Environment and energy

The analysis of natural and environmental context of our Country can count on very old historical records (observations on rainfall, temperature, water levels, forests, etc.), while other aspects are covered by more recent information, usually running from the second half of the last century.
Official statistics made a leap in quality in this area in particular during the last decades of the 20th century, including new measurements aimed at describing the environmental effects of human activity alongside atmospheric and geological observations. Thanks to the estimates deriving from Environmental Accounting – also developed thanks to the intervention of the European Commission in the early 1990s – it became possible to make ever more detailed records of the interaction between the general state of the environment and the overall development of productive activities.
In the evolution of this national and international information snapshot, energy sector figures also take on an ever greater importance and weight due both to the close correlation with the economic system in general and to the sector's direct impact on environmental conditions.
The modernisation and perfecting of the methods used to estimate polluting emissions and the contemporary accounting in the national energy balance of renewable energy sources reflect the high level of awareness and attention to the issues relating to environmental protection in the last decades of the 20th century, issues which appear likely to take on an ever more important role the years to come. The development of renewable sources has in fact become one of the pillars of EU energy policy in the new millennium, setting binding targets for each member state. In 2005, with the ratification of the Kyoto Protocol, Italy undertook to develop, publish and regularly update national emission inventories, in addition to formulating and implementing emission reduction programs.

Weather statistics

In Italy, the first certain documents that testify to a systematic observation of meteorological phenomenon date back to the first half of the 18th century, thanks to the activity of universities, colleges and academics.
After the constitution of the Kingdom of Italy, the General Statistical Division of the Ministry of Agriculture, Industry and Trade of the time took over these activities and, in 1865, established a centralised Weather Information Centre with the task of collecting the figures from astronomical observatories, schools and other adequately equipped institutions, in addition to setting up new measurement stations.
The first publications of weather statistics relating to the entire national territory begin in 1865 and continue to 1878. Note in particular the volumes entitled *La meteorologia italiana (Italian Meteorology),* published first every 10 days and later on a monthly basis, by the Statistics-weather Service. From 1879 to 1935, with the exception of the interruption due to the first world war, the publications of figures and reports on the weather continued in the *Annali (Annals)* published by the Royal central weather office, established in November 1876 and directed by the General Statistical Division of the Ministry of Agriculture, Industry and Trade. From 1907 to 1920 and from 1926 to 1935, however, only scientific work and reports were published rather than the usual tables of meteorological figures. Furthermore, from 30th November 1879 the Royal central weather office published a *Bollettino meteorico giornaliero (Daily weather bulletin)* containing the figures
from the main Italian and selected foreign observatories, including up to 122 stations in 1914.
After the establishment of the Hydrological Office of the waters magistrate in Venice (1907) and the Po Hydrological Office in Parma (1912), in 1912 *Bollettini mensili (Monthly Bulletins)* began to be published, with particular attention to rainfall figures. Later, in 1917, when the Central Hydrological Authority was established under the supervision of the Consiglio Superiore delle Acque (Superior

Water Council) at the Ministry of Public Works, publication began of *Annali idrologici (Hydrological Annals)* by the various territorial regions.
In 1925, the forecasting Section of the Royal central weather office merged with the aerological office in the Superior Direction of aeronautical construction and invention into a single "Forecasts office", under the direction of the Commissariato per l'Aeronautica (Air Force Commissariat). Within a few years the modern-day Servizio Meteorologico dell'Aeronautica Militare (Military Aeronautical Weather Information Service) was founded, together with the publication of a *Bollettino giornaliero (Daily Bulletin)*, the descendant of that previously published by the Central Weather Office. The publication of weather figures were later discontinued, also due to the commencement of the Second World War.
From 1926 the Central Statistical Institute has been responsible for publishing the weather data from approximately 60 stations distributed over the entire national territory, in detailed tables in the *Italian Statistical Yearbook* and in *Statistics Bulletins.*
In response to the growing interest for the recording of meteorological phenomenon and to ensure the necessary historical continuity of the publication of this information, from 1959 to 2005 ISTAT published a specific series of *Special yearbooks* entitled *Meteorological statistical yearbooks* ideally designed to accompany the volumes in the *Italian Meteorology* series.
Over time, the number of stations providing figures began to fall. Currently, the Italian meteorological network is essentially based on:

- Regional Environmental Agencies (Arpa);
- Independent Regions and Provinces, which united after 1980 the major part of the technical offices of Ministry of Public Works and Hydrological authority;
- the Central office of agricultural ecology;
- the Ministry of Defence and Italian Air Force, Weather information service;
- the Italian Flight Assistants Association (ENAV), previously part of the Ministry of Defence and Italian Air Force.

Numerous other stations also exist, established and run by public, cultural, religious and private bodies such as universities, scholastic institutions, private centres and companies.
It is important to specify that the meteorological-climate data recorded in individual stations depend on the specific geographical-morphological features of the area surrounding each measuring station. Therefore, the data from each station can be taken to represent the climate conditions of that particular area and, with the appropriate caution, the climatic region to which they belong.
The tables presented in this section show the annual and monthly data for the stations, generally located in the larger urban areas. These, which can boast the most complete time series from the second half of the 19th century onwards, succeed in providing an overview, with precise territorial detail, of the main climatic phenomena linked to rainfall and temperature measurements.

Warnings for time series comparisons

- Up until 1983 the station of Milan processed data from the Milan Linate station. From 1984 the data were collected from the station in Milan Malpensa.
- For all the stations considered, up until 1996 the annual figure was calculated by analysing the figures included from December to November in the following year (meteorological year). From 1997 onwards, the annual figure has been calculated using the solar year, i.e. the data from January to December.

National parks

National Parks constitute an important natural, historical and cultural heritage. The first parks to be instituted in Italy were the Gran Paradiso Park in 1922, the Abruzzo National Park in 1923, the Circeo National Park in 1934 and the Stelvio National Park in 1935. In more recent years, the most well-

known historical parks have been joined by many more, extending the range of protected areas. Italy has 23 national parks which, together with regional parks, integrate and complete the protection of the territory. In the state protection programme, marine parks are taking on increasing importance, destined to protect areas of sea and Mediterranean coastline (often including entire islands or archipelagos) that represent exceptional and typical environmental or scenic features in an integrated manner.
The Ministry of the Environment decree creating the Italian Register of protected areas was published on 05th May 1991. This Register is formed of two sections: an administrative section collecting ministerial decrees and regional or state laws establishing the protection criteria for the individual protected areas; and a cartographical section, collecting the official maps showing the perimeters of each protected area and any zoning schemes created within them. The Register is managed by the Nature Conservation Service at the Ministry of the Environment, which takes care of processing the existing data on national protected areas both from a quantitative and qualitative point of view and regarding the territorial structure of the areas themselves. National parks are generally protected by state laws, but no information tools currently exist to allow for the reconstruction of a complete and reliable overview. Some indications, including those relating to management Body of the area, are provided by the Official List of protected areas approved by the Committee for protected areas in compliance with Law no. 394/1991.

Forest area

The first large-scale survey of wooded areas took place in 1868 and is known as the “1870 forest statistics”, from the year in which the survey results were published, or also as the “Castagnola survey” from the name of the Minster of Agriculture who ordered it. From 1871 to 1926, before the foundation of the Central Statistical Institute, various “general” and “special” surveys were carried out on the “forests”, which only provided however a limited amount of information on the subject. The surveys generally had the aim of ascertaining the *extension* of the stocked area, distinguished by type of government, tree species and property category, and the *production,* intended as extraction of timber form the forests, or more often as “use”, usually considering both “timber” and “non-timber” products, in particular “chestnuts”.
Among the special surveys of stocked areas, the survey initiated in 1922 and concluded in 1924 of the land owned by municipalities and other publict institutions is particularly noteworthy. The survey ascertained the extension of forests and, at the same time, the land belonging to other types of cultivation, divided into “crops” and “pasture”. The survey distinguished between different forms of forest management and included chestnut orchards. From 1927 to 1945 records and measurements progressively improved, to the point of creating the first *Italian forest registry,* although incomplete, and a *forest statistics service* which employed new methods in surveys and a greater quantity of resources to those used in the past.
When the central statistical institute was created, and the responsibility for agrarian and forest statistics passed to it (with Royal Decree no. 1035 dated 02nd June 1927), the need for an organisation of the registry according to exclusively technical criteria had already been apparent for some time. The direct measurement of all elements, regarding both extension and production, was fundamentally important for the quality of the Italian forest registry. This survey was performed independently of the agrarian registry, although the two sources remained linked by the common use of distinctive features of individual types of cultivation, in order to allow checking of any discrepancies in results. The principle of direct measurements was not always applied with the same procedures; the instructions given to operators in 1928 were applied up until 1939, but different methods were used from 1939 to 1945.
With regard to definitions, in 1928 the Central statistical institute defined “forests” as land covered in timber forest plants, trees or bushes, covering more than 50 per cent of the surface and whose production was higher than that of uncultivated productive areas. In that period, moreover, the Forestry Administration gave an important contribution to the statistical system, both directly contributing to the collection and transmission of administrative data and carrying out direct and independent surveys, such as those performed in the 1930s for the compilation of the “Italian forests map” created with reference to 1935. The “map” cannot be considered to entirely substitute the

registry, although it did provide a useful guide for estimating the size
and types of forests and their geographical distribution at the time. Also the map, despite did not show particularly detailed territorial data and not immediate link with the other statistical information in the same subject, was a reference for the subsequent updating of the annual area statistics.

A genuine programme of forest statistical surveys, in any case, was created and initiated only in the early 1930s, following the issue of the first and fundamental legislative text, still in force today, for the forestry sector – Royal Legislative Decree no. 3267/1923 – coupled with the effect of Royal Decree no. 1035/1927 which resulted in the foundation of a forest statistics service at the kingdom's Central statistical institute.

The period running from 1946 to 1956 saw an intense activity regarding forest statistics. From 1949, in order to improve and uniform the data collected in the survey, the number of factors observed was amplified, measurements were perfected, records simplified (without damaging results) and a more rapid and efficient critical exam was carried out on data from the provincial Commission, in collaboration with Istat. These operations together allowed for the construction of annual time series of surface data, divided by type of forest and production, with an adequate degree of accuracy and greater structure with respect to the past, also thanks to the combination of more adequate methods and means.

With the extraordinary general survey – of surface and production – performed to establish the situation as at 30th June 1947, in response to a specific request from the Food and Agriculture Organisation (FAO), it became possible to give a good estimate of the areas corresponding to different types of forest, for a total of 29 types. This same typing system was adopted by modern statistics from 1948. The classification of types has undergone a few variations over time, reducing the number of types from 29 to 25: 14 types of high forest system, 6 coppices with standards systems and 5 simple coppice systems.

Over the course of the following decades, the *Forest statistics* were revised several times to adapt them to the requirements and characteristics of a sector that has progressively transformed in line with economic development, the changes in sector policy and the transferral of responsibility: from the State to the Regions, on one hand and from the State to the European Union and the United Nations on the other.

The time series presented here starts in 1861, although up until 1949 only showing total forest areas, with homogeneous and comparable data for types of forest only from 2004 onwards.

The survey of stocked areas ascertained, with reference to 31st December each year for each individual municipality, the areas on which at least half a hectare of forests were replanted, according to their size, the type of forest, the property category and the altitude zone. The unit of measurement was the forest area subject to replanting or deforestation. In this way, the balance of forest areas was calculated by the difference between the increase (replanting of land previously used for cultivation other than forest) and the decrease (authorised deforestation, abusive deforestation, failed replanting, avalanche, landslides, etc.). Variations due to changes in administrative circumstances or variations for changes in agrarian district resulted in adjustments to the balance, as did changes to areas previously reported. It must be noted that the definition of forest area adopted by ISTAT up until 2004 and used for the national time series specified a minimum coverage of 50% of tree cover, compared with a minimum of 10% accepted by recently introduced international definitions.

The "Forest statistics" were discontinued in 2004. From 2005 onwards the estimate of stocked areas, their size, the type of forest, property category and altitude zone are updated, in variable periods, starting with the "National forest and forest carbon stock inventory" (INFC) performed by the State Forestry Department in 2005, with the collaboration of the Ministry of the Environment, the National Statistical Institute and the scientific supervision of the Agricultural research council, in order to meet the requirements of international commitments, in particular the "Kyoto Protocol", the operational tool of the United Nations Framework convention on climate change (UNFCCC, 1992), but also to respond to the need for a modern information tool for Italian forestry[1]. The 2005 edition of the INFC is the last inventory to have been made on a national level. An update is planned within the next ten years.

[1] The first "National forest INVENTORY" (IFNI, 1985) was performed in the mid-1980s, the first post-war inventory of Italian forests. An interesting precedent was set by the old Forest militia map of the 1930s.

Warnings for time series comparisons

The time series for forest areas is affected by the different definitions and inventories or cartographic surveys performed in certain base years:

- the 1922-1942 series is affected by the revision performed following the 1933 forest areas survey;
- the 1943-1984 series is affected by the revision performed following the forest areas survey performed between 1947-1949.
- Extraordinary replanting was performed during the 1960s.
- From 1977 the figure refer to the solar year rather than the forestry statistical year (01st April to 31st March).
- From 1985 onwards the total forest areas also include areas dedicated to Mediterranean brush;
- Up until 2004, the definition of forest area referred to a minimum tree coverage of 50 per cent. In 2005 this changed to 10 per cent, in compliance with recent international definitions, implemented by the "National forest and forest carbon stock inventory" (INFC) performed by the State Forestry Department.

Forest fires

Statistic records of the phenomenon of forest fires began to be taken in the 1960s, as the seriousness of their effect on the environment began to be perceived in a more concrete manner. The change in climate conditions, with long periods of drought, and the progressive urbanisation have led to an increase in the number of abandoned areas and an accumulation of fuel in recent decades, exacerbating the problem of forest fires and worsening their effect both in number and the areas damaged.
The collection of figures on the fires has historically been the responsibility of the State Forestry Department. ISTAT processes part of these data and publishes them through its own publications, including the *Italian statistical yearbook.* From 1996 onwards, with reference to the 15 regions under ordinary government, the State Forestry Department has developed an accurate computerised system for data collection on forest fires, known as the Mountain Information System (SIM - MIS), guaranteeing detailed and reliable information. This system has allowed the State Forestry Department to gain solid experience in the use of GIS systems, an important support for its institutional duties of combating and preventing violation of environmental legislation.
Moreover, from 2008 the new "Electronic forest-fire information base" (FEI), available within the information system, allows for local administrations to access, in a single electronic file, statistical data describing each single event, , and in addition to the perimeter of the fired area by its geographic coordinates. Regional operations Centres of State Forestry Department activate the procedure indirectly through a program used by office personnel, known as Emergency management, entering the first information received when the fire is reported and assigning the FEI to the Command station responsible for the area. The Command station then fills out the FEI, collecting data and entering the information into the system, in line with pre-established deadlines. The provincial Command coordinates the activities for the whole procedure, checks the information entered and ensures the quality of the data by the definitive validation, known as "FEI Publication". Only the data contained in the final published FEI are used to calculate national forest fire Statistics, published by the State Forestry Department.
The independent regions and provinces, which operate through local forest Departments, have their own data collection and cataloguing procedures, and information is periodically submitted to the State Forestry Department in order to be entered into national statistics. Activities are currently underway to develop automatic procedures to align the data submitted by these local authorities, thereby allowing them to be entered into the Mountain information system.

Main river channels

The flow of water in a river bed represents a fundamental component of the hydrological cycle. The flow of a course of water, in addition to being determined by natural factors such as climate, vegetation, and the geomorphological and hydrogeological features of the water basin, is also strongly influenced by several anthropic factors, such as water removal and derivations for various uses and soil use. The quantity of water flowing in rivers is, therefore, an important indicator of the overall state of water resources.
Differently from the main European countries, from a hydrological standpoint Italy is characterised by an extremely variable range of situations. The large river systems of the North that flow to the Adriatic Sea (the Po, Adige, Piave, Tagliamento, Brenta-Bacchiglione and Isonzo rivers) and the large rivers of mainland Italy (the Tiber, Arno, Liri-Garigliano and Volturno rivers) are countered by rivers with more limited hydrographical basins and a more irregular flow along the entire length of the Apennine ridge, in Sicily and in Sardinia.
The area normally taken as reference for water flow analysis is the water basin, which represents the area in which rainwater or melted ice from snow and glaciers flowing on the surface, gather through a series of torrents, rivers and sometimes lakes before flowing into the sea at a single mouth, estuary or delta. The amount of water flowing through a specific section of a water course is usually calculated using the measurement of the hydrometric level, defined as the elevation of the water surface above an established level (hydrometric zero). In general, hydrometric zero is placed in correspondence with the minimum level possible for the water course, so as to avoid negative readings. The measurement of the hydrometric level is then converted into a flow value using a function known as “flow scale” or “discharge table”, experimentally calculated by measuring the flow speed and the geometry of the section of riverbed. The measurement of the hydrometric level can be calculated using systematic manual readings of hydrometers, or by hydrometrographs or tele-hydrometers which record data automatically, with the possibility of transferring information to a pre-established data collection centre. Not all Italian rivers, especially those from minor river basins, are monitored through measuring stations.
In Italy, the first observations of rainfall and the first systematic readings of the levels of certain water courses date back to the beginning of the 19th century. After the first world war, the Ministry of Public Works set up the National hydrological authority under the (auger) (?? auspices) of the Superior public works council, with the specific task of uniforming, organising and making thermometric, pluviometric and hydrometric information available in Italy through the periodical publication of *Hydrological yearbooks.* The National hydrological authority was structured in fourteen departments distributed over the territory, drawn up in consideration of the hydrographical basins of the main Italian rivers and the particular administrative nature of the various areas. The Italian hydrological authority has collected information on hydrological phenomenon for the whole of the 20th century, based on approximately four thousand thermo-pluviometric measuring stations distributed over the entire national territory, developing analyses and studies on the full flow of Italian water courses.
Knowledge, through the systematic collection of data, of the hydrological phenomena that have taken place in the past still represents today the fundamental basis for designing hydraulic defence works, for calculating hydraulic risk factors and for correct territorial planning.
With Law no. 183 dated 18th May 1989 “Regulations for the organisational and operational structure of soil defence” as part of the Technical services for the Presidency of the Council of Ministers founded the National hydrographical and marine biology service. As responsibility was transferred from the State to the Regions, the Italian hydrographical and marine biology service also underwent changes. In fact, Legislative Decree no. 112 dated 31st March 1998 entitled “Assignment of State administrative functions and duties to regional and local authorities”, in implementation of Law no. 59 dated 15th March 1997 and Presidential Decree dated 24th July 2002 ordered that departmental Offices be transferred to Regional authorities, while the Direction of the National hydrological authority came under the umbrella of the Environmental protection and technical services agency (APAT), now the Higher institute for environmental protection and research (ISPRA).
Following these transfers, some departmental hydrographical Offices were placed under the supervision of regional environmental agencies (ARPA), while others were placed in regional civil protection structures, commissions and agencies for soil protection. The *Hydrological yearbooks* were therefore no longer published and each regional structure took on the responsibility for publishing its

own figures.
Framework Directive 2000/60/EC on waters, issued by the European Parliament and EU Council[2] introduced the main units for managing hydrographical basins: the so-called "hydrographical district". This is formed of one or more neighbouring hydrographical basins and their respective underground or coastal waters. Article 64 of Legislative Decree no. 152 dated 03rd April 2006 divides the national territory into eight hydrographical districts: Padano, Eastern Alps, Northern Apennines, River Serchio basin, Central Apennines, Southern Apennines, Sicily and Sardinia.

Seismic events

Seismic activity is a physical feature of the territory just like the climate, mountain ranges and water courses. Italy is one of the Mediterranean countries with the highest seismic risk, both in terms of the frequency and strength of the earthquakes that occur.
Since the 19th century, academics have been working on a seismic history of Italy, drawing from the chronicles of the time. One of the first problems to resolve in order to perform this task was to classify seismic events. To this end, macroseismic scales were introduced, designed to synthesize the seriousness of the effects of an earthquake zone by zone in a numeric value: macroseismic intensity. From the collection and systematic classification of seismic events the first catalogues of earthquakes were created which, although affected by the intrinsic uncertainties in the sources, still constitute an irreplaceable tool for describing the seismic value of an area today. Starting from the end of the 1960s, this collection of information was computerised and is currently held at the Italian National institute of geo-physics and volcanology (INGV).
In 1935, Charles Francis Richter introduced, as a measure of the size of an earthquake its "magnitude", representing an estimate of the quantity of energy released , based on the amplitude and duration of seismic waves. In Italy, in 1936 Guglielmo Marconi founded the National geophysical institute responsible for monitoring and analysing seismic events. Following the destructive earthquakes which took place in Friuli in 1976 and Irpinia in 1980, this sector received considerable attention, resulting in the creation of the National centralised seismic network which still collects and publishes data on seismic activity today. Ever since the early 1980s, the signals from the seismic network have been systematically analysed in digital format. This made it possible to create a 24 hour a day supervision service, capable of providing the location and magnitude of any Italian earthquake within two minutes of its occurrence.
Today, the Network is managed by the Italian National institute of geo-physics and volcanology, the research body officially responsible for monitoring seismic activity in Italy (as per Legislative Decree no. 381 dated 29th September 1999). Seismic events are recorded on an ongoing basis and transmitted in real time to the National earthquake centre, functioning from its offices in Rome. The Network is composed of various stations distributed over the national territory. The Naples and Catania branches, in collaboration with the Umbria and Marche Regional authorities, manage in their turn other local seismic networks. The data collected are published in the *Seismic Bulletin* which, since 2002, is published on a bi-monthly basis on the INGV website. In addition to the *Seismic Bulletin,* the INGV has produced and recently updated a Historical catalogue of seismic activity with information on seismic events in the past, covering 35 thousand earthquakes in Italy from 1975 onwards.

Energy

The National Energy Balance

The theme of energy, due to its close links to the economic system and its environmental impact, has taken on a growing importance over time. Knowledge of the characteristics of the sector has made a wide range of data available, collected and processed by some sector operators: the Ministry of Economic Development, regarding the statistics relating to the National Energy Balance, collected

[2] Directive 2000/60/EC by the European Parliament and Council dated 23rd October 2000 which establishes a framework for community action regarding water management, published in the Official Gazette of the European Union dated 22nd December 2000.

since the 1960s, and the Terna - Rete elettrica nazionale Spa company for statistics from the electricity sector.
The Energy Balance is the accounting tool used to quantify the flows of each primary energy source derived, in all phases, from production or importation of energy sources right up to the final uses in each economic sector. In the Italian National energy balance (BEN) the quantity of energy produced, imported, transformed and consumed in a year is calculated for each energy source in the national territory. The BEN is drawn up and published in a yearly basis by the current Ministry of Economic Development (MSE) according to the methodology set down by European regulations on energy statistics. The data accounted in the BEN are the result of processes performed partly on the basis of the direct measurements that the Ministry performs at operators in the petrol, carbon and gas sectors, and partly on the basis of the measurements performed by the Terna – Rete elettrica nazionale Spa statistical office, the company which is responsible, in the context of the National statistical system, for publishing official statistics relating to the electricity system.
The BEN was published for the first time in 1971. Since then, a few important changes have been introduced with the aim of highlighting different details in the energy sources used. Some obsolete sources, such as “Nuclear fuels”, have been eliminated from the balance, while since 1994 “Renewable energy sources” have been introduced, systematically entering under that heading those sources that, although already present in the BEN to some extent, were previously grouped under other headings.
The Ministry of Economic Development processes the Energy balance in an extended and synthetic format. In the summary version, the individual energy sources are aggregated into five homogeneous classes (solid fuel, petrol products, gas fuels, renewable fuels and electric energy), taken into consideration in the extended version of the balance, with the elimination of the duplications due to energy transformation activities. The fundamental identity of the energy balance must be checked for both the extended and the summary versions, given by the equality between availability (offer) and use (demand) of energy.
The most commonly used units of measurement for processing energy balances are the tonne of oil equivalent (TEP - TOE) and its multiples. To aggregate quantitative data from the various energy sources, a conversion operation is employed through which the units of measurement for the various energy sources are substituted with a common unit, allowing their aggregation on a global level. The Ministry of Economic Development, in the “Energy statistics” section of its website (http://dgerm.sviluppoeconomico.gov.it/dgerm/) publishes national energy balances both in their extended and summary versions since 1998, in addition to specific statistics including the natural gas balance, the prices of certain petrol products, carbon, natural gas and electricity and some statistics relating to the petrol market. In addition to Italian National energy balances, regional energy balances prepared by ENEA since 1990 are also available. These balances are constructed using the same method as the Italian National energy balance and offer an exhaustive overview of the regional energy situation.
The National Agency for New Technology, Energy and Sustainable Economic Development (ENEA) publishes the Energy and environment report on its website (http://old.enea.it/produzione_scientifica/REA.html), since 1999, containing the data form the National and regional energy balances. The Energy and environment report offers a periodic in depth analysis of the energy situation on national and regional level, in relation to the economic and social context and technological and environmental development.

The electricity Balance

The first data relating to electricity date back to 1883, the year in which this source of energy first began to be used in Italy. Only data relating to energy production were recorded at the time, while from 1931 those relating to demand for electricity together with the characteristics of generation plants and the electric network began to be collected. Up until 1962, these statistics were under the responsibility of ANIDEL (Italian National Association of Electricity Distribution Companies).
On 06th December 1962 ENEL (National Electricity Authority) was founded with the task of producing, importing, exporting, transporting, transforming, distributing and selling electric energy. Enel started its activities in 1963 with the gradual absorption of the existing electricity companies. By the end of 1995,

1,270 companies had been absorbed. Since1963, therefore, ENEL was responsible for providing data on traditional
thermoelectric generation, divided according to the type of fuel used, and those relating to consumption of electricity, structured by sector of use. Enel took care of the collection and processing of the data relating to the electricity sector up until 1998, recording some important phenomena linked to national economic history.
In 1992, nearly thirty years after its foundation, ENEL became a joint stock company, the first step towards privatisation, with the Italian Treasury as sole shareholder. In 1999 Enel Produzione, Terna and Enel Distribuzione were born, at the same time as new operators entered into the market together with other figures including the National Grid Operator (GRTN), responsible for electricity transmission and distribution and the collection and publication of sector statistics up until 2005. Since2005, official statistics relating to the national electricity sector were produced by the statistics office of Terna - Rete elettrica nazionale Spa. This company was founded in 1999 within the ENEL group in implementation of Legislative Decree no. 79 dated 01st November 2005 following the unification of the ownership and management of the national electricity grid operator.
The figures collected by Terna cover, in 2009, the whole range of approximately 1,800 operators in the electricity sector, such as producers, distributors and wholesalers, providing a complete overview of the electricity sector in Italy. This information is contained in various publications made available by Terna, including the "*Electricity balances"* drawn up from 1947 onwards, which balance the data relating to the production of electricity divided by energy source used and the figures relating to the use of energy in the various sectors of use. Today, all the figures relating to the electricity sector are available at the http://www.terna.it/default/Home/SISTEMA_ELETTRICO/statistiche.aspx website, from where the "Electricity statistics" section may be accessed, where "historical data" are stored together with other figures relating to the electricity system.

Electricity from renewable sources

The development of renewable energy sources is one of the pillars of EU energy policy over the last decade. Directive 2009/28/EC issued by the European Parliament and Council on 23rd April 2009, in substitution of Directive 2009/77/EC, entitled "Promotion of electricity produced from renewable energy sources", sets binding targets for each member State; for Italy, the national target for electricity to be produced from renewable energy sources out of the total amount of energy used is of 17 per cent by 2020.
Energy from renewable sources is derived from non-fossil fuels and is classified into the following types: solar, wind, hydraulic, geothermal, biomass, tidal power (tides and currents) produced energy. Renewable energy sources are included in national energy balances since 1994, while data relating to geothermoelectricity is available from 1916 and for gross electricity production from wind and solar power from 1992. Since 1999 the energy services provider has supplied an overview of the renewable energy sources used in Italy in the form of annual reports (*Statistics on renewable energy sources in Italy*). Since 1999 ENEA (National Agency for New Technology, Energy and Sustainable Economic Development) also presents an *Energy and the environment report* with a section dedicated to renewable energy sources.

Warnings for time series comparisons

- With regard to electricity balances, since 1983 in compliance with international methods, losses relating to transformers in plants, previously entered under transmission and distribution losses are included under the heading "energy consumption for auxiliary services".
- Since 1994 some obsolete energy sources have been removed from the "National energy balance", such as "Nuclear fuels", while "Renewable energy sources" have been introduced and some sources already present in the BEN but previously appearing under other headings have been moved to this category.
- In 1996 the classification of economic activities for electric use was brought into line with

ISTAT ATECO91 and European Union NACE Rev.1 classifications. As a result, figures are no longer perfectly comparable to those from previous years.

- In 1998 the evaluation of the hydroelectric source net of pumping has been modified in the "National energy balance", causing a difference in the new tables with respect to the past. In fact, in the new version only the quantity of energy effectively obtained from hydroelectric production is entered, while losses from pumping transformation are in any case considered in the total. The final result is that only approximately 70 per cent of the contribution from pumping is subtracted from total energy consumption, rather than 100 per cent.
- Since 2008 in the "National energy balance", natural gas is estimated to have a calorific value of less than 8.190 kcal/m^3 rather than 8.250 kcal/m^3, in line with international and Eurostat statistics.

Atmospheric pollution

The method used to estimate pollution figures presented in this section is that established during the European Coordination Information Air project (Corinair), which had the aim of harmonising, organising and developing information on atmospheric emissions, within the wider EU programme entitled "Coordination of information on the environment" launched in 1985. The estimates previously drawn up by ENEA[3] in the context of the Corinair project considered three pollutants (SOx, NOx, volatile organic compounds -VOC- including methane) and 120 activities divided into eight groups (combustion in thermoelectric and heating plants, petrol refinery, industrial combustion, industrial processes, solvent evaporation, road transport, natural sources, other). An update and perfection of the method was subsequently performed as part of the European work programme Corinair90[4], which aimed to draw up an inventory of emissions, in the context of the Convention on transboundary atmospheric pollution and the Framework Convention on climate change, ratified by the Italian Parliament in January 1994.
The main innovations introduced by Corinair90 were:

1) an extension of the range of pollutants considered, passing from three to eight, including sulphuric oxides, nitric oxides, volatile non-methane organic compounds, methane, carbon monoxide, carbon dioxide, nitrous oxide and ammonia, i.e. all types directly or indirectly linked to the greenhouse effect;
2) a more detailed and differently structured classification of activities and sources of pollution, covering more than 260 activities;
3) an increase in the number of countries involved.

In 1994, the Corinair90 method was reviewed again by the European Environment Agency, which launched the Corinair94[5] project and developed a group of methodological proposals for estimating emissions, to be implemented on an annual basis.
In December 1997 the Kyoto Protocol was signed, representing the implementation of the United Nations Framework Convention on Climate Change, approved in New York on 09th May 1992, with the aim of combating and reducing the negative effects of climate change on our planet to a minimum. According to the Convention and the Kyoto Protocol, which entered into force in Italy on 16th February 2005, Italy undertook to develop, publish and regularly update national emissions inventories, in addition to formulating and implementing programmes to reduce emissions.
For each of the pollutants analysed,[6] the annual updating of time series was performed by the Higher Institute for Environmental Protection and Research (ISPRA), using the EMEP-EEA (European

[3] For a complete illustration of the calculation methods used in 1985, please refer to the Enea, Central Research Department for the Corinair Project, Inventory of polluting emissions in Italy in 1985 (edited by W. Boccola, M.C. Cirillo, D. Gaudioso, C. Trozzi, R. Vaccaio, C. Napoletano), Rome, 1989.

[4] The Corinair90 system was developed in compliance with the EMEP programme (Evaluation and monitoring of long range transmission in Europe of air Pollutants) aimed at dealing with transboundary atmospheric pollution issues, and with the Ipcc/Oecd (Intergovernmental Panel on Climate change/Organization for the economic cooperation and development).

[5] See European environment agency "Review of Corinair90 Proposals for air emissions 94", 1995.

[6] In 1999 the responsibility for calculating national emissions passed from ENEA to ANPA, currently known as ISPRA.

Environment Agency) methodology in compliance with the indications provided by Corinair94. It was specified that, when necessary, the methodology would be updated by technical groups coordinated by the EMEP programme in collaboration with the EEA, and that the entire time series would be revised in order to guarantee coherence and comparability of data over time. The time series produced are the result of the national inventory of emissions. The values relating to emissions and absorption from natural sources are excluded. The totals obtained coincide with the official figure communicated by Italy as part of the United Nations Framework Convention on Climate Change (UNFCCC) – regarding carbon dioxide, methane and nitrous oxide[7] - and the United Nations Economic commission for Europe convention on long range transboundary air pollution for the remaining pollutants.

Interaction between the economy and the environment in the satellite account system in national accounts

In the early 1990s ISTAT initiated a programme for the development of environmental accounting, an integrated information system on the economy and the environment based on the satellite accounts in national accounts, allowing the system to be linked with the information traditionally produced in national economic accounts. In the same period Eurostat, the European Union statistics office, following the first projects in environmental expenditure initiated at the end of the 1980s, launched a wide-ranging development programme for environmental accounting. Furthermore, studies promoted by the UN following the 1992 Rio Conference on environment and development led to the definition of the first version of the SEEA environmental accounting manual. The methodological basis developed in this phase on an international level, which also saw a contribution from ISTAT, constitutes the foundation of the calculations produced by the Institute from the 1990s onwards. The subsequent extension of the production of environmental accounts by ISTAT was performed in line with the methodological developments underway in the international sphere, prioritising the creation of the parts of the accounting system which dealt with the most important aspects for the European political agenda.
The environmental accounting series correspond to themes of top priority in a European context: material flows, atmospheric emissions, environmental expenditure and taxation. The phenomena described relate to the overall potential pressure of the human system on the natural system (material flows), the pressure on the environment from specific economic sectors in terms of flows of pollutants (air emissions in environmental accounting as it stands),the responses to environmental problems - created by the economic system - through “economic” instruments available to environmental policy (environmental taxation) and the actions and activities aimed at protecting the environment (environmental expenditure). This is combined with the information on the use of energy products by economic activity, the publication of which will start up again on this site in response to the growing interest in this theme on a European level.
Environmental accounting calculations are based, among other things, on environmental data which are produced and used in relation firstly with the typical dimensions of the natural system, and not with reference to the economic system. A specific difference between environmental accounts with respect to numerous base statistics used for their construction lies in the adoption in the accounts – as satellite accounts in National Accounts – of the *residence principle:* “A unit is said to be a resident unit of a country when it has a centre of economic interest on the economic territory of that country – that is, when it engages for an extended period (one year or more) in economic activities on this territory”. (Esa95 § 1.30). This entails, for example that atmospheric emissions in environmental accounting include flows of pollutants that are not necessarily generated within national boundaries, where on the other hand the original data produced with the emission inventory (defined within the European Corinair project) refer to the natural system within national territory.

[7] These totals are net of Lulufcf (*land use, land use change and forestry*).

Use of material resources

The accounts concerning the use of material resources (material flows) relating to the entire socio-economic system (economy-wide) are calculated by ISTAT in the context of the National Accounts and, in particular, the satellite economic-environmental accounts in physical terms. These accounts began to be part of official Italian statistics only in the early years of this century thanks to financing granted by Eurostat which coordinated the pilot applications, performed on the basis of a methodological guide drafted by a European *task force*, in which Italy took active participation. In the past the system was developed in the context of economic-environmental research, especially in Germany, as a tool to respond to new information requirements deriving from the ever increasing need to promote the ecological sustainability of socio-economic processes.
Material flow accounts record the withdrawal, use, apparent consumption and overall requirements for materials activated by production and final national use of goods and services. The accounts are formed according to international methods and, in particular, those codified by Eurostat in the methodological guide mentioned above[8]. Up to now, the figures deriving from this source had been constructed and published only for the years after 1980. The first issue covered the period from 1980 to 1998, and the series were subsequently revised several times, in compliance with the most recent methodological indications from Eurostat.
For the series presented here, ad hoc calculations were made, allowing for the drafting of a time series running from 1951 to 1979. This extension – also performed in compliance with European methodology – provides the elements necessary for an initial historical evaluation of the implications for the natural environment of the large changes in Italian production and consumption, starting in the years following the Second World War. The construction of the material flow accounts, from which we have taken the indicators used here, requires the use of a vast and diversified range of data, auxiliary information and estimation models. The calculations performed on these sources are aimed at ensuring the coherence of the physical aggregates of the material flow accounts with the monetary accounts in national accounts, both from the point of view of respecting the *residence principle* – for which, for example, fuels purchased abroad by Italians are included in the account of national fuel use – and from that of the completeness of the estimates and the exhaustiveness of the aggregates.
The calculation of the *Domestic extraction* (of material resources used and unused) relies on the following sources:

- for the extraction of *biomasses,* on figures from ISTAT statistics on agricultural cultivations, forests and fishing in addition to agronomic coefficients relating to sub-products and waste which accompany the extractions recorded by these statistics;
- for the extraction of *energy minerals*, on information deriving from ISTAT statistics on the quantities extracted, communications from the competent Ministry (of Industry, Productive Activities, Economic Development, etc.), in addition to technical coefficients for the amounts unused;
- for the extraction of *non-energy-producing minerals* from quarries and mines, on ISTAT statistics on extraction industries, the joint ISTAT-Ministry of Industry survey of quarries and peat bogs (up until 1997), on the annual statistical survey on industrial production (from 1997 onwards), on ISTAT statistics on construction permits, on *ad hoc* communications by ANAS and Italian State railways, in addition to technical coefficients and estimation models constructed *ad hoc* for certain parts both of used and of unused materials.

The calculation of materials' *Use,* that of *Apparent consumption* and of *Overall requirements* are based, in addition to the domestic sources listed above, on figures concerning the flows of goods from or to other countries and their indirect requirements, i.e. on ISTAT foreign trade figures, ISTAT transport statistics and on coefficients relating to indirect flows, provided by a specialised Institute.

[8] The methodology requires the recording, in units of weight, of all the materials that cross the boundaries of the national socio-economic system, excluding water and air when used as such and not incorporated into products (for example, water used for irrigation in agriculture or air used to cool industrial plants are excluded).

Warnings for time series comparisons

- From 1990 indicators incorporate the estimates of direct foreign purchases made by units resident in Italy and of those made directly in Italy by non-resident units, which increase imports and exports respectively resulting in the *to and from abroad* headings. As the additional quantities represent less than 2 per cent of those already present, the readability of the data as series is only partially altered. Furthermore, the influence on the balance of direct flows to/from abroad is very limited, while indirect requirements are not affected at all, since direct purchases do not contribute to their calculation.
- The quality of the estimates of indirect requirements is higher for more recent years, thanks to the availability of ever more complete data bases, allowing for calculations on a progressively more detailed level. For the years before 1980, estimates were made using 13 groups of goods for imports and 14 for exports. From 1980 onwards the groups were several hundreds, guaranteeing a substantial homogeneity within each group regarding the flows activated "upstream," i.e the direct withdrawals from the natural environment necessary, on a global level, for the production of goods actually imported or exported. These are important withdrawals from an environmental point of view, because the part of resources used in the corresponding productive processes which are not physically incorporated in the goods traded remain in the producer's country, transformed into waste and emissions. The simulations performed in years for which it was possible to operate on both levels of detail indicate a difference of not more than 5 per cent between the results obtained using the two methods.
- Moreover, from 1991 onwards the country of origin was also taken into account for some imported products characterised by a high level of variability in the intensity of indirect flows. All the estimates relating to this type of flows, such as those relating to flows of unused materials from domestic extraction, are in any case considered as prudential as they are indicating minimum values and trends of flows rather than complete valuations.

Energy use

For the first time ISTAT will publish the time series of data from 1990 to 2008 relating to the use of energy products, broken down by type of use, as received from Environmental accounting. These figures are the result of calculations from data present in the TIPU (Table of uses of energy products by type of use) currently produced by ISTAT for the construction of the Namea Air Emission Accounts[9], and have recently become an independent output of satellite Accounting. TIPU data are constructed in compliance with the *residence principle,* are expressed in physical units (tonne, Mmc, MWh) and are broken down by energy product, type of use and economic activity (27 energy products, 8 types of use and 102 economic activities, of which 101 production activities plus end users, i.e. households)[10]. The main sources of data for constructing the TIPU are the energy use tables in physical units by economic activity and by energy product (but not by type of use) provided annually by ISTAT for the construction of the Table of resources and uses in monetary terms, the National Energy Balance (BEN) produced annually by the Ministry of Economic Development, the energy use data used as inputs for the Corinair national inventory of atmospheric emissions and calculated on an annual basis by the Institute for Environmental Protection and Research (ISPRA).
Thanks to the TIPU's coherence with the products of National Accounts, in terms of definitions, principles, classifications, reference manuals and, at times, sources used, it is possible to guarantee a meaningful relation between the physical data (energy uses) and other physical aggregates of

[9] Namea (national accounting matrix including environmental accounts) is an accounting system, adopted on a European level, representing the interaction between economy and the environment in such a way as to ensure the comparability of the economic and social data (output, income, occupation, etc.) with data on the stress posed by human activities on the natural environment (environmental pressure).

[10] The three-dimensional nature of TIPU (by energy product, type of use and economic activity) – and its layout (27 x 8 x 102) – ensures that no figure on the table is affected by double counting (which may occur when the energy incorporated in the products used to be transformed into other energy products is also counted in the different uses of derivative products); on the contrary, the aggregation of the figures by energy product, type of use and/or economic activity may result in the double counting of the same energy in different phases (substantially in the production/transformation phase or consumption phase).

environmental accounting (for example, Namea air emissions by economic activity) or the traditional monetary aggregates (output, value added, employment, households' consumption, etc.). In the 1980s ISTAT constructed and published data on energy uses in Italy for the years 1975, 1980, 1982, 1985 and 1988 in connection with the construction of the Input/Output Tables for the Italian economy. These figures, expressed in physical units, present the use of energy products broken down by economic activity (classified according to NACE70) and households. Furthermore, for each of the 25 products considered, the data are split by to purpose or type of use (transport, heating, non-energy use, other energy use) and by origin of supply (domestic output, imports).
Subsequently, the construction of an energy account in physical units describing the resources (domestic output, imports) and uses (intermediate uses, households' consumption, changes in inventories and exports) of energy products has been performed annually as part of the construction of the estimates for National Accounts in monetary terms. Furthermore, for each product, intermediate uses are disaggregated by branch of economic activity (according to NACE Rev.1). The matrix of uses "product x branch" is not published. With respect to the energy use data constructed in the 1980s, those produced after that date present differences both in the methodology applied and in their structure. In fact, in addition to being classified according to the different version of NACE, the total number of energy uses includes some components which were previously excluded (use of fuel for military transport, for agriculture, livestock and forestry, for industrial removals and for gardening). Lastly, they do not provide a disaggregation of intermediate uses of production activities broken down by use. Only the figures relating to the household consumption of energy products is divided into "use for transport" and "other uses" (mainly heating). From 1999 onwards disaggregation exercises were performed on the figures relating to energy uses by branch, by energy product and by function with the aim of estimating atmospheric emissions for the Namea environmental accounting project and for the compilation of the pilot Eurostat Standard Table on energy consumption.

Warnings on aggregations used in the tables

Considered as a whole the figures on energy product use, presented separately for the household sector and for production activities, have the following shared features:

- the use of energy products is shown in aggregated form, i.e. totalling the uses of different products after converting all figures to a single *unit of measurement* (Terajoule);
- the following *energy products* are considered: coal, lignite, peat, natural gas, crude oil, semi-finished products, waste (only waste used as fuel for the production of electricity or heat), electricity, coke, coke oven gas, non-energy coal products, lpg (liquid propane gas or liquified petroleum gas), refinery gas, naphtha, motor gasoline, jet fuel, kerosene, gas work gas, blast furnace gas, diesel oil, fuel oil, petroleum coke, white spirit, bitumes, lubricating oil, chemicals, other non-energy oil products;
- the division by *type of use* considers "energy use with combustion", "energy use without combustion" and "non-energy use".
  Energy use with combustion is in turn divided into use for "heating" (of homes, shops, offices, plants, enterprises, etc.), "transport" (road and off-road transport, including by rail, air and sea, in addition to all the operations of ships, boats, tractors, construction machinery, lawnmowers, military and other equipment; household transport is considered separately; for production activities, transport is considered both as a main, secondary and ancillary activity), "transformation in electricity", "other energy use with combustion" (transformation with combustion in energy products other than electricity, for example the transformation of coke into blast furnace gas; use of energy products by production activities in production processes in a strict sense, excluding heating, transport and transformation; use of energy products by households for cooking and hot water production)[11].
  Energy use without combustion includes the transformation without combustion of energy products into other energy products (for example the transformation of crude oil into motor gasoline) and the use of electricity for any use.

[11] In the original TIPU, "transport" is divided into "road transport" and "off-road transport", while "transformation with combustion into energy products other than electricity" is separated from "other energy use with combustion".

Non-energy use includes the transformation of energy products into non-energy producing products (for example, the transformation of crude oil into plastic) and the use of energy products for non-energy uses (degreasing, dry cleaning, lubrication, etc.);

- the figures presented are *gross of transformations*, in that the energy incorporated in the products used to be transformed into other energy products is also counted in the various uses of the derivative products. In principle, therefore, the "total use of energy products" is affected by double counting in that:

  a) the energy incorporated in the products used for the production of electricity is also counted in the phase in which the electricity itself is used;
  b) the energy incorporated in the products transformed by combustion into other energy products is also counted in the various uses for said derivative products;[12]
  c) the energy incorporated in the products transformed without combustion into other energy products is also counted in the various uses for the derivative products (for example, the energy counted in the crude oil used to produce motor gasoline is recounted in the use of petrol for transport).

On a practical level the above implies that the data for *production activities*, if we consider the individual types of use of energy products, do not present the phenomenon of double counting in the case of heating, transport, transformation into electricity and non-energy producing use, while the phenomenon does occur, marginally, in the case of the other energy use with combustion and energy use without combustion. The total use of energy products is, in contrast, strongly affected by the double count.
The data by *individual production activity* are affected by the same considerations as for production activities as a whole, but the disaggregation by activity considerably attenuates the phenomenon of double counting. The figures for *households* are not affected by double counting as households do not perform any type of transformation of energy products.

Atmospheric emissions in Environmental Accounting

The figures relating to pressure caused by economic activities (production activities and households) on the natural environment, in the form of air emissions, derive from the air emissions satellite account known as Namea (*National accounting matrix including environmental accounts*). The main source for the calculation of Namea figures is the national air emission inventory, created as part of the European Corinair project, which is produced on an annual basis by the Institute for Environmental Protection and Research (ISPRA), which produces the figures for the Italian Communications on an international level under the United Nations Framework Convention on Climate Change and the Convention on Long Range Transboundary Air Pollution[13] (see Atmospheric Pollution).
However, the total emissions calculated using Namea methodology is different from both the total emissions according to the Corinair inventory and that calculated as part of the main international conventions mentioned above. This difference is due to the adoption in the Namea data of the principles and standards used to calculate national economic accounts, established by the European system of national and regional accounts *European System of Accounts* ("ESA95"). With reference to the data presented here, it is important to point out the residence principle. For coherence with this principle, the emissions from resident units operating abroad (for transport activities) are added to the Corinair emission data, which refer to the national territory, and the emissions from non-resident units operating in the national territory (for transport activities) are subtracted. Furthermore, the satellite account for atmospheric emissions includes only emissions caused by human activity and not those associated with natural phenomena, which in contrast are included in the Corinair inventory.
Regarding production activities, the Namea data include the emissions caused by production

[12] In practice the only case in which this does take place is when the energy incorporated in coke used in blast furnaces to produce blast furnace gas, which in turn is used both for the production of electricity and for industrial steel-working processes and in cokeries.
[13] United nations - *Economic commission for Europe convention on long range transboundary air pollution*.

processes characteristic of the principal activity, those generated by any secondary activities and the emissions caused by anncillary activities such as in-house heating or transport processes[14]. With regard to households, the data are structured into three headings which are of particular interest for emissions: “transport” (including household emissions deriving from the use of fuel for private transport and gardening), “heating” (including cooking) and “other” (which includes household emissions caused mainly by the use of solvents).
The time series included here, both with reference to households and to production activities, cover the years 1990-2008. These are coherent with the 2010 version of the Corinair[15] inventory and include emissions from nineteen atmospheric pollutants: carbon dioxide (CO_2), nitrous oxide (N_2O), methane (CH_4), nitrogen oxides (NOx), sulphur oxides (SOx), ammonia (NH_3), non-methane volatile organic compounds (NMVOCs), carbon monoxide (CO), particulates (PM_{10}), fine particulates ($PM_{2,5}$), arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), mercury (Hg), nickel (Ni), lead (Pb), selenium (Se) and zinc (Zn), in addition to the aggregate indices for “greenhouse”, “acidification” and “tropospheric ozone” environmental issues.
The methodological coherence of the Namea data with the figures in the national economic accounts allows for the economic National Accounts data to be used to calculate indicators representing the efficiency of production activities such as emission intensity[16] (emissions/output, emissions/full time equivalent employees).

Environmental taxes

The source of the figures on environmental taxes is the ‘General Government aggregates and Accounts’, calculated by National Accounts in compliance with the rules established by EU regulation no. 2223/96 (ESA95).
A tax is defined as environmental if its base is ‘a physical unit (possibly substituted by a proxy) of something which has a proven, specific negative impact on the environment[17].
Environmental taxes, as part of the overall group of taxes, constitute compulsory payments to the government, not directly linked to the benefits which the individual taxpayer receives from the activities of the Public Authorities (PA).
On the other hand, payments provided for a service and which have a positive link with the volume of the service itself, even if paid obligatorily to the PA sector, are defined as charges or fees . The revenue from charges and fees is excluded from the data on environmental taxes.
Some taxes are known as “earmarked taxes”[18], in that the revenue from these taxes is destined at least in part for financing environmental expenditure. They include: the contribution on phytosanitary products and pesticides, the tax on coal consumption, the regional tax on aircraft noise, the provincial tax for environmental protection and the special tax on landfill dumping.
The series published here are calculated from 1980 onwards and are divided into: energy taxes, transport taxes and pollution taxes. The first include taxes on energy products (independently from the product’s intended use: transport, heating, etc.); the second include mainly taxes associated with property and vehicle use; the last relate to taxes on emissions, waste management and noise.

[14] For a given production unit, the primary activity is that whose value added is higher than any other activity performed in the same unit, a secondary activity is an activity performed in addition to the primary activity and an ancillary activity consists in a supporting activity (purchases, sales, marketing, data processing, transport, stocking, etc.) performed with the aim of creating suitable conditions for the performance of the primary or secondary activities.

[15] See: www.sinanet.apat.it/it/sinanet/sstoriche.

[16] The higher the value of the indicator, the less efficient the production activity is.

[17] See *Environmental Taxes – A Statistical Guide*, Eurostat, Luxembourg, 2001, catalogue number KS-39-01-077-EN-N.

[18] For additional details on the destination of revenue, see the following institutional laws of the various instruments:

- for the Tax on sulphur dioxide and sulphurous oxide emissions, Law no. 449 dated 27th December 1997, art. 17;
- for the Contribution on phytosanitary products and pesticides, Law no. 388 dated 23rd December 2000, Art. 123, and Law no. 488 dated 23rd December 1999, art. 59;
- for the Regional special tax on landfill dumping, Law no. 549 dated 28th December 1995, Art. 3;
- for the Provincial Tax for environmental protection, Legislative Decree no. 504 dated 30th December 1992, Art. 19;
- for the Regional Tax on aircraft noise, Law no. 342 dated 21st November 2000, Art. 90.

The revenue from environmental taxes is also calculated as a share of *total revenues from all taxes and social contributions* received by the Public Authorities, made up of the sum of the following four aggregates[19]:

- taxes on production and imports
- current taxes on income, wealth, etc.
- capital taxes
- actual social contributions

[19]The same components are part of the denominator used by Eurostat and the Directorate General "taxation and Customs Union" of the European Commission to calculate the quota of environmental taxes on the total amount of taxes and social contributions.