Terna's main contribution to the environment coincides with the progressive integration of renewable sources, accompanied by a commitment to minimising the visual impact on the landscape of its assets and to implementing voluntary programmes design to reduce our environmental footprint.

>>

8

Environment

In brief

Terna's main contribution to achievement of the climate change reduction targets is to carry out the investment provided for in the Development Plan, building a grid capable of enabling the energy transition towards a carbon-free system, based on renewable energy.

Terna's most significant impact on the environment coincides with the physical presence of power lines and electricity substations around the country: to minimise this, we adopt solutions such as the use of pylons with a reduced visual impact and, when possible, the use of underground sections of line or, the use of natural engineering. The most important contribution is the physical removal of power lines that are obsolete following rationalisation initiatives[94].

The activities involved in the construction, maintenance and removal of electricity infrastructure is linked to the production of waste, a high proportion of which is recovered [95].

In terms of greenhouse gas emissions, Terna has for many years focused on a number of voluntary programmes, primarily regarding the achievement of reductions in SF_6 leakage[96], making buildings energy efficient and saving energy at substations.

HIGHLIGHTS:

179 km of lines demolished	**94%** of waste recycled	an SF_6 leakage rate of **0.40%** regarding total equipment installed

[94] See the paragraph "Managing the environmental impacts of the electricity grid" on page 203.
[95] See the paragraph "Use of resources and waste management" on page 190.
[96] See the paragraph "Containment of emissions: SF_6 leakage" on page 214.

Terna and the environment

In terms of environmental impact, Terna's activities regard less the use of natural resources and the emission of pollutants, and rather more the physical presence of power lines and electricity substations and their interaction with the surrounding natural and manmade environment.

Occupancy of the land, visual impact on the landscape, electric and magnetic fields and the effect of power lines on biodiversity, especially birdlife, are aspects that relate to the implementation and physical presence of Terna's assets. Greenhouse gas emissions and hazardous waste are, however, relevant within the context of operations.

Terna has adopted an Environmental Policy that sets out its commitment to containing and reducing its environmental impact, in some cases going beyond legal requirements when this does not compromise the protection of other general interests provided for under the concession. This Policy is fully implemented through the Integrated Management System (see page 76) - which also covers efforts to reduce greenhouse gas emissions, the implementation of energy efficiency initiatives (see page 215) and the adoption of measures designed to protect birdlife (see page 208). Terna extends the issue of environmental protection to both its supply chain (see page 92) and local stakeholders directly affected by NTG development projects (see page 105). From an organisational standpoint, these matters are managed by several departments with responsibility for specific aspects.

With reference to the scope of environmental data, it should be noted that data relating to Tamini Trasformatori S.r.l. and Avvenia-The Energy Innovator S.r.l., subsidiaries of Terna Energy Solutions, in turn controlled by Terna, are not included in this section (see the Methodological Note for details on the scope of reporting).

Environmental indicators for the Tamini Group are shown in a specific Focus (see page 230). With regard to Avvenia, a company acquired in 2018, the initial assessment completed in 2019 did not unearth any significant environmental impacts, considering the type of activities carried out and the small number of staff involved.

Managing the environmental impacts of the electricity grid

The construction, maintenance and presence of electricity infrastructure have an impact on their surroundings. The responsible management of these impacts is illustrated below. Aspects relating to greenhouse gas emissions, connected with grid operation and electricity transmission, are dealt with in the section on “Atmospheric emissions and energy efficiency” on page 212.

413-2 >

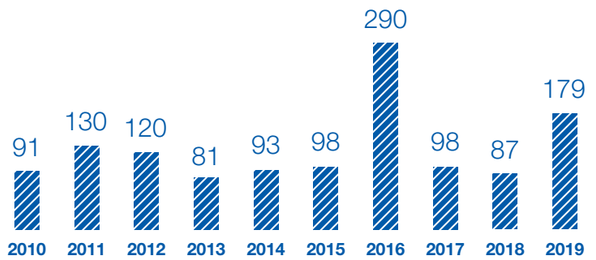
Integration of power lines in the environment

The transmission grid has effects on the environment, primarily in terms of the visual impact on the landscape produced by the physical presence of power lines and electricity substations.

The physical removal of existing lines is one of the most radical ways Terna reduces environmental impacts, also in terms of land use. Demolitions are a component of upgrade initiatives, often resulting from agreements signed with local authorities during the consultation phase prior to the construction of new infrastructure.

In 2019, 179 km of lines were demolished (target: 125 km), freeing up an area equal to 556 hectares. In the period 2010-2019, a total of 1,268 km of lines were demolished. The fact that the target was exceeded in 2019, due to accelerated implementation of the plans, is the reason why the target for 2020 is lower.

Demolition is defined as the physical removal of overhead lines and does not include declassified or upgraded lines.



1,268 km

LINES DEMOLISHED FROM 2010

The figure for 2016 is exceptional due to the demolition of over 200 km of obsolete power lines in Valtellina, which had been in preparation in previous years. After adjusting for this removal, demolitions amounted to approximately 80 km, in line with previous years (approximately 100 km/per year).

“TRANSMISSION IMPACTS” TARGET

KPIS AND TARGETS IN THE STRATEGIC PLAN 2020-2024*

KPI	2019 TARGET	2019 RESULT	TARGET 2020	2021	2022	2023	2024
VISUAL IMPACT							
Km of overhead lines demolished during the year	125	179	41	87	137	212	141
Km of new underground lines during the year	46	144	63	156	70	152	120

** With respect to that published in the 2018 Sustainability Report, the targets set for 2020-2023 have been revised in order to take new planning and the 2019 results into account.*

An approach based on environmental sustainability guides all of Terna’s activities, especially those regarding grid development. In terms of NTG development requirements, the interventions with the least environmental impact are rationalisation and reclassification.

Rationalisation

This comprises complex initiatives involving several components of the grid, replacing certain components with others of a superior type, thereby eliminating parts of the grid that are of little use following the installation of new infrastructure or adding new elements of the grid to avoid the upgrade of power lines that have reached saturation point.

Reclassification

This involves the conversion of existing power lines to a higher voltage through the installation of new conductors and pylons to replace existing ones, which may be larger in size and therefore take up more space. Unlike the construction of a new line, this type of intervention usually has the advantage of using existing infrastructure corridors, thus avoiding the occupation of new areas of land.

When grid development requirements entail the construction of new infrastructure, environmental sustainability considerations are taken into account in all phases of a project.

Planning and consultation

Terna's planning uses assessments based on digital thematic maps, mostly deriving from official sources (regional authorities, water concession authorities, monitoring agencies), which are organised in a large and constantly updated database. Since 2002, Terna has voluntarily brought forward dialogue with local stakeholders in order to identify shared solutions ahead of any consents process for new projects. Dialogue with local authorities, the Strategic Environmental Assessment (SEA) procedure in the Development Plan and public initiatives that address the members of local communities directly affected by the presence of new infrastructure all contribute to the design of initiatives to mitigate environmental impact (see page 201).

Design

Choosing the route is the most delicate phase of the design process, as it determines the environmental impact of the entire development project.

For this reason, notwithstanding the need to identify a route that makes it possible to operate and maintain the power line, Terna looks for design solutions that minimise land use, interference with areas of environmental, natural, landscape and archaeological value, as well as urbanised or built-up areas, and the related easements.

Terna's design process includes the study of construction plans aimed at using existing roads or tracks to minimise the opening up of new access routes, especially in wooded or protected areas, and the assessment of problems relating to vegetation management. This entails the adoption of methods and tools to minimise the impact on biodiversity, such as optimising the height of pylons and their location.

The drawing up of the Environmental Impact Study provides detailed information on the various components that help designers to turn the blueprint into an optimised project.

Great attention is paid to minimising the visual impact. If this cannot be mitigated by means of precise and appropriate choices of location and/or by taking advantage of morphological features, the following actions may be taken:

- **Choice of pylons with reduced visual impact**. In recent years, Terna has expanded the range of available pylons that may be used, with the introduction of new single-pole pylons with a low environmental impact (with an overall surface area of 10 square metres compared to 150 square metres for traditional pad/pyramid type pylons) and the design by internationally renowned architects of pylons that are more integrated into the landscape.
- **Use of underground cables**, which eliminates or reduces the typical visual impact of overhead lines, is perceived as negative especially in built-up areas. Underground cables, although appreciated and requested by local authorities, pose technical and financial problems. Underground lines can only be built for a limited number of consecutive kilometres, are less reliable than overhead power lines over time and require much longer repair times in the event of a malfunction. For this reason, they often do not guarantee adequate security for the electricity system and continuity of service. Underground cables also have a greater impact during the construction phase - for example, in terms of road works - and higher construction costs.

>>

Execution: site operations

Terna manages the impact of its construction sites on the environment via the operating manual, "The management of environmental aspects during infrastructure construction", in line with the Group's Environmental Policy and existing regulations.

This operating manual introduces the role of the environmental contact, a person tasked with monitoring the environment requirements contained in the EIA Decrees and in the opinions of authorities with responsibility for the environment as well as compliance with legal obligations, also with reference to contractors' activities. The environmental contact also monitors the indicators set out in ISO 14001 certification, relating to complaints/reports, environmental accidents, waste and the consumption of energy and natural resources.

Special attention is paid to the identification of areas and access roads of sites which, if compatible with technical and design requirements, are located in areas of reduced natural importance. Upon completion of the construction work, Terna restores the areas concerned to their natural state. < EU13

If these areas regard natural or semi-natural habitats, in addition to the normal restoration works, specific interventions are implemented. Based on natural engineering techniques, they involve the creation of habitats suitable for animal and/or plant species or communities, the replanting of live native plants, which do not require irrigation, special fertilisation or the use of materials (even if only inert) in order to recreate favourable living conditions for animal species (https://www.aipin.it/).

Terna's environmental policies, which are also applied at construction sites, have been drawn up in accordance with applicable environmental laws and the ISO 14001 Standard. These include such aspects as prevention of groundwater contamination and limitation of damage to vegetation, the management of accidents, the diminution of atmospheric and noise pollution, the use of vehicles and the proper management of waste and excavated earth (see page 203). Internal audit campaigns regarding construction sites make it possible to identify any deviations from the Company's environmental policies.

Mitigation and offsetting

In compliance with requirements received during the consents process, or voluntarily, Terna adopts mitigation measures to reduce the impact and improve the integration of electricity infrastructure within local areas.

Specifically, in its design process, the Company gives priority to line locations that take advantage of natural morphological features, creates camouflage systems for its electricity substations and makes use of natural engineering techniques for habitat reconstruction and the stabilisation of slopes and embankments.

With regard to the new overhead power lines, other mitigation procedures consist of camouflaging pylons with paint and the use of coloured insulators that enable the new lines to blend in better with the landscape.

Offsetting, which is usually of a technical and/or environmental nature, is specified by the authority issuing the consents. In the preparation of a project proposal - together with national, regional and local regulations - this constitutes a "binding standard" for the detailed design and execution of the project.

In most cases, offsetting accentuates or better defines the mitigations proposed in the environmental impact study or imposes new offsets on the advice of specialist bodies (government bodies, grantors of water concessions, park authorities, etc.). Offsets may take the form of compensation. If the competent authority does not consider a residual impact to be sufficiently mitigated, it takes into account another initiative located elsewhere capable of offering environmental compensation.

>>

Activities in 2019

During the year, a camouflaging project regarding the Scilla substation ("Sorgente-Rizziconi" line) was carried out, as was the restoration of vegetation following construction of the "Udine Ovest - Redipuglia" power line. Moreover, detailed designs for numerous substation camouflaging projects were completed for implementation in coming years.

Thanks to the field surveys completed by specialists, it was possible to apply and perfect the Incremental Ecological Indicator (IEI) developed in 2018. This tool is used to make a qualitative and quantitative assessment of the ecological status of new ecosystems resulting from initiatives such as vegetation restoration, camouflaging, offsets and so forth. This indicator will enable the ongoing monitoring of mitigations and offsets regarding vegetation, showing the various stages of progress and "health" (biodiversity).

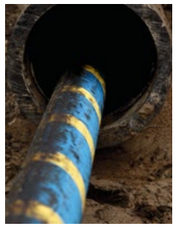
An Italic necropolis with funeral objects and 12 tombs was found in Abruzzo during work on installation of the 380kV "Villanova-Gissi" power line. Upon making the discovery, Terna began closely collaborating with the competent agencies in order to ensure recovery, restoration and enhancement of the artefacts, deemed to be of particular interest, so that they could be housed in a museum. Plans are underway for an exhibition to be held in collaboration with the authorities of the municipality where the acropolis was discovered.

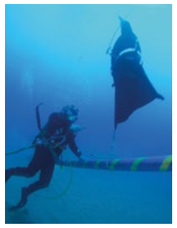
Terna prepares for adoption of the Envision Protocol for sustainable infrastructure

The **Envision Protocol** is a rating system created to certify the sustainability of infrastructure throughout its entire life cycle. It is based on a comprehensive framework comprising 64 sustainability and resilience criteria, called "credits", arranged into five categories: Quality of life, Leadership, Resource Allocation, Natural World, Climate and Resilience.

In 2019, a working group consisting of Terna personnel working in various companies and organisational units, was set up in order to pool a multitude of visions and experiences with regard to stakeholder engagement, sustainability, management systems and activities relating to the design, implementation and maintenance of projects. All workgroup members have received training on the Envision methodology and some have been qualified as Envision Sustainable Professionals (ENV SP).

In preparation for upcoming certification, the working group is putting together some guidelines for application of the Envision Protocol to power transmission infrastructure and identifying a pilot project for application of the Envision methodology.

Use of resources and waste management

Development and maintenance of the NTG requires a substantial amount of capital goods, such as power lines (pylons, conductors, insulators) transformer substations (transformers, circuit breakers, other equipment) and control systems.

< 303-1

Notably, with regard to water consumption, environmental and materiality analyses indicate that the subject is not material. This is because water does not usually form part of the production cycle for electricity transmission and dispatching. This is except for a few items of equipment, mostly used in the installation phase, that in any event require overall consumption of a marginal volume of water compared with the volumes generally recorded in the electric utilities sector. Indeed, water is used for hygiene purposes, office cleaning and cooling systems and derives from connections to water systems for civil use (water withdrawn is shown in the Key Indicator Table on page 279).

Evolution of the electricity system and environmental impacts: water consumption

In recent years, Terna has introduced compensation systems (Synchronous Compensation Units or SCUs), as one way of responding to evolutions in the electricity system in terms of the integration of production plants fuelled by renewables and new connections to the DC grid. These plants play a key role in regulating voltage in the portion of the grid where they are installed.

Four synchronous compensators fitted with adiabatic cooling towers, thereby requiring the use of water, are currently in operation at Terna's substations. In order to ensure the correct use of water, Terna has installed intelligent systems that, by recording internal and external temperatures and the electrical readings from the SCUs, regulate the flow of water, thus minimising consumption.

Partly due to these interventions, the amount of water used to cool the synchronous compensators accounts for only 3% of Terna's total water consumption.

Moreover, for future installations, the choice of cooling system will be evaluated during the design stage, also taking into account the area's water stress level (especially in dry periods).

The production and direct management of waste primarily regards the maintenance of electricity infrastructure.




301-1>

Resources

Terna does not use raw materials, but does purchase finished products (electrical equipment, conductors, tools and other components). An estimate of the materials contained in the main products purchased is shown in the table below. Amounts have been estimated taking into account the average material content of the various products purchased in the years referred to. The methodology used to evaluate materials has been modified with respect to previous editions of the Sustainability Report, in order to take account of the outcomes and information acquired from LCA studies on power lines (see page 220). For this reason, the data for 2018 and 2017 differ from those previously published. The bulk of the materials used are steel (pylons), aluminium and copper (conducters and cables).

MAIN MATERIALS PROVIDED BY SUPPLIERS (TONNES)

	2019	2018	2017
Steel	12,694	11,483	7,074
Aluminium	12,590	8,667	4,216
Copper	5,349	4,355	1,885
Glass	3,393	4,189	1,466
Dielectric oil	1,535	1,405	1,329
of which vegetable oil	448	431	486
Porcelain	822	626	266
Polymers	402	577	234
SF_6	17	8	9

Specifically, amounts shown in the table reflect a levelling off in the purchasing of equipment used for electricity substations and some considerable changes in the main materials of line components (e.g. aluminium and steel).

Waste

< 306-2

At the end of their normal lifecycle, the materials used in electricity infrastructure are recovered for reuse in operations. Only a residual portion is sent to landfill and has an impact on the environment.

The percentage of waste recovered amounted to 94% in 2019 (86% in 2018 and 87% in 2017).

Whilst the effective, overall amount of waste produced reflects the timing of equipment replacements, effectual recovery depends on the materials contained in the waste: some of them are easy to separate out and thus reuse (for example, the iron parts of pylons). In other cases, it is either too costly or not possible to separate the various parts, above all when dealing with the most obsolete equipment.

For these reasons, annual changes in the amount of waste generated and the percentage of waste recycled should not be interpreted as indicating a trend.

WASTE BY TYPE* IN TONNES

	2019	2018	2017
Waste produced*	**5,912.8**	**6,774.2**	**4,801.5**
of which hazardous	3,285.8	3,484.2	2,250.6
of which non-hazardous	2,630.3	3,290.0	2,550.8
Waste sent for recovery	**5,558.1**	**5,799.1**	**4,188.1**
of which hazardous	3,181.7	2,936.1	1,832.1
of which non-hazardous**	2,376.3	2,863.1	2,356.0
Waste sent for disposal***	**220.3**	**1,050.3**	**315.6**
of which hazardous	48.9	555.8	171.4
of which non-hazardous	266.0	494.5	144.2

* *Only special waste produced during production processes is included, not waste produced by services (urban waste). Effluents and waste from septic tanks, produced by substations not connected to the sewer network, are not included; the quantity for effluents and waste from septic tanks was 578 tonnes in 2019, 388 tonnes in 2018 and 617 tonnes in 2017.*

** *This comprises uncontaminated metal waste deriving from the decommissioning of transformers, electrical equipment and machinery (e.g. generators), with an average recovery rate of 100%.*

*** *Waste sent for disposal may differ from the mere disparity between waste generated and recovered due to temporary waste storage.*

The main special hazardous waste generated by Terna's operating activities consists of:

Metal waste

This derives from the decommissioning of transformers, electrical equipment and machinery no longer in use and is contaminated by hazardous substances; they have an average recovery rate - after treatment by third parties - of over 95%.

Batteries (lead and nickel)

In the event of a blackout, batteries enable emergency generators to be switched on in order to keep the energy transformation and transportation service up and running during emergencies; they have a recovery rate of 100%.

Dielectric oils

These are used for insulating transformers replaced after periodic checks carried out for maintenance purposes. They constitute hazardous waste and have a recovery rate in the three-year period of around 100%.

306-3 >

The waste sent for disposal mainly consists of materials deriving from infrastructure maintenance and cleaning activities (sludge, oily emulsions and rags containing solvent oils) and insulating materials containing asbestos, for which no form of recovery is envisaged.

As in the previous two-year period, no significant spills of polluting liquids were reported in 2019.

"Terna Plastic Free" and "Terna Recycling" projects

Terna's attention to environmental sustainability in its operations also prompts the Company to promote awareness of environmental sustainability and the adoption of responsible behaviour on the part of its employees.

At the start of 2019, Terna launched two campaigns, **"Terna Plastic Free"** and **"Terna Recycling"**, at its headquarters in Rome in order to spread the culture of sustainability via active commitment in everyday work activities.

"Terna Plastic Free" is the initiative that is eliminating single-use plastic from offices. Specifically, Terna has eliminated the consumption of approximately 140,000 bottles of water and an equal number of plastic cups a year, equal to **4 tonnes of waste per year** and approximately 20,000 kg of CO_2 equivalents.

In the canteen, the snack bar and vending machines, plastic water bottles have been replaced by hot and cold, natural and mineral water dispensers. Disposable plastic cups have also been replaced by around 1,000 stainless steel thermal flasks, which have been distributed by the Company and even personalised for each employee.

"Terna Recycling", launched concomitantly with "Terna Plastic Free", aims to step up separate waste collection schemes for the solid urban waste produced by Terna's offices through the use of separate waste bins, located on all office floors, for plastic, glass, paper, organic and unsorted waste.

In 2019, both projects were extended to offices in Milan Pero, Rome Marcigliana, Parma and Camin (PD). The aim is to rollout the projects at all Terna's main offices, with an impact once fully up and running equal to 139 tonnes of CO_2 equivalents avoided and a 26 tonnes reduction in plastic waste per year.

Monitoring and supervision of electromagnetic fields

Protection of the population from exposure to electromagnetic fields is precisely defined by law (the Cabinet Office Decree of 8 July 2003). This legislation provides for:

- **exposure limits**: In the event of exposure to electric and magnetic fields generated by power lines at a frequency of 50 Hz, the limit is 100 microteslas for magnetic induction and 5kV/m for the electric field, considered as effective values;
- **safety thresholds**: As a precautionary measure to protect against long-term effects, which may be linked to exposure to magnetic fields generated at the network frequency (50 Hz), in children's play areas, residential areas, schools and places where people spend not less than four hours a day, a threshold of 10 microteslas has been set for magnetic induction, based on the average of measurements taken over 24 hours under normal operating conditions;
- **quality targets**: In the design of new power lines at the above-mentioned sensitive locations and in the design of new settlements and new areas close to lines and electricity installations already present in the vicinity, in order to gradually minimise exposure to electrical and magnetic fields generated by power lines operating at a frequency of 50 Hz, a quality target of 3 microteslas has been set for magnetic induction, based on the average of measurements taken over 24 hours under normal operating conditions.

The values of the three parameters, especially the threshold value (10 microteslas), and the quality target (3 microteslas), show that Italian legislation has adopted the prudential approach described in art. 15 of the Rio Principles. These parameters are among the strictest at European level. Terna's compliance with the law in its activities implicitly shows that it has adopted the same principle.
Terna carries out inspections on its own lines to ensure compliance with the limits laid down by the regulations in force and seeks innovative technological solutions in order to mitigate the impact of magnetic fields. If any complaints or requests are received from competent administrative bodies and authorities, the Company provides the necessary data to access the actual exposure to electric and magnetic fields generated by its infrastructure.
Finally, with a view to providing accurate, easily understandable information on the subject, Terna has prepared an in-depth study on electromagnetic fields (EMF), which may be found in the "Sustainability" section of the Company's website www.terna.it.

Reports and complaints regarding environmental concerns

In line with the ISO 14001 Environmental Management System, Terna monitors and classifies complaints received regarding significant environmental matters.

Any written communication from stakeholders reporting that an activity carried out by Terna causes or has caused damage may be submitted to one of the Group's offices or organisational units, where it will be filed and handled by the competent operating unit.

Complaints received are classified in terms of environmental aspects as defined by environmental analysis: waste, noise, biodiversity, landscape, electrical and magnetic fields, lighting, the management of vegetation and others.

As in the past three years, 2019 also reported a reduction in complaints: most regarded power lines and refer to the need to cut back vegetation along power line corridors, the noise emitted by the lines when in operation and requests to measure electromagnetic fields.

Terna replies as soon as possible, and, in any event, within 30 days from receipt of the request or within 60 days if the scope and complexity of a request are such that it cannot be handled within the first 30 days.

In this case, Terna promptly notifies the person making the request of the extension and explains why it is necessary. Details of the concerns reported and dealt with over the last three years are published on page 265.

Electricity power lines, biodiversity and birdlife

The impact of Terna's grid on biodiversity may take different forms.

During the grid construction phase, the impact on biodiversity is linked to construction site activities (e.g. the opening up of access routes to build pylons, soil excavation and the removal of residual materials) and is temporary and reversible.

EU13 >

During the operational phase, the potential impacts of existing lines on biodiversity are twofold. On the one hand, the route of the line may be a factor in increasing biodiversity and protecting certain species as pylons, with their bases, make it impossible for land to be used for intensive agriculture and constitute "islands" where biodiversity can flourish. On the other hand, the presence of lines has potentially negative effects on biodiversity, in particular on birds, due to the risk of collision, and in protected areas or areas of natural interest.

The main tool for identifying critical line sections is a fully comprehensive land use database, containing data provided by regional authorities and ministries. This GIS (Geographic Information System) enables integrated analysis of all the layers of information on the various types of land use and protections (local, natural, cultural, landscape, etc.). Using this tool, Terna has compiled an inventory of the lines that may interfere with protected or highly biodiverse areas, as shown in the table below.

304-1 >

POWER LINES IN PROTECTED AREAS*

	UNIT	2019	2018**	2017
Lines impacting on protected areas	km	6,746	6,730	6,024
Lines with an impact as a percentage of total lines operated by Terna	%	10.5	10.4	10.0

* *To calculate the percentage of lines impacting on protected areas, the Company has used "ATLARETE" data, which may differ from data in the table showing indicators of the number of lines.*

** *Data for 2018 have been revised so as to be in line with the calculations made for 2019. Thus, the data for both years take account not only of the km of overhead power lines with an impact but also of the underground and underwater cables having an impact.*

From 2019, the indicator of lines impacting on protected areas has been modified in order to take account not only of overhead power lines having an impact but also of cables (underground and submarine). For the sake of completeness, it should be noted that out of the 888 substations managed by the Terna Group, only 35 are located in protected areas.

On this basis, potential threats from the risk of collision for bird species included in the IUCN Red List have been assessed.

The presence of power lines may have negative effects on birdlife. While the risk of electrocution regards LV and MV lines and therefore does not concern Terna's infrastructure, HV lines are associated with the risk of collision.

In order to minimise this risk, special devices called "deterrents" have been installed along sections of line with frequent bird traffic, which, with their visual impact and the noise they generate when blown by the wind, make the power lines easier to see for birds in flight.

BIRD DETERRENTS ON THE NTG

	UNIT	2019	2018	2017
Lines involved	no.	72	70	66
Total deterrents installed	no.	15,552	15,503	14,728

Over the years, Terna has promoted research and scientific studies to further investigate this issue and identify increasingly effective solutions. The first Italian study devoted to collisions, based on the results of an agreement between Terna and LIPU (the Italian League for the Protection of Birds), highlights a low risk of collision (see, for example, the 2010 Sustainability Report, page 116 "Terna-LIPU agreement: a study of the interaction between birdlife and the National Transmission Grid").

In order to support scientific research and the re-naturalisation of local areas, in collaboration with environmental associations, Terna carries out targeted projects. Over recent years, Terna has implemented the following projects.

Collision risk prevention tools

In 2018, Terna conducted a market survey - using the CESI research centre - on the availability of different types of deterrents, including a scientific study on their effectiveness. In 2019, the deterrents deemed suitable for installation on our electricity assets will be purchased and field-tested.

Radar monitoring of the passage of migratory birds along the "Sorgente-Rizziconi" power line (the last year) was completed, as was an assessment of the effectiveness of deterrents. Terna published the results of the monitoring on its website: www.terna.it.

Trials of AVIMON, the device that records bird strikes against ground wires on power lines, were completed on the "Villanova-Gissi" power line after a period of six months without registering any collisions. The experiment carried out on the section of the "Redipuglia-Planais" power line crossing the Isonzo river was completed as planned. A waveform analysis showed that it was the cause of only one collision, attributing the others to weather conditions. Nonetheless, onsite monitoring via ground observation did not report discoveries of any bird carcasses.

>>

304-4 >

Identification and monitoring of bird species on the IUCN Red List

Terna has carried out a study aimed at identifying the protected species included in the IUCN Red List that are potentially impacted by its infrastructure.
The IUCN Red List is the largest existing international database on the conservation status of thousands of plant and animal species, which are catalogued according to their risk of extinction. In its analysis, Terna specifically considered the presence of bird species on the IUCN Red List and at Natura 2000[97] sites, namely in protected areas with a high level of biodiversity (approximately 3,000 SPAs and SCIs).

The study selected the Natura 2000 areas affected by Terna power lines, then verified which protected species - among those included on the Red List and classified as Vulnerable, Endangered, Critically Endangered and Regionally Extinct - had chosen them as their habitat[98]. These species are conservation priorities as without specific measures to neutralise the threats they face, and in some cases to increase their populations, their extinction is a real prospect. The analysis showed that Terna's electricity infrastructure could interfere with the habitats of eight species. After checking scientific publications and via targeted consultations, no specific critical issues emerged regarding bird species except for a potential risk of collision for the corncrake (*Crex crex*), a species present in the Alpine area between Friuli-Venezia Giulia and Lombardy. A specific study on the ecology of the species is in progress with a view to mitigating this risk.

>>

[97] Natura 2000 is the main instrument of the European Union's biodiversity conservation policy. This ecological network which covers the entire territory of the European Union, was set up under the Habitats Directive (Council Directive 92/43/EEC) to ensure the long-term maintenance of natural habitats and of endangered or rare species of flora and fauna at EU level. The Natura 2000 network consists of Sites of Community Importance (SCIs), identified by Member States in accordance with the Habitats Directive, which are subsequently designated as Special Areas of Conservation (SACs), and also includes Special Protection Areas (SPAs) established under Directive 2009/147/EC "Birds" regarding the conservation of wild birds.

[98] There are 11 risk categories, ranging from Extinct (EX), applied to species for which there is a definite certainty that the last individual has died, to the Least Concern (LC) category, used for species that are not at risk of extinction in the short or medium term. The Extinct and Least Concern categories include categories under threat, which identify species at increasing risk of extinction in the short or medium term: Vulnerable (VU), Endangered (EN), Critically Endangered (CE) and Regionally Extinct (RE).

Alternative uses for electricity power lines

Terna, in partnership with environmental associations, has for some years been working on projects that aim to develop alternative uses for power lines. The most important, carried out in collaboration with the ornithological association, *Ornis italica*, is the **Nests among the pylons** project. This involves the installation of nest boxes, followed by annual surveys of the species that occupy the nests and the results of the breeding season. The project regards many species, including: the kestrel, peregrine falcon, scops owl, cuckoo, common roller, bat and stork. Launched in 2015, the GIS census (location via geographical coordinates) of the nests installed has registered a total of 384 nests.

GEOREFERENCED NESTS AT 31 DECEMBER 2019

LOCATION	NESTS		SPECIES CONCERNED*
	NUMBER OF NESTS	OF WHICH IN PROTECTED AREAS	
Abruzzo	30	0	Kestrel
Calabria	30	23	Kestrel
Campania	1	0	
Emilia-Romagna	95	31	Kestrel; scops owl, cuckoo common roller
Lazio	47	14	Kestrel, scops owl, common roller
Lombardy	15	0	
Piedmont	54	25	Common roller
Puglia	72	0	
Sicily	30	10	
Trentino-Alto Adige	8	0	
Veneto	1	1	
Overall total	**384**	**104**	

** The relevant species are identified by the type of nest box installed and by subsequent monitoring. However, the possibility that nests may be used by another unrecorded species cannot be excluded.*

As part of the contract regarding new nest box installations, in addition to the supply of boxes, Terna has also contracted out monitoring of occupation of the new boxes.

This activity is completed with the **Birdcam project**, involving the installation of cameras trained upon the artificial nests: the idea is to monitor the birds' reproductive period (online at www.birdcam.it and on Terna's website).

Atmospheric emissions and energy efficiency

At international level, convergence on the action to be taken to combat climate change was best reflected in the agreement signed at the United Nations Climate Conference (COP21) in Paris in December 2015. SDG 13 (Climate action) was also included in the UN's 17 sustainable development goals in the same year.

The guidelines in Terna's Strategic Plan are consistent with these positions and with the objective of facilitating transition to the production of energy from renewable sources and, more generally, the decarbonisation of production processes.

Climate change entails both risks and opportunities for Terna's business (see page 64) in terms of Regulated and Non-regulated Activities. In particular, with regard to the former, investment in grid development meets the need to facilitate the energy transition by strengthening transmission capacity and interconnections with other countries, while research and innovation are aimed at identifying smart and sustainable solutions to be offered to the customers of the Non-regulated Activities.

Terna has also carried out a number of trials focusing on battery storage, which could specifically encourage the use of renewable energy sources and, at the same time, solve problems with control of the grid deriving from sudden reductions in renewable electricity production.

With regard to the reduction of CO_2 emissions into the atmosphere by the electricity system as a whole, Terna's main contribution is to carry out the investment provided for in the NTG Development Plan (see page 143). In this section, the focus is on emissions relating to Terna's operating activities.

Direct and indirect CO_2 emissions

305-1 > 305-2 >

Direct greenhouse gas emissions (Greenhouse Gas Protocol, Scope 1) connected with Terna's activities derive mainly from SF_6 gas leaks (88% of total direct emissions in 2019), which are up from the previous year and due both to an increase in assets managed and to some faults reported at plants, for which extraordinary maintenance work has been planned. The remaining direct and indirect emissions (Scope 2) are due to energy consumption, especially electricity. There was a slight increase (2%) in indirect emissions, reflecting the rise in electricity consumption (see the specific section on page 215). It should be borne in mind that, for technical reasons, Terna's energy consumption is not attributable to a supply contract. This makes it impossible to reduce indirect emissions by selecting supplies from renewable sources and accounts for the need to use an average conversion factor for Italian electricity production.

TOTAL DIRECT AND INDIRECT GREENHOUSE GAS EMISSIONS - TONNES OF CO_2 EQUIVALENT*

	2019	2018	2017
Direct emissions			
Leakages of SF_6	60,162.2	54,846.1	67,371.4
Leakages of refrigerant gases (R407C, R410A)**	178.2	427.9	489.4
Petrol for motor vehicles	61.6	36.8	39.9
Diesel for motor vehicles	6,767.0	6,295.0	6,269.0
Jet fuel for helicopters	502.4	605.6	582.2
Natural gas for heating	305.5	316.0	419.9
Fuel oil for heating and generators	427.5	471.8	621.3
Total direct emissions	**68,404.4**	**62,999.2**	**75,792.9**
Indirect emissions			
Electricity* **	**65,246.9**	**64,050.5**	**72,489.3**

* *The conversion of direct energy consumption and leakages of SF_6 (sulphur hexafluoride) and refrigerant gases into equivalent CO_2 emissions has been carried out using the parameters indicated in the IPCC Fifth Assessment Report (AR5) and the Greenhouse Gas Protocol (GHG) Initiative.*

** *The significant reduction in leakages of refrigerant gases (R407C and R410A) mainly derives from the use of new gases having a lower environmental impact in machines and equipment, for which the correct monitoring method is currently being drawn up.*

*** *The conversion of indirect electricity consumption is carried out taking into account the share of total Italian electricity production represented by thermoelectric production in 2019. Allocation for the purposes of the production mix was based on the December 2019 issue of the "Monthly Report on the Electricity System" available on the website at www.terna.it.*

The increase in total direct and indirect CO_2 emissions, mainly linked to the rise in SF_6 leakages, is reflected in the slight upswing in the figure for carbon intensity, i.e. the ratio between direct and indirect emissions and revenue, within the context of a gradual downward trend.

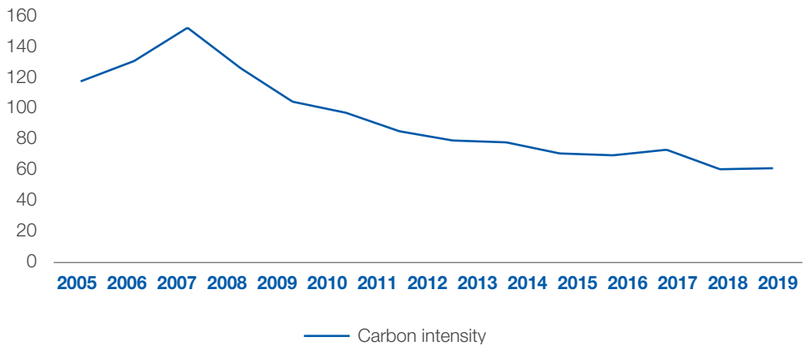
CARBON INTENSITY - TONNES OF CO_2 EQUIVALENT/ REVENUE (€M)

< 305-4

	2019	2018	2017
Total emissions (direct and indirect)	133,651.3	127,049.7	148,282.2
Ratio of total emissions to revenue	58.2	57.8	68.6

An alternative measure of carbon intensity is the ratio of direct emissions and value added, which for Terna, in 2019, amounts to 45.4 tonnes of CO_2 per million euros. This measure is comparable with the national figure: in 2017, it was 53.5 for Terna, whilst the Italian average was 178.3 tonnes of CO_2 per million euros (source: ISTAT, SDGs Report 2019).

CARBON INTENSITY CALCULATED ON REVENUES



Terna focuses its attention on a number of voluntary action programmes aimed at reducing its main sources of greenhouse gas emissions, which primarily regard curbing the SF_6 leakage rate, the energy efficiency of buildings and energy saving at electricity substations.

305-1 >

305-5 >

Containment of direct emissions: SF_6 leakage

SF_6 (sulphur hexafluoride) gas is used as insulation in certain electrical equipment (circuit breakers, current transformers and armoured equipment). Part of the gas in the equipment leaks into the atmosphere due to defective seals, when faults occur, and also sometimes during the re-pressurising process. SF_6 has a very powerful greenhouse effect, which is 23,500 times greater than CO_2: leakage into the atmosphere of 1 kg of SF_6 is equivalent to 23.5 tonnes of CO_2.

The amount of SF_6 present in the Group's infrastructure has risen steadily. This trend, which is common to many transmission grid operators, is linked to the better insulating performance of this gas and the smaller footprint of substations built with equipment containing SF_6 in comparison with more traditional solutions.

During the period from 2012 to 2017, the related target for the in which the SF_6 leakage rate was 0.60%, down 0.10% compared with the average for previous years.

In the light of the actual performance recorded until 2017, in the early months of 2018, the target was reformulated as follows: 0.47 for 2018 and 2019; 0.45 in subsequent years.

"TRANSMISSIONS IMPACTS" TARGET

KPIS AND TARGETS IN THE STRATEGIC PLAN 2020-2024

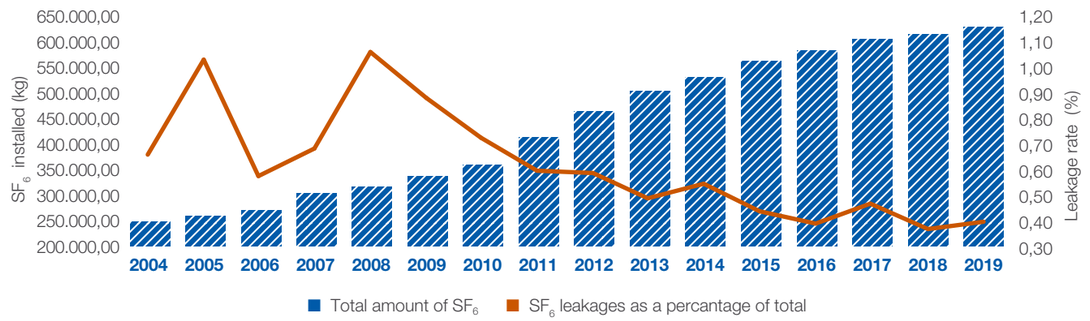
KPI			TARGET				
	2019		2020	2021	2022	2023	2024
	TARGET	RESULT					
SF_6 leakage rate* (%)	0.47	0.40	0.45	0.45	0.45	0.45	0.45

** Baseline: average for the five-year period 2013-2017 (0.47%).*

The target values should be qualified, bearing in mind the already substantial decrease recorded in the previous five-year period, and the higher average leakage rates of other leading European TSOs (0.7% in 2017).

In the following three-year period 2020-2022 the target will be even more challenging (0.45%), thanks to the expected effect of the additional containment measures implemented in the first two years.

SF_6 LEAKAGE



In 2019, the leakage rate regarding total equipment installed and cylinders was 0.40%, one of the all-time lows, even if up slightly from 2018. Routine and extraordinary maintenance activities have already been planned to resolve the most significant faults arising in 2019.

Consumption and cuts in emissions: energy efficiency

< 302-3

< 302-1

The transmission of electricity only requires direct energy consumption for certain support activities, including:

- fuel for the Company's operational vehicles, cars and helicopters used for line inspections, fault repair and other line and substation maintenance activities (see "Asset management" on page 152);
- fuel oil for emergency generators that only come into operation in the event of a power failure. It is estimated that, nationwide, generators were used for a total of 4,107 hours (consumption equal to 0.5 GJ per hour);
- fuel oil and natural gas for office heating.

Indirect energy consumption coincides with the electricity used to run substations and operating equipment (86% of the total in 2019) and for office and laboratory use. The figure relating to office consumption is 97,278 GJ (down from 111,113 GJ in 2018) which, compared to the total number of Terna employees (less blue-collar workers), corresponds to per capita consumption of 34.0 GJ. This last figure is the latest in a constant downward trend (39.7 GJ in 2018 and 47,8 GJ in 2017), bearing out the effectiveness of the energy efficiency measures in offices and buildings described on page 218.

DIRECT AND INDIRECT ENERGY CONSUMPTION BY PRIMARY SOURCE (GIGAJOULE)*

	2019	2018	2017
Direct consumption in GJ			
Petrol for motor vehicles**	889.2	531.8	576.8
Diesel for motor vehicles**	91,433.4	85,056.6	84,704.5
Jet fuel for helicopters	7,027.2	8,470.0	8,193.5
Natural gas for heating	5,448.6	5,636.3	7,489.9
Fuel oil for generators and heating	5,776.5	6,375.2	8,394.2
Total direct consumption	**110,574.9**	**106,069.8**	**109,358.8**
Indirect consumption in GJ			
Electricity to power substations and offices***	697,600.2	684,672.4	703,737.8

* *Direct consumption data in tonnes and thousands of m^3 are shown in detail in the "Key indicator tables". To convert the volumes of primary resources into gigajoules, the parameters set out in the Global Reporting Initiative (GRI) protocols were used.*

** *Only the consumption of operating vehicles is taken into account and not the cars used by managers.*

*** *Allocation for the purposes of the production mix was based on the December 2019 issue of the "Monthly Report on the Electricity System" available on the website at www.terna.it.*

Compared with 2018, the overall trend in direct and indirect consumptions was up by 2%, reflecting, on the one hand, increases in electricity consumption to power both substations and asset monitoring equipment. Both increases are also linked to the scope of data recording, which expanded due to the addition of former RFI substations during the year (up by 67, see page 28) and, especially, to fuel consumption and stepped up monitoring with respect to 2018 (+34% monitoring of substations, + 37% monitoring of the cutting back of vegetation and + 8% inspections of underground cable routes). On the other hand, there was a reduction in other types of consumption, especially those linked to heating and the use of electricity in offices and sites. The improvements are primarily due to the effects of restructuring and the use of more efficient heating systems (see page 218).

Energy Management System

In line with its energy efficiency objectives, the Group has been certified in accordance with the UNI CEI EN ISO 50001:2011 standard since 2015.

After the installation of sensors to measure energy consumption in real time at 80% of Terna's main sites, the subsequent analysis using time bands unearthed numerous peculiarities regarding electricity use and enabled the definition of long-term improvement initiatives for all of the sites monitored (2017).

In 2018, a pilot project regarding the online monitoring of the electricity consumed by transformer stations was launched and, in 2019, this project was extended nationwide via a representative sample of 23 substations, broken down by type of activity. More than 20 meters are being installed in each station to accurately monitor the electricity used and, after monitoring, energy audits will be carried out to define improvement targets.

In compliance with Legislative Decree 102/2014 and in agreement with ENEA, a cluster of 14 substations and 5 sites of relevance to the Company were selected for the energy audit, the outcomes of which are available on the ENEA portal.

Collection and assessment of the data monitored online as well as energy audits for other Terna sites are planned also for 2020. The distinctive feature of the latter regards the fact that, over time, the Group has decided to continue carrying out energy audits internally, thereby improving staff's know-how and taking advantage of colleagues' longstanding experience in the area of electricity substations. Moreover, the Company plans to install sensors to measure energy consumption in office buildings so as to define possible ways to reduce consumption. As concerns substations, a target to reduce power consumption for auxiliary services is currently being defined for implementation following replacement of the autotransformers.

>>

Energy efficiency in substations and offices

At Terna, the development of energy efficiency programmes relating to the use of electricity in substations and offices is experimental, as the Company's electricity consumption falls within the category of "own transmission uses" which, according to the industry's regulator, are not to be included in operating costs.

In offices, the main sources of energy consumption relate to lighting, the data centre, air-conditioning and heating. Notably, a number of Terna's offices have either been refurbished or are newly built under a long-term programme, which aims to upgrade the energy efficiency class of buildings owned by the Group, thereby combining civil engineering works with improved energy performance.

Below is a description of initiatives launched in recent years to reduce energy consumption, of which the benefits are measurable:

- **Summary of previous years' initiatives**

  At 31 December 2019, the energy efficiency initiatives launched in 2014 had led to an overall reduction of around 706 tonnes of CO_2 (equal to 262 tonnes of CO_2 in 2019 alone).

- **Improving the efficiency of air conditioning systems**

  In January 2020, a geothermal heating system that uses flowing water began operating at the 380kV substation in Martignone (BO). The system, developed in collaboration with our technology partner, Ateneo from Bologna, will lead to a reduction of approximately 28 tonnes in annual CO_2 emissions.

- **Improving the efficiency of lighting systems**

  In 2019, the lighting system at the Company's office in Rome in Via Galbani was replaced with an LED lighting system: Terna expects to see a reduction of 37,519.36 kWh/annually, the equivalent of 153.33 tonnes of CO_2 a year.

- **Self-production of electricity from renewable sources**

  A plant for self-producing electricity has been in operation in Morigallo (GE) for the offices of the Infrastructure Unit in Genoa since January 2019, resulting in a reduction of around 25 tonnes of CO_2 via the production of 70,000 kWh of electricity.
  In 2018, the plant for self-producing electricity from renewables for the Turin Botticelli office (guard house) entered service, resulting in a reduction of approximately 2 tonnes of CO_2 via the production of 5,420 KWh of electricity.
  A self-production plant has been operating at the Camin (PD) Infrastructure Unit since 2017, resulting in an estimated savings of around 6 tonnes of CO_2 in 2019.

Vehicle fleet

The Company's operational vehicles are used nationwide to carry out power line inspections and, in general, to visit infrastructure and construction sites.

Terna's vehicle fleet consists of four helicopters, purchased in 2015, used to carry out scheduled and random inspections of power lines, and a fleet of cars that is frequently renewed, of which over 87% are equipped with Euro 6 and Euro 5 engines (for further information on vehicles and the related impact of the fleet, see the relevant table in the "Key indicator tables" on page 278).

Other indirect CO_2 emissions

< 305-3

In addition to emissions relating to electricity consumption, Terna's most significant indirect emissions are connected to grid losses. The indicators relating to emissions produced as a result of air travel by staff are shown on page 278.

Grid losses

< EU12

Grid losses are defined as the difference between energy injected by producers (including imported energy) and final consumption; the relevant losses for Terna are those associated with the transmission grid. The figures shown in the following table are based on direct measurement of the energy injected and withdrawn from the transmission system. In 2017, Terna became responsible for the direct measurement, whereas in previous years the Company had been responsible only for the measurement of energy injected into the NTG and not for the energy withdrawn, for which the distribution companies were responsible. The margin of uncertainty regarding the accuracy of the readings made tended to decrease over the years, as a result of cross-checks and the gradual elimination of discrepancies with distributors' data.

In order to reduce the risk of interpreting the effect of measurement errors and the related corrections as actual trends, it was decided to use the arithmetic moving average of losses with a three-year window as annual data (three-year period 2015-2017 for 2017, 2016-2018 for 2018). In order to maintain the consistency of the published data, the three-year moving average was also published for 2019.

GRID LOSSES

	2019		2018		2017	
	% Compared with energy demand	GWh	% compared with energy demand	GWh	% compared with energy demand	GWh
VHV and HV grid	1.4	4,555	1.4	4,613	1.4	4,583

Grid losses are a physical effect of the electricity lost as it passes through conductors and during transformation. Losses are influenced by the level of voltage, the volume of electricity transported, the materials used and the distance between the points at which the energy is produced and consumed. Terna can only determine the extent of the losses, which are not completely under its control.

Grid development activities, given the same structure of production, would lead to greater efficiency and thus a reduction in losses. However, the actual impact of development initiatives on losses is unpredictable and not under the control of the transmission operator, as it depends on concomitant changes in production capacity and electricity supply and demand at local level.

Dispatching operations, needed to guarantee a constant balance between injections and withdrawals and to prevent the occurrence of grid security problems and disruptions, are carried out in accordance with regulatory criteria within the production set-up created by the energy market. They cannot be influenced by Terna with the aim of minimising losses.

CO_2 emissions associated with grid losses amounted to 1,533,654 tonnes in 2019 (1,553,716 tonnes in 2018 and 1,699,607 in 2017). The trend differs from the one regarding losses measured in GWh due to changes in the conversion factor used to convert energy into CO_2 equivalent emissions, which in turn is affected by changes in the production mix among Italian power generators.

LCA studies on power lines

One of Terna's environmental objectives is to draft an initial assessment of the Group's overall carbon footprint. For this reason, Terna is conducting various Life Cycle Assessment (LCA) studies on components of the grid, with methodological support from Bocconi University. The assessments are carried out in accordance with UNI EN ISO 14040:2006 and UNI EN ISO 14044:2006 standards and in application of the Circular Footprint developed by the European Commission within the framework of the Product Environmental Footprint. In 2019, an initial assessment was made considering a 150kV single triad overhead power line. The LCA studies measure impacts based on different categories. The calculation method developed by the European Commission's Joint Research Centre is used to assess the relative importance of the impacts. This method enables identification of both the most important categories of impact and the most significant phases in the life cycle. It is based on materiality assessments evaluating the relative impact of the various categories as determined by experts in the sector. The analysis has revealed that:

- the most significant impact category is "Climate change", linked primarily to the presence of grid losses. The main cause of this impact relates to the production of electricity from fossil sources. The solution entails decarbonisation of the energy mix (see the paragraph on the effects of Terna's Development Plan);
- in moving towards decarbonisation, the "Climate change" category loses relative significance, whilst the category "Mineral, fossil & renewable resource depletion" gains in importance, refecting the production of materials used in conductors and pylons.

A possible reduction in these impacts involves considering changes on the supply chain side.

Environmental costs

Terna's commitment to the environment is reflected in the costs incurred for environmental reasons, in terms of both capital expenditure and operating costs. Separate representation of environmental costs is based on the definitions set out below, through aggregating information derived from the Company's general and management accounting. These definitions and the methodology described below are taken from the Terna Group's operating guidelines.

Accounting methodology

The identification of environmental costs is based primarily on available definitions, primarily those of ISTAT (Italy's Office for National Statistics), Eurostat and GRI, as well as the European Commission Recommendation on the recognition, measurement and disclosure of environmental data in annual accounts and annual reports (Recommendation 2001/453/EC). According to this Recommendation, the term "environmental expenditure" includes the cost of initiatives undertaken by a company, directly or via third parties, in order to prevent, reduce or repair damage to the environment caused by its operating activities.

Secondly, the relevant definitions have been cross-referenced with the environmental aspects assessed as being significant (e.g. substation noise, electromagnetic fields, etc.) within the Company's ISO 14001 certified Environmental Management System, in order to identify Terna's environmentally relevant operating and capital expenditure activities within the main business processes.

Many of Terna's activities described in this Report entail environmental expenditure. However, certain limitations have been introduced in determining the scope of reporting:

- the exclusion of integrated costs, namely those related to activities that have no exclusively environmental purpose (e.g. the use of pylons with innovative characteristics, also in terms of how well they blend into their surroundings) due to the subjective nature of accounting for environmental components only;
- the exclusion of additional costs linked to the consideration of environmental constraints and demands when planning and designing new lines (re-routings and sections of cable laid underground).

Additional conditions were also imposed if costs were significant, consistent with annual accounting requirements (a clear distinction between operating costs and capital expenditure) and directly measurable on the basis of the Company's existing accounting system.

The latter condition meets the need to minimise the use of estimates based on non-accounting procedures.

Capital expenditure and operating costs

The table below provides the best possible view of Terna's capital expenditure and operating costs in relation to the environment.

It should be noted that these costs exclude expenses relating to internal resources, and only take into account the cost of external supplies. An exception is the item "Environmental activities - Existing plant", which does include the cost of internal personnel.

Based on the methodology adopted and the footnotes to the table, it should be noted that the environmental costs shown represent a subset of the total environmental costs actually incurred, as defined above.

ENVIRONMENTAL COSTS - CAPITAL EXPENDURE AND OPERATING COSTS (€M)

	2019	2018	2017
Capital expenditure			
Environmental offsets [1]	8.7	7.1	7.9
Environmental impact studies [2]	3.8	3.5	4.2
Environmental activities - new plant [3]	5.5	3.9	4.8
Environmental activities - existing plant [4]	3.4	2.9	3.6
Demolitions [5]	1.7	2.2	0.8
Total capital expenditure	**23.1**	**19.6**	**21.2**
Costs			
Cost of environmental activities [6]	24.2	23.8	24.1
Total operating costs	**24.2**	**23.8**	**24.1**

[1] ***Environmental offsets**: these are amounts allocated to offset the works provided for in the Grid Development Plan, as identified by specific agreements signed with local authorities.*

[2] ***Environmental impact studies**: these relate to plants provided for in the Grid Development Plan that are under construction or awaiting the necessary consents from the competent authorities.*

[3] ***Environmental activities - new plant**: The amount shown is an estimated figure. Based on an analysis of certain large investment projects, it has been found that at least 1% of total project costs correspond to environmental items, usually deriving from regulatory requirements (for example, tree screens, noise barriers, the installation of bird deterrents, environmental monitoring, the testing of excavated soil and rocks). Therefore, a value of 1% of the capital expenditure cost for projects with similar characteristics has been taken into account.*

[4] ***Environmental activities - existing plant**: These are the costs of upgrading plants to comply with new legal requirements and regulations in the environmental field (e.g. noise and visual and landscape aspects).*

[5] ***Demolitions**: This is the cost of the final decommissioning of power lines as part of rationalisation programmes.*

[6] ***Cost of environmental activities**: This regards vegetation management, grass cutting, waste management and demolition/decommissioning activities, which represent small amounts and are not included under investment. These cost items, which are directly identifiable within the management accounts, do not cover all environmental operating costs, but do comprise the majority of such costs.*