	**-193.8**

Finally, the relative cost savings from 2023 to 2047 were calculated: to this end, reference was made to the unit values per tonne emitted for Italy, from the "*Update of the Handbook on External Costs of Transport, Final Report, 2014 - DG MOVE*" and represented in the table.

Table 9 - Polluting costs: unitary values per tonne emitted

Emission factors	Unitary pollution Cost
NO_x	10,824
SO_2	9,875
NMVOC	1,242
$PM_{2,5}$ (average of non-urban area)	37,342

Note: Values expressed in €$_{2010}$ per tonne emitted.

Unitary values have been updated to 2018 EUR values and indexed over time according to the evolution of GDP per capita at constant prices until 2047.

Reducing greenhouse gas emissions

Methodology adopted and results

The so-called greenhouse effect is mainly caused by emissions of carbon dioxide (CO_2), as well as methane (CH_4) and nitrous oxide (N_2O).

[30] For the year 2023, the unitary emission factors estimated in 2024 shall apply.

For the estimation of the emission factors of cars, reference was made to Regulation (EC) No. 333/2014 which, by amending Regulation (EC) No. 443/2009, sets a target of 95 gCO_2/vehicle.km for the average level of emissions for new car registrations starting from 2020, a deadline later extended by one year. Considering the structure of the vehicle fleet in the regions covered by the route in 2016 and its evolution over the years, it is possible to estimate an average emission value of 138 g.v.km in 2024 and the achievement of the target value, as an average for the entire vehicle fleet, in 2035.
In order to consider the evolution of the emission factors over time, a linear interpolation was carried out up to that year, while for the following years a decrease in unit emissions of 0.5% per year was assumed.

Table 10 - Greenhouse gas emission unitary factors - passenger car

2016	2024	2035	Post-2035
170 g.v.km	138 g.v.km	95 g.v.km	-0.5% per year

Notes: This value is considered consistent with the data suggested in "*Update of the Handbook on External Costs of Transport, Final Report, 2014 - DG MOVE*", based on the TREMOVE 3.2.2 study, which for the car mode indicates an average value of 189 gCO_2e/vehicle-km.

For the estimation of the emission factors of HGVs, expressed in gCO_2e/vehicle-km, reference was made to the data suggested in "*Update of the Handbook on External Costs of Transport, Final Report, 2014 - DG MOVE*"[31], in particular considering the suggested emission value for heavy-duty vehicles of the HGV category 16-32 t., equal to 715 g CO_2e/vehicle-km (value in 2008)[32].
On the basis of the strategies outlined in the European framework[33] the forward-looking figure has been estimated considering a 20% reduction by 2030 of the TREMOVE values measured in 2008. This results in the following unit values:

Table 11 - Greenhouse gas emission uniform factors - heavy-duty vehicle

2008	2026	2030	Post-2031
715 g.v.km	598 g.v.km	572 g.v.km	-0.5% per year

The emissions g/vkm per passenger car and heavy-duty vehicle were multiplied by the decrease in vehicle.km on the road resulting from the traffic scenarios, thus determining the total annual avoidable emissions due to the activation of the new railway and the consequent modal diversion.
The following table summarises the point values concerning certain years and the overall figure for the entire 2023-2047 time frame.

[31] The emission factors presented are based on data from the TREMOVE 3.2.2 model.
[32] This category is the most representative of the average type of heavy-duty vehicles assumed in this analysis.
[33] COM/2014/0285 final "Strategy for reducing Heavy-Duty Vehicles fuel consumption and CO_2 emissions".

Table 12 - "Avoided" greenhouse gas emissions

Vehicle Type	Period	CO_2 Emissions (tonnes)
Car	2026	-145,610
	2035	-105,979
	2047	-99,792
	2023-2047	**-2,515,196**
Heavy-duty vehicle (HGV)	2026	-31,912
	2035	-29,769
	2047	-28,031
	2023-2047	**-652,274**
Total 2023-2047		**-3,167,470**

For the monetary valuation of the cost savings, reference was made to the central value proposed in the "*Update of the Handbook on External Costs of Transport, Final Report, 2014 - DG MOVE*", equal to EUR 90/t.CO_2e for the year 2010, which is derived from values estimated from literature[34].

The unit cost of GHG emissions varies greatly over the years as it depends on various elements, such as the technological development of the vehicles, the trend of the emissions market, etc. For the purposes of this analysis, it is assumed that from 2010 the value will grow by 2% per year until 2040, year in which it is estimated to be equal to EUR 163/t.[35] and that it will remain constant for the following years.

With regard to rail transport, it should be noted that no diesel trains run on the route under analysis.

Table 13 –Noise pollution: marginal unit costs

Noise pollution costs		Euro-Cent / train-km Euro-Cent / vehicle-km
Freight traffic	Train	6.15
	Road traffic (HGV)	0.76
Passenger traffic	Train	2.23
	Road traffic (Car)	0.06

Note: Values expressed in €$_{2018}$.

Mitigation of climate change

Methodology adopted and results

With specific reference to the *"Variante alla linea Napoli-Cancello"* (New section to the Naples-Cancello route) project, it should be noted that the project directly contributes to the improvement, in sustainable terms, of the local mobility of a vast and densely populated territory, which includes the metropolitan area of Naples and the provinces of Avellino, Benevento and Caserta, which will benefit from having a transport

[34] Kuik, O., Brander, L., and Tol, R. S. (2009). Marginal abatement costs of greenhouse gas emissions: A meta-analysis. Energy Policy, vol. 37, No. 4, pp. 1395-1403.
[35] Value conservatively estimated to be less than EUR 168/t., which is the upper limit of the range proposed in the "Update of the Handbook on External Costs of Transport".

interchange not binding to access to the inner city of Naples. Therefore, the completion of this railway junction will have significant repercussions in terms of encouraging the use of public transport by rail to the detriment of road transport, with direct effects in terms of reducing the use of fossil fuels, the emission of climate-changing gases into the atmosphere and, last but not least, in terms of improving the quality of the urban environment concerned and the well-being of the population in the area.
The high level of human activity in the area, which is also affected by environmental degradation, meant that the project had to avoid negative effects on local flora and fauna. In addition, the provisions of the Environmental Impact Assessment (EIA) imposed appropriate mitigation measures to protect the local fauna (crossings, tree belts and wooded areas).

Considering the whole *"Itinerario Napoli-Bari"* ("Naples-Bari Route") Investment Programme, it should be noted that RFI has adopted the "**Envision**" TM sustainability protocol, recently introduced in Italy from the United States, which estimates the degree of environmental, economic and social sustainability of the infrastructure works.
The Protocol provides for an assessment based on 60 sustainability criteria, divided into 5 categories:

- *Quality of life: Purpose, Wellbeing, Community;*
- *Leadership: Collaboration, Management, Planning;*
- *Resource Allocation: Materials, Energy, Water;*
- *Natural World: Siting, Land-water, Biodiversity;*
- *Climate and Risk: Emissions, Resilience.*

The **Envision** system provides four levels of certification, based on the percentage achieved in respect to the maximum applicable score for the work (20% for the "Bronze" level, 30% for the "Silver" level, 40% for the "Gold" level and 50% for the "Platinum" level respectively).
According to a preliminary assessment of the Naples-Bari route, the work can be classified in the **"Gold" level** overall, with particularly significant results obtained for the aspects relating to the "Climate and Risk" category (66.4%)[36].

Within this category, the work was assessed against the following objectives:

- to reduce greenhouse gas emissions through appropriate design and analysis of the entire life cycle of the infrastructure;
- to design the infrastructure in such a way as to reduce pollutants during its operation;
- to avoid designing infrastructures that, during their service life, may be vulnerable due to resource scarcity, risky configurations or outdated environmental regulations;
- to carry out an assessment of climate change impacts;
- to design infrastructures that are resilient and able to adapt to short-term changes and threats;
- to reduce the "heat island" effect by using reflective materials or green spaces.

The excellent result achieved in the "Climate and Risk" category shows that the design solutions chosen for the construction of the infrastructure feature, in general, effective climate change mitigation and adaptation measures.

In particular, in order to ensure resilience to climate change, the protection strategies for the Naples-Bari route have been strengthened with a return time for extraordinary hydraulic interventions of 300 years, which is a considerable safer margin compared to current regulations (100 and 200 years). The project documents illustrate a capacity to withstand exceptional stresses and events without suffering any particular damage.

[36] The assessment is currently being revised based on the recently issued definitive draft of the project.

With regard to the "heat island" phenomenon, which is particularly critical both near the asphalt parts of car parks, freight terminals and freight yards and near the railway superstructure, materials that reduce heat build-up were chosen for the project. In addition, the railway superstructure is designed to absorb thermal expansion and contraction of the rail by up to several degrees without causing any problems to the superstructure itself or to the safe running of the trains.

The estimated cost of the Investment Programme, amounting to EUR 5,524 million, includes all costs of the adopted design solutions, including those aimed to mitigate and adapt to climate change.

As regards the project's impact on greenhouse gas emissions, the modal shift of passenger and freight traffic from road to rail **is expected to reduce CO_2 emissions.**
Table 14 summarises the figures recorded for a number of years and the overall figure for the entire 2023-2047 time horizon:

Table 14 – "Avoided" greenhouse gas emissions

Vehicle Type	Period	CO_2 Emissions (tonnes)
Car	2026	-145,610
	2035	-105,979
	2047	-99,792
	2023-2047	**-2,515,196**
Heavy-duty vehicle (HGV)	2026	-31,912
	2035	-29,769
	2047	-28,031
	2023-2047	**-652,274**
Total 2023-2047		**-3,167,470**

As mentioned, for the monetary valuation of the cost savings, reference was made to the central value proposed in the "*Update of the Handbook on External Costs of Transport, Final Report, 2014 - DG MOVE*", equal to EUR 90/t.CO_2e for the year 2010 and, considering an annual increase of 2% until 2040, which is estimated at EUR 163/t.
The total savings in present value terms as of 2018 (assuming a 3% discount rate) amounts to approximately EUR 296 million.

HS/HC Milan-Venice railway line (Brescia-Verona section)

Externalities related to passenger and freight traffic during operation

Methodology adopted and results

Air pollution

In order to assess the costs of air pollution, the impacts resulting from the emissions of the following types of pollutants into the atmosphere - due to combustion processes - are considered: nitrogen oxides (NO_x); sulphur dioxide (SO_2); non-methane volatile organic compounds (NMVOC); particulate matter ($PM_{2.5}$).

In order to calculate the annual externalities of pollution, the emissions generated by the circulation of road vehicles, expressed in tonnes/vehicle-km, were considered and the unit cost per tonne emitted was applied, according to the following formula:

*[emissions in tonnes per km * total vehicles.km covered] * cost EUR/tonne emitted*

For the emission factors, expressed in grams per vehicle.km, the sources provided in the "*Update of the Handbook on External Costs of Transport, Final Report, 2014 - DG MOVE*" were taken as a reference. In particular, the following average values were estimated for 2026 and 2050, while a linear evolution was hypothesised for the years in between.

Table 15 – Average emission factors for road transport

Vehicle Type	Year	Emission factors			
		SO_2	NO_x	NMVOC	$PM_{2,5}$
Car	2026	0.0012	0.2333	0.0433	0.0054
	2050	0.0012	0.2200	0.0400	0.0038
Heavy-duty vehicle (HGV)	2026	0.0029	3.1967	0.0567	0.0338
	2050	0.0023	3.1267	0.0467	0.0276

Note: Values expressed in expressed in grams per vehicle-kilometres.

The average emissions in g.v.km for passenger cars and HGVs have been multiplied by the estimated decreasing changes in vehicle.km on the road, thus determining the total annual emissions that can be avoided with the new railway.

Finally, the monetary value of the cost savings from 2026 to 2050 was calculated. To this end, reference was made to the unit values per tonne emitted recorded for Italy, taken from the "*Update of the Handbook on External Costs of Transport, Final Report, 2014 - DG MOVE*" and illustrated in Table 16.

Table 16 – Costs of pollution: unit values per tonne emitted

Emission factors	Unitary pollution cost
NO_x	10,824
SO_2	9,875
NMVOC	1,242
$PM_{2,5}$ (urban area)	197,361
$PM_{2,5}$ (sub-urban area)	50,121
$PM_{2,5}$ (rural area)	24,652

Note: Values expressed in $€_{2010}$ per tonne emitted.

The values have been updated to Euro 2017 values and indexed over time according to the evolution of GDP per capita at constant prices until 2050.
In the case of electric traction rail transport, the emission of pollutants is mainly related to the processes for producing the electricity used in the railway network to move trains. The related incremental "external" cost is therefore considered in the context of the externalities related to upstream and downstream processes, which are discussed below in this CBA.

Effects on climate change (the so-called greenhouse effect)

The so-called greenhouse effect is mainly caused by the emissions of the following gases: carbon dioxide (CO_2); methane (CH_4); nitrous oxide (N_2O).
To estimate the emission factors for cars, Regulation (EC) No. 333/2014 was used, which, by amending Regulation (EC) No. 443/2009, sets a target of 95 gCO_2/vehicle-km as the average emission level for the new car fleet, starting from the year 2020. Therefore, in 2026 a vehicle fleet consisting of vehicles with an average emission level of 100 g.v.km was estimated. From 2026 a decrease in unit emissions equal to 1% was assumed and from 2031 onwards a decrease of 0.3%

Table 17 – Estimation of emission factors: car fleet emission scenarios

2026	2030	Post-2031
100 g.v.km	96 g.v.km	-0.3% per year

For the estimation of the emission factors of HGVs, expressed in gCO_2e/vehicle-km, the data suggested in the "*Update of the Handbook on External Costs of Transport, Final Report, 2014 - DG MOVE*" were used, in particular the highest emission value suggested for heavy-duty vehicles with Diesel traction (HGV > 32 t), equal to 906 gCO_2e/vehicle-km (2008 value).
Based on the strategies outlined at European level, the future figure was estimated assuming a 20% reduction by 2030 of the TREMOVE values measured in 2008. This results in the following unit values:

Table 18 – Estimation of emission factors: HGV emission scenarios

2008	2026	2030	Post-2031
906 g.v.km	756 g.v.km	725 g.v.km	-0.3% per year

The emissions in g/vkm per passenger car and HGVs were multiplied by the decrease in road vehicles.km resulting from the traffic scenarios, thus determining the total annual emissions that can be avoided with the new railway project.
For the monetary valuation of the cost savings, the central value proposed in the study "*Update of the Handbook on External Costs of Transport, Final Report, 2014 - DG MOVE*" was used, which was equal to EUR 90 per tonne, revalued to 2017 and indexed over the analysis time horizon on the basis of the change in per capita GDP at constant prices.
In the Project under consideration, no diesel-powered trains were considered, only trains powered by electricity. Therefore, the climate change costs of the railway mode (related to the production of electricity) are included in the scope of the externalities related to upstream and downstream processes.

Calculation of total savings for "external" costs

Considering all externalities, the annual external cost savings related to road transport are higher than the incremental costs related to rail transport and therefore the net effect is included in the benefits of the project, starting from the year 2026.
The table below shows the results of the calculation of "external" costs discounted to 2017 at a discount rate of 3%.

Table 19 – Present value of "external" cost savings during operation

Externalities	Present value 2017 (million of EUR)	%
Air pollution	302.0	22,7%
Greenhouse effect	579.4	43,5%
Noise pollution	46.7	3,5%
Accidents	171.7	12,9%
Congestion	307.6	23,1%
Upstream and downstream processes	-76.2	-5,7%
Total net benefits from externalities in the operating phase	**1,331.3**	**100%**

3.3 Interventions for rapid mass transport (*trasporto rapido di massa*, TRM)

Description

Provided for by the 2017 Italian Budget Law (Article 1, paragraphs 613-615 of Italian Law No. 232/2016), the Italian Prime Ministerial Decree of 30 April 2019 approved the National Strategic Plan for Sustainable Mobility (*Piano strategico nazionale della mobilità sostenibile*, PNSMS), an investment plan aimed at renewing the bus fleet of local and regional public transport services and promoting and improving air quality with innovative technologies, in order to implement international agreements on reducing emissions, as well as European guidelines and legislation.

In particular, the legislation provides for the financing of the renewal of the bus fleet used for local and regional public road transport, the introduction of vehicles powered by alternative fuels and facilities complying with the provisions of Italian Legislative Decree No. 257 of 16 December 2016 implementing Directive 2014/94/EU on the development of alternative fuel infrastructure (DAFI). The Plan also intends to provide strategic guidelines to local public transport (LPT) companies and to the industry of the reference chain in a medium and long term perspective. The plan stems from the need to support a sector of great importance in terms of economic size, which has been characterised for years by a deep crisis due to a persistent financial crisis and a sharp drop in demand.

According to the PNSMS, an efficient, comfortable, less polluting public transport system and better coordinated with the urban environment is a key element for sustainable mobility and the development of cities and metropolitan areas, not only because of its direct impact (especially in urban contexts) in terms of emissions, but also because the increase in public transport use will lead to a reduction in the use of private vehicles.

Projects to renew the bus fleet by purchasing buses powered by alternative fuels have been implemented differently by public authorities and, in several cases, the same authority has purchased both buses powered by alternative fuels and Euro 6 diesel vehicles.

The engines of Euro 6 vehicles - the most widespread for LPT - have reached a high level of quality and have significantly reduced the impact on air pollution. The new generation of Euro 6 diesel buses is characterised by a gCO_2e/passenger-kilometre (gCO_2e/pkm) value per passenger on urban and inter-urban vehicles that ranges between 12 and 18 gCO_2/pkm, below 50 gCO_2e/pkm.
Below, the absolute values per vehicle by route category (to be divided by the number of passengers = ~50 for interurban buses, =~90/130 for urban buses):

- urbanway (urban) between 1000 and 2000 gCO_2/km depending on the route and length of the vehicle 10/12/18 m
- crossway (suburban and interurban) between 600 and 1100gCO_2/km, depending on the urban/suburban/interurban/ route
- for the same buses using compressed natural gas-CNG these values are reduced by ~10%.

Many other technologies capable of replacing diesel exist and are continually evolving. It is precisely because of their variety that the transition to new solutions is a delicate process which must take into account several variables and the related costs. The choice made by administrations is often based on the orographic characteristics of their territory, the flow and comfort of passengers and the image of the city.

Possible alternative engines use:

- compressed natural gas (CNG), which is the most widely used vehicle technology for local public transport after diesel. CNG buses can also be fuelled with biomethane without needing any special change.
- liquid methane (LNG), which has the advantage of having a smaller volume than its gaseous counterpart, meaning that large quantities can be stored in small spaces.
- hybrid systems, meaning that buses have both a diesel engine and an electric drive subsystem (series-hybrid). These vehicles have low purchase costs and significant cuts in consumption and harmful emissions.
- lithium-ion battery electric drive, which allows for relatively short charging times. This technology is considered most promising in the medium to long term.
- hydrogen: series-hybrid electric buses equipped with a hydrogen-powered primary generator are very efficient in terms of performance and provide good energy and environmental benefits. However, the lack of an extensive hydrogen distribution network and the high investment costs mean that this technology is unlikely to become widespread in the short term.

Impact analysis

Below is an analysis produced by ENEA on data provided by ISPRA, which shows the positive environmental effects produced by replacing Euro 0-1-2-3 buses with the new generation of Euro 6 buses.

Table 20 shows the European regulations from 1988 (Euro 0) to 2014 (Euro 6). Note that in many cases the maximum permitted emissions have fallen by more than an order of magnitude. The largest emissions concern nitrogen oxides and particulate matter, the main pollutants produced by diesel engines, with particulate matter going from 0.36 g/kWh in the case of Euro 1 to 0.01 g/kWh in the case of Euro 6.

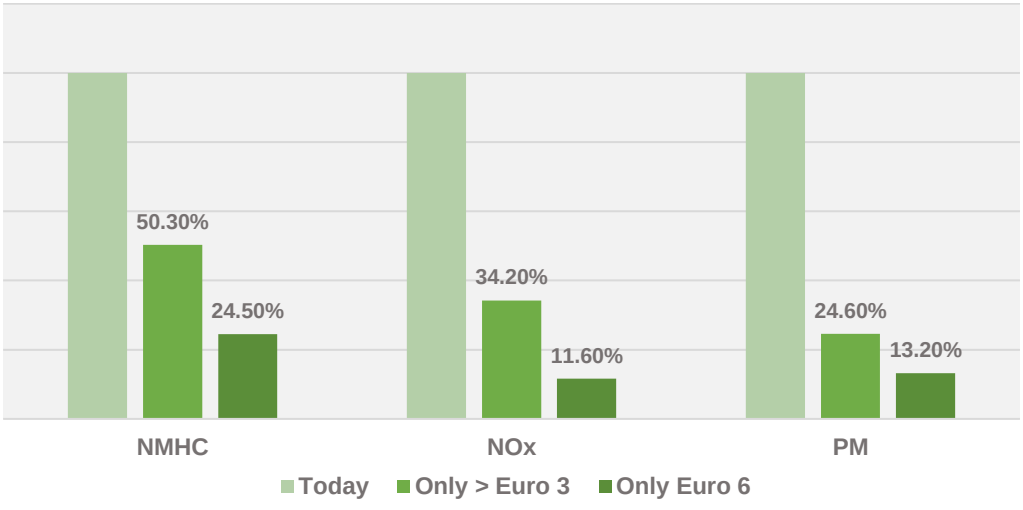
Table 20 – Euro 0 to Euro 6 standards for buses/trucks

Emission level and year of enforcement		Test procedure (operating conditions)	Carbon monoxide CO (g/kWh)	Hydro-carbons HC (g/kWh)	Non-methane hydrocarbons NMHC (g/kWh)	Methane CH_4 (g/kWh)	Nitorgen oxides NO_x (g/kWh)	Particulate matter PM (g/kWh)
Euro 6	2014	Steady states, WHSC	1.5	0.13	-	-	0.4	0.01
		Transient, WHC	-	-	-	-	-	-
Euro 5	2008	Steady states, ESC	1.5	0.46	-	-	2	0.02
		Transient, ETC	4	-	0.55	1.1	2	0.03
Euro 4	2005	Steady states, ESC	1.5	0.46	-	-	3.5	0.02
		Transient, ETC	4	-	0.55	1.1	3.5	0.03
Euro 3	2000	Steady states, ESC	2.1	0.66	-	-	5	0.1
		Transient, ETC	5.45	-	0.78	1.6	5	0.16
Euro 2	1996	Steady states, 13 mode	4	1.1	-	-	7	0.15
Euro 1	1996	Steady states, 13 mode	4.5	1.1	-	-	8	0.36
Euro 0	1988	Steady states, 13 mode	11.2	2.4	-	-	14.4	-

Source: TNO (2013), "Smart choices for cities: clean buses for your city", European Project CIVITAS WIKI.

Chart 2 shows a study highlighting the reduction in NMHC, NO_x and PM emissions that would result from switching the current fleet to one made up only of vehicles with emissions standards higher than Euro 3 or one made up only of Euro 6 vehicles.

Chart 2 – Effects on the environment resulting from the renewal of the European LPT fleet



Source: www.3ibs.eu.

Emissions by fuel type

Using the values on pollutant emissions provided by ISPRA, it is possible to compare emission levels by route type (Table 21).

Table 21 – Emissions by engine type g/km

Urban

Emission	Euro 0	Euro 1	Euro 2	Euro 3	Euro 4	Euro 5	Euro 6	Methane Euro 6 (a)	Hybrid	Electric
NMVOC	2.480	0.530	0.410	0.370	0.050	0.050	0.037	0.005	n/a	0
NO_x	14.100	9.250	10.870	9.750	5.440	6.390	0.437	0.240	0.104	0
PM_{10}	0.890	0.420	0.250	0.260	0.110	0.130	0.079	0.001	0.001	0.001
CO_2	1,057	858	899	953	803	881	921	921	n/a	0

Suburban

Emission	Euro 0	Euro 1	Euro 2	Euro 3	Euro 4	Euro 5	Euro 6	Methane Euro 6 (b)	Hybrid	Electric
NMVOC	0.420	0.380	0.270	0.270	0.040	0.040	0.029	0.005	n/a	0
NO_x	9.130	6.940	7.760	6.340	4.310	3.260	0.234	0.240	0.104	0
PM_{10}	0.340	0.260	0.160	0.170	0.070	0.080	0.040	0.001	0.001	0.001
CO_2	679	619	621	667	650	674	671	671	n/a	0

Notes: The emission produced in the production phase of the fuel or the electricity are not considered. The weighted average emission factors for diesel engines are derived from the COPERT IV model applied to the bus fleet circulating in Italy in 2015. **(a)** Emission factors based on ADEME/RATP data (emission factors COPERTare currently being updated). **(b)** In the absence of further elements, the emissions of the methane-fueled suburban buses were considered equal to those of the methane-fueled urban buses, with the exception of CO_2 for which the emission factor of the diesel-fueled suburban buses was deemed more plausible. In the COPERT V model, the official data on methane are much more impactful than those on diesel on NO_x, and slightly higher on CO_2. The emission factors for methane are still subject to a certain uncertainty given the scarcity of road tests and ISPRA raised the need for further investigations during the last meeting of the "Task force on emssions, inventories and projections" of the EIONET-UNECE network.

Distribution of rolling stock by emission class

Table 22 shows the regional distribution of urban rolling stock by emission class.

Table 22 – Regional distribution of rolling stock by emission class (urban)

Regions	Euro 0	Euro 1	Euro 2	Euro 3	Euro 4	Euro 5	Euro 6	E.	Total
Abruzzo	72	1	61	169	25	136	28	8	**500**
Basilicata	4	0	11	11	9	15	1	0	**51**
Calabria	7	7	39	111	1	104	30	0	**299**
Campania	37	38	219	187	111	449	61	0	**1,102**
Emilia-Romagna	12	18	415	311	63	620	201	23	**1,663**
Friuli Venezia Giulia	0	0	0	37	14	212	159	2	**424**
Lazio	32	25	247	1,032	63	1,301	411	8	**3,119**
Liguria	27	15	233	354	51	173	132	16	**1,001**
Lombardia	12	4	225	884	162	1,178	718	26	**3,209**
Marche	13	8	100	68	17	198	27	0	**431**
Molise	6	3	9	44	7	10	6	0	**85**
Piemonte	6	3	309	186	38	578	55	45	**1,220**
Puglia	22	15	54	293	62	186	163	14	**809**
Sardegna	4	1	21	51	16	476	5	0	**574**
Sicilia	25	24	187	254	134	190	115	10	**939**
Toscana	0	2	114	346	16	412	369	18	**1,277**
Trentino Alto Adige	1	0	69	101	13	320	73	5	**582**
Umbria	0	0	14	7	2	14	0	3	**40**
Valle d'Aosta	0	0	0	1	5	36	9	0	**51**
Veneto	51	12	301	332	31	430	278	1	**1,436**
Total	**331**	**176**	**2,628**	**4,779**	**840**	**7,038**	**2,841**	**179**	**18,812**

Notes: Absolute values (as of 25 September 2018).
Source: Italian Ministry of Sustainable Infrastructure and Mobility – DG for DMV – Data processing center.

Table 23 shows the regional distribution of extra-urban rolling stock by emission class.

Table 23 – Regional distribution of rolling stock by emission class (extra-urban)

Regions	Euro 0	Euro 1	Euro 2	Euro 3	Euro 4	Euro 5	Euro 6	Total
Abruzzo	60	5	169	291	32	233	85	**875**
Basilicata	68	26	229	238	77	96	28	**762**
Calabria	103	50	314	490	86	298	144	**1,485**
Campania	119	73	320	322	352	153	108	**1,447**
Emilia-Romagna	20	11	311	471	32	303	313	**1,461**
Friuli Venezia Giulia	0	0	0	115	21	219	172	**527**
Lazio	159	46	552	910	308	276	653	**2,904**
Liguria	3	14	90	160	39	110	69	**485**
Lombardia	13	7	392	410	258	844	664	**2,588**
Marche	30	18	186	229	31	276	91	**861**
Molise	20	20	100	149	34	46	14	**383**
Piemonte	7	22	359	675	83	294	220	**1,660**
Puglia	18	23	433	491	219	445	372	**2,001**
Sardegna	16	10	231	155	8	449	4	**873**
Sicilia	173	30	264	575	165	205	142	**1,554**
Toscana	14	38	457	487	56	130	214	**1,396**
Trentino Alto Adige	0	4	129	169	12	329	179	**822**
Umbria	15	17	18	14	11	33	21	**129**
Valle d'Aosta	0	0	0	11	5	69	36	**121**
Veneto	55	44	447	665	15	264	162	**1,652**
Total	**893**	**458**	**5,001**	**7,027**	**1,844**	**5,072**	**3,691**	**23,986**

Notes: Absolute values (as of 25 September 2018).
Source: Italian Ministry of Sustainable Infrastructure and Mobility – DG for DMV – Data processing center.

Table 24 shows the regional distribution of urban and extra-urban rolling stock by emission class, expressed in absolute values and as a percentage.

Table 24 – Total: urban + extra-urban
Regional distribution of rolling stock by emission class

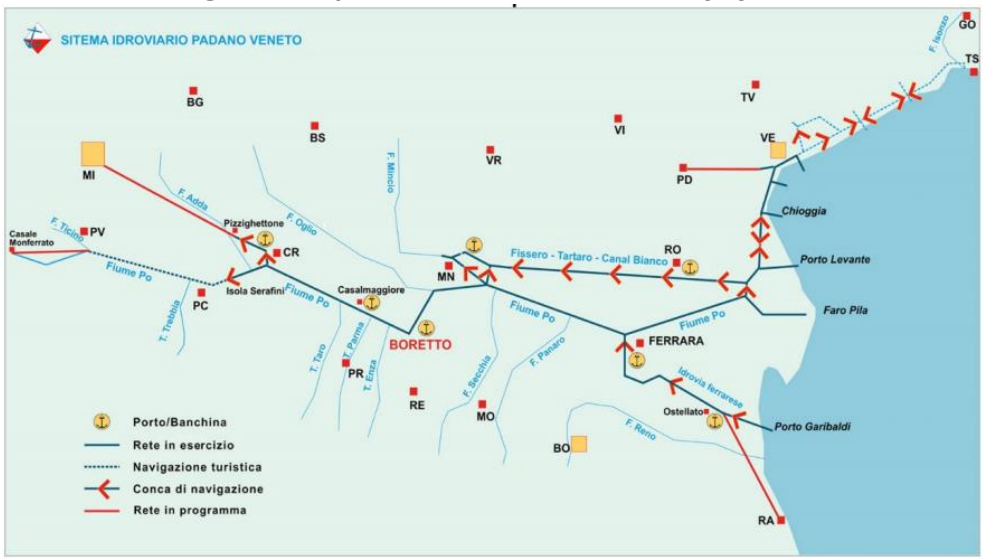
Regions	Euro 0		Euro 1		Euro 2		Euro 3		Euro 4		Euro 5		Euro 6		E		Total
	A.V.	%	A.V.	%	A.V.	%	A.V.	%	A.V.	%	A.V.	%	A.V.	%	A.V.	%	A.V.
Abruzzo	132	9.60%	6	0.44%	230	16.73%	460	33.45%	57	4.15%	369	26.84%	113	8.22%	8	0.58%	**1,375**
Basilicata	72	8.86%	26	3.20%	240	29.52%	249	30.63%	86	10.58%	111	13.65%	29	3.57%	0	0.00%	**813**
Calabria	110	6.17%	57	3.20%	353	19.79%	601	33.69%	87	4.88%	402	22.53%	174	9.75%	0	0.00%	**1,784**
Campania	156	6.12%	111	4.35%	539	21.15%	509	19.97%	463	18.16%	602	23.62%	169	6.63%	0	0.00%	**2,549**
Emilia-Romagna	32	1.02%	29	0.93%	726	23.24%	782	25.03%	95	3.04%	923	29.55%	514	16.45%	23	0.74%	**3,124**
Friuli Venezia Giulia	0	0.00%	0	0.00%	0	0.00%	152	15.98%	35	3.68%	431	45.32%	331	34.81%	2	0.21%	**951**
Lazio	191	3.17%	71	1.18%	799	13.27%	1,942	32.24%	371	6.16%	1,577	26.18%	1,064	17.67%	8	0.13%	**6,023**
Liguria	30	2.02%	29	1.95%	323	21.74%	514	34.59%	90	6.06%	283	19.04%	201	13.53%	16	1.08%	**1,486**
Lombardia	25	0.43%	11	0.19%	617	10.64%	1,294	22.32%	420	7.25%	2,022	34.88%	1,382	23.84%	26	0.45%	**5,797**
Marche	43	3.33%	26	2.01%	286	22.14%	297	22.99%	48	3.72%	474	36.69%	118	9.13%	0	0.00%	**1,292**
Molise	26	5.56%	23	4.91%	109	23.29%	193	41.24%	41	8.76%	56	11.97%	20	4.27%	0	0.00%	**468**
Piemonte	13	0.45%	25	0.87%	668	23.19%	861	29.90%	121	4.20%	872	30.28%	275	9.55%	45	1.56%	**2,880**
Puglia	40	1.42%	38	1.35%	487	17.33%	784	27.90%	281	10.00%	631	22.46%	535	19.04%	14	0.50%	**2,810**
Sardegna	20	1.38%	11	0.76%	252	17.42%	206	14.24%	24	1.66%	925	63.93%	9	0.62%	0	0.00%	**1,447**
Sicilia	198	7.94%	54	2.17%	451	18.09%	829	33.25%	299	11.99%	395	15.84%	257	10.31%	10	0.40%	**2,493**
Toscana	14	0.52%	40	1.50%	571	21.36%	833	31.16%	72	2.69%	542	20.28%	583	21.81%	18	0.67%	**2,673**
Trentino Alto Adige	1	0.07%	4	0.28%	198	14.10%	270	19.23%	25	1.78%	649	46.23%	252	17.95%	5	0.36%	**1,404**
Umbria	15	8.88%	17	10.06%	32	18.93%	21	12.43%	13	7.69%	47	27.81%	21	12.43%	3	1.78%	**169**
Valle d'Aosta	0	0.00%	0	0.00%	0	0.00%	12	6.98%	10	5.81%	105	61.05%	45	26.16%	0	0.00%	**172**
Veneto	106	3.43%	56	1.81%	748	24.22%	997	32.29%	46	1.49%	694	22.47%	440	14.25%	1	0.03%	**3,088**
Total	**1,224**	**2.86%**	**634**	**1.48%**	**7,629**	**17.83%**	**11,806**	**27.59%**	**2,684**	**6.27%**	**12,110**	**28.30%**	**6,532**	**15.26%**	**179**	**0.42%**	**42,798**

Notes: Absolute values and % values (data as of 25 September 2018).
Source: Italian Ministry of Sustainable Infrastructure and Mobility – DG for DMV – Data processing center.

3.4 The Padano-Veneto waterway system

The Padano-Veneto waterway system has an extension of 957 kilometres, 564 of which can be used for commercial purposes. The system is formed mainly by the central axis of the river Po, flanked by the Fissero Tartaro Canal Bianco canal up to the Po di Levante (outlet into the sea in the north of the system) and the Ferrara waterway (outlet into the sea in the south of the system).

Figure 1 – Map of the Padano-Veneto waterway system



The system is fully included in the European Union's policy instruments for the TEN-T corridors and is part of the so-called "Mediterranean Corridor No. 3". The fact that the Italian waterway system is part of this European context means that it is of great European importance. The improvement and revival of the Padano-Veneto waterway system can also contribute to decarbonisation, promote the modal shift and boost tourism in Italy.

Along the axis of the Po river and the connected waterways there are ports and river docks. Public commercial ports are:

- the port of Cremona;
- the port of Mantua (on the Fissero-Tartaro-Canalbianco waterway);
- the river dock of Boretto or the Terminal of Emila Central (TEC);
- the port of Rovigo (on the Fissero-Tartaro-Canalbianco waterway);
- the recently completed ports of Revere and Ostiglia in Lombardy.

There are numerous ports and marinas (each coastal municipality has one or more) and there is also a fair number of private commercial quays, i.e. infrastructures connected to activities established along the waterway system.
The waterways have a very considerable potential in terms of mobility and freight capacity, which is currently not fully exploited but can be taken advantage of with limited intervention and provided that the waterways become part of a combined transport system.
River freight transport also offers significant advantages in terms of safety and respect for the environment: it is estimated that external costs, including those relating to pollution (water, air, soil and

noise), land use and accidents (relating to inland navigation), amount to around 1/18th of those associated with road transport.

Table 25 – External costs of transport modes

External cost	Road	Railway	Waterway
Accidents	100	6.3	1
Noise pollution	100	173	0
Air pollution	100	12.3	14.4
Water and soil pollution	100	0	0
Barrier effect	100	0	0
Land use	100	32.8	0
Total	**100**	**22.5**	**5.4**

Source: elaborations by Aufschwung Binnenschiffart. **Notes**: indices for road = 100.

In addition to advantages in terms of external costs, there are also advantages in terms of energy savings: the energy consumption per tonne of waterway transport is lower than that of rail transport and about one third of that of road transport.

Table 26 – Energy consumption for freight transport.

Road	Railway	Waterway
4.1	1.7	1.3

Source: elaborations by Aufschwung Binnenschiffart. **Notes**: values expressed in litres of diesel per t.-km.

Therefore, the cost of freight transport by waterway, expressed in t-km of goods transported, is significantly lower than that of both rail and road transport (with savings, in Italy, in the order of 20-30%). Obviously, this comparison concerns goods that can be transported by waterway and transport networks that are equally integrated and connected to the production system. There is no doubt that the limits linked to the inevitable process of loading and unloading and to the longer journey times compared to road transport have yet to be resolved, as they deter private individuals from using this mode of transport. Below is a table containing the currently available data on freight traffic on the Padano-Veneto waterway system.

Table 27 – Padano-Veneto waterway traffic

Ports	2016	2017	2018	2019
Port of Rovigo (Fissero waterway)	100 (d) large packages, etc.	2,650 (d) metallurgical	410 metals	150 (s) semifinished metals 270 (d) semifinished metals
Po-Brondolo Canal	1,800 miscellaneous goods	-	-	-
Port of Mantova (Fissero and Po waterway)	25,000 (s) metal sheets and coils 4,200 (s) fertilizers 2,500 (s) containers n. 789 containes (s/d)	33,000 (s) metal sheets and coils 7,000 (d) metal sheets and coils 2,500 (s) fertilizers 2,500 (s) containers n. 426 containes (s/d)	38,655 semifinished metals 45,795 chemical products 1,060 electromechanical equipments 10,593 miscellaneous goods	1,356 (d) electromechanical equipments 1,140 (s) semifinished metals
Industrial docking of Mantova (Fissero and Po waterway)	37,500 (d) acetone 4,500 (d) large packages, etc.	37,500 (d) acetone 10,000 (d) large packages, etc.	-	26,000 (d) chemical products 10,000 (d) semifinished metals
Dock of Viadana (Po waterway)	-	-	-	-
Port of Cremona (Po waterway)	350 (d) large packages, etc.	1,000 (d) large packages, etc.	12,592 semifinished metals	3,405 (d) semifinished metals
Industrial docking of Cremona (Po waterway)	-	-	-	-
Doks (Ferrarese waterway)	-	-	-	-
Mantuan docks: Roncoferraro (Fissero), S. Benedetto Po, Revere (Po)	n/a	40,000 Inert material (estimated value)	n/a	n/a
Private industrial docking on the Po	n/a	n/a	n/a	n/a
Total	**75,950**	**135,650**	**109,105**	**42,321**

Notes: values expressed in tonnes;
s = loaded (sea-river direction); d = unloaded (river-sea direction).
Source: AIPO data – Settore Navigazione Interna.

The Padano Veneto waterway system has been financed over the years by numerous national laws. Below are some examples of the most substantial investments:

- construction works managed by AIPO (completed and tested in August 2020) for the new navigation lock of Isola Serafini on the river Po;

- the final and executive design of the works to regulate the low water bed of the river Po, (underway);
- works to upgrade to class V the Ferrarese waterway from Pontelagoscuro to the sea in Porto Garibaldi - the most challenging work in terms of both structure and economic impact (underway).

4 Pollution prevention and control and circular economy

4.1 Integrated water systems and networks

With regard to the water sector, in the four-year period from 2016 to 2019 the investment expenditure to be financed through tariffs was 178 EUR per capita at the national level. The **availability of public financing** for the construction of water infrastructures caused the value to rise to 235 EUR per capita at the national level.
Investment expenditure in absolute terms, including the availability of public funds, amounted to EUR 3.5 billion and EUR 3.4 billion in 2018 and 2019 respectively. The audits carried out by the Authorities showed an implementation rate of the investments of over 97.5%.

As for the four-year period from 2020 to 2023, investment expenditure to be financed through tariffs amounted to EUR 224 per capita at the national level. Considering also the **availability of public financing** for the construction of water infrastructures, investments increased to EUR 261 per capita at the national level.
During the same period, investment expenditure in absolute terms, including the availability of public funds, amounted to approximately EUR 3.9 billion each year. The audits carried out confirmed again general improvements in the capacity to carry out planned investments, with data currently being processed.

On the other hand, as regards the final stages of the water cycle, Italy is currently suffering from delays in upgrading its sewage and treatment systems. There are four infringement procedures against Italy for failure to implement or for an inadequate implementation of Directive 91/271/EEC on waste water treatment.

In order to settle EU litigations, additional economic resources have been set up for infrastructure investments. In addition, in 2016, the Legislator appointed a Single Extraordinary Commissioner with the tasks of coordinating and implementing functional interventions, to ensure that the sentences of the Court of Justice of the European Union of 19 July 2018 (Case C-565/10) and 10 April 2014 (Case C-85/2013) are complied with as quickly as possible.

With reference to the first two infringement procedures, case C-251/17 and case C85/13, the Commissioner structure estimates that the interventions necessary to resolve the disputes will be fully implemented by 2026 (with a total value of EUR 2 billion).

Additional impact assessments on the allocation of resources to items in this category will become available in the future and will be included in future Reports.

5 Protection of the environment and of biological diversity

5.1 MO.S.E. and the protection of the Venetian lagoon

The Venetian lagoon is increasingly affected by "high water" episodes (tides of unusually high amplitude) which, in the absence of intervention, cause significant erosion and re-suspension of surface sediment, with consequent damage to the benthic biosphere. Raising the gates of the MoSE, which only occurs when there is a very significant rise in sea level, prevents this erosion and protects the lagoon ecosystem. In order to prevent negative developments, a study was carried out to verify the impact of the first significant activations of the MO.S.E. during the major high water events recorded in December 2020.

In fact, when the gates of the MO.S.E. system are closed, the exchange of water between the lagoon and the Adriatic Sea is interrupted, albeit for a limited period of time. The stability and regularity of this exchange is considered essential to guarantee the renewal of water in the lagoon and the preservation of its ecological balance.

The monitoring of water quality in the lagoon is carried out by the SAMANET automatic monitoring network[37], which acquires and processes data relating to periods when the gates are closed in order to assess how the closure of the gates affects the quality of water in the lagoon. The network is an effective tool both for identifying medium- to long-term trends in the lagoon ecosystem and for detecting sudden, localised changes in the quality of lagoon water.

During the period covered by the analysis carried out[38] in December 2020, which served as an important test bed for verifying the functionality and effectiveness of the MO.S.E., the system was successfully activated 10 times and reduced flooding in the urban centres of Venice and Chioggia and the islands of the lagoon, also during prolonged and intense high tide conditions.

By analysing the data acquired, it was possible to establish that when the gates were closed for almost a day, the effects on the characteristics of the water in the lagoon, in particular on the concentration of dissolved oxygen (DO), were modest and quickly reversible.

In the event of prolonged periods of closure, as occurred for example from 4 to 6 December, the changes observed in the characteristics of lagoon water were of greater intensity and duration. However, in the case observed, the concentrations of dissolved oxygen did not change to the extent that they represented a danger to aquatic life.

Overall, the changes in dissolved oxygen concentration produced by the activation of the MO.S.E. in December 2020 were of the same order of magnitude, in both intensity and duration, as those that occurred during the alternation of the astronomical cycles of syzygy [39] and quadrature [40].

[37] http://provveditoratovenezia.mit.gov.it/pubblicazioni-antinquinamento.html
[38] http://provveditoratovenezia.mit.gov.it/files/La-qualita-delle-acque-della-laguna-durante-le-chiusure-del-MoSE.pdf
[39] Moon conjunction and opposition phase (new moon and full moon).
[40] The lunar phase in which the Moon, Earth and Sun form a right angle to each other (first or last quarter).

5.2 Marine Protected Areas, National Parks and National Nature Reserves

Italy has an articulated system of protected natural areas such as parks and reserves, established at national or regional level, and marine protected areas. In addition to these, there are Sites of Community Importance (SCIs) and Special Protection Areas (SPAs), which are part of the Natura 2000 Network, established by EU legislation to protect habitats and animal and plant species identified as priorities.

The purpose of these natural areas is to protect the significant biodiversity of the Italian territory[41]: 57,468 species of fauna, of which 1,255 are vertebrates (excluding marine fauna). Of these, 4,777 (8.6%) can be considered endemic, i.e. exclusive to Italy.

In terms of plant species, there are almost 8,000 species in Italy, and more than 12,000 if we factor in algae and lichens.

In Italy there are **871 protected areas**[42], for a total of more than 3 million hectares of land, about 2,850 thousand hectares of sea and 658 kilometres of coastline under protection.

The existing **24 national parks** are evenly distributed throughout the country and cover a total area of more than 1.5 million hectares. In addition, there are **29 marine protected areas** and two **underwater parks,** Baia and Gaiola, which cover an area of 234,616 hectares and 755 km of coastline. The marine protected area of Capo Spartivento, in Sardinia, covering 3,698 hectares, is also on the way of recognition. Finally, an agreement between Italy, France and the Principality of Monaco has established the Pelagos International Sanctuary, a marine area of 87,500 km² for the protection of marine mammals in the area.

The national system of protected areas includes not only national parks and marine protected areas, but also state and regional nature reserves, regional parks and other types of protected areas recognised and included in the **Official List of Protected Areas (Elenco Ufficiale delle Aree Protette, EUAP)**[43], as well as **Natura 2000 sites**[44].

Overall, the protected territory amounts to more than 10,400,000 hectares - more than 20% of the Italian land surface and 11% of the marine area under Italian jurisdiction. This system plays an essential role in protecting the biodiversity of species and habitats and allows to perform research projects and reintroduction and repopulation initiatives: as a matter of fact, in Italy almost half of the more than 1,200 species of vertebrates are at risk, as are 15% of higher plants and 30% of the main natural environments. The ibex, the Marsican bear, the Apennine chamois and the osprey are some of the species saved from extinction thanks to the protected areas.

All protected areas provide ecosystem services that are fundamental to people's lives and health: woods and forests in national parks alone, for example, **absorb 145 million tonnes of CO_2e/year**.

These areas are centres of excellence for the sustainability of the relationship between man and nature, where the local communities living in the areas have acquired a strong awareness of the significant role they play, not only in protecting the environment in which they live, but also in ensuring the balanced development of the territory and the economy.

They constitute an avant-garde laboratory for agri-food sustainability in which the support and promotion of good practices together with farmers, breeders, fishermen and artisans strengthen the virtuous union between quality production and environmental management.

[41] Source: WWF (https://www.wwf.it/dove-interveniamo/il-nostro-lavoro-in-italia/aree-protette/).
[42] https://www.mite.gov.it/aree-protette
[43] https://www.mite.gov.it/pagina/elenco-ufficiale-delle-aree-naturali-protette-0.
[44] https://www.mite.gov.it/pagina/rete-natura-2000.

Finally, from a tourism point of view, they represent a driving force for this kind of activities with 27 million visitors for an economic value of more than EUR 5 billion, contributing to the spread of sustainable and quality tourism through the certification of the European Charter for Sustainable Tourism (ECST).

6 Research

6.1 Main projects funded

This section provides examples of projects financed in the four-year period from 2018 to 2021 through the allocation of proceeds raised from green government bonds. This is in accordance with the GBF, which includes the number of projects funded as a measure of environmental impact for the "Research" category.

European Centre for Medium-Range Weather Forecasts

Centre/Institute	Programme/Project	Description
ECMWF	Climate Data Store and open data hackathon (2018)	https://www.ecmwf.int/en/about/media-centre/news/2018/ecmwf-hackathon-put-new-climate-data-store-through-its-paces
ECMWF	Energy-efficient SCalable Algorithms for weather and climate Prediction at Exascale – ESCAPE-2 project (2018)	The ESCAPE-2 project aims to develop next-generation weather models with high-performance computing capabilities for forecasting weather and climate in Europe. More information is available at: https://www.hpc-escape2.eu/
ECMWF	ERA5 climate reanalysis (2018)	More information is available at: https://www.ecmwf.int/en/forecasts/datasets/reanalysis-datasets/era5
ECMWF	CO_2 Human Emissions (2018);	The European Commission's CO_2 Human Emissions (CHE) project, coordinated by ECMWF, aims to develop a European system to monitor global carbon dioxide (CO_2) emissions caused by human activity. More information is available at: https://annualreport.ecmwf.int/en/annual-report-2018/co2-human-emissions-che
ECMWF	Workshop on high performance computing in meteorology (2018)	The workshop, organised by ECMWF, brings together experts from across national and international meteorological centres, academia and industry to discuss and present recent developments in high-performance computing models for weather forecasting applications.
ECMWF (partner)	EU-funded APPLICATE project (2019)	It is aimed at improving the ability to predict weather events and climate change in the polar region and to understand the impact of climate change in the Arctic on the mid-latitudes of the Northern Hemisphere.
ECMWF	EU-funded Copernicus C3S Climate Data Store (2019)	The Copernicus Climate Change Service (C3S), by combining the observations of the climatic system with the last scientific findings, aims at the development of information about the status of the climate on past, present and future in Europe and worldwide. Further information is available at the website: https://cds.climate.copernicus.eu/about-c3s
ECMWF	S2S pilot launched (2019)	The initiative of the World Weather Research Programme (WWRP) and World Climate Research Programme (WCRP) aims to provide real-time access to forecast data stored in the S2S database, currently available with a three-week delay, for 16 application projects. ECMWF acts as the supplier and main storage centre for S2S data.

ECMWF	Wildfire and river flow reanalyses released through CDS (2019)	The Copernicus Climate Data Store (CDS) has been able to release the first river flow and wildfire danger reanalyses to be updated in near real-time. The datasets, produced by ECMWF for the EU-funded Copernicus Emergency Management Service (CEMS), provide daily information over the whole of the globe (stretching back almost 40 years)
ECMWF	Ocean Re-Analysis System 5 (2019)	Ocean5 is ECMWF's current ocean and sea-ice analysis system.
ECMWF	Copernicus Emergency Management Service (2019)	ECMWF continues to contributes to the Copernicus Emergency Management Service (CEMS), in particular the early warning systems for flood and fire danger.
ECMWF	Copernicus Climate Change Service's Climate Data Store (2019)	Developed by ECMWF, it supports climate services in Europe by providing seamless access to high-quality climate datasets past, present and future.
ECMWF	ECMWF data supports COVID research (2020)	Data from the Copernicus Climate Change (C3S) and the Copernicus Atmosphere Monitoring Service (CAMS), systems implemented by ECMWF on behalf of the European Commission, were used to help researchers, policy makers and citizens alike counter the spread of COVID-19.
ECMWF	Centre of Excellence in HPC, AI and Quantum Technologies (2020)	ECMWF and Atos have opened a centre of excellence for weather forecasting and climate change monitoring that benefits from the technological resources of the data centre in Bologna.
ECMWF	WMO Systematic Observations Financing Facility (2020)	ECMWF has signed a Joint Statement with WMO, EUMETNET and EUMETSAT for the funding of the Systematic Observations Financing Facility (SOFF), which aims to increase the availability of weather and climate change forecast data through the involvement of national weather agencies, data centres, aid agencies and the private sector.

Euro-Mediterranean Center on Climate Change

Centre/Institute	Description
CEMCC	During 2018, **61 new projects** were launched while existing projects continued to be carried out. As of December 2018, there were 129 projects in progress. During 2018, scientific partnerships were set up with **9 international and 12 national institutes** for the continued development of research activities. During 2020, **80 new projects** were launched while existing projects continued to be implemented. As of December 2020, the institute had 411 proposals funded. As of December 2020, there were 11 scientific cooperations at international level and 28 at national level.

Istituo Nazionale di Oceanografia e di Geofisica Sperimentale (National Institute of Oceanography and Applied Geophysics)

Centre/Institute	Description
OGS	Purchase of a vessel to serve as a scientific research and support infrastructure for the Antarctic base, in line with the objectives of the Italian 2015-2020 National Research Programme (PNR) and the Italian National Antarctic Research Programme, and with the aim of supporting Italian research in polar areas.

ITER-DTT nuclear fusion project

Centre/Institute	Description
ENEA – The Fusion and Technology for Nuclear Safety and Security Department (FSN)	Research activities focused on the European ITER project within the programme managed by Eurofusion (the European Consortium of which ENEA is a member) and on the new Divertor Tokamk Test facility (DTT)

CNR-IRBIM contribution Stazione zoologica Anton Dohrn of Naples

Centre/Institute	Description
CNR-IRBIM SZN	Upgrading of the scientific aquarium in Naples Upgrading of the head office in Naples Upgrading of the Turtle Point in Portici Upgrading of equipment and facilities

Appendix I: allocation table detail

This section of the document aims to provide more details on the green expenditure reported in the allocation table, specifying for each sub-category of eligible expenditure:

- the corresponding expenditure chapter in the state budget;
- the breakdown of eligible expenditure over the four-year period from 2018 to 2021;
- the competent Ministry[45].

Ministry	Chapter	Des. chapter of expenditure	2018	2019	2020	2021	Total
Category	**1**	**Renewable sources for the production of electricity and heat**	**59,600,000**	**123,000,000**	**54,210,000**	**59,600,000**	**296,410,000**
Sub.	***1.1***	***Tax benefits for energy from renewable sources***	**59,600,000**	**123,000,000**	**54,210,000**	**59,600,000**	**296,410,000**
MEF	(*)	Tax benefits for energy from renewable sources	59,600,000	123,000,000	54,210,000	59,,600,000	296,410,000

Notes: (*) These are tax benefits (Italian Legislative Decree No. 28 of 3 March 2011, implementing Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources) and therefore no expenditure chapters can be identified within the State budget. The loss of revenue is estimated by the Italian Revenue Agency and ENEA.

Ministry	Chapter	Des. chapter of expenditure	2018	2019	2020	2021	Total
Category	**2**	**Energy efficiency**	**1,634,200,000**	**0**	**0**	**0**	**1,634,200,000**
Sub.	***2.1***	***Tax benefits for energy efficiency in buildings***	**1,634,200,000**	**0**	**0**	**0**	**1,634,200,000**
MEF	(*)	Tax benefits for energy efficiency in buildings	1,634,200,000	0	0	0	1,634,200,000

Note: (*) These are tax benefits (Art. 1, paragraphs 344 to 349, of Italian Law No. 296 of 2006; Art. 1, paragraph 48, of Italian Law No. 220 of 2010; Art. 14 of Italian Decree-Law No. 63 of 2013, converted by Italian Law No. 90 of 2013 and last amended by Art. 1, paragraph 58, letter a) of Italian Law No. 178 of 2020), therefore no expenditure chapters within the State budget can be identified. The loss of revenue is estimated by the Italian Revenue Agency and ENEA.

Ministry	Chapter	Des. chapter of expenditure	2018	2019	2020	2021	Total
Category	**3**	**Transports**	**1,541,829,911**	**1,585,533,631**	**1,726,065,913**	**2,764,543,739**	**7,617,973,193**
Sub.	***3.1***	***Metros***	**189,812,933**	**50,496,099**	**126,519,786**	**257,749,971**	**624,578,790**
MIMS	7059	Design/construction of strategic works and works for the collection/adduction of water resources	0	0	0	16,077,000	16,077,000
MIMS	7060	Strategic works of major national interest and works for the collection and adduction of water resources	94,477,834	49,792,472	102,073,916	144,410,809	390,755,031
MIMS	7424	Funds to be allocated to the Turin Metro	9,835,099	703,627	24,445,870	97,262,163	132,246,759

[45] Ministry of the Ecological Transition (**MITE**); Ministry of Economy and Finance (**MEF**); Ministry of Sustainable Infrastructure and Mobility (**MIMS**); Ministry of Economic Development (**MISE**); Ministry of Agricultural and Forestry Policy (**MIPAAF**); Ministry of University and Research (**MUR**).

MIMS	7427	Funds for the completion of the Naples Metro Line 1	85,500,000	0	0	0	85,500,000
Sub.	***3.2***	***Funds for freight transport (rail)***	**22,890,186**	**135,395,645**	**99,906,193**	**232,756,325**	**490,948,349**
MIMS	1246	Funds for intermodal rail transport services connected with logistical hubs and ports	18,390,186	35,490,645	0	32,880,683	86,761,514
MIMS	1274	Sums to be paid to railway companies to promote freight transport	4,500,000	99,905,000	99,906,193	199,875,642	404,186,835
Sub.	***3.3***	***Interventions for mass rapid transport***	**23,227,928**	**98,666,507**	**96,893,860**	**109,088,405**	**327,876,701**
MIMS	7060	Strategic works of major national interest and works for the collection and adduction of water resources	0	12,868,261	0	0	12,868,261
MIMS	7241	Funds for the purchase and/or replacement of buses and/or other means of public passenger transport	3,932,711	3,220,000	1,840,000	0	8,992,711
MIMS	7400	Expenditure for the completion of interventions in the field of rapid mass transport	0	60,134,825	59,074,000	67,884,901	187,093,726
MIMS	7403	Construction of guided rapid mass transport systems and urban rapid tramways	17,967,323	13,550,159	35,979,860	22,837,354	90,334,696
MITE	8405	Initiatives to combat pollution and improve air quality	1,327,894	8,893,263	0	18,366,151	28,587,307
Sub.	***3.4***	***Expenditure and funding for railway infrastructure and HS/HC lines***	**1,299,478,049**	**1,299,404,776**	**1,400,798,404**	**2,160,800,502**	**6,160,481,731**
MEF	7122	Funds to FFSS for investment in the development and modernisation of railway infrastructure	1,118,822,668	1,071,815,413	1,110,591,063	2,017,968,232	5,319,197,376
MEF	7123	Grants to be paid to FFSS for expenditure on plant and equipment for specific works	7,343,894	3,244,444	3,282,779	2,584,782	16,455,900
MEF	7124	Grants to FFSS for interventions related to the HS/HC system of the TO-MI-NA lines and traditional network	1,152,388	1,642,527	23,663	0	2,818,577
MIMS	7060	Strategic works of major national interest and works for the collection and adduction of water resources	106,078,158	25,645,123	151,722,247	24,905,000	308,350,528
MIMS	7518	Funds to be allocated to RFI for the Milan-Genoa HS/HC line: *Terzo Valico dei Giovi*	47,180,940	197,057,269	135,178,653	113,182,489	492,599,350
MIMS	7539	Funds to the Valle d'Aosta region for the Piedmont-Valle d'Aosta rail link	18,900,000	0	0	2,160,000	21,060,000
Sub.	***3.5***	***Padano-Veneto waterway system***	**6,420,815**	**1,570,604**	**1,947,669**	**4,148,534**	**14,087,622**
MIMS	7700	Expenditure for the development of the Padano-Veneto waterway system	6,420,815	1,570,604	1,947,669	4,148,534	14,087,622

Ministry	Chapter	Des. chapter of expenditure	2018	2019	2020	2021	Totale
Category	**4**	**Pollution prevention and control and circular economy**	**109,176,691**	**113,043,223**	**176,964,268**	**125,563,585**	**524,747,766**
Sub.	***4.1***	***Fight against marine pollution***	**47,551,863**	**31,616,683**	**41,830,413**	**45,597,893**	**166,596,852**
MISE	3531	Supervision/safety monitoring (including environmental) of hydrocarbon exploration/production installations at sea	11,662,985	4,105,772	4,845,128	4,914,683	25,528,568
MISE	3532	Expenses incurred by the Offshore Safety Committee in carrying out its tasks	5,368	91,309	0	10,554	107,231
MITE	1644	Expenditure for the marine environment protection service	35,883,511	27,419,603	36,985,285	40,672,656	140,961,054
Sub.	***4.2***	***Plans for environmental recovery and integrated waste cycle***	**4,865,840**	**6,175,244**	**59,941,609**	**43,503,959**	**114,486,652**
MITE	7503	Expenditure on land reclamation and remediation and on waste management, also designed to support the development of the deprived areas of the country	4,865,840	6,175,244	59,941,609	43,503,959	114,486,652
Sub.	***4.3***	***Water purification operations***	**55,391,800**	**75,236,295**	**70,645,565**	**33,549,169**	**234,822,828**
MIMS	7253	Project Fund. Funds for the completion of the integrated water system in the Abruzzo Region	721,247	3,035,500	2,344,133	2,833,398	8,934,279
MIMS	7281	*Piano Straordinario Invasi* (Extraordinary Reservoir Plan)	0	43,776,780	19,076,415	20,479,879	83,333,075
MITE	7503	Expenditure on land reclamation and remediation and on waste management	0	1,213,976	3,290,456	0	4,504,431
MITE	7645	Expenditure on land reclamation and remediation and on waste management	7,932,313	6,613,374	13,734,561	6,126,118	34,406,366
MITE	7648	Expenditure on financing interventions for water purification	46,738,239	20,596,664	32,200,000	4,109,774	103,644,677
Sub.	***4.4***	***De-pollution and improvement of air quality***	**1,367,188**	**15,000**	**4,546,681**	**2,912,564**	**8,841,433**
MITE	8405	Initiatives to combat pollution and improve air quality	1,367,188	15,000	4,546,681	2,912,564	8,841,433

Ministry	Chapter	Des. chapter of expenditure	2018	2019	2020	2021	Total
Category	**5**	**Environment and biological diversity protection**	**522,738,787**	**437,623,093**	**512,010,705**	**563,694,528**	**2,036,067,113**
Sub.	***5.1***	***MO.S.E. and protection of the Venetian lagoon***	**213,210,000**	**37,698,614**	**56,857,170**	**53,943,836**	**361,709,619**
MIMS	7059	Design/construction of strategic works and works for the collection/adduction of water resources	0	0	0	133,023	133,023

MIMS	7060	Strategic works of major national interest and works for the collection and adduction of water resources	0	0	0	4,652,849	4,652,849
MIMS	7187	Fifteen-year grants to update studies on the Venetian lagoon	4,161,452	1,968,011	915,562	1,915,694	8,960,718
MIMS	7200	Expenditure for the implementation of the MO.S.E. system	192,655,420	34,208,534	55,941,608	47,242,270	330,047,832
MIMS	7403	Setting up of guided rapid mass transport systems and rapid tramways in urban areas	16,393,128	1,522,069	0	0	17,915,197
Sub.	***5.2***	***Water infrastructures***	**65,073,683**	**120,560,187**	**69,739,718**	**196,823,664**	**452,197,252**
MIPAAF	7438	Funds for the launch of works under the national irrigation plan	5,484,638	10,559,423	7,115,388	11,099,476	34,258,926
MIPAAF	7470	Investments in national infrastructure development	658,065	11,508,478	16,660,393	48,526,811	77,353,746
MIPAAF	7471	Extraordinary maintenance/upgrading of works to protect against subsidence	0	6,000,000	4,000,000	4,000,000	14,000,000
MIMS	7012	Expenditure on projects and structural interventions to secure Gran Sasso area and on water intake systems	0	20,000,000	0	100,000,000	120,000,000
MIMS	7059	Strategic works of major national interest and works for the collection and adduction of water resources	0	0	0	704,591	704,591
MIMS	7060	Strategic works of major national interest and works for the collection and adduction of water resources	35,426,065	6,558,591	6,808,827	1,952,198	50,745,681
MIMS	7253	Project Fund. Sums for the completion of the integrated water system in the Abruzzo Region	721,247	3,035,500	2,344,133	2,833,398	8,934,279
MIMS	7281	*Piano Straordinario Invasi* (Extraordinary Reservoir Plan)	0	43,776,780	19,076,415	20,479,879	83,333,075
MIMS	7403	Setting up of guided rapid mass transport systems and rapid tramways in urban areas	14,851,354	12,508,040	0	1,101,193	28,460,588
MITE	7645	Expenditure on land reclamation and remediation and on waste management	7,932,313	6,613,374	13,734,561	6,126,118	34,406,366
Sub.	***5.3***	***Marine Protected Areas, National Parks and National Nature Reserves***	**77,795,295**	**76,352,491**	**72,867,609**	**421,398**	**227,436,794**
MITE	1551	Funds to be disbursed to bodies, institutes, associations, foundations and other organisations	73,170,952	71,033,160	66,309,130	0	210,513,241
MITE	7217	Interventions aimed at establishing, promoting and operating national parks	1,237,442	1,131,922	3,882,843	0	6,252,208
MITE	7219	Grants and transfers to national parks	2,162,417	1,695,249	1,801,021	0	5,658,687
MITE	7222	Investment in fauna/flora conservation, biodiversity protection and the marine ecosystem	34,967	2,492,161	874,615	0	3,401,743

MITE	7311	Interventions for the promotion and establishment of marine protected areas	1,189,517	0	0	421,398	1,610,915
Sub.	***5.4***	***Soil protection and action against hydrogeological instability***	**166,659,809**	**203,011,801**	**312,546,208**	**312,505,629**	**994,723,447**
MITE	7511	Interventions to secure the territory against hydrogeological instability	98,643,272	139,110,937	156,586,872	101,198,515	495,539,597
MITE	8533	Environmental protection fund and urgent interventions for soil protection in areas at hydrogeological risk	39,186,564	8,930,862	42,285,398	39,952,179	130,355,003
MITE	8535	Expenses for financing hydrogeological risk mitigation interventions	5,608,571	54,960,533	98,671,096	151,798,357	311,038,557
MITE	8551	Interventions for soil improvement and for the most urgent needs in case of disasters	21,467,823	0	10,387,431	19,080,873	50,936,126
MITE	8582	Expenses for operations in the event of a national disaster	470,627	0	915,410	475,705	1,861,742
MITE	8631	Expenditure on soil protection measures	1,282,953	9,469	3,700,000	0	4,992,422

Ministry	Chapter	Des. chapter of expenditure	2018	2019	2020	2021	Total
Category	**6**	**Research**	**327,656,169**	**299,482,833**	**170,912,429**	**453,327,605**	**1,251,379,036**
Sub.	***6.1***	***Grant to ENEA***	**211,133,248**	**276,463,410**	**141,180,591**	**453,327,605**	**1,082,104,854**
MISE	7630	Contribution to the New Technologies, Energy and Environment Agency (ENEA)	209,788,672	151,586,724	141,180,591	141,231,115	643,787,102
MISE	7660	Implementation of projects aimed at promoting and improving energy efficiency	1,344,576	124,876,686	0	312,096,490	438,317,752
Sub.	***6.2***	***Contribution to the Euro-Mediterranean Centre for Climate Change***	**5,000,000**	**5,000,000**	**5,000,000**	**0**	**15,000,000**
MUR	7239	Contribution to the Euro-Mediterranean Centre for Climate Change	5,000,000	5,000,000	5,000,000	0	15,000,000
Sub.	***6.3***	***ECMWF participation***	**5,226,913**	**5,741,456**	**6,037,263**	**0**	**17,005,632**
MUR	7291	Convention establishing the European Centre for Medium-Range Weather Forecasts (ECMWF)	5,226,913	5,741,456	6,037,263	0	17,005,632
Sub.	***6.4***	***OGS contribution to support scientific research at the Antarctic base***	**13,000,000**	**0**	**4,000,000**	**0**	**17,000,000**
MUR	7636	Contribution to OGS for the purchase of a vessel serving as a scientific research infrastructure to support the Antarctic Base	12,000,000	0	3,000,000	0	15,000,000
MUR	7335	Fund for the Arctic research programme	1,000,000	0	1,000,000	0	2,000,000
Sub.	***6.5***	***ITER-DTT nuclear fusion project***	**0**	**0**	**10,000,000**	**0**	**10,000,000**
MISE	7640	Resources for the ITER-DTT nuclear fusion project	0	0	10,000,000	0	10,000,000
Sub.	***6.6***	***Interventions to promote sustainable development***	**3,078,146**	**10,277,966**	**4,694,575**	**0**	**18,050,687**

MITE	7953	Fund to encourage measures to promote sustainable development	3,078,146	10,277,966	4,694,575	0	18,050,687
Sub.	***6.7***	***CNR-IRBIM contribution: Anton Dohrin Zoological Station of Naples***	**0**	**2,000,000**	**0**	**0**	**2,000,000**
MITE	7337	Strengthening research in Southern Italy for CNR-IRBIM (SZN)	0	2,000,000	0	0	2,000,000
Sub.	***6.8***	***ISPRA contributions***	**90,217,863**	**0**	**0**	**0**	**90,217,863**
MITE	3622	Contribution for the Italian Institute for Environmental Protection and Research (ISPRA)	70,362,776	0	0	0	70,362,776
MITE	8832	Italian Institute for Environmental Protection and Research (ISPRA)	19,855,087	0	0	0	19,855,087

Appendix II: Ex-post external review

ISS ESG

EX-POST EXTERNAL REVIEW
Impact reporting

"Italian Sovereign Green Bond Allocation and Impact Report" The Republic of Italy

10 May 2022

VERIFICATION PARAMETERS

Type(s) of reporting	Green Bond Allocation and Impact Report
Relevant standard(s)	Harmonized Framework for Impact Reporting (HFIR), as administered by ICMA (as of 06.2021)
Scope of verification	Italian Sovereign Green Bond Allocation and Impact Report (as of 10.05.2022) The Republic of Italy's Framework for the Issuance of Sovereign Green Bonds (as of February 2021)
Lifecycle	Post-issuance verification
Validity	As long as no material changes are undertaken by the issuer to its Green Bond Allocation and Impact Report as of 10.05.2022

CONTENTS

SCOPE OF WORK

The Republic of Italy ('the Issuer') commissioned ISS ESG to provide an External Review on its Green Bond Allocation and Impact Report by assessing:

1. The alignment of the Republic of Italy's Sovereign Green Bond Allocation and Impact Report with the commitments set forth in the Framework for the Issuance of Sovereign Green Bonds (February 2021 version).
2. The Republic of Italy's Sovereign Green Bond Allocation and Impact Report - benchmarked against Harmonized Framework for Impact Reporting (HFIR), as administered by ICMA updated as of 06.2021.
3. The disclosure of proceeds allocation and soundness of reporting indicators[1] – whether the metrics align with best market practices and are relevant to the Green Bonds issued.

THE REPUBLIC OF ITALY OVERVIEW

Italy is a parliamentary republic; it has a population of 62.335.424 (as of 2020). Italy is a founding member of the European Union, the NATO, and member of the G7. The Republic of Italy is committed to the European Commission's framework for achieving climate neutrality by 2050 and the goals set out in the European Green Deal. In December 2019, Italy published its Integrated National Plan for Energy and Climate (INPEC), establishing national targets for 2030 on energy efficiency, renewable energy (30% of final energy demand) and for the reduction of CO_2 emissions (33% reduction for plants not covered by the EU Emission Trading System compared to 2005).

The Republic of Italy fosters a partnership between the public and private sectors to further develop the supply of sustainable finance. To that end, initiatives are being taken by: (1) the Government, through the implementation of the Non-Financial Reporting Directive and the issuance of SGB, for example; (2) the Bank of Italy, through favouring greater purchases of green assets; and, (3) Borsa Italiana, through listing climate-friendly and social bonds. The Republic of Italy has decided through the Budget Law for 2020, to extend its commitment to the environment by issuing Sovereign Green Bonds.

[1] ISS ESG's review does not follow auditing or assurance standards or guidance. ISS ESG does not provide assurance on the information presented in The Republic of Italy Sovereign Green Bond Allocation and Impact Report. ISS ESG solely conducted a review of the Use of Proceeds' allocation and impact reporting against ICMA's Harmonized Framework for Impact Reporting (HFIR) core principles and recommendations where applicable, and criteria outlined in the Issuer's Framework

ISS ESG ASSESSMENT SUMMARY

REVIEW SECTION	SUMMARY	EVALUATION
Part 1 **Alignment with the Issuer's commitments set forth in the Framework**	ISS ESG finds that The Republic of Italy's Italian Sovereign Green Bond Allocation and Impact Report meets the issuer's commitments set forth in the Framework for the Issuance of Sovereign Green Bonds.	**Aligned** (however, proceeds have also been allocated to the project "Ecobonus[2]", which does not meet the criteria originally set in the framework)
Part 2: **Alignment with the ICMA Harmonized Framework for Impact Reporting (HFIR)**	ISS ESG finds that the Italian Sovereign Green Bond Allocation and Impact Report is in line with ICMA's Harmonized Framework for Impact Reporting (HFIR). The Issuer follows core principles and where applicable key recommendations. Allocation of proceeds is disclosed at a project category level. The report was produced on an annual basis and includes impact indicators for most of the financed projects.	**Aligned**
Part 3: **Disclosure of proceeds allocation and soundness of reporting indicators**	ISS ESG finds that the allocation of the bond's proceeds has been disclosed, with a detailed breakdown across different eligible project categories[3]. The indicators are relevant and align with the reporting criteria set forth in the Issuer's Framework. The impact indicators are qualitative and material to the Use of Proceeds categories financed through this bond, as they draw from the suggested impact reporting metrics from the ICMA HFIR. The Issuer uses internal methodologies to assess the impact indicators and sources data from internal data systems.	**Positive**

[2] The Green Allocation and Impact report includes a project category which was not identified in the eligibility criteria included in the original Framework. However, the Issuer has transparently reported on the rationale for it. The project category financed can still be considered in line with the ICMA Green Bond Principles. As such, ISS ESG considers the Green Allocation and Impact Report as overall aligned with the commitments set forth in the Framework.

[3] ISS ESG bases its assessment on the information provided in the allocation reporting. The Issuer is responsible for the preparation of the report including the application of methods and procedures designed to ensure that the subject matter information is free from material misstatement

ISS ESG EXTERNAL REVIEW ASSESSMENT

PART I: ALIGNMENT WITH COMMITMENTS SET FORTH IN THE FRAMEWORK FOR THE ISSUANCE OF SOVEREIGN GREEN BONDS

The following table presents ISS ESG's assessment of the Italian Sovereign Green Bond Allocation and Impact Report against the commitments set forth in The Republic of Italy's Framework, which are based on the core requirements of the Green Bond Principles 2018 as well as best market practices.

CORE GBP REQUIREMENT OR BEST MARKET STANDARD	THE REPUBLIC OF ITALY'S FRAMEWORK FOR THE ISSUANCE OF SOVEREIGN GREEN BONDS	THE REPUBLIC OF ITALY'S SOVEREIGN GREEN BOND ALLOCATION AND IMPACT REPORT	ALIGNMENT WITH COMMITMENT
1. Use of Proceeds			
.1. Alignment with project/ categories defined by the GBP	The net proceeds will be exclusively allocated to finance or re-finance projects in the following categories: • Renewable electricity and heat • Energy efficiency • Transport • Pollution prevention and control and circular economy • Protection of the environment and biological diversity • Research	In accordance with the eligibility criteria established in the Framework, the proceeds have been used to finance or re-finance projects in the following categories: • Renewable electricity and heat • Energy efficiency • Transport • Pollution prevention and control and circular economy • Protection of the environment and biological diversity • Research With regard to the category Energy Efficiency, the project financed (Fiscal incentives to improve building efficiency, called "Ecobonus") is not in line with the criteria "Investment expenditures that bring at least two levels improvement on the Italian energy efficiency	✓ (with only one exception, the project Fiscal incentives to improve building efficiency, called "Ecobonus")

		scale". This incentive is targeted at interventions such as building insulation, fixtures upgrade, solar panels installation. After the intervention it is required to provide a new EPC but the increase of two levels is not mandatory.	
.2. Defined and transparent criteria for eligible projects	Renewable electricity and heat: • Expenditures focused on the development of renewable and other low-carbon energies such as wind, solar, hydropower, geothermal, hydrogen and other (e.g. heat pumps). • All assets have to respect a 100 gCO_2e/kWh threshold. • Hydrogen will be produced by the electrolysis with an average carbon intensity for producing the electricity that is used for hydrogen manufacturing that is at or below 100 gCO_2e/kWh. Energy efficiency: • Investment expenditures that bring at least a two levels improvement on the Italian energy efficiency scale. • Smart grids to manage a higher renewable energy production will be considered and SF6 gas leakage prevention measures will be included. • Eligible heating networks use at least 50% renewable energy, excluding biomass. • Thresholds set by Law are applied when selecting expenditures related to energy efficiency of buildings. Transport • Expenditures related to Railway and Road Public Transportation that comply with the following thresholds: ○ For diesel passenger trains, emissions must be less than 50g	The Issuer has for the most part financed projects with the same criteria as identified in the Framework The issuer transparently reports on the deviation from the eligibility criteria in the framework and has a provided its rationale for it.	

CO_2e per passenger-kilometer (gCO_2e/pkm) until 2025 (subsequently only electric or hydrogen locomotives will be allowed).

- For freight trains, the emissions per tonne-kilometer (gCO_2e/tkm) must be less than 50% of the reference average indicated in the "Heavy Duty CO_2 Regulation" and will be updated in 2025.
- For road related public transportation, expenditures related to the acquisition of new local Road Transport will follow the EU Directive on Alternative Fuels Infrastructure (DAFI) which requires that the energy supply of vehicles to be at least 25% from electricity, methane, liquified natural gas and hydrogen. Incentives for the acquisition of hybrid or electric cars by private individuals or companies are also included.

- Expenditures related to Maritime Transport:
  - Expenditures for electrical infrastructures in ports to reduce ship fossil fuel use.
  - expenditures to finance maritime transport complying with the IMO legislation which requires (from 1 January 2020) the use of fuels for ships with a limit of 0.5% m / mto sulphur emissions15, the reduction of GHG emissions, and of CO_2 produced

Pollution prevention and control and circular economy: Expenditures targeted to promote:

- Sustainable consumption and production modes and aimed at developing pollution monitoring and control systems.

	• Wastewater management. Protection of the environment and biological diversity: • Expenditures focused on: ○ sustainable land use and protection as well as protection and restoration of terrestrial and marine biodiversity and ecosystems ○ water collection and saving. • Primary investments in the security of water supply. • Expenditures on sustainable management of water resources Investments aimed at reducing losses in water distribution networks. Research: • Expenditures on research projects on: ○ linear to circular paradigm; ○ policy measures to prompt the achievement of the UN SDG targets (such as policy tools related to nudging, subsidies, incentives schemes, public private partnership, etc.); ○ innovative production processes to reduce water and carbon footprint; ○ new technologies that help the preservation and enhancement of natural capital, biodiversity, and ecosystems; ○ new technologies aimed at improving energy efficiency, weather forecast, meteorology and climatology. • Expenditures related to climate research centres and institutes.		
.1. Description of the expected environmental and/or social benefits of the project categories	Environmental objectives and benefits are defined for each project category in The Republic of Italy's Framework.	A detailed description of core environmental impacts for each target area is available in the report.	✓

.2. Refinancing/ Financing	An amount equal to the net proceeds of the Bonds will be exclusively allocated to finance or re-finance, in whole or in part, new and/or existing loans/projects.	As of 31.12.2021 the Republic of Italy has allocated all of the proceeds, which have been assigned to existing and new projects, for a total amount of EUR 13.26 billion.	✓
.3. Exclusion of harmful project categories	The Republic of Italy will not allocate proceeds received from the issuance of Green, Bonds to any expenditure mainly related to the following sectors: • Exploration, manufacturing and transport of fossil fuels • Nuclear power (fission) • Energy plants (including biomass) with CO_2 emission level of more than 100g CO_2/kWh; • Manufacturing and production of alcoholic beverages; • Military contracts; • Gambling; • Arms manufacturing; • Manufacture and production of tobacco products; and, • Mining.	The proceeds have been not allocated in any of the excluded sectors listed.	✓
2. Process for project evaluation and selection			
2.1 Documented process to determine whether projects fit within defined categories	The Department of the Treasury (MEF) is responsible for identifying potential expenditures based on the screening of budget data received from the General Accounting Department (MEF), which is then followed by interactions with the relevant Ministries, in order to verify the eligibility of expenditures in the portfolio. This portfolio of eligible expenditures is shared with an Inter-ministerial Committee ("the Committee") for information and review.	The Eligible Green Projects were designated by Inter-ministerial Committee for Sovereign Green Bonds.	✓
2.2 Information on responsibilities	The potential Eligible Green Projects will be designated by the Committee.	The Eligible Green Projects were designated by the	✓

	and accountability	The roles and responsibilities of the Committee were disclosed in the framework.	Inter-ministerial Committee.	
2.3	Stakeholders involved in the process	The committee is composed of representatives of the: • Prime Minister's office, • Minister of Ecological Transition, • Minister of Economy and Finance, • Minister of Infrastructure and Sustainable Mobility, • Minister of Economic Development, • Minister of Agricultural and Forestry Policies, • Minister of University and Research, • Minister of Culture.	The Issuer confirms that various stakeholders are involved throughout the process.	✓
3. Management of Proceeds				
3.1	Green Bond proceeds tracked in an appropriate manner	The Republic of Italy will manage the net proceeds of the bonds on a portfolio basis. As long as the bonds under this Framework are outstanding, the Republic of Italy aims to allocate an amount equivalent to the net proceeds of these instruments towards its Eligible Green/Social Projects, as defined in the "Use of Proceeds" section. The net proceeds of the Bonds will be placed in the General cash Account of the Treasury at the Bank of Italy and will be tracked by the Issuer in an appropriate manner and attested to in a formal internal process.	The proceeds have been fully allocated.	✓
3.2	Disclosure of intended types of temporary investment instruments for unallocated proceeds	The Republic of Italy intends to fully allocate the proceeds as soon as possible by selecting expenditures that will be incurred in within six months. Certain expenditures, due to their nature (e.g. infrastructure projects) belong to multi-annual budgets and will be disbursed over the course of several years, in which case the first disbursements will take place within 24 months. The net proceeds of the Bonds will be credited to the Treasury General cash	The proceeds have been fully allocated.	

		Account at the Bank of Italy and will be managed in cash.		
3.3	Procedure in case of divestment or postponement	In case of expenditure postponement, cancelation, divestment or ineligibility, the Issuer has committed to replace the no longer Eligible Expenditure by a new Eligible Expenditure. The Issuer commits to reallocate the divested proceeds within twelve months.	The proceeds have been fully allocated.	✓
3.4	Disclosure of portfolio balance of unallocated proceeds	The Republic of Italy will produce a report on its Green Bonds which will include the balance of unallocated proceeds, if any.	The proceeds have been fully allocated.	✓
4. Reporting				
4.1	Use of Proceeds reporting	The annual report will show the allocation of proceeds arising from the Sovereign Green Bonds issued in the previous year. It will include details on the progress of the disbursement of the proceeds, at least at the sector level, and will contain a summary sheet of the progress of the implementation of the financed interventions.	The section "Allocation reporting" of the Italian Sovereign Green Bond Allocation and Impact Report complies with the pre-issuance commitment expressed in the framework and with the requirements defined in the GBP. *Further analysis of this section of the report is displayed in Part III of this report.*	✓
4.2	Impact reporting	The Republic of Italy will report annually on environmental impacts of the Eligible Green Projects (re)financed by the net proceeds of the Green Bonds. The impact report will refer to the environmental objectives of regulation EU 852(2020) and it will provide information on contribution of each project to the indicators of sustainability and the achievement of the objectives.	The section "Impact Reporting" of the Italian Sovereign Green Bond Allocation and Impact Report complies with the pre-issuance commitment expressed in the framework and with the requirements defined in the GBP. *Further analysis of this section is available in Part III of this report.*	✓

4.3 Means of disclosure: where the information is published	This reporting will be published on the website of the Ministry of Economy and Finance.	The report is intended to be publicly available.	
4.4 External review	A Second Party Opinion (SPO) will be issued by an independent external verifier in order to provide an external verification on The Republic of Italy's Framework for the Issuance of Sovereign Green Bonds.	The Republic of Italy has obtained a Second Party Opinion (SPO) on its Framework for the Issuance of Sovereign Green Bonds.	✓

Opinion: *ISS ESG finds that the Italian Sovereign Green Bond Allocation and Impact Report meet the general conditions set forth in The Republic of Italy's Framework for the Issuance of Sovereign Green Bonds. Core components as defined by ICMA have been considered in the Framework and have then been transposed accordingly in the Italian Sovereign Green Bond Allocation and Impact Report.*

PART II: ASSESSMENT AGAINST THE ICMA HARMONIZED FRAMEWORK FOR IMPACT REPORTING (HFIR)

Reporting is a core component of the GBP. Green bond issuers are required to report on both the use of green bond proceeds, as well as the expected environmental impacts at least on an annual basis. The ICMA Harmonized Framework for Impact Reporting has been chosen as benchmark for this analysis as it represents the most widely adopted standard.

The table below presents the findings of an ISS ESG assessment of the Italian Sovereign Green Bond Allocation and Impact Report against ICMA Harmonized Framework for Impact Reporting.

CORE PRINCIPLES		
ICMA HFIR	ITALIAN SOVEREIGN GREEN BOND ALLOCATION AND IMPACT REPORT	ASSESSMENT
Reporting on an annual basis	The Republic of Italy has reported on an annual basis from issuance and all the proceeds have been fully allocated. The report will be available on the Italian Ministry of Economy and Finance website.	✓
Illustrating the expected environmental impacts	The assessment and measurement of the impacts generated by the Italian Sovereign Green Bonds covered the following areas: a. Renewable electricity and heat – Fiscal incentives focused on the development of renewable and other low-carbon energies: CO_2 avoided emissions. b. Energy efficiency – Fiscal incentives to improve building efficiency: CO_2 avoided emissions. c. Transport – Subways: improving the overall performance of public transport through a modal shift from private car use to public electric transport. Impact data will be available in the following reports. Incentives for rail freight transportation: estimated increased use of rail for goods transportation. Incentives for high-speed rail connections: future estimated decrease of energy consumption and CO_2 emissions. Rapid mass transport: vehicles emissions reduction. Inland water transportation: estimated reduction of noise, air, water, and soil pollution; estimated energy consumption reduction. d. Pollution prevention and control, and circular economy Financing of water infrastructure: impact data will be available in the following reports.	

	e. Protection of the environment and biological diversity Protected marine areas, national parks and state natural reserves: CO_2 avoided emissions[4] f. Research: number of projects financed; qualitative descriptions of the projects	
Transparency on the currency	Allocated proceeds have been reported in a single currency. Projects on which proceeds have been allocated have been disclosed.	✓

RECOMMENDATIONS		
ICMA HFIR	ITALIAN SOVEREIGN GREEN BOND ALLOCATION AND IMPACT REPORT	ASSESSMENT
Define and disclose the period and process for including projects in their report.	The entirety of proceeds has been allocated to Green Assets. No modifications of the portfolio are planned so far.	✓
Indicate the total signed amount and the amount of environmental bonds proceeds allocated to eligible disbursements.	A total of EUR 13.26 billion has been raised through Issuer's Green Retail Bond. The entirety of the proceeds has been allocated to Green Assets.	✓
Put in place a formal internal process for the allocation of proceeds linked to their lending and investment operations for Green Projects and to report on the allocation of proceeds.	The Issuer followed a transparent process for selection and evaluation of Eligible Green Projects. Projects financed and/or refinanced through the Green Bonds issued under Framework for the Issuance of Sovereign Green Bonds were evaluated and selected based on compliance with the Eligibility Criteria as laid out in the Framework.	✓
Provide a list of projects to which environmental bonds proceeds have been allocated, or report solely on a portfolio level.	The Italian Sovereign Green Bond Allocation and Impact Report includes the total amount of proceeds allocated per eligible project category, type of sub-projects within categories and per year of investment.	✓
Describe the approach to impact reporting	The issuer identifies the specific eligible projects and clearly defines, for each project, the total project's allocated proceeds.	✓
Report the estimated lifetime results and/or project economic life (in years).	The Issuer has not disclosed this information.	○

[4] The issuer confirmed that all protected areas, national parks, and state natural reserves under its jurisdiction have been transversally financed under this project category.

Ex-post verification of specific projects	The Issuer does not sample ex-post verification of specific projects	N/A
Report on at least a limited number of sector specific core indicators for projects included in their green bond programmes	The Republic of Italy has reported on sector specific indicators for most of the projects financed.	✓
For the calculation of indicators, where there is no single commonly-used standard, issuers may follow their own methodologies, disclosing the methodologies	The issuer elaborated its own methodologies to calculate or estimate the impacts of the financed projects. The calculations are trasparently disclosed in the Sovereign Green Bond Allocation and Impact Report.	✓
Elect to convert units reported for individual projects. Disclosure on the conversion approach	Where needed, the issuer has used conversion factors. These factors are taken from italian nation-wide database.	✓
Be transparent about projects with partial eligibility	The project Fiscal incentives to improve building efficiency, called “Ecobonus”, does not meet the eligibility criteria set in the framework. The issuer has transparently reported on the matter and the project can still be considered in line with the ICMA GBP.	✓
In case the expected impacts of different project components may not be reported separately, issuers may attribute the results to each component based on their relative share in the related financing, disclosing the attribution approach	An attribution approach has been developed for the investments on “Water infrastructure”. These type of projects have two dimensions: management of water distribution and wastewater treatment. As details necessary to identify the different components within each project are missing or hard to obtain, It was decided to split the expenses in half between the project category “Pollution prevention and control, and circular economy” and “Protection of the environment and biological diversity”.	✓

Opinion: *ISS ESG finds that The Republic of Italy follows the ICMA Harmonized Framework for Impact’s core principles and key recommendations. The issuer provides transparency on the level of expected reporting as well as on the frequency, scope and duration, aligned with best practices. Allocation of proceeds is disclosed at a project category level. The report was produced on an annual basis an includes impact indicators for most of the financed projects.*

PART III: DISCLOSURE OF PROCEEDS ALLOCATION AND SOUNDNESS OF THE IMPACT REPORTING INDICATORS

Methodology note: *ISS ESG's review does not follow auditing or assurance standards or guidance. ISS ESG does not provide assurance on the information presented in The Republic of Italy Sovereign Green Bond Allocation and Impact Report. ISS ESG notes that it has not verified or audited the allocation reporting and thus cannot provide any assurance on its soundness. ISS ESG solely conducted a review of the Use of Proceeds' allocation and impact reporting against ICMA's Harmonized Framework for Impact Reporting's core principles, recommendations and best market practices.*

Use of Proceeds Allocation

Use of Proceeds allocation reporting is key to put the impacts into perspective with the number of investments allocated to the respective Use of Proceeds categories. ISS ESG solely conducted a review of the Use of Proceeds' allocation reporting against ICMA Green Bond Principles' requirements on the level, scope and information to be provided in the allocation reporting. ISS ESG finds that The Use of Proceeds allocation reporting occurred on an annual basis from the issuance, after full allocation of the proceeds.

Proceeds allocated to Eligible Projects

The proceeds' allocation is broken down by the project category level, and also by type of project. The issuer has provided detail about the type of projects included in the portfolio.

ISS ESG finds that the allocation report section of the Sovereign Green Bond Allocation and Impact Report of The Republic of Italy aligns with best market practices by providing information on:

- The types of projects (re-)financed
- The total amount of proceeds in million euros (divided per environmental project)

Impact Reporting Indicators

ISS ESG finds that the impact indicators used by the Sovereign Green Bond Allocation and Impact Report of the Republic of Italy align with best market practices using ICMA's recommended metrics, in the HFIR. The table below shows the assessment conducted by ISS ESG. The issuer measures and discloses relevant indicators for each Use of Proceeds project category.

ELEMENT	ASSESSMENT
Relevance	The impact indicator chosen by the issuer for this bond is the following: a. Renewable electricity and heat – Fiscal incentives focused on the development of renewable and other low-carbon energies: CO_2 avoided emissions b. Energy efficiency – Fiscal incentives to improve building efficiency: CO_2 avoided emissions c. Transport: Incentives for rail freight transpiration: estimated increased use of rail for goods transportation Incentives for high-speed rail connections: future estimated decrease of energy consumption and CO_2 emissions. Rapid mass transport: vehicles emissions reduction. Inland water transportation: estimated reduction of noise, air, water, and soil pollution; estimated energy consumption reduction. d. Pollution prevention and control, and circular economy Financing of water infrastructure: impact data will be available in the following reports. e. Protection of the environment and biological diversity: Protected marine areas, national parks and state natural reserves: CO_2 avoided emissions f. Research: number of projects financed; qualitative descriptions of the projects These indicators are qualitative and material to the Use of Proceeds categories financed through this bond and draw from the Suggested Impact Reporting metrics for Green Building Projects by the ICMA Harmonized Framework for Impact Report for Green Bonds. Some indicators were designed by the issuer to capture the specificity of their projects. This aligns with best market practices.
Data sourcing and methodologies of quantitative assessment	For the impact indicator, the issuer uses internal methodologies and sourcing data from the Interministerial Committee. For data collection and data processing Ministries use in-house companies and specialized agencies. Some data are calculated using conversion factors provided by Italian nation-wide database.
Baseline selection	The impact data is compared with relevant baseline, where needed, as relevant internal data were used.

Scale and granularity	The impact data is presented at the Use of Proceed type of project level for the indicator(s).

High-level mapping of the impact indicators with the UN Sustainable Development Goals

Based on the project categories financed and refinanced by the bonds as disclosed in the issuer's Sovereign Green Bond Allocation and Impact Report, the impact indicator(s) adopted by the Republic of Italy for its Green Bond can be mapped to the following SDGs, according to the ICMA "A High -Level Mapping to the Sustainable Development Goals"[5].

IMPACT INDICATORS	SUSTAINABLE DEVELOPMENT GOALS
a) Renewable electricity and heat Fiscal incentives focused on the development of renewable and other low-carbon energies: CO_2 avoided emissions	
b) Energy efficiency Fiscal incentives to improve building efficiency: CO_2 avoided emissions	
c) Transport Incentives for rail freight transportation: estimated increased use of rail for goods transportation	
c) Transport Incentives for high-speed rail connections: future estimated decrease of energy consumption and CO_2 emissions	
c) Transport Rapid mass transport: vehicles emissions reduction.	
c) Transport Inland water transportation: estimated reduction of noise, air, water, and soil pollution; estimated energy consumption reduction.	
e) Protection of the environment and biological diversity Protected marine areas, national parks and state natural reserves: CO_2 avoided emissions	

[5] https://www.icmagroup.org/assets/documents/Regulatory/Green_-Bonds/June-2020/Mapping-SDGs-to-Green-Social-and-Sustainability-Bonds-2020-June-2020-090620.pdf

DISCLAIMER

1. Validity of the External Review: As long as no material changes are undertaken by the issuer to its Green Bond Allocation and Impact Report as of 27.04.2022
2. ISS ESG uses a proprietary methodology to assess the post-issuance reports. In doing so, we adhere to standardized procedures to ensure consistent quality of responsibility research worldwide.In addition, we conduct External Reviews solely based on data provided by the issuer.
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ANNEX: Methodology

ISS ESG Review of the post-issuance Reports

The external review of post-issuance reports provides the Issuer with an independent opinion on the soundness of its post-issuance report and of its alignment with recognized market guidelines and it provides investors with independent information regarding the reliability of the report produced. On the basis of the information provided by the Issuer, ISS ESG assesses the alignment of the report with recognized market guidelines, the metrics chosen by the Issuer and the soundness of process and methodology of reporting. The analysis of the metrics adopted is based on specific sets of indicators developed by ISS ESG referring to common market guidelines.

High-level mapping to the SDG

The 17 Sustainable Development Goals (SDGs) were endorsed in September 2015 by the United Nations and provide a benchmark for key opportunities and challenges toward a more sustainable future. Using a proprietary method based on ICMAs Green, Social and Sustainability Bonds: A High-Level Mapping to the Sustainable Development Goals, ISS ESG identifies the extent to the issuers reporting and project categories contribute to related SDGs.

About ISS ESG External Review

ISS ESG is one of the world's leading rating agencies in the field of sustainable investment. The agency analyses companies and countries regarding their environmental and social performance.

As part of our Sustainable (Green & Social) Bond Services, we provide support for companies and institutions issuing sustainable bonds, advise them on the selection of categories of projects to be financed and help them to define ambitious criteria.

We assess alignment with external principles (e.g. the ICMA Green / Green Bond Principles, Social Bond Principles and Sustainable Bond Guidelines), analyse the sustainability quality of the assets and review the sustainability performance of the issuer themselves. Following these three steps, we draw up an independent External Review so that investors are as well informed as possible about the quality of the bond/loan from a sustainability perspective.

Learn more: https://www.isscorporatesolutions.com/solutions/esg-solutions/green-bond-services/

For information on External Review services, contact: SPOsales@isscorporatesolutions.com

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