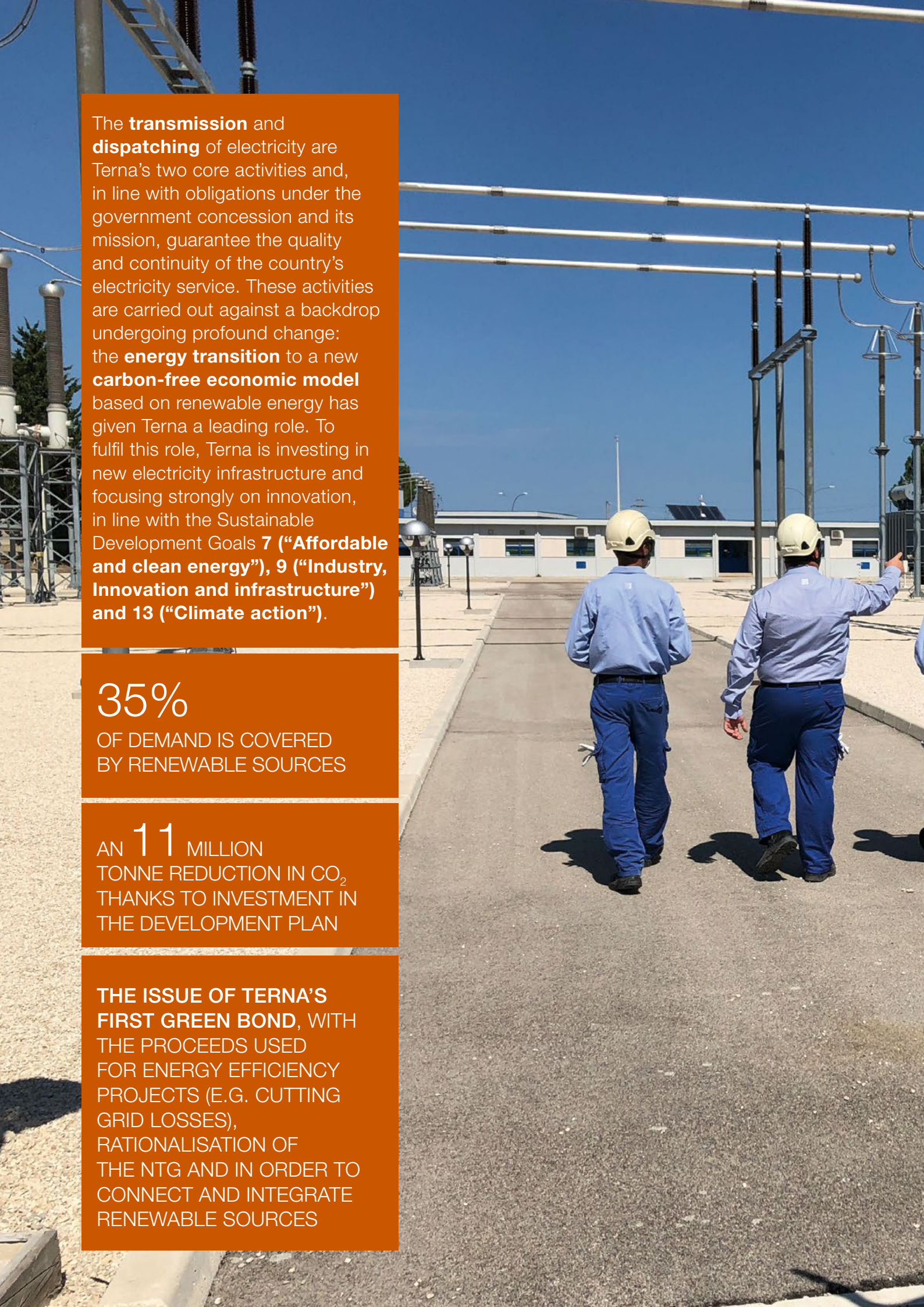


The **transmission** and **dispatching** of electricity are Terna's two core activities and, in line with obligations under the government concession and its mission, guarantee the quality and continuity of the country's electricity service. These activities are carried out against a backdrop undergoing profound change: the **energy transition** to a new **carbon-free economic model** based on renewable energy has given Terna a leading role. To fulfil this role, Terna is investing in new electricity infrastructure and focusing strongly on innovation, in line with the Sustainable Development Goals **7 ("Affordable and clean energy"), 9 ("Industry, Innovation and infrastructure") and 13 ("Climate action")**.

35%

OF DEMAND IS COVERED BY RENEWABLE SOURCES

AN 11 MILLION TONNE REDUCTION IN CO_2 THANKS TO INVESTMENT IN THE DEVELOPMENT PLAN

THE ISSUE OF TERNA'S FIRST GREEN BOND, WITH THE PROCEEDS USED FOR ENERGY EFFICIENCY PROJECTS (E.G. CUTTING GRID LOSSES), RATIONALISATION OF THE NTG AND IN ORDER TO CONNECT AND INTEGRATE RENEWABLE SOURCES

4

Electricity service and innovation

Energy sector

At international level, guidelines for development of the energy sector are provided in the United Nations Sustainable Development Goals (SDGs), which - in keeping with the decisions set out in the COP 21[34] - set out a path for creating an energy system based around renewable sources by 2030. In the meantime, the European Union's Clean Energy Package, which is in the process of being approved, will lead to major changes in the rules and policies applied to the sector, ranging from the electricity markets to the energy efficiency of buildings. In line with these guidelines, the Italian government approved the country's National Energy Strategy (*Strategia Energetica Nazionale* or "SEN") at the end of 2017. This is a key policy document, forming the basis for plans to develop the Italian energy system of the future. At the end of 2018, the government also drew up a proposed Integrated National Energy and Climate Plan (NECP).
The NECP was recently submitted to the EU and will be consulted on with stakeholders. The document has not introduced significant quantitative changes with respect to the figures included in the SEN, but proposes a revision of the related objectives and is firmly based around the Energy Union's five dimensions: energy efficiency, decarbonisation, the internal energy market, energy security and research, innovation and competitiveness.

One of the objectives of the NECP is to boost the share of total consumption generated by renewable energy sources from 18.6% in 2020 to 30% by 2030. The electricity sector has been set even more challenging goals, with the aim of increasing the share of total electricity consumption represented by renewables from 34.1% in 2017 to 55.4% in 2030. Measures designed to promote security of supply for energy, above all electricity, are dependent on the introduction of the Capacity Market, which is due to be launched in 2019, and on revision of the Emergency Plan for the Security of the Electricity System (*piano di Emergenza per la Sicurezza del Sistema Elettrico* or "PESSE"). The strategy also includes plans to boost storage systems (above all pumping), cross-border interconnections (see page 128) and investment in resilience in order to contribute to efforts designed to increase the ability of the grid to handle extreme weather events and emergencies (see page 134).

In 2018, renewable sources (including hydroelectric and biomass) accounted for 40% of Italy's production (35% of demand).

ELECTRICITY DEMAND IN ITALY	2018*	2017	2016	% CHANGE 2018-2017
Net domestic production	280,234	285,265	279,703	-1.8%
From overseas suppliers (imports)	47,179	42,895	43,181	10.0%
Sold to overseas customers (exports)	-3,270	-5,134	-6,154	-36.3%
For use in pumping**	-2,233	-2,478	-2,468	-9.9%
Total demand in Italy	**321,910**	**320,548**	**314,261**	**0.4%**

* *Provisional data.*

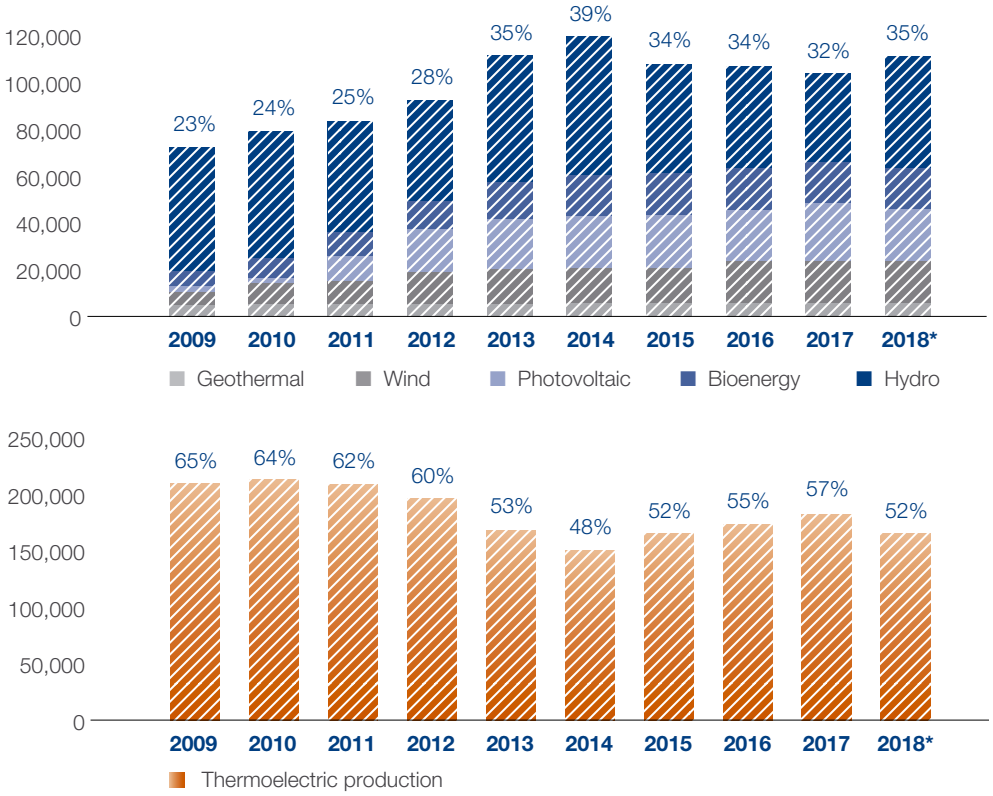
** *Electricity used for pumping water, solely for subsequent use in electricity production.*

[34] The Rio Earth Summit, COP 21 or CMP 11 was held in Paris between 30 November and 12 December 2015. This was the 21st annual session of the Conference of the Parties to the UN Framework Convention on Climate Change (UNFCCC) of 1992 and the 11th session of the Meeting of the Parties to the Kyoto Protocol of 1997.

ELECTRICITY PRODUCTION IN ITALY (GWh)	2018*	2017	2016	% CHANGE 2018-2017
Net hydroelectric production	49,275	37,557	43,785	31.2%
Net thermal production	167,363	182,487	172,815	-8.3%
Renewable production	63,596	65,221	63,103	-2.5%
Total net production	**280,234**	**285,265**	**279,703**	**-1.8%**

(*) Provisional data.

PERFORMANCE OF PRODUCTION SOURCES IN TERMS OF DEMAND*



The increase in the share of demand met by renewable production in 2018 is due to the significant rise in hydroelectric production, which offset the slight fall in other renewable sources.

(*) The percentages shown in the two graphs compared refer to the share of demand met by renewable sources (top graph) and thermal sources (bottom graph).

NO. OF HOURS IN WHICH COVERAGE OF DEMAND BY RENEWABLE SOURCES EXCEEDS THRESHOLD

	>30%	>40%	>50%
2015	5,194	2,174	712
2016	5,083	2,298	800
2017	4,434	1,769	524
2018*	**5,617**	**2,537**	**727**

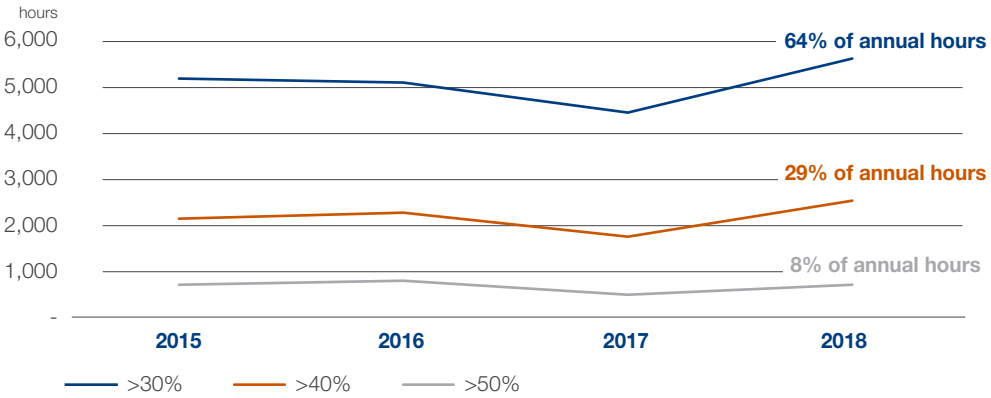
NB: there are usually 8,760 hours in a calendar year, with 8,784 in a leap year.
(*) Provisional data.

The trend in recent years has seen a significant increase in the number of hours during which the share of demand met by RES exceeds the 30% threshold. This reflects both growth in renewable capacity installed and increasing integrated approach managing the various renewable energy sources available.

If we exclude the decline in 2017, due to a lack of water for use in hydroelectric production, we can see that the trend is towards a growing number of hours when there is a contribution from renewable sources.

This shows that the "green transition" is well underway and making solid progress.

SHARE OF DEMAND MET BY RENEWABLE SOURCES



Continuity and quality of service

EU28 >

EU29 >

Each segment of the electricity system - generation, transmission and distribution - plays a role in ensuring the availability of electricity in Italy, guaranteeing adequate quality standards and keeping the number of outages below pre-set thresholds.

Terna is responsible for service continuity on the transmission grid[35], which is monitored through various indicators, a number defined by ARERA[36].

The RENS and ASA indicators are the most significant, as they record the frequency and impact on the service of events affecting the electricity network and linked to faults or external factors, such as weather events.

INDICATOR	WHAT IT MEASURES	HOW IT IS CALCULATED
RENS*	Energy not supplied following events affecting the relevant grid**.	The sum of the energy not supplied to users connected to the NTG (following events affecting the relevant grid, as defined in the ARERA regulations governing quality of service).
ASA***	Availability of the service provided by the NTG.	Based on the ratio of the sum of energy not supplied to users connected to the NTG (ENS) and energy fed into the grid.

* *Regulated Energy Not Supplied.*
** *The "relevant grid" refers to all the high-voltage and very high-voltage network.*
*** *Average Service Availability.*

The RENS indicator is also important due to the impact it has on regulated revenue. Indeed, ARERA[37] regulates the quality of service provided by Terna through a bonus/penalty mechanism based on this indicator.

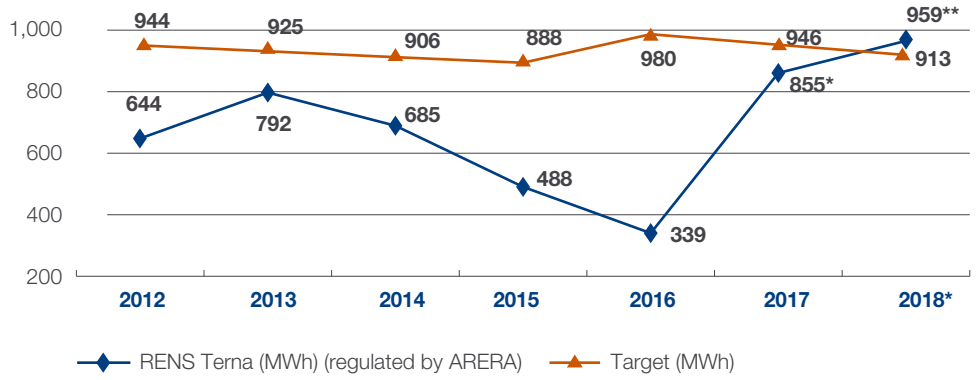
As regards the ASA indicator, the operating performance shows that ASA has remained stable at a high level over the years (the higher the indicator, the better the performance). This indicator shows that the energy not supplied following a fault on the owned grid represents a minimal part of the total quantity of energy supplied to users of the grid.

[35] The monitored portions of the NTG belong to Terna S.p.A. and, from 2012, also the subsidiary, Terna Rete Italia S.r.l.

[36] Resolution 250/04.

[37] Resolution ARG/elt 197/11. This regulates the quality of the service provided by Terna via a bonus/penalty mechanism applicable to the regulatory period 2012-2015 and relating to the Regulated Energy Not Supplied (RENS) indicator attributed separately to the grid owned by Terna S.p.A. and to the one owned by the subsidiary, Terna Rete Italia S.r.l. Since 2016, the quality of the service provided by Terna has been regulated by Resolution 653/15/R/EEL, the latter applicable to the 2016-2023 regulatory period, which takes into account only one indicator, NTG RENS, including the grid owned by Terna S.p.A. and its subsidiary, Terna Rete Italia S.r.l. Resolution 38/2016/R/eel recently clarified that the portion of the network acquired from the FSI Group is excluded from the bonus/penalty mechanism regarding Energy Not Supplied.

RENS INDICATOR

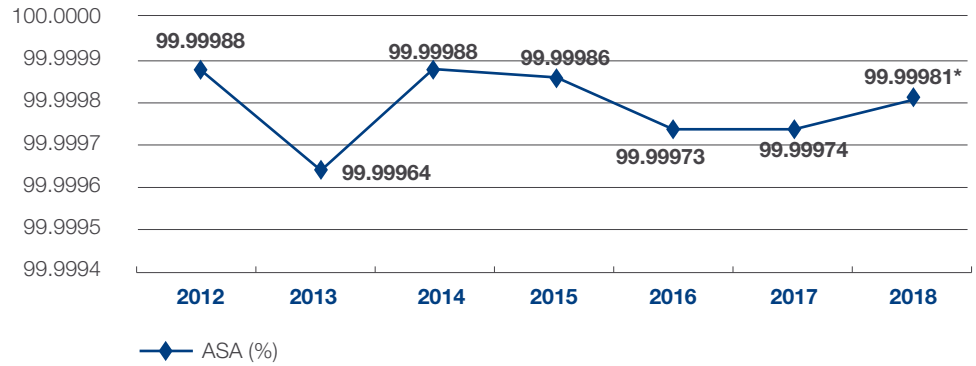


For the RENS indicator, the targets for 2012-2015 have been set as an average of the RENS 2008-2011 indicator, referred to in ARERA Resolution ARG/elt 197/11, with a 2% improvement in performance required for each year compared with the previous one. The target for 2016-2023 has been set as an average of the 2012-2015 RENS indicator, referred to in ARERA Resolution 653/15/R/eel, with a 3.5% improvement in performance required for each year compared with the previous one.

(*) The RENS indicator for 2017 is provisional and is subject to change following confirmation of the related amount by ARERA.

(**) This figure takes into account the major incident of 29 October, which affected northern Italy and led to the misalignment of numerous primary substations in the Padua and Milan local Operating Areas for Transmission (above all in the provinces of Belluno, Trento, Vicenza and Brescia), amounting to 625 MWh. Terna is in talks with ARERA with a view to having the event classified as a catastrophe. The RENS indicator calculated on this basis is 969 MWh and falls within the quality of service allowance.

ASA INDICATOR



The ASA indicator refers to the observation period 2012-2018.
(*) The figures for 2018 have not yet been finalised and approved by ARERA.

Investment and innovation for the SDGs

Terna's main activity coincides with its obligations under the concession and translates into a constant commitment to ensuring a secure, high-quality and affordable electricity service for the whole of Italy, via management and development of the transmission grid.

In the current phase of transition towards a decarbonised economic system, in addition to its traditional tasks, the Company is also responsible for promoting the integration of renewables as far as possible. This is achieved by directly connecting them to the grid or through grid upgrades, and by improving grid management capabilities when using non-programmable renewable sources to meet high demand. Increased use of renewables and development of the electricity grid go hand in hand. Indeed, the latter is an essential enabling factor for the former.

Terna's activities are, therefore, an integral part of the form of sustainable development set out in the United Nations Sustainable Development Goals and, especially, in Goal 7 ("Affordable and clean energy"), Goal 9 ("Industry, innovation and infrastructure") and Goal 13 ("Climate action").

For the specific implementation of its contribution to the achievement of these SDGs, Terna relies on four main instruments:
- investment in development of the transmission grid (the Development Plan);
- investment in the security of the service (the Security Plan);
- investment in the resilience of the grid and the service (the Resilience Plan contained in the Security Plan);
- asset management (the renewal and maintenance of plant);
- innovation, aimed at supporting the transition to renewables and promoting energy efficiency.

The Development Plan also refers to SDG 8 ("Decent work and economic growth"), as the infrastructure drives the country's economic growth, and SDG 11 ("Sustainable cities and communities"), introducing "Focus on local communities" as a driver in the 2019 edition of the Development Plan (such as the integration of electric mobility projects in metropolitan areas).

GROUP CAPITAL EXPENDITURE

(€m)	2018
Development Plan	**472**
Security Plan	**136**
Projects to renovate electricity assets	**296**
- of which electricity assets (before functional separations)	*228*
- of which functional separations	*68*
Other capital expenditure	**85**
Total regulated assets	**989**
Other non-regulated assets*	**103**
TOTAL CAPITAL EXPENDITURE	**1,091**

** includes financial expenses of €15 million in 2018 and €13 million in 2017.*

BENCHMARK SDGs FOR TERNA

TARGET	TERNA' ACTIONS	SDG
7.1 - By 2030, ensure universal access to affordable, reliable and modern energy services. **7.2** - By 2030, increase substantially the share of renewable energy in the global energy mix. **7.a** - By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology.	**7.1** - Focus on innovation to increase energy efficiency and contribute towards decarbonisation of the economy (see page 138); Carry out the investment provided for in the Development Plan (see page 119); Seek new non-regulated business opportunities (see page 44). **7.2** - Carry out the investment provided for in the Development Plan (see page 119). **7.a** - Play an active role in policy coordination at international level (ENTSO-E, see page 102) and develop overseas operations (see page 47).	
9.1 - Develop quality, reliable, sustainable and resilient infrastructure, including regional and trans-border infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all. **9.a** - Facilitate sustainable and resilient infrastructure development in developing countries through enhanced financial, technological and technical support to African countries, least developed countries, landlocked developing countries and small island developing States.	**9.1** - Carry out the investment provided for in the Development Plan (see page 119) and implement the Resilience Plan (see page 135); Construct cross-border interconnections (see page 128). **9.a** - Develop International Activities (see page 47).	
13.1 - Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries.	**13.1** - Implement the Resilience Plan; Research and Development; Innovation. Focus on innovation to increase the resilience of the NTG (see page 135).	

Grid development

Each year, Terna prepares a National Transmission Grid (NTG) Development Plan, which sets out the grid development initiatives envisaged over the next ten years, as well as the state of progress of the development works planned in previous years.

By analysing electricity flows through the grid and developing supply and demand projections, Terna is able to identify areas of the grid requiring attention. As a result, it is able to plan the new projects needed to ensure that the system is fit for purpose over the short, medium and long term, in relation to demand, security of supply, quality, continuity and the cost-effectiveness of the service.
The Plan contains all the investments that Terna is committed to carrying out in order to guarantee the efficiency of the grid, the security of supply and of the service. At the same time, it represents the community's need for a secure, efficient electricity service and Terna's commitment to meet that need.

Given that these objectives are of general interest, all investment in development of the grid is subject to a prior **cost-benefit analysis**, comparing the related expenditure with the resulting benefits, expressed in monetary terms. The cost-benefit analysis largely applies the criteria and methods applied by ENTSO-E, examining contrasting scenario and indicators of the environmental and social benefits. Medium- to long-term development scenarios have been drawn up in line with these guidelines.

A positive cost-benefit ratio is a necessary condition of the investment's inclusion in the Development Plan.

The Development Plan is assessed and approved by the Ministry for Economic Development, following the outcome of the public consultation[38] organised by ARERA, and is submitted for evaluation by the grid users' Consultation Committee (also see page 92).

The Plan is also subjected to a Strategic Environmental Assessment (SEA)[39] process by the Ministry of the Environment and of the Protection of Land and Sea in agreement with the Ministry of Cultural Heritage, with a view to incorporating environmental considerations when preparing the plan, thereby ensuring its environmental sustainability.

[38] Pursuant to art. 36.13 of Legislative Decree 93/11.
[39] Or, if necessary, to the procedures for verification of eligibility for the SEA procedure pursuant to Legislative Decree 1 of 24 January 2012.

2019 Development Plan

The 2019 Development Plan is fully in keeping with changes in the electricity sector at Italian and European level, reflecting the impact of the drive for decarbonisation. This is in keeping with the proposed Integrated National Energy and Climate Plan (NECP) submitted to the European Commission on 8 January 2019 and which should receive final approval during the current year.

The 2019 Development Plan is also a response to changes in the state of the climate and the occurrence of increasingly significant weather events, whilst placing a growing emphasis on local issues and the promotion of local initiatives.

The Development Plan is based on the following drivers:

- **decarbonisation**: the electricity system's transition to complete decarbonisation requires use of all the tools necessary in order to fully integrate renewable production plants in order to reduce emissions, guaranteeing the system's security;
- **market efficiency**: the structure and mix of Europe's generation mix in general and of Italian generation in particular are undergoing a radical transformation, just as transmission lines are being developed in keeping with new European directives regarding Market Design;
- **security of supply**: the third driver for the Plan aims to ensure the security of the national electricity system and, at the same time, create an increasingly resilient system, capable of handling critical events external to the system itself;
- **systemic sustainability**: meaning the ability to conceive, design and implement projects on the basis of cogent analysis capable of maximising the both the environmental and economic benefits.

The 2019 Development Plan entails investment of approximately €13 billion, which will enable the Company to achieve the following electricity system efficiencies and benefits:

800 GWH A YEAR	**OVER 5,000 MW**	**UP TO AROUND 6,000 MW**	**AROUND 5,500 MW**
in reduced energy losses	in reduced congestion	in increased interconnection capacity with other countries	in increased capacity provided by renewable sources in the short term

Terna successfully launches first green bond issue

The positive effects of investment in the development of Terna's grid were behind the launch, in July 2018, of the Group's first ever green bond for institutional investors. The bonds, which proved a great success with investors with the issue being six times oversubscribed, amount to €750 million and have a term to maturity of five years. Further bonds amounting to €250 million were issued in January 2019 in the form of a private placement.

As indicated in the "Green Bond Framework", the net proceeds will be used to finance eligible green projects that Terna has already selected or that will be selected in compliance with the Green Bond Principles 2018 published by ICMA, the International Capital Market Association. The projects will regard energy efficiency (e.g. reducing energy losses), rationalisation of the NTG and the connection and integration of renewable sources. The Green Bond Framework was reviewed by Vigeo Eiris, which provided an independent Second Party Opinion (see the "Green Bond Report 2018" on page 216).

The bond issue was managed by a syndicate of banks consisting of Banca Akros, Banca IMI, Bank of America Merrill Lynch, BNPP (which also acted as Green Structuring Advisor), Credit Suisse, J.P. Morgan, Natixis and UniCredit.

Reduction of CO_2 emissions in the electricity system

Construction of the new power lines and substations provided for in the Development Plan generates positive effects not only regarding the security of supply and the final cost of electricity, but also in terms of a reduction in the emissions produced by the electricity system. The effects, which will be achieved on completion of the Plan, derive from a reduction in energy losses through the grid, improvements to the production mix and interconnections with other countries, as well as the connection of plants that use renewables.

The overall reduction in CO_2 emissions could add up to approximately 11 million tonnes per year.

Reduction in grid losses	Grid losses depend, among other things, on the length of the section of the transmission grid over which the electricity has to travel. In the simplest possible terms, the further away the point of consumption (withdrawal from the NTG) is from the point of production (injection into the NTG), the greater the losses for the same amount of consumption. In addition, over an equal distance, the losses are greater on a lower voltage line. Development works that improve the grid bring the points of withdrawal and consumption closer together: if all else is equal, grid losses are consequently reduced. A similar result is achieved by upgrading a section of the grid, for example, when a 400 kV line replaces a 150 kV line along the same route. The entry into service of the main development works provided for in the 2019 Development Plan will lead to an estimated reduction in energy losses through the grid of approximately 800 GWh a year. If such a loss reduction were to equate to a decrease in production from fossil fuel sources, this would amount to a reduction in CO_2 emissions of approximately 280,000 tonnes per year.
Improvement in the production mix and interconnections with other countries	One of the primary aims of developing the electricity transmission grid is to overcome transport limitations between “electricity zones”. The existence of these limitations imposes certain restrictions on being able to use the most efficient generating units for production, namely those that are less polluting in terms of CO_2 emissions, while at the same time, for grid security reasons, necessitating production by obsolete power plants. The initiatives provided for in the Development Plan, together with the expansion of interconnections with other countries, would enable a more efficient production mix, with a greater share of production from higher yielding plants. The same amount of final consumption would thus be achieved with less fuel: the benefits would add up to a reduction in CO_2 emissions of up to 6,340,000 tonnes per year.

Increase in renewable energy production

The main contribution to the reduction in CO_2 emissions derives from the increased integration of renewable energy plants. Production of energy from renewable sources has grown rapidly in potential in recent years. In particular, wind and photovoltaic generation plants have witnessed a considerable increase, especially in Italy's southern and island regions.

One of Terna's main tasks is to plan upgrades of the NTG in order to promote the production of electricity from renewable sources, seeking to overcome any grid and operational constraints that may affect the injection of such energy into the grid, which benefits from priority dispatching rights.

The development solutions planned in response to these critical issues include interventions to upgrade sections of the primary grid, which indirectly reduces the limits on production from non-programmable renewable sources (NPRS), and interventions designed to upgrade local sub-transmission grids into which the energy produced from NPRS is directly injected (see page 126). In addition to these interventions, collection stations have been planned for NPRS on the primary 400 kV grid, which will limit the number of new 150 kV power lines to be built with respect to the number that would otherwise be required. Overall, the works envisaged in Terna's 2019 Development Plan will release power from renewable resources amounting to approximately 5,500 MW, thereby obtaining a reduction in CO_2 emissions of approximately 4,427,000 tonnes a year.

Cuts in CO_2 emissions in 2018

In 2018, the benefits in terms of reductions in CO_2 emissions were mainly due to the installation of new "zero emission" production plants.

The provisional figures for installed capacity from renewable sources in 2018 are shown below.

ENERGY SOURCE	INSTALLED CAPACITY - MW
Wind	~10,311
Photovoltaic	~20,116
Total	**30,427**

(*) Provisional data from Terna.

Principal projects for the National Transmission Grid

Investment in the Development Plan:

UP 32%

on the previous Plan

Investment in 2018

UP 5.5%

versus 2017

Key to main projects included in the Development Plan

- Lines
- Restructuring in urban areas
- Overseas interconnections
- Grid upgrades

DEVELOPMENT PLAN - €472 million

Interconnectors and lines	Km of circuit	Status	Driver
Italy-Montenegro interconnector	445	◉	CO2 ◯
Italy-France interconnector	190	◉	CO2 ◯ ⚡ ❄
Italy-Austria interconnector	24	○	CO2 ◯ ❄
Italy-Switzerland interconnector	100	○	CO2 ◯ ⚡ ❄
Italy-Slovenia interconnector	114	○	CO2 ◯ ❄
Sardinia-Corsica-Italy interconnector	540	○	◯ ⚡ ❄
HVDC Centre South - Centre North	221	○	CO2 ◯ ⚡ ❄
HVDC Italy-Tunisia	200	○	CO2 ◯ ❄
HVDC Mainland Sicily-Sardinia	882	○	CO2 ◯ ⚡ ❄
Venetian lagoon cables	20	●	◯ ❄ ⚡
Sorrento Peninsula interconnector	20	◉	❄ ⚡
Reorganisation of metropolitan areas ✓	182	◉	❄ ⚡
Foggia-Benevento II power line	18	●	CO2 ◯ ❄
Bono-Buddusò	29	●	CO2 ⚡ ❄
Messina-Riviera-Villafranca	12	●	CO2 ◯ ⚡ ❄
Ciminna-Casuzze	35	●	⚡ ❄
Chiaramonte-Gulfi-Ciminna	173	○	CO2 ◯ ⚡ ❄
Rationalisation in the Mid Piave Valley ✓	90	○	CO2 ⚡ ❄
Colunga-Calenzano ✓	85	○	CO2 ◯ ⚡ ❄
Gissi-Foggia	140	○	CO2 ◯ ⚡ ❄
Cassano-Chiari	36	○	◯ ⚡
Deliceto Bisaccia	36	◉	CO2 ◯ ⚡ ❄
Upgrade Northern Calabria	10	○	CO2 ◯ ⚡ ❄
Paternò-Pantano-Priolo	63	◉	CO2 ◯ ⚡ ❄
Elba-Mainland	35	○	CO2 ◯ ⚡ ❄
Substations			
8 new substations entered service (San Severo, Quartu Quartucciu, Santa Teresa, San Salvo9, Portella Pero, Siculiana, Ravenna industrial estate, Canino)		●	⚡ ❄

SECURITY PLAN - €136 million

Projects	Status	Driver
Fiber for the Grid	◉	◯ ⚡ ❄
Ice and snow risk mitigation systems ✓	◉	CO2 ⚡ ❄
Control devices	◉	◯ ⚡ ❄

RENEWAL PLAN - €296 million

The Renewal Plan electricity assets provides for widespread initiatives across the entire NTG, aimed at improving the reliability of the electricity grid. Work continued in 2018 on replacing assets and individual components in the interests of service quality, adopting the most modern market solutions in terms of plant digitisation (replacement of substation systems with digital technology) and in terms of better environmental compatibility with the host environment (replacement of fluid oil cable connections with extruded insulation and use of machinery with insulation using vegetable esters instead of mineral oil).

Key *

✓ Resilience Plan	○ Awaiting consents/under design	◉ Under construction	● Completed/in service
CO2 Decarbonisation	◯ Market efficiency	⚡ Security of supply	❄ Systemic sustainability

(*) The other initiatives completed in 2018 are shown in the section "Changes in the dimensions of the NTG" in the annexes.

Principal development activities in progress

Each year, grid development activities take the form of numerous interventions at various stages of completion.

Construction work carried out and expected benefits

VENICE LAGOON CABLES - POWER LINES LINKING THE "SACCA SERENELLA PRIMARY SUBSTATION - CAVALLINO PRIMARY SUBSTATION " AND "FUSINA 2 - SACCA FISOLA PRIMARY SUBSTATION"

Status

The 132 kV power lines between the "Sacca Serenella Primary Substation - Cavallino Primary Substation" and "Fusina 2 - Sacca Fisola" in cable, provided for in the Development Plan, have entered service. The related consents were provided by the Ministry for Economic Development on 6 August 2009 with Decree EL-106.

Benefits

→ **For the electricity system:** this infrastructure will improve operational security and increase the reliability of the grid that serves the city of Venice, whilst also overcoming the current structural antenna that powers the Cavallino primary substation and simultaneously increasing connections with the portion of the grid associated with the 380/132 kV Salgareda substation.

→ **For the country as a whole:** the new infrastructure is expected to result in savings of between €9 and €18 million a year for the Italian electricity system.

→ **For local communities:** in terms of the environment, the infrastructure will make it possible to retire around 7 km of 132 kV lines.

Targets

RES integration	Quality of service	Inter-connectors	Congestion solutions	NTG connection	Resilience	RFI integration	SEN 2018
●		●		●			

RESTRUCTURING ON THE CAGLIARI AREA

Status

Work was completed in the Cagliari area in October with the entry into service of the 150 kV cable linking Quarto and Quartuccio. This project is included in the NTG Development Plan and the related consents were received from the Ministry for Economic Development on 9 September 2015 with Decree EL-304/230.

Benefits

→ **For the electricity system:** the new power line brings significant benefits for the electricity system in Cagliari, in terms of both the security and efficiency of the electricity service and greater reliability in the event of maintenance.

→ **For the country as a whole:** the work will result in a major improvement in the security of local electricity supplies.

→ **For local communities:** in terms of the environment, the infrastructure will make it possible to retire approximately 8 km of old lines and 26 pylons.

Targets

RES integration	Quality of service	Inter-connectors	Congestion solutions	NTG connection	Resilience	RFI integration	SEN 2018
●		●		●			





Principal works in progress and expected benefits

380KV "PATERNÒ-PANTANO-PRIOLO" POWER LINE

On 12 April 2018, Terna received the necessary consents to build the new 380 kV power line linking the electricity substation at Paternò (CT) with the 380 kV electricity substation at Priolo (SR).

Status

Benefits

→ **For the electricity system:** the new 380 kV connection will help to improve service continuity and voltage stability in eastern Sicily, partly in the expectation of a significant increase in wind power production in the south-eastern part of the island. The future 380 kV "Paternò-Priolo" power line will be connected to a new 380/220/150 kV electricity substation to be built at Pantano D'Arci (CT).

→ **For the country as a whole:** this will overcome restrictions on the quantity of power that can be produced by plants located in eastern Sicily and enable existing and future plants to be fully exploited.

→ **For local communities:** the project will connect the 380 kV system with the 150 kV network serving the Catania area, where the existing network is due to be rationalised, improving security and the local grid's operational flexibility.

Targets

RES integration	Quality of service	Inter-connectors	Congestion solutions	NTG connection	Resilience	RFI integration	SEN 2018
●		●		●			

380KV VIZZINI SUBSTATION

In September 2018, Terna obtained the necessary consents for construction of a new 380/150 kV electricity substation at Vizzini with 380-150 kV overhead lines connecting to the NTG and the related works.

Status

Benefits

→ **For the electricity system:** the new substation will reduce congestion on the HV grid serving the east-central part of the island, which carries large amounts of renewable energy.

→ **For the country as a whole:** there will be significant benefits in terms of an increase in social economic welfare and the full use of renewable resources, as well as improved electricity supply security.

→ **For local communities:** in terms of the environment, the infrastructure has been designed with the aim of maximising its integration within the local area.

Targets

RES integration	Quality of service	Inter-connectors	Congestion solutions	NTG connection	Resilience	RFI integration	SEN 2018
●		●		●			

Connecting new plants

Terna has an obligation to connect all potential users requesting connection to the grid[40], identifying connection solutions in terms of criteria that guarantee the continuity and safe operation of the grid to which an applicant's new plant will be connected.

In particular, Terna is responsible for high and very high voltage connections to the NTG of plants with a capacity of 10 MW or more.

The technical, procedural and financial terms and conditions regarding provision of the connection service to the NTG are governed by the relevant determinations issued by ARERA. The related resolutions are implemented in the Grid Code, which describes transparent and non-discriminatory rules for granting access to the grid and the technical regulations.

At any one time, Terna handles over 1,600 applications for connection to the grid in relation to future or existing initiatives. These procedures include those for which applicants, having filed an application to Terna, fulfil the obligations of the Grid Code during the various phases of the connection process and in agreement with Terna.

A total of over 800 procedures, relating in particular to the connection of plants using renewable energy sources (RES) to the NTG and representing total capacity of 40 GW, are currently active.

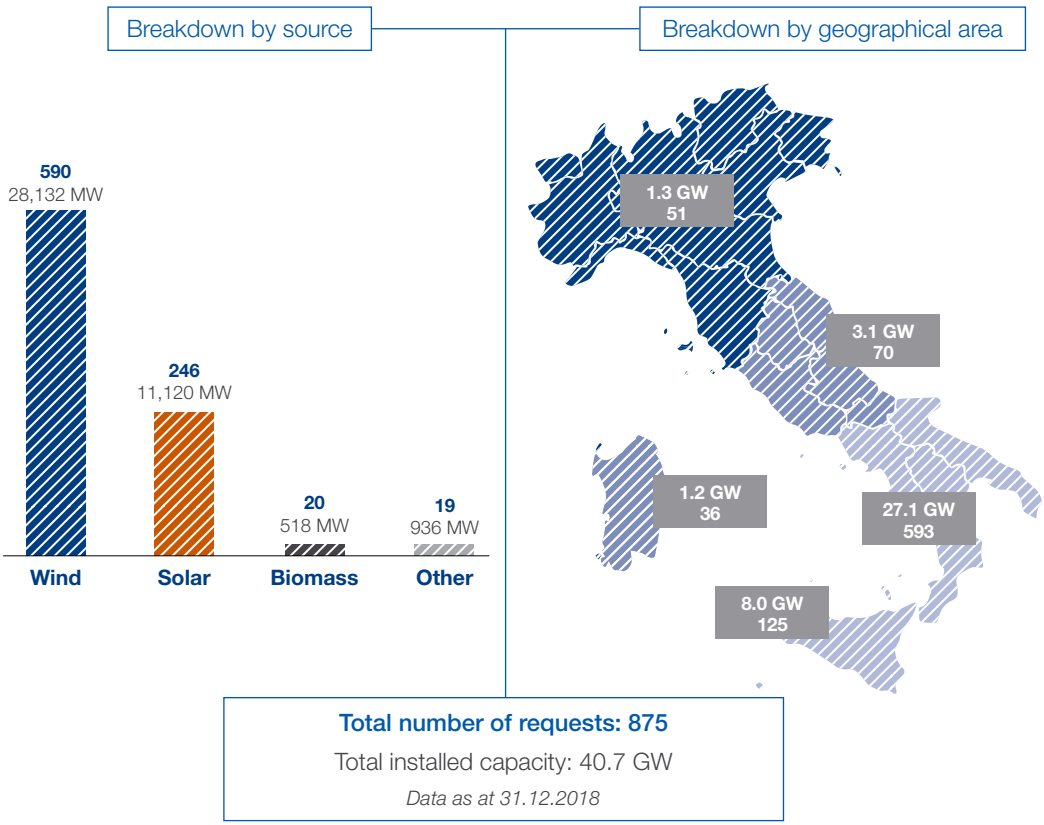
The National Energy Strategy (SEN), which has set challenging targets for growth in the volume the country's energy needs to be met by RES, has given rise to renewed interest in the development of projects for RES plants, as can be seen from the rapid increase in applications for connection to the NTG. New projects at the development stage primarily regard wind and solar power plants, with a sharp rise in the number of photovoltaic projects in 2018 compared with previous years.

The chart below shows applications for connection to the NTG operated by Terna, broken down by source and geographical distribution.

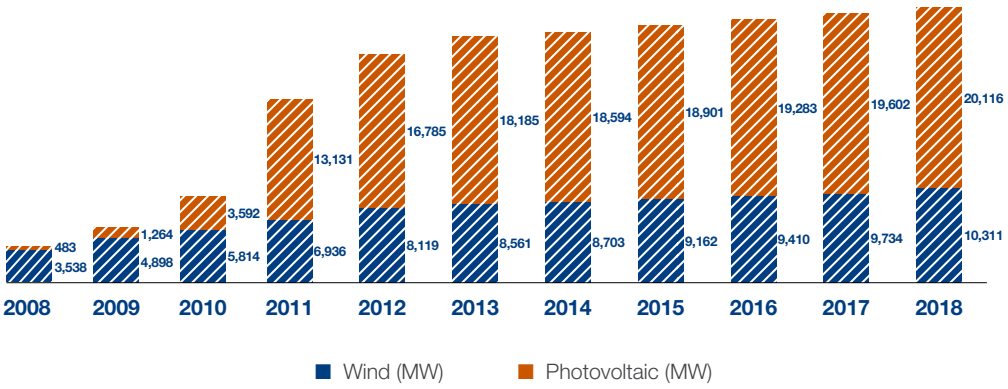
This shows that:

- 86% of the applications received are from southern Italy and the islands (representing capacity equivalent to over 89% of the total);
- applications at an advanced stage, which are close to receiving the related consents and where work is in progress, amount to approximately 4 GW;
- 18 connection contracts were signed in 2018 (representing total capacity of 462 MW), regulating relations between Terna and the applicant in respect of the connection service.

[40] Legislative Decree 79 of 16 March 1999 - art. 3, paragraph 1: *"The Operator has the obligation to connect all those making such a request to the National Transmission Grid, without compromising continuity of service and provided the technical rules as per paragraph 6 of this article, and the technical and financial terms and conditions for access and interconnection established by ARERA, are complied with"*.



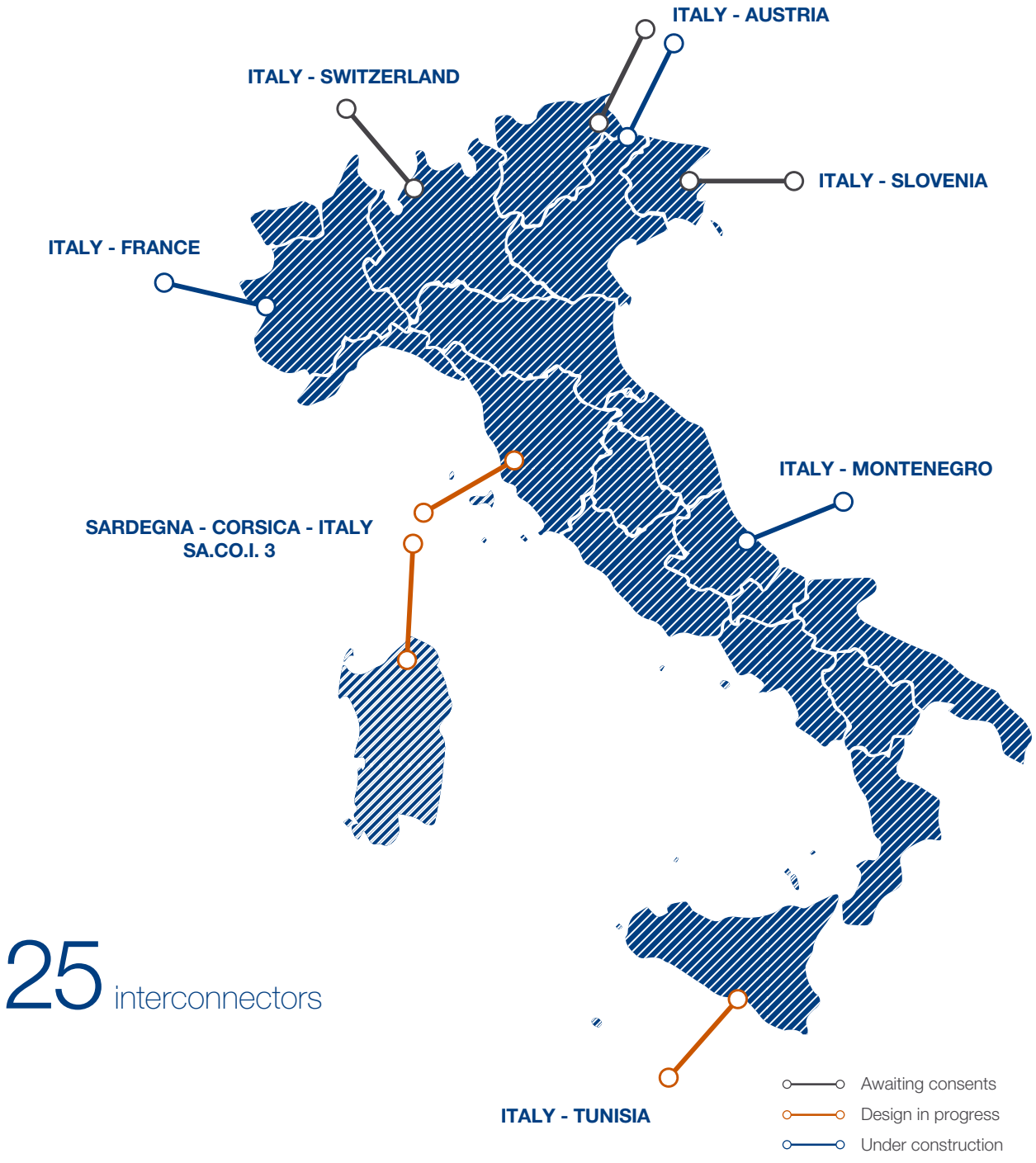
INSTALLED PHOTOVOLTAIC AND WIND CAPACITY 2008-2018* (GW)



(*) Provisional data from Terna for 2018 (updated to 31 December 2018).

Overseas interconnections

Its geographical position makes Italy a natural hub in the Mediterranean area and it can count on an electricity border made up of 25 interconnectors[41], in addition to new lines under construction. This development work (shown on the following map) aims to increase interconnection capacity (Net Transfer Capacity - NTC) on the electricity borders with foreign countries, enabling a reduction in energy procurement costs and the integration of markets, with the possibility of having more resources for use in managing the Italian and European electricity system.



25 interconnectors

[41] These include 3 merchant lines, or lines not owned by Terna, and the Italy - Malta connection owned by Enemalta.

Principal interconnections in progress

"ITALY-FRANCE" INTERCONNECTOR

Status

The new Italy - France interconnector is a project unique in the world in terms of the engineering, technological and environmental solutions used: 190 km of line connecting the substations of Piossasco (Italy) and Grand'Ile (France) through 25 municipalities in the province of Turin, consisting entirely of direct current underground cable.
The power line will be the longest underground line in the world and will have a very low impact on the environment and the local area, thanks to the latest in design techniques.

Benefits

→ **For the electricity system:** the increase in the quantity of energy exchanged will result in a reduction in congestion between the two countries and the possibility of more efficient use of renewable sources. This therefore also makes the interconnector a Project of Community Interest (PCI). In November 2017, it was included in the third PCI list, published by the European Commission[42].

→ **For the country as a whole:** the infrastructure will increase social and economic welfare at European level, reducing the price differential between Italy and France. Additionally, based on the content of the ENTSO-E TYNDP, the interconnector will increase production from renewables in Italy and improve energy efficiency at European level.

→ **For local communities:** the use of underground cable technology guarantees lower environmental and visual impacts, thereby preserving the Alpine landscape in both France and Italy. The creation of the new infrastructure in the same location as road infrastructure, such as the Fréjus safety tunnel, offers another strategic advantage in terms of social/environmental issues.

Targets

RES integration	Quality of service	Inter-connectors	Congestion solutions	NTG connection	Resilience	RFI integration	SEN 2018
●		●		●			

"ITALY-MONTENEGRO" INTERCONNECTOR

Status

The interconnector between Italy and Montenegro is a strategic project at European level, marking a major opportunity for the Italian electricity system as part of efforts to develop the interconnection between Italy and the Balkans. The project involves construction of a direct current connection, part in submarine cable and part in terrestrial cable, between the substations of Villanova (IT) and Lastva (ME) and covering a distance of approximately 445 km.
Construction, which is currently in progress, will involve the use of engineering and technical solutions capable of minimising the environmental impact. Entry into service of the first module of the interconnection will result in interconnection capacity of 600 MW by the end of 2019. To date, the laying and protection of the first pole of the submarine cable between Italy (Pescara) and Montenegro (Kotor) has been completed, as has the laying of the terrestrial cables. The converters in both Italy and Montenegro are at an advanced stage of completion.

Benefits

→ **For the electricity system:** the work, which when completed at the end of 2019 will provide interconnection capacity of 600 MW, has been included by the European Commission among the Projects of Common Interest (PCIs), after the Commission had already co-financed the feasibility studies in connection with the Trans-European Network (TEN-E) programme. The interconnector will enable an increase in cross-border energy exchange, whilst also improving security and the operational flexibility of the national electricity system and facilitating the integration of energy from renewable sources.

→ **For the country as a whole:** the infrastructure is a key step for the European Energy Union and crucial for integrating the electricity system serving the entire Balkan area into the European system, via Italy. As indicated in the NTG Development Plan and in the ENTSO-E TYNDP, the interconnector will lead to major increase in Social and Economic Welfare in Italy and Europe, facilitating the use of more efficient resources, including production from renewable sources in both Italy and the Balkans. The project also an important role to play in boosting security and service continuity at national level.

→ **For local communities:** the project involves the creation of direct current infrastructure extending a total of 445 km between Villanova (Pescara) and Kotor. There will be minimal environmental impact, as it involves the use of cables placed 1,200 metres beneath the Adriatic sea and buried for the remaining terrestrial portion.

Targets

RES integration	Quality of service	Inter-connectors	Congestion solutions	NTG connection	Resilience	RFI integration	SEN 2018
●		●		●			

[42] In accordance with EU Regulation 347/2013.

"ITALIA - AUSTRIA" INTERCONNECTOR

Status

The high-voltage interconnector between Prati di Vizze (IT) and Steinach (AT) will take advantage of the existing Prati di Vizze - Brennero power line. Preparations to create the new 132/110 kV electricity substation in Brennero and the related lines are currently in progress.

Benefits

→ **For the electricity system:** The line will significantly increase electricity interconnection capacity between Italy and Austria, supporting market integration, the use of renewable sources and security of supply.

→ **For the country as a whole:** It will provide significant benefits in terms of increased social economic welfare, helping to reduce price differentials between Italy and Austria, and ensuring full use of hydroelectric resources, whilst also improving the security of electricity supply. The use of existing infrastructure will minimise the environmental impact of the works.

→ **For local communities:** To allow imported power transported along the future Prati di Vizze - Steinach interconnector to be securely added to the grid, the mesh of the local 132 kV grid will be strengthened and transport limitations will be removed as appropriate. This will enable optimal use and further development of production capacity from renewable sources, which will serve the relevant portion of the local grid.

Targets

RES integration	Quality of service	Inter-connectors	Congestion solutions	NTG connection	Resilience	RFI integration	SEN 2018
●		●		●			

Principal interconnections at the planning stage

"Sardinia-Corsica-Italy (Sa.Co.I.3)" interconnector

The existing connection linking Sardinia with Corsica and Continental Italy (Sa.Co.I.2) has reached the end of its useful life.
The new Sa.Co.I.3 connection will ensure that the Sardinian electricity system has adequate capacity margins, avoiding the need to reduce reserve margins to below security limits in order to meet demand. Sa.Co.I.3 will also help to regulate and stabilise a system that is intrinsically weak like the one in Sardinia.
With the aim of ensuring that the infrastructure is well integrated into the surrounding area, a number of solutions designed to minimise the territorial and environmental impact will be adopted.
To coordinate construction of the new Sa.Co.I.3 connection in Italy and Corsica, on 11 October 2017, Terna and the system operator in Corsica, EDF, signed a specific Memorandum of Understanding.

"Italy-Tunisia" interconnector

This project involves the construction of a new HVDC[43] connection between Tunisia and the primary grid in south-western Sicily. The infrastructure is considered to be of strategic importance for the electricity transmission system in the Mediterranean basin as it will enable:
- an increase in energy exchanges between Europe and North Africa;
- integrate higher quantities of renewable energy;
- improve the performances of the electricity systems involved in terms of security and operational flexibility.

In terms of creating a Euro-Mediterranean electricity network, capable of connecting the North African and European markets, the interconnector is also of strategic importance for Europe. For this reason, in November 2017, the project was included for the first time among the Projects of Common Interest (PCIs) pursuant to EU Regulation 347/2013.
The new interconnector will help to bring greater benefits for the Italian electricity system, primarily in terms of sustainability and market integration. Implementation of the project is however, conditional on receiving adequate funding.
In this regard, in view of its strategic and geopolitical importance for the entire Mediterranean area, the project has received funding from the World Bank to finance detailed feasibility studies.

[43] High-Voltage Direct Current.

Private interconnectors pursuant to Law 99/2009

In order to support the development of a single electricity market by expanding the infrastructure needed for interconnections with other countries, EU legislation was introduced, setting out guidelines for the creation of interconnections with other countries by entities other than grid operators.
The European guidelines have been introduced into Italian legislation by Law 99/2009, which assigned Terna responsibility for selecting undertakings (the "selected undertakings"), on the basis of public tenders, willing to finance specific interconnectors in exchange for the benefits resulting from a decree granting a third-party access exemption with regard to the transmission capacity provided by the new infrastructure. In particular, the law states that these entities, in exchange for a commitment to finance such projects, are required to commission Terna to build and operate the interconnectors.
A total of 5 interconnectors are planned for the borders with France, Montenegro (both at an advanced stage of completion), Austria, Switzerland and Slovenia (currently awaiting the necessary consents).

The Group has continued with construction of the private line, in implementation of Law 99/09, on behalf of the company, Piemonte Savoia S.r.l., transferred to the private finance providers on 4 July 2017. On the section not appertaining to Sitaf (Società Italiana per il traforo autostradale del Frejus), the civil works and the laying of cable for the entire section were completed at the end of August 2018. By December 2018, approximately 24.5 km of civil works along the A32 motorway had been completed and 13.2 km of cable laid. In addition, as regards the Middle section, by December 2018, approximately 17.5 km of cable had been laid and around 21.5 km of civil works had been completed. The production of transformers and the converter for the Piossasco Converter has been completed, whilst erection of the main buildings and creation of the area housing the transformers has also been completed.	Private "Italy-France" interconnector
On 29 March 2018, the Ministry for Economic Development and the Ministry of the Environment and of the Protection of Land and Sea issued the decree partially transferring the consents from Monita Interconnector S.r.l. to Terna S.p.A., in line with the new scope of the private interconnector. On 19 April 2018, Monita Interconnector S.r.l. submitted a revised application for exemption to the Ministry for Economic Development. On 14 June 2018, ARERA issued clearance for the exemption. Terna is currently awaiting clearance for the exemption from the Ministry for Economic Development. Entry into service of the first module of the interconnector will result in interconnection capacity of 600 MW by the end of 2019, with a part of this, corresponding with the private interconnector, available in third-party access exemption to the selected undertakings.	Private "Italy-Montenegro" interconnector
The Italy-Austria interconnector (the Reschenpass project), which is currently awaiting the necessary consents, involves construction of a new 220kV AC interconnection between the Glorenza (Italy) and Nauders (Austria) substations. This will consist of 26 km of underground cable and the necessary upgrade of the domestic grid. On 16 July 2018, the Terna Group set up the special purpose vehicle, Resia Interconnector S.r.l., which, on behalf of the energy-intensive companies selected in accordance with Law 99/09, is to prepare and submit a request for exemption from the right of third parties to access the transport capacity the infrastructure will make available. The related consents process on the Italian side is expected to be completed by the end of the first quarter of 2019.	Private "Italy-Austria" interconnector
The project involves the development of new transmission lines between Italy and Switzerland, in part in alternating current and in part in direct current. It will increase interconnection capacity between Italy and Switzerland, raising it by approximately 1 GW.	Private "Italy-Switzerland" interconnector
The creation of a direct current line is planned, partly in undersea cable, between the substations of Salgareda (IT) and Bericevo (SL), together with work on upgrading the domestic grids in Italy and in Slovenia. The project is currently awaiting the necessary consents on the Italian side. The expected increase in cross-border capacity of approximately 1 GW will raise the interconnection capacity to more than double the current level.	Private "Italy-Slovenia" interconnector

Asset management

Asset management is the set of systematic and coordinated activities and procedures that enables Terna to operate and maintain its assets in the best and most sustainable way, optimising the Group's return on investment and demonstrating its ability to create value.

The Asset Management system entails a structured approach based on best practices for managing assets throughout their lifecycle, taking into account the related cost cycles and associated risks. It plays an essential role in the efficient management of assets.

In this regard, the Asset Management system combines management of both financial and engineering aspects and includes management of all the phases that make up the lifecycle of infrastructure: design, construction, commissioning, operation, maintenance, repair/replacement and, finally, decommissioning.

Terna's main benchmark is the international standard, ISO 55001:2014 "Asset Management", which specifies the requirements for an optimal asset management system. In 2018, Terna became the first Italian company to obtain the related certification (see page 61).

To achieve its asset management objectives, Terna prepares an Asset Management Plan (AMP) specifying the activities to be carried out in order to maintain and renew its electricity grid infrastructure.





Infrastructure maintenance

Maintenance of electricity grid infrastructure is essential in order to guarantee quality of service, with the aim of ensuring that grid reliability meets the very highest standards.

The tools used to support maintenance activities are subject to continuous innovation, as regards identification of the most suitable interventions (MBI-Monitoring and Business Intelligence, a tool used to support decision-making), the scheduling and execution of operations (WFM - Work Force Management) and the adoption of modern aerial inspection techniques for the electricity grid.

Implementation of the plan to progressively assume responsibility for operation and maintenance (O&M) of the electricity substations owned by Rete S.r.l. (following acquisition of RFI's assets) proceeded in 2018. By the end of the year, responsibility for 239 of the 354 substations acquired had been transferred.

Infrastructure monitoring and control

- 26,000 checks on substations of various voltage levels;
- visual inspections of 107,700 km of power line, of which 58,500 km using helicopters (visual + infra-red) with an average total frequency of around 1.5 inspections a year for each transmission line;
- a further 46,500 km of power line underwent instrumental controls, both from the ground (including with the use of the LLW or live-line working technique), and from the air using helicopters to operate flights that use laser scanning surveys to identify any obstructions, particularly trees;
- inspections of 44,800 km of underground cable with a total average frequency of 24.2 inspections per year.

Routine maintenance

Repairs are carried out when signs of deterioration are identified as a result of the monitoring process or by on-line sensors. These indications and any problems identified are processed by the expert system used to support decision-making (MBI-Monitoring and Business Intelligence). This system draws up the maintenance plan on the basis of engineering models developed by the Asset Management department.

Vegetation management

During 2018, vegetation was cut back on around 21,200 km of power line (the total length of line where vegetation was cut back); this has to be done to ensure the correct and safe operation of the lines.

Live-line working

Approximately 3,400 checks and line maintenance interventions using live-line working were carried out. These activities, performed with the line in operation, increase the availability of the infrastructure and help to improve quality of service.

Renewal Programme

The Renewal Programme is based on an analytical method that, starting from consistent, objective technical criteria, identifies and evaluates extraordinary maintenance works ("renewal"), assessing the state of repair and technical status of components in relation to the conditions under which they operate and giving priority to components and plant that play a key role in operation of the grid.

The Programme includes work to be carried out on specific components, limiting interventions to parts of the infrastructure that effectively require attention in order to continue operating efficiently over as long a period of time as possible.

Renewal work is associated with three types of benefit:

- **Sustainability**, resulting from the use of more environmentally friendly components, the replacement of fluid oil cables and improvements to the reliability of assets;
- **Innovation and digital transformation**, reflecting the adoption of monitoring systems for existing assets using digital and innovative solutions;
- **Resilience**: work on strengthening the NTG in order to boost the resilience of the infrastructure.

The principal renewal ("extraordinary maintenance") works carried out are as follows:

Extraordinary maintenance

Renewal work (the replacement of components and entire systems) was carried out in 2018 at a cost of approximately €300 million in order to prolong the useful lives of power lines and substations. In terms of power lines, 1,100 km of conductors, 1,400 km of ground wires and 400 pylons were replaced; in terms of substations, 10 static machines, 70 circuit breakers, 120 disconnectors, 289 current transformers and 130 voltage transformers were replaced. Protection and control systems for approximately 200 HV bays were also replaced.

Security and resilience of the electricity system

The Electricity System Security Plan, prepared annually by Terna and approved by the Ministry for Economic Development, is a four-year programme that sets out initiatives to prevent and reduce the consequences of malfunctions on the electricity grid.

In 2018, investment carried out for projects provided for in the Plan totalled approximately €126 million.

The sixteenth edition of the Security Plan for the period 2019-2022 provides for total investment of €803 million.

The Plan breaks down into eight grid operation areas, regarding the planning, supervision, regulation and protection, restart and monitoring of the electricity system, as well as an area dedicated to safe and optimal management of renewable energy sources.

The Plan also defines initiatives to protect the physical integrity of the grid, including surveillance and protection activities regarding the most critical electricity substations and actions to protect the IT security of infrastructure against attempts at forced entry, unauthorised access and possible cyber-attacks.

These areas of intervention are confirmed in the 2019 Security Plan, in which the activities carried out in 2018 and those planned for the period 2019-2022 are described.

The **key drivers** for the **2019 Security Plan** are:

1. **A system that is secure and fit for purpose**, with the continued installation of reactive power compensation equipment in order to manage the system safely and new work on installing STATCOM devices and stabilising resistors to control the grid's stability, improve voltage quality and reduce grid oscillations.
2. **Resilience**, in the form of **Defence Towers** using Terna's existing infrastructure to gather and transmit environmental data to support the grid's physical resilience and the control system.
3. **Digital transformation and system innovation**, to meet new requirements for:
   - a new SCADA control system capable of managing a system with a high level of distributed generation penetration;
   - a reengineering of the new Control, Defence and Monitoring System with innovative modules for grid control and analysis;
   - observable distributed generation to acquire key electrical data, improve the management of real-time, forecasting and ex-post applications and monitor the development and spread of electric mobility in order to analysis its impact on the electricity system;
   - the new IoT Security project in order to adopt adequate Cybersecurity solutions at all levels of the organisation, as indicated in the new corporate IoT model, putting in place tools designed to monitor and guarantee security, governance and compliance with the applicable legislation.

Resilience Plan

In accordance with MED directives[44], starting with the 2018 Security Plan, this document contains a specific section on the "Work plan for increasing grid resilience nationwide" (the Resilience Plan), especially in relation to the measures to be implemented in areas affected by wet snow. This section includes:

- a list of grid development, expansion and upgrade initiatives designed to increase the grid's mesh (included in the Development Plan)
- a list of extraordinary maintenance/renewal works (including scheduled interventions after an accurate assessment of the state of power lines)
- a list of mitigation initiatives.

The Resilience Plan for snow/ice presented in the 2019 Security Plan envisages investment of approximately €410 million over the five-year period from 2019 to 2023. This reconfirms the need to make the electricity system increasingly more resilient and capable of coping with extreme weather events, given that almost all the electricity transmission infrastructure is directly exposed to the immediate impact of atmospheric agents.
On 18 December 2018, ARERA issued resolution 668/2018/R/eel, setting out a mechanism designed to incentivise distributors to take steps to boost resilience. The regulator is continuing to look into the possibility of extending such a mechanism to include Terna, which will be the subject of a later resolution.

Agreement between Terna and the Civil Protection Department for the joint management of emergencies

In July 2018, Terna and the Civil Protection Department signed a Memorandum of Understanding with a view to exploiting synergies in relation to predicting, preventing and mitigating the related risks and managing and overcoming emergencies.
The agreement provides for the optimisation of procedures and the flow of communications between Terna and the Department under both ordinary and emergency conditions. This may include potential integration of the respective information systems, based on the different reference scenarios and types of risk, and the creation of specific training programmes and exercises for staff engaged in managing emergencies, with the aim of improving synergies in emergency response and raising awareness of organisational and operational models. Links between the Company and the various branches of the National Civil Protection Service (at regional and provincial level and within Prefectures and Local Government Offices) will also benefit.

[44] Communication of 3 August 2017.

Information and cyber security

The cyber risk scenario is increasingly complex and intricate. In addition to the traditional threats that affect every ICT project, there has been a sharp rise in the number of threats relating to the current digital transformation process at highly innovative companies and the increase in interconnections between the various operators.

The entry into force of new European regulations, above all the General Data Protection Regulation (GDPR) and the Network & Information Security (NIS) directive means companies are having to rethink some of their information and cyber security processes, in order to ensure full compliance.

For some time, Terna has used an Information Security Governance Model, based on policies and procedures combined with a coordinated Information Risk Management ("IRM") operating programme. This is coordinated by the Group's CISO (Chief Information Security Officer).
The Model takes into account all the risk factors (organisational, technical and technological, physical, environmental and cyber, etc.) to which the Group's ICT ecosystem is exposed, including compliance with data protection legislation and efforts to combat cyber-crime, with the aim of countering their impact (disruption to computer networks or services critical to the operation of the electricity system and/or resulting in potential damage to the National Transmission Grid (NTG); loss of confidentiality; and the theft or alteration of sensitive, strategic and confidential data held by Terna relating to the electricity market and/or third parties).
Finally, via the operational safeguards put in place by the Security and Service department's cyber security unit, Terna promptly identifies and contains security incidents, thereby minimising information loss and facilitating restoration of the services involved.

ACTIVITIES IN 2018	
Cyber security training	An extensive awareness-raising campaign on cyber security issues, aimed at senior managers, middle managers and roles with particular responsibilities, as well as newly recruited staff, has been completed. Terna also took part in a special competition (red team versus blue team type) under the patronage of ENTSO-E and SANS, in which over 100 European TSOs and DSOs took part. Terna performed well during the competition to rank among the top five.
Strengthening of the Information Security Framework	The Information Security Framework and, above all, the set of countermeasures that Terna puts in place to combat cyber risk was updated in line with the latest version of the NIST standard, adopting additional security measures relating to critical areas such as GDPR, IoT and SCADA/ICS systems. During 2018, Terna began the process of assessing and testing solutions for transferring cyber risk to third parties, entering into insurance policies to cover the risks posed by ransomware, phishing and the theft of personal data for which Terna is the data owner or manager. The process was completed once the Company had obtained cover and the policy will be extended to cover additional risks in the three-year period 2019-2021.
Consolidation of the capabilities of the Cyber Security Operations & Data Protection Centre	The process of strengthening and refining corrective actions and new initiatives designed to prevent cyber risk continued within the Security and Service department. Terna's Computer Emergency Readiness Team (CERT) redesigned its Real Time Security Monitoring, Incident Handling, Threat Intelligence and Security Content Engineering & Threat Hunting processes on a 24h/365d basis. Info Sharing with public bodies, other essential service providers and the CERT's Threat Intelligence partners was further developed as regards tailored intelligence. The Cyber Security Engineering centre was used to set up important working groups aimed at reducing the cyber risk associated with the Industrial Automation and Control Systems (IACS) that support Terna's core business. These new departments complement and integrate with the Cyber Security Assessment department, which carried out periodic assessments of the vulnerabilities in Terna's IT systems and checks on the related recovery plans.

Consolidation of GDPR compliance

An audit of GDPR compliance was completed, with the adoption and initial implementation of numerous initiatives necessary in order to ensure full compliance and the rollout of a data protection model across the Group.
This included training and internal communication initiatives, including specific workshops for senior management and online courses and training pills for all staff, with the aim of creating a Group-wide privacy and data protection culture.

Identity and Access Management (IAM)

The Identity and Access Management (IAM) process regarding the management of access authorisations to critical IT resources has been strengthened. This has involved the implementation of first use case monitoring (identity governance) in order to extend visibility (and governance) for applications supporting Terna's operational activities and financial reporting.

Monitoring and cyber defence capabilities

During the year, the extension and update of security monitoring services for systems and networks of platforms incorporated within Information Security and Event Management (ISEM) system continued. With regard to the detection of cyber threats, a technological solution based on machine learning and artificial intelligence using non-formal logic was adopted. There was also continuous analysis and threat hunting using Indicators of Compromise (IOC) reports, especially those deriving from public bodies (e.g. the Italian Computer Emergency Response Team, the National Anti-Cyber Crime Centre for the Protection of Critical Infrastructure, etc.) and the entry into operation of an advanced anti-malware solution for all workstations, involving monitoring, analysis and continuous recording of all executable and non-executable file activities, regardless of whether they are already known to be malware. Work on the protection of SCADA systems using a whitelisting solution and on the logical segregation of networks is continuing.

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As in previous years, no complaints have been received regarding data protection violations, or improper use or unauthorised processing of personal data entrusted to Group companies, neither via the dedicated mailbox (privacy@terna.it) nor through other reporting or communication channels.

Agreement between Terna and the Italian Police to combat cybercrime

On 10 May 2018, Terna and the Italian Police signed an agreement designed to ensure the protection of the information networks and systems that support the Company's operations. The agreement aims to develop cooperation between the Police and the grid operator in order to adopt effective strategies for preventing and combatting cybercrime.
On the part of the Police, support will be provided by the National Anti-Cyber Crime Centre for the Protection of Critical Infrastructure unit within Italy's Postal and Communications Police service which, for many years, has been engaged in protecting the information systems of public and private organisations of strategic importance to the country.
Risk analysis, information exchange, projections for the future of cybercrime and growing cyber threats, and the management of critical events and situations with the support of the 24-hour operations room are some of the initiatives covered by the agreement, and which represent an effective response to continually evolving cyber threats.

Innovation

At a time of transformation and innovation, value added activities are central to the creation of long-term value, not only for Terna, but for the country's entire electricity system.

The current energy transition process requires a new systemic and organic approach to innovation, based around the acceleration of a portfolio of effective Research, Development and Innovation initiatives in keeping with the Group's strategies.

Terna decided to further speed up innovation in 2018, adopting a centralised, coordinated vision in order to encourage and coordinate research and the development of ideas, with the aim of creating a synergistic innovation ecosystem within the Company, capable of enabling the transition to a new TSO 2.0 model. The transition requires a new, smarter approach to managing the electricity system, which should be increasingly intelligent and flexible both at the level of the grid, thanks to the use of Industry 4.0 enabling technologies, above all the Internet of Things or IoT (advanced sensors, big data, advanced analytics), and in terms of the market. This will entail an unprecedented revolution that will rapidly result in the integration of distributed generation resources, storage and market demand for services, and the Europe-wide integration of national markets. Moreover, in the medium term, it will be necessary to ensure the progressive integratability and interoperability of electricity grids and other networks (transport, gas, water, etc.), in order to make the Italian and European economies stronger and more eco-sustainable.

The steps taken in this regard include implementation of an Open Innovation process within the Company and the creation of a structured Innovation Plan. Today's form of innovation calls for an approach capable of opening up new possibilities for development and cooperation with the outside world and the creation of dynamic interactions, including close attention to start-ups, which offer Terna the chance to invest in technological initiatives capable of creating more value for the Company and for Italy's electricity and energy system.

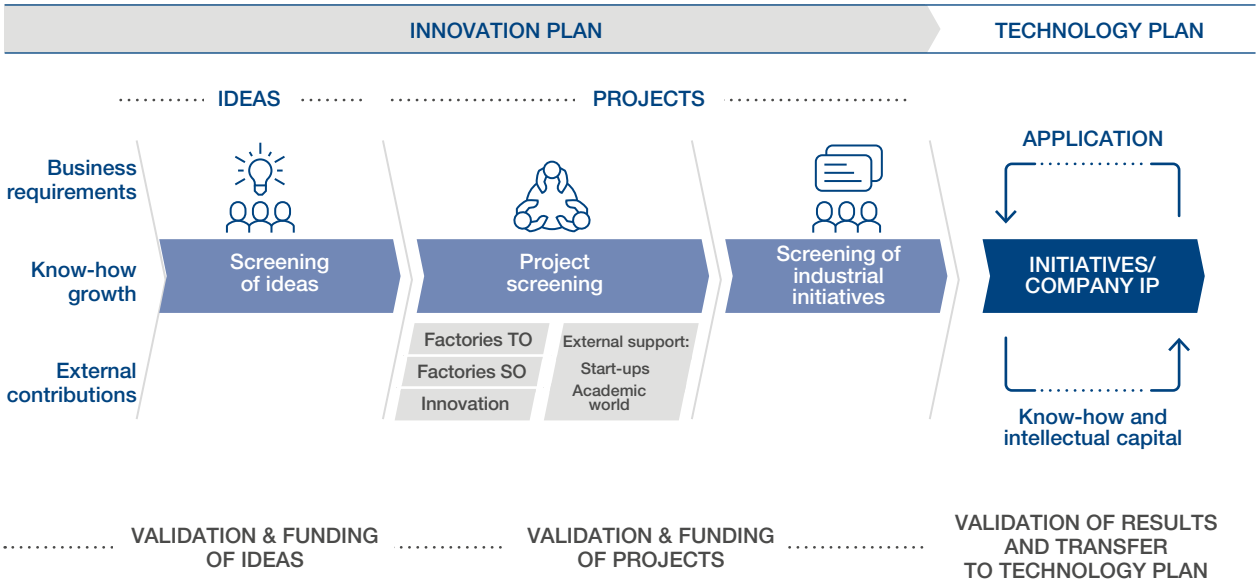
The Innovation Plan organises the innovation flow in a consistent manner, from the birth of new ideas through to project development. New initiatives, which may be driven by requirements within the Company or by the Open Innovation process, are classified within a coherent framework, based on the principal new technologies earmarked by Terna as being capable of influencing both current and future innovation:

1. Internet of Things: IoT, Industrial IoT, Sensors and Wearables;
2. Energy Tech: technologies linked to the new Energy Resources (Storage, Demand Side Response, E-mobility) and Smart Grids;
3. Advanced Materials: nanotechnologies, biomimicry and smart dust.

Factories

The main strategic project streams relating to Transmission Operator (TO) and System Operator (SO) activities have been identified and the related innovation factories set up: the TO Innovation Factory and the SO Innovation Factory, with the role carrying out innovation projects.

Management model: from ideas to projects



Specifically, R&D and Innovation activities regarding TO activities are guided by the Development Plan. In this regard, priorities are focused on aspects relating to HVDC (High-Voltage Direct Current), cable laying technologies, the optimisation of overhead lines and asset management technologies. The primary focus in relation to SO activities is on enabling the market participation of distributed generation resources and demand for electric power and storage, with the main aim of encouraging the penetration and integration of non-programmable renewable sources within the National Electricity and Energy System. The priority innovation project streams in this sector, therefore, relate to the flexibility of the Electricity System (e.g. vehicle-to-grid projects, demand-side response, etc.) and the secure management of the Electricity System (e.g. R&D activities regarding the resilience of the Electricity System, pilot projects on improved observability of distributed resources, etc.).

Digital transformation is the main enabling tool for innovation and, in general, the current energy transition, to be implemented via projects in the following areas: connectivity (e.g. IoT technologies for Asset Management and dynamic network management), synchronous data management (e.g. advanced forecasting technologies for data management and electricity market processes), asynchronous data management (e.g. big data technologies and machine learning for use in data analytics and the exploitation of historical data).

Innovation within the Company is supported and promoted through a series of tools and resources, most of which managed centrally, such as:

- **Systems and processes to support the enhancement of assets and internal expertise:** this includes tools for enhancing intellectual capital and sharing corporate know-how, as well as portfolio management tools;
- **Open innovation:** this encourages openness towards new areas for development within and beyond the Company, through dynamic interactions with universities and research centres, partnerships with peers and large industrial players, as well as access to start-ups and innovative small and medium-sized enterprises;
- **Access to incentive and soft financing mechanisms:** this promotes access to incentives (e.g. tax relief for companies investing in research and development and patent box schemes) and specific funding programmes for both international and national R&D projects.

OPEN INNOVATION IN THE INNOVATION PLAN

Sector	Description
Energy sector and infrastructure peers	The signature of agreements and partnerships with energy businesses who are not competitors (TSOs, DSOs, utilities, etc.). Membership of and active participation in leading associations and international bodies involved in the electricity sector and innovation. Examples: RTE, ENI, RFI, ENTSO-E, EASE
Universities and research centres	Collaborations to promote and coordinate studies and research with national universities and research centres of excellence in areas of strategic interest, in order to contribute to the preparation of expert researchers in this field and to promote and encourage initiatives aimed at teaching and training in the energy sector. Examples: RSE, Ensiel
Large Companies and Industries	The signature of agreements and partnerships with suppliers or companies who may be competitors, regarding areas of common interest in the electricity sector or applications aimed at ensuring greater sustainability, cost-effectiveness and security in the management of grids.
Start-ups and SMEs	The scouting of start-ups and mature enterprises in order to grasp opportunities for the development of specific initiatives of interest to Terna and/or business partnerships. Examples: the Next Energy programme

The key innovation, research and development initiatives undertaken in 2018 are summarised below.

KEY INITIATIVES

Projects and programmes	Description
NEXT ENERGY programme and the start-up ecosystem	Terna and the Cariplo Foundation ran the third edition (2018-2019) of the initiative, using the same proven structure for the three calls: the "Call for Talent", "Call for Ideas" and "Call for Growth". The third edition of Next Energy relates to the theme "Interaction between electricity infrastructure and local areas", focusing on environmental sustainability, and includes: • "Call for Talent": 10 internships lasting 6 months for talented young engineers, economists, mathematicians, physicists and statisticians; • "Call for Ideas": the selection of 10 early-stage start-ups with a medium to low level of technology readiness (a TRL of 2-5). The chosen start-ups will have access to incubators selected by the Cariplo Factory and the winner will receive a €50,000 voucher to be exchanged for services; • "Call for Growth": the selection of up to 5 mature start-ups with medium to high levels of technology readiness (a TRL of 5-8), chosen on the basis of specific requirements identified by Terna with the aim of developing pilot projects.
Monitower Call	Terna has entered into partnership with the start-up accelerator, Digital Magics, an incubation program specialising in digital start-ups which, in the energy sector, works in partnership with Compendia, an innovative energy services company. The first call, which was completed on 20 November, resulted in the selection of Wisense, a start-up based in the Marche region of Italy founded by three Ancona University students. The company is using Artificial Intelligence and Machine Learning technologies to develop a system capable of recording and analysing data on seismic wave propagation, for potential use in projects that Terna is developing as part of efforts to boost the resilience of the electricity system.
Academy	Terna has joined the research programme launched in October 2016 by the Precourt Institute of Energy at Stanford University (one of 30 research centres at this Californian university that specialises in engineering). The programme, called Bits & Watts as a reminder of the strong correlation between electricity grids and digital transformation, aims to identify solutions to facilitate and accelerate the current transition in the electricity sector, by combining university and industry expertise to develop innovative projects and solutions. The initiative's strategic value lies in its integrated approach to research focusing on three key areas, ranging from the coordinated management of electricity transmission and distribution grids, to the active integration of consumers within the electricity system and the use of data analysis in the development of new automated energy management tools. Following the memorandum of understanding signed with Ensiel (a consortium set up by the main Italian universities operating in the power systems sector), and the adoption of the innovative contractual format with the direct award of contracts for research and development services, in 2018, Terna launched 11 projects involving 9 Italian universities from among those most active in the electricity and energy systems sector.